WORKBOOK

McCURNIN'S

Joanna M. Bassert / John A. Thomas

Clinical Textbook for Veterinary Technicians

Eighth Edition

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McCurnin's Clinical Textbook for Veterinary Technicians

Eighth Edition

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Notice

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Preface

This workbook is intended to accompany the eighth edition of the textbook *McCurnin's Textbook for Veterinary Technicians.* Each chapter in the workbook relates to a corresponding chapter in the textbook and stresses the essential information of the chapter through the use of definitions, short essays (comprehension), photo quizzes, matching, completion, true and false, multiple choice questions, word searches, and crossword puzzles.

Learning objectives are included at the beginning of each chapter to help you focus on the material and concepts that you are expected to learn and how this is to be applied in the veterinary clinical setting.

The following suggestions will help you use this workbook to identify strengths and weaknesses.

1. Review the contents of each chapter before you attempt to do the exercise. Do not treat the questions individually and then refer to the text for the correct answer. Deal with the chapter's subject matter as a whole, since many of the questions are interrelated. This is a learning exercise meant to help you learn the material presented in the textbook, not an examination for grades.
2. Remember that the same subject matter may be repeated in different question forms in each chapter or other chapters, since the material overlaps. The subjects of the questions are not necessarily in the same order as they appear in the textbook, although the questions in each exercise are grouped to match the order of the main sections in the text (e.g., both the main sections and workbook questions for *Chapter 25: Emergency Nursing* are ordered as follows: a) Emergency and Critical Care Nursing: Small Animal; b) Canine and Feline Electrocardiography; c) Equine Emergency Nursing; d) Emergency and Critical Care Nursing: Food Animal).
3. Read each question and study each illustration carefully before answering. You may know the answer or you may arrive at the correct answer by knowing which answers are incorrect.
4. This workbook is designed so that the pages can be easily removed, submitted if required, and placed in your notebook with the corresponding lecture notes.

The answers to all the exercises appear in the *TEACH Instructor Resource* for *McCurnin's Textbook for Veterinary Technicians* on the Evolve website. For additional study, short answer exercises for each chapter are available in the Student Resources on the Evolve website.

Contents

Part One: Veterinary Technology: An Overview, 1

Chapter 1: Veterinary Technology: An Overview, **1**
Chapter 2: Veterinary Practice Management, **9**
Chapter 3: Veterinary Medical Records, **19**
Chapter 4: Occupational Health And Safety In Veterinary Hospitals, **25**

Part Two: Patient Management and Nutrition, 33

Chapter 5: Animal Behavior, **33**
Chapter 6: Restraint and Handling of Animals, **45**
Chapter 7: History and Physical Examination, **57**
Chapter 8: Preventive Health Programs, **67**
Chapter 9: Small Animal Clinical Nutrition, **79**
Chapter 10: Large Animal Nutrition, **91**
Chapter 11: Animal Reproduction, **97**

Part Three: Clinical Sciences, 115

Chapter 12: Hematology and Cytology, **115**
Chapter 13: Clinical Chemistry, Serology and Urinalysis, **127**
Chapter 14: Parasitology, **139**
Chapter 15: Microbiology, **153**
Chapter 16: Diagnostic Imaging, **165**
Chapter 17: Basic Necropsy Procedures, **181**

Part Four: Medical Nursing, 191

Chapter 18: Diagnostic Sampling and Therapeutic Techniques, **191**
Chapter 19: Small Animal Medical Nursing, **207**
Chapter 20: Large Animal Medical Nursing, **223**
Chapter 21: Neonatal Care of the Puppy, Kitten, and Foal, **233**
Chapter 22: Care of Birds, Reptiles, and Small Mammals, **245**
Chapter 23: Physical Therapy, Rehabilitation, and Alternative Medical Nursing, **251**

Part Five: Emergency and Critical Care, 263

Chapter 24: Fluid Therapy and Transfusion Medicine, **263**
Chapter 25: Emergency and Critical Care Nursing, **273**
Chapter 26: Wound Management and Bandaging, **293**

Part Six: Pharmacology, Anesthesia, and Analgesia, 309

Chapter 27: Pharmacology and Pharmacy, **309**
Chapter 28: Pain Management, **329**
Chapter 29: Veterinary Anesthesia, **339**

Part Seven: Surgical Nursing, 359

Chapter 30: Surgical Instruments and Aseptic Technique, **359**
Chapter 31: Surgical Assistance and Suture Material, **381**
Chapter 32: Small Animal Surgical Nursing, **389**
Chapter 33: Large Animal Surgical Nursing, **401**
Chapter 34: Veterinary Dentistry, **409**

Part Eight: End of Life, 437

Chapter 35: Geriatric and Hospice Care: Supporting the Aged and Dying Patient, **437**
Chapter 36: The Human–Animal Bond, Bereavement, and Euthanasia, **445**

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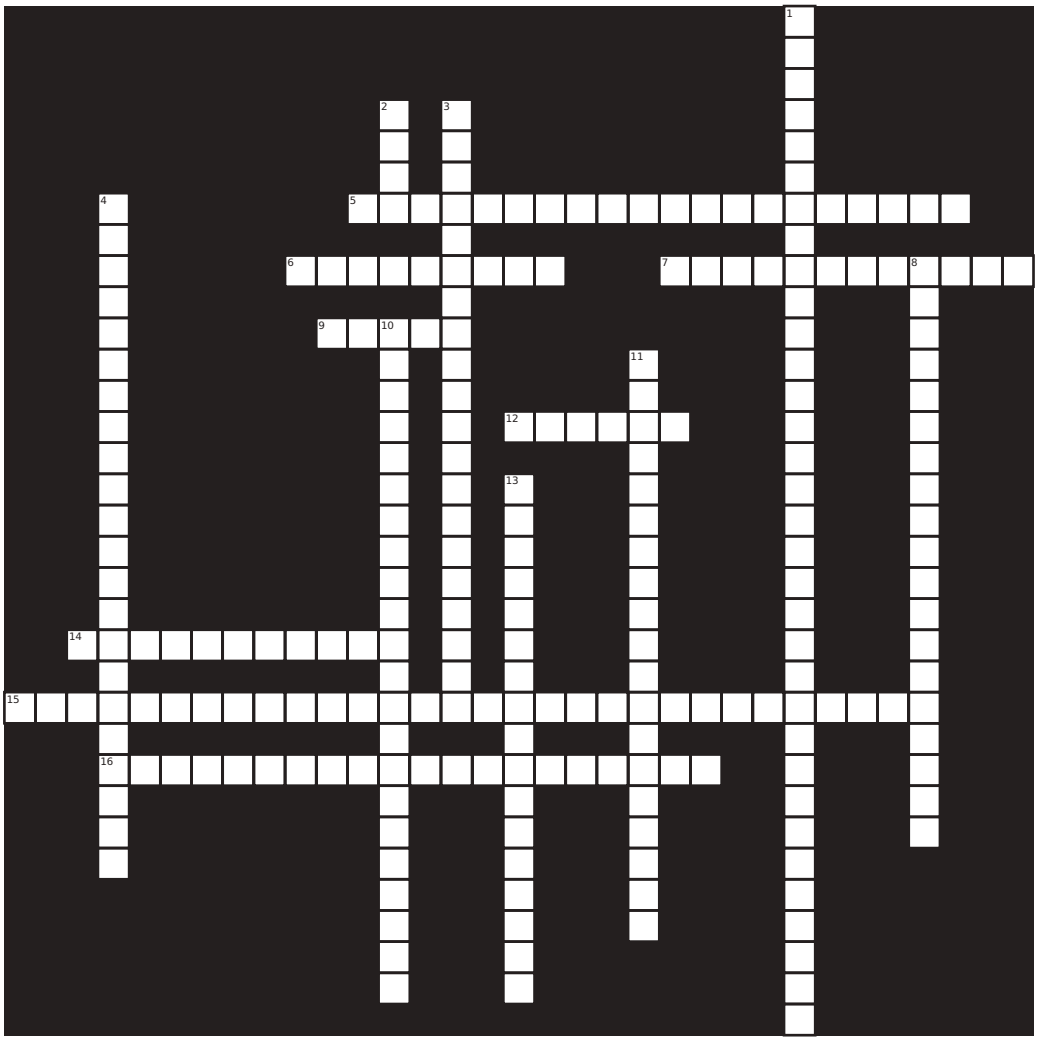
1 Veterinary Technology: An Overview

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all of the Key Terms in this chapter.
2. Describe the events from 1963 to 1990 that led to the development of modern veterinary technology in the United States and Canada.
3. Describe the educational and credentialing requirements established in most states for entry into the profession of veterinary technology.
4. Explain the structure, format, and scheduling of the VTNE.
5. List the six features that characterize a profession.
6. Describe the five steps of the veterinary technician practice model.
7. Describe the scope of practice for veterinary technicians and list four duties performed only by veterinarians.
8. Describe areas of responsibility for veterinary technicians in clinical practice.
9. List the members of the veterinary health care team and describe their respective roles. In your description of veterinary technician specialists include a list of the veterinary technician academies recognized by NAVTA.
10. Describe professional appearance, conduct, and communication.
11. Name the organizations represented by the acronyms AVMA, CVMA, CVTEA, NAVTA, and AAVSB, and describe their roles in the education and credentialing of veterinary technicians.
12. Describe professional ethics.
13. Differentiate between statutes (laws) and regulations.
14. Describe the role of state boards in the credentialing of veterinary professionals.
15. List possible grounds for disciplinary action by state or provincial boards, list three levels of supervision defined in the NAVTA Model Rules and Regulations, and describe how these levels affect the veterinary technician's scope of practice.
16. Describe steps and possible sanctions carried out during disciplinary action against a licensee.
17. Describe how laws related to labor, medical waste, controlled substances, and animals relate to the profession of veterinary technology.
18. Name and describe laws that are specific to Canada regarding animals.

EXERCISE 1.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

5 The science and art of providing professional support to veterinarians. (two words)
6 Disciplinary actions carried out by the veterinary medical board.
7 A member of the veterinary health care team who may prognose, diagnose, and prescribe.
9 The acronym for a veterinary technician association that has written the code of ethics and the veterinary technician oath.
12 The acronym for a veterinary technician association that represents the joining together of seven provincial associations.
14 The primary state law or statute written and passed by the legislature to govern the practice of a profession in that state. (two words)
15 A member of the veterinary health care team with a higher level of skill in a particular discipline of veterinary technology. (three words)
16 Conclusions drawn from patient assessment and analysis of the database. (two words)

Down

1 The process carried out by veterinary technicians when assessing, caring for and reevaluating animal patients, which provides a methodology for providing consistently excellent patient care. (four words)
2 In most states, a passing score on this test is required to become an LVT, CVT, or RVT.
3 A member of the veterinary health care team with an AS degree, who completes all patient care duties except those exclusive to the practice of veterinary medicine. (two words)
4 An action planned and implemented by the veterinary technician to address a patient's reaction to illness, risk of future problems, and owner knowledge deficit. (two words)
8 Mandates written by the state board. (three words)
10 A member of the veterinary health care team with a BS in veterinary technology. (two words)
11 A member of the veterinary health care team who may be trained on the job. (two words)
13 The "father" of veterinary technology.

EXERCISE 1.2 MATCHING #1: IMPORTANT EVENTS IN THE HISTORY OF VETERINARY TECHNOLOGY (SEE TIMELINE IN THE FRONT MATTER OF THE TEXTBOOK)

Instructions: Place the 16 listed events in the proper chronological order (least recent to most recent) by placing the appropriate letter in the space provided on the left. Then, in the space on the right, place the year that each event occurred.

Column A

	Event	**Year**
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____
6.	_____	_____
7.	_____	_____
8.	_____	_____
9.	_____	_____
10.	_____	_____
11.	_____	_____
12.	_____	_____
13.	_____	_____
14.	_____	_____
15.	_____	_____
16.	_____	_____

Column B

A. The first specialty in veterinary technology is established (the Academy of Veterinary Emergency and Critical Care Technicians).

B. The AVMA Advisory Committee on Animal Technicians urges all state veterinary medical associations to establish advisory committees on animal technicians.

C. A group of eight students graduate from the SUNY at Delhi animal technician program. (This represents the first group of graduates from an animal technician program.)

D. NAVTA adopts a national code of ethics for veterinary technicians.

E. The Committee on Accreditation of Training for Animal Technicians (CATAT) is formed by the AVMA to accredit training programs for animal technicians.

F. Walter Collins, DVM, receives federal funding to develop model curricula for training veterinary technicians.

G. The Canadian Association of Animal Health Technicians (CAAHT) is formed.

H. The first professional journal for veterinary technicians, *Methods: The Journal for Animal Health Technicians,* is published.

I. The first Animal Technician National Exam (predecessor to the VTNE) is given in Maine.

J. The AVMA accredits the first distance-learning program in veterinary technology.

K. The North American Veterinary Technician Association (NAVTA) is organized.

L. The first two programs are accredited by the AVMA (Michigan State University and Nebraska College of Technical Agriculture).

M. Members of the Ontario Association of Veterinary Technicians (OAVT) in Canada passed bylaws establishing it as the first self-regulating group in the profession of veterinary technology.

N. The AVMA House of Delegates approves the use of the term *veterinary technician,* which replaces animal technician.

O. NAVTA creates the Committee on Veterinary Technician Specialties (CVTS) to oversee the development of veterinary technician academies.

P. In December, the premier issue of *The NAVTA Journal* is released.

EXERCISE 1.3 MATCHING #2: ACRONYMS RELATED TO ASSOCIATIONS, AGENCIES, AND COMMITTEES

Instructions: Match each acronym in column A with the corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ AALAS
2. _____ CVMA
3. _____ AAVSB
4. _____ CAAHTT
5. _____ ACC
6. _____ CALAS
7. _____ IACUC
8. _____ AVTE
9. _____ CVTEA
10. _____ USFWS

Column B

A. The committee that accredits Veterinary Technology Programs in the United States under the auspices of the AVMA.

B. A Canadian association dedicated to advancing the knowledge, skills, and status of those who work with laboratory animals.

C. The agency that coadministers the Endangered Species Act in the United States.

D. An association dedicated to strengthening the Animal Health Technologist/ Veterinary Technician profession in Canada.

E. Organization that accredits Veterinary Technology Programs in Canada.

F. A committee that works with research and educational institutions in the United States to help ensure compliance with and to enforce the Animal Welfare Act.

G. A professional association in the United States that is dedicated to the humane care and treatment of laboratory animals.

H. A group whose members are primarily instructors, staff, and managers of Veterinary Technology Programs.

I. Organization responsible for appointing members of the Veterinary Technician National Exam Committee (VTNE).

J. A committee that oversees the care and use of animals in education and research in Canada.

EXERCISE 1.4 MATCHING #3: ACRONYMS RELATED TO CERTIFICATIONS, LAWS, AND OTHER ENTITIES

Instructions: Match each acronym in column A with the corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ RACE
2. _____ ALAT
3. _____ VTS
4. _____ MLAT
5. _____ LATG
6. _____ AWA
7. _____ LAT
8. _____ VTNE
9. _____ HPA
10. _____ PES

Column B

A. The second highest level of certification for technicians caring for laboratory animals in the United States.

B. A designation that a veterinary technician has the credentials to qualify as a specialist.

C. The highest level of certification for technicians caring for laboratory animals in the United States.

D. A program administered by the AAVSB to uphold quality standards of continuing education.

E. An entity that works with the AAVSB to develop the Veterinary Technician National Exam.

F. The U.S. law that governs the humane treatment of animals in education and research.

G. A law designed to protect horses from the practice of “soring”.

H. The first level of certification for technicians caring for laboratory animals.

I. The highest level of certification for technicians caring for laboratory animals in Canada.

J. A passing score on this test is required to practice in most states and provinces.

EXERCISE 1.5 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If the statement is false, correct the statement to make it true.

1. _____ Graduates of accredited Canadian Veterinary Technology programs are eligible for recognition in the United States.

2. _____ Most states and provinces require veterinary technicians to attend continuing education (CE) lectures and workshops to maintain licensure, certification, or registration.

3. _____ An additional 25 new questions are added to each VTNE, but these additional questions do not count toward the final score of the candidate.

4. _____ Veterinary technicians are prohibited from entering drug prescriptions onto the patient's record.

5. _____ According to the American Association of Veterinary State Boards (AAVSB) Veterinary Technology State Practice Act Model, a veterinary technician may provide a patient's chances of recovery to a client.

6. _____ Routine dental procedures are often performed by veterinary technicians.

7. _____ At the time of this writing, there are 38 veterinary colleges in the United States.

8. _____ Most U.S. educated veterinarians have completed at least 8 years of post-high school study.

9. _____ In order to call themselves a specialist, a veterinarian must be board certified by a specialty organization.

10. _____ Because animals are often messy, uniforms are uncommon in small animal veterinary practices.

11. _____ The veterinary technician's professional apparel must include a watch with a second hand.

12. _____ The medical record is a legal document owned by the client but housed at the veterinary practice or supervising institution.

13. _____ Your email address does not reflect on your level of professionalism.

14. _____ All states regulate the practice of veterinary medicine, but not all of them regulate veterinary technology.

15. _____ The unlicensed practice of veterinary medicine is a criminal offense.

16. _____ Violations of laws or regulations may be punishable by fines or imprisonment.

17. _____ Someone convicted of crimes of moral turpitude may be denied a license to practice veterinary technology.

18. _____ Most jurisdictions require professional licensees, including veterinary technicians, to complete continuing education to renew their licenses.

19. _____ In virtually every state, a licensee may be prosecuted and disciplined for misconduct, even if the licensee's misconduct did not cause any harm to an animal.

20. _____ It is legal for a veterinary technician to sign a form for the veterinarian that the veterinarian is required to sign if requested.

21. _____ A licensee may be prosecuted and disciplined for misrepresentation, which may include telling a client that a certain treatment will cure a patient.

22. _____ A licensee may be prosecuted and disciplined for animal abuse, animal neglect, or animal cruelty.

23. _____ An unlicensed veterinarian may function as a veterinary technician.

24. _____ Any licensed person who assists an unlicensed person in performing tasks that the statute includes as the practice of the profession may be aiding unlicensed practice.

25. _____ Many states have continuing education requirements for veterinary technicians.

26. _____ If a licensee is found guilty of malpractice, the board can direct a monetary award be paid to the animal's owner.

27. _____ The patient does not have to suffer any injury for the professional to be disciplined for malpractice.

28. _____ Veterinarians can also be found negligent or guilty of malpractice because of the actions of a staff member.

29. _____ Whenever a veterinary technician is disciplined by a licensing board for exceeding the technician's authorized scope of practice, the veterinarian responsible for supervising the technician may also be disciplined.

30. _____ If you are summoned to a disciplinary hearing by the board, they must appoint an attorney to represent you.

31. _____ The Occupational Safety and Health Act confirms that all workers have a fundamental right to a safe workplace.

32. _____ Veterinarians are prohibited from using controlled substances in practice of veterinary medicine.

33. _____ Private veterinary hospitals are inspected by the USDA under the Animal Welfare Act.

EXERCISE 1.6 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. Which organization or agency accredits veterinary technology programs in the United States?
   a. State boards
   b. NAVTA
   c. AVMA
   d. AAHA

2. As of 2012, approximately how many accredited veterinary technology programs are there?
   a. 51 to 100
   b. 101 to 150
   c. 151 to 200
   d. over 200

3. Which organization or agency has established veterinary technician specialties?
   a. State boards
   b. NAVTA
   c. AVMA
   d. AAHA

4. What was the average salary for veterinary technicians nationwide in 2010?
   a. $18,500
   b. $22,500
   c. $30,580
   d. $40,500

5. Approximately how many recommended and essential tasks are listed in the CVTEA handbook?
   a. 250
   b. 350
   c. 450
   d. 550

6. Who writes the VTNE questions?
   a. AVMA
   b. PES
   c. AAVSB
   d. VTNE committee

7. What is the format of the VTNE?
   a. Essay questions
   b. Multiple choice questions
   c. Short answer questions
   d. Short answer and multiple choice questions

8. Where are the VTNEs administered?
   a. Veterinary technology schools
   b. Veterinary schools
   c. Board of Veterinary Medicine auditoriums
   d. Prometric Testing Centers

9. To whom does a veterinary technology student apply to take the VTNE?
   a. AAVSB
   b. AVMA
   c. State Board of Veterinary Medicine
   d. PES

10. Which of the following merits the highest priority in patient intervention?
    a. Chronic pain
    b. Acute pain
    c. Inadequate oxygenation
    d. Diarrhea

11. Which U.S. veterinary school awards the VMD degree rather than the DVM?
    a. University of Virginia
    b. University of Georgia
    c. Tufts University
    d. University of Pennsylvania

12. What is the term used for veterinary technician specialist organizations?
    a. Academy
    b. College
    c. Board
    d. Society

13. Animals used in research facilities and teaching institutions are registered by which government agency?
    a. AVMA
    b. USDA
    c. HSUS
    d. Board of Veterinary Medicine

14. Graduates of AVMA and CVMA accredited programs must complete how much additional training in a registered facility before they are eligible for the level one ALAT examination?
    a. 2 years
    b. 1 year
    c. 6 months
    d. 90 days

15. Which of these organizations wrote the veterinary technician code of ethics, the veterinary technician oath, and the veterinary technician portion of the model practice act?
    a. AVMA
    b. CVTEA
    c. NAVTA
    d. AALAS

16. When is National Veterinary Technician week?
    a. The first week in November
    b. The third week in October
    c. The second week in May
    d. The second week in February

17. Who has the ultimate decision-making authority over the care provided to an owned animal?
    a. The attending veterinarian
    b. The state
    c. The owner
    d. The veterinary technician

18. What is the overriding purpose of the board of veterinary medicine?
    a. To protect the public
    b. To protect the animals
    c. To protect the veterinary profession
    d. To protect the veterinary and veterinary technology professions

19. Malpractice is also known as _____.
    a. Unprofessional conduct
    b. Negligence
    c. Misrepresentation
    d. An illegal act

20. Conduct that increases the risk that negligence will occur, even if negligence has not yet actually occurred, is known as _____.
    a. Malpractice
    b. Unprofessional conduct
    c. Incompetence
    d. Practicing beyond the scope of veterinary medicine

21. What is considered the most severe penalty a board may impose?
    a. Revocation of a license
    b. Monetary fine
    c. Imprisonment
    d. Closing of the hospital

22. What is the term for the public censure of a licensee without suspension or probation?
    a. Ridicule
    b. Dunking
    c. Prohibition
    d. Reprimand

23. Which act establishes that licensees have an IACUC?
    a. Animal Welfare Act
    b. Occupational Safety Act
    c. Controlled Substance Act
    d. Medical Waste Tracking Act

24. The Horse Protection Act protects horses against which procedure?
    a. Slaughter
    b. Soring
    c. Castration without anesthesia
    d. Nerving

25. Which government agency enforces the Endangered Species Act?
    a. USDA
    b. DEA
    c. Commerce Dept
    d. USFWS

EXERCISE 1.7 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 1.8 CASE STUDY: PROFESSIONAL ETHICS

1. You moved to a small town in a state that requires veterinary technicians to be licensed by the board. You secure a job in a two-veterinarian clinic with no other LVTs and obtain a license. You spend the first week shadowing the veterinarians in the examination rooms with clients and assisting with canine and feline spays. They appear to practice quality medicine and surgery. The next week you are left alone in the treatment area to collect samples, perform lab tests, and administer medications. You notice that an assistant is taking dogs and cats in and out of a room in the rear of the clinic, and when you walk in, you find someone you have not met performing castrations. When you ask the assistant you are told that, although he is not a veterinarian, he has worked at the practice for more than 25 years and has always done neuters there.

   a. How should you respond to this situation?

   b. You are still in your probationary period. Should you say anything to the veterinarians?

   c. What are your legal and/or ethical responsibilities in this situation?

EXERCISE 1.7 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. How do the duties of a veterinary technician differ from a human nurse?

2. What careers other than private veterinary practice are available to veterinary technicians?

3. What employment benefits do veterinarians often offer veterinary technicians?

4. What are some of the reasons for the high rate of attrition of veterinary technicians?

5. What is the NCVEI and how is this organization working to decrease the number of veterinary technicians leaving the profession?

6. Summarize the process of accreditation of a veterinary technology program by the CVTEA. Include each of the following points:

   a. What four general aspects of the program are addressed in the 11 essential criteria?

   b. How often do reports need to be submitted, and how is the frequency of submission determined?

   c. The accrediting body makes recommendations to each program. What are the three major categories these recommendations fall into, and on what are these recommendations based?

7. How do distance education programs in veterinary technology differ from the more traditional on-campus programs in terms of each of the characteristics listed below?

   a. The methods of delivery of course content.

   b. The level of difficulty.

   c. The types of students best served by each type of program.

   d. The main reasons that many distance education programs require that students work in a veterinary practice while completing the online course work.

8. Describe the VTNE including the number of questions on the test, the seven primary domains, when and where the examination can be taken, and how the candidate knows he or she passed.

9. Veterinary Technology is considered to be a profession. What six characteristics distinguish a profession from any other occupation?

   i. _____

   ii. _____

   iii. _____

   iv. _____

   v. _____

   vi. _____

10. The veterinary technician practice model provides a structured approach to patient assessment, analysis of patient data, and the development of individual patient care plans that are uniquely tailored to each patient. It consists of the five steps listed below. In the spaces provided, briefly explain the purpose for each.

    Step 1: Gather data about the patient.

    Step 2: Identify and prioritize patient evaluations.

Step 3: Develop and implement a plan for patient care by establishing a series of technician interventions.

Step 4: Evaluate the patient's response to the plan of care.

Step 5: Gather additional data.

11. What is the difference between objective and subjective data that the veterinary technician needs to acquire when assisting the veterinarian in gathering an initial database?

12. According to the AVMA, AAVSB, and many state boards of veterinary medicine, what four tasks related to the care and treatment of patients may only be performed by veterinarians?

    a.

    b.

    c.

    d.

13. In a veterinary hospital with full lab capabilities, which tests may be run by veterinary technicians?

14. What are the ways that hospital staff personnel protect themselves from harmful radiation in the veterinary hospital?

15. In many veterinary practices, the veterinary technician is responsible for induction and maintenance of anesthesia. What specific tasks are involved in the induction and maintenance of anesthesia?

16. What are the 10 areas of specialty currently available in veterinary technology?

i. _____

ii. _____

iii. _____

iv. _____

v. _____

vi. _____

vii. _____

viii. _____

ix. _____

x. _____

17a. What is AALAS and CALAS?

AALAS: _____

CALAS: _____

17b. What role do these organizations play in the veterinary technology profession?

_____

_____

_____

_____

_____

_____

18. What are the 11 guiding principles included in the Veterinary Technician's Code of Ethics?

i. _____

ii. _____

iii. _____

iv. _____

v. _____

vi. _____

vii. _____

viii. _____

ix. _____

x. _____

xi. _____

19. What is the major difference between veterinary laws and regulations?

_____

_____

_____

_____

_____

_____

20a. What is the nature of the sanctions or penalties that a board of veterinary medicine may impose on a licensee who violates the regulations?

20b. How does this differ from the sanctions or penalties imposed on a licensee who violates the practice act?

21. How can the public affect the practice of veterinary medicine?

22. What is the difference among certified, registered, and licensed veterinary technicians?

23. What is meant by the term *crimes of moral turpitude*?

24. Give three examples of technical violations of a veterinary practice act.

    i. _____

    ii. _____

    iii. _____

25. What would be considered substantive violation of a veterinary practice act?

_____

_____

_____

_____

_____

_____

_____

_____

_____

26. State veterinary medical boards often require a level of supervision by a veterinarian for a veterinary technician to perform any particular task. The NAVTA Model Rules and Regulations for Veterinary Technicians include three levels of supervision. How do direct, indirect, and immediate supervision differ?

    Immediate supervision: _____

    _____

    Direct supervision: _____

    _____

    Indirect supervision: _____

    _____

27. What is the ultimate safeguard against being found guilty of a deviation from or failure to conform to the acceptable standards of practice?

_____

_____

_____

28. Professionals licensed by the veterinary medical board may be prosecuted and disciplined for incompetence. List three examples of incompetence in a veterinary hospital.

    i. _____

    _____

    ii. _____

    _____

    iii. _____

    _____

29. What constitutes a hostile work environment?

    _____

    _____

    _____

    _____

    _____

    _____

30. What is considered medical waste from a veterinary hospital?

    _____

    _____

    _____

    _____

31. Which animals are protected under the Animal Welfare Act?

    _____

    _____

    _____

32. In Canada, there are government and nongovernment agencies that serve different functions in regards to enforcement of laws relating to animal welfare. In the spaces provided, indicate the primary function of each agency.

    a. Canadian Food Inspection Agency (CFIA)

    b. The National Farm Animal Care Council (NFACC)

2 Veterinary Practice Management

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, spell, and define each of the Key Terms in this chapter.
2. List the terms used to describe various types of veterinary facilities.
3. List the roles and responsibilities of each member of the veterinary health-care team.
4. Describe the basic flow of clients, patients, and employees through a typical veterinary hospital.
5. Outline the key elements of effectively working with clients, including the importance of communication skills, myths about communication skills, and how to diffuse the anger of difficult clients.
6. Describe the major job management functions needed to effectively run a veterinary hospital.
7. Describe the components of a comprehensive business model.
8. Describe the primary components of excellent practice management.
9. List examples of stressors in the veterinary workplace, and describe ways to ameliorate the effects of those stressors on personnel.
10. Describe the major areas in which veterinary practices employ internal and external marketing techniques.
11. List some of the major tasks associated with good financial management.
12. List reasons why management and financial analysis are important to the business of veterinary medicine.
13. Discuss the importance of efficient operations for practice revenue.
14. Discuss key areas in which computerization adds to the efficiency and productivity of a veterinary practice.

EXERCISE 2.1 DEFINITIONS

Instructions: Define each Key Term in your own words.

1. Traffic flow: _____

2. Outpatient: _____

3. Strategic planning: _____

4. Walk-in system: _____

5. Appointment system: _____

6. Consultation: _____

_____

7. NCVEI: _____

_____

8. AAHA: _____

_____

9. CVPM: _____

_____

EXERCISE 2.2 MATCHING #1: KEY TERMS AND DEFINITIONS RELATED TO FINANCES

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Cash flow
2. _____ Accounts receivable
3. _____ Petty cash
4. _____ Net income
5. _____ Profits
6. _____ Gross revenue

Column B

A. Money owed to the practice by the client for the sale of goods and services.

B. The total money taken in by a practice before subtracting expenses incurred.

C. The amount of money left over after all business expenses are subtracted from the gross revenue.

D. The measurement of the amount of money coming into and going out of a practice.

E. The total amount of money brought in by a practice minus all expenses incurred and taxes paid.

F. A small amount of discretionary funds that are used to make small purchases for which it is not practical to write a check or use a credit card.

EXERCISE 2.3 MATCHING #2: KEY TERMS AND DEFINITIONS RELATED TO VETERINARY FACILITIES

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

Match the term with the definition.

1. _____ On-call emergency service
2. _____ Veterinary teaching hospital
3. _____ Haul-in facility
4. _____ Specialty facility
5. _____ Hospital
6. _____ Mobile facility
7. _____ Referral facility
8. _____ Emergency facility
9. _____ Office
10. _____ Clinic

Column B

A. A facility in which the practice conducted may include inpatient as well as outpatient diagnosis and treatment.

B. A practice that conducts its work from a vehicle that can make farm or house calls.

C. A facility that consists of a large staff of DVMs who provide clinical and hospital services, but who also perform significant research, along with educating professional veterinary students.

D. A facility that is set up to allow large animals to be brought to the practice for examination or treatment.

E. A facility in which the practice conducted typically includes inpatient as well as outpatient diagnosis and treatment.

F. A facility in which veterinarians with a special interest in a specific species or area of veterinary medicine provide services.

G. A practice that is limited in the service it provides as they do not have the facilities to perform inpatient diagnostics or treatment.

H. A facility in which the primary function is to treat and monitor critically ill or injured animals.

I. An option provided by some veterinary facilities that will treat emergencies but do not necessarily have veterinarians and staff on the premises during all operating hours.

J. A facility where services are provided by board certified veterinary specialists.

EXERCISE 2.4 MATCHING #3: EMPLOYEE POSITIONS

Instructions: Match each job duty in column A with the name of the veterinary personnel who would perform each duty (in a well-run practice) in column B by writing the appropriate letter in the space provided. Each answer can be used more than once.

Column A

1. _____ Basic animal husbandry
2. _____ Performing surgery
3. _____ Updating client and patient information
4. _____ Animal restraint
5. _____ Making appointments
6. _____ Patient assessment
7. _____ Client education
8. _____ Filling prescriptions

Column B

A. Veterinarian

B. Veterinary technician/technologist

C. Veterinary assistant

D. Receptionist

E. Kennel attendant

EXERCISE 2.5 MATCHING #4: MARKETING

Instructions: Indicate whether each of the following activities would be considered internal marketing or external marketing by writing an "I" for internal or an "E" for external in the space provided.

1. _____ Sending out vaccine reminders
2. _____ Sponsoring a Little League team
3. _____ Personal appearance of staff
4. _____ Sincere care for and concern about each client
5. _____ Creating a Facebook page for the practice
6. _____ Sending out newsletters
7. _____ Placing an advertisement in the Yellow Pages
8. _____ One-stop shopping
9. _____ A clean and attractive facility
10. _____ A sign outside the practice

EXERCISE 2.6 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ For a veterinary practice to be successful, most of the staff will play some type of role related to management.

2. _____ The types of staff positions that are needed will vary greatly depending on the size and type of practice.

3. _____ When it comes to naming veterinary facilities, the terms *hospital, clinic,* and *office* can be used interchangeably.

4. _____ When it comes to delegating tasks, the best-run clinics assign tasks to the lowest paid person who can legally and competently complete the task.

5. _____ In most well-run veterinary practices, job duties are performed by any staff member who is available to accomplish the task.

6. _____ Pet owners who have owned pets previously usually have a good understanding of the care their pet needs.

7. _____ A separate entrance and exit to the veterinary practice should be provided to make it easier for clients to enter and exit the practice.

8. _____ To save time during an appointment, it is okay to have a client restrain his or her own pet.

9. _____ If laboratory samples (e.g., blood, urine) need to be collected during an appointment, the patient should be taken to the treatment area.

10. _____ As long as clients wear the proper personal protective equipment, they can accompany their pet into the radiology suite.

11. _____ When discharging an animal and reviewing home care instructions with the client, it is best to have the client pay their bill before their pet is brought out to them.

12. _____ Anyone entering the operating room during a surgery should be wearing the appropriate clothes, shoes, cap, and mask.

13. _____ In a mixed-animal practice, the same examination rooms are used for large-animal and small-animal patients.

14. _____ Many larger equine practices have a single room used for anesthetic induction and anesthetic recovery.

15. _____ Job descriptions should be used for hiring new employees and for replacing existing employees.

16. _____ If an applicant submits a résumé and cover letter to a practice, there is no need to have them also complete a job application.

17. _____ When a practice hires a new staff member who has many years of experience from previous work at a different clinic, training is not necessary.

18. _____ Stress can be caused by both positive and negative life events.

19. _____ The terms *marketing* and *advertising* mean the same thing.

20. _____ The main goal of external marketing is to attract new clients to the practice.

21. _____ If a client does not respond to the first reminder they are sent, the practice should follow-up by sending a second reminder, and even a third reminder, if needed.

22. _____ Veterinary practices are relying less on the use of telephone Yellow Book advertisements as a marketing tool.

23. _____ Newspaper advertisements are a good marketing tool for a practice that is located in a larger metropolitan area.

24. _____ The money that a veterinary practice owes for the purchase of a new piece of equipment would be considered an asset of the practice.

25. _____ To insure that clients pay their bills in full at the time of service, clinics should not offer payment options to clients.

26. _____ If a pet is brought to the clinic with life-threatening injuries, the pet should be stabilized before a treatment plan/estimate is prepared.

27. _____ Pet insurance works in a similar manner to human health insurance.

28. _____ Ideally, physically counting the inventory in a veterinary practice should be done once a year.

29. _____ Some veterinary practices have completely eliminated paper medical records and replaced them with electronic medical records.

EXERCISE 2.7 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. Increased competition, new technology, increasing numbers of malpractice threats, and shifting client expectations have
   a. Caused many veterinary practices to go out of business
   b. Made it more difficult to manage a veterinary practice
   c. Caused a significant drop in client compliance
   d. Caused many veterinary practices to hire more staff

2. In a typical veterinary practice, the person who acts as the CEO and delegates areas of responsibility is usually the
   a. Financial manager
   b. Veterinarian-owner
   c. Hospital administrator
   d. Practice manager

3. When it comes to practice management positions, individuals who are typically responsible for all activities of the practice and run the hospital in conjunction with the practice's owner(s) would be referred to as the
   a. Office manager
   b. Practice manager
   c. Hospital administrator
   d. Associate veterinarian

4. The best way to insure that all of the major pieces of equipment in a veterinary practice are cleaned and maintained on a regular basis is to
   a. Assign each member of the team a specific piece of equipment to clean and maintain
   b. Make sure that every member of the team takes part in equipment cleaning and maintenance during down times
   c. Hire an outside vendor to clean and maintain the equipment as most of it is very complex and expensive
   d. Assign one person in the practice to clean and maintain all of the equipment on a regular basis

5. To minimize the amount of time clients have to wait in the reception area, there should be _____ examination rooms available for each veterinarian working on a particular day.
   a. One
   b. Two
   c. Three
   d. Four

6. Placement of the laboratory and pharmacy in a central location is very important because
   a. They can be used in place of an examination room during busy periods
   b. They are often used for both outpatients and hospitalized patients
   c. They are both important profit centers for the practice
   d. This is where the material safety data sheets should be located

7. Practices need to get the maximum use out of their storage area because
   a. This space is usually cluttered and disorganized
   b. The practice must have enough inventory on hand to meet their clients' needs
   c. This space typically generates very little income
   d. It will reduce the chance that inventory becomes outdated

8. It is more common to perform a necropsy when a large animal dies than when a small animal dies because
   a. There is a need to determine if the rest of the herd is threatened
   b. Large animals are a lot more expensive to replace than small animals
   c. When a large animal dies, the owners are more likely to file a lawsuit against the practice
   d. Most small animal owners cannot afford to pay for a necropsy if their pet dies

9. A client's judgment regarding the quality of medicine provided at a veterinary practice is generally based on
   a. The cost of the care provided
   b. The amount of time the doctor spends with them
   c. The health status of their pet
   d. The level of service the client receives

10. One of the most common selection criteria used by clients when choosing a veterinary practice is
    a. The fees charged
    b. The location
    c. The number of staff
    d. The hours of operation

11. Complaints against veterinary practices are usually caused by
    a. Long wait times in the examination room and/or reception area
    b. The staff or DVM making a medical mistake
    c. The fees charged
    d. Ineffective communication

12. Which one of the following practices should be the most successful when it comes to annual strategic planning for the practice?
    a. The practice in which all staff are involved in the planning
    b. The practice in which the owner does all the planning
    c. The practice in which the management team does all the planning
    d. The practice in which the manager and doctors do all the planning

13. A document that is a visual representation of how authority and responsibility flow between the various areas of the practice or practice staff is called a(n)
    a. Job description
    b. Business plan
    c. Organizational chart
    d. Employee manual

14. When it comes to determining compensation for an employee, it is best to base the employee's pay on
    a. Performance
    b. Seniority
    c. Experience
    d. Education

15. One of the most important reasons for holding regular employee evaluations is to
    a. Reprimand the employee for not following practice protocols
    b. Judge whether or not the employee's goals were met
    c. Determine if the employee deserves a raise
    d. Improve the employee's performance

16. Which one of the following statements is the most accurate when it comes to describing what marketing is for a veterinary practice?
    a. Any effort the practice makes to increase sales and generate a profit
    b. Any effort the practice makes to retain or obtain clients and make the practice more visible in the community
    c. Advertising the services the practice offers using tools such as Yellow Book pages and an Internet website
    d. Any effort the practice makes to offer new and different products and services to existing and new clients

17. When it comes to the sales of products such as pet food, the veterinary practice is at an advantage over feed stores and grocery stores because
    a. The veterinary clinic usually offers a wider selection than other stores
    b. Practice employees can educate clients about the food they purchase
    c. The pet food sold at a veterinary practice is usually higher quality
    d. The veterinary practice has a lower overhead

18. When it comes to a veterinary practice's website, it is important that
    a. The website generates a return on investment
    b. An outside professional is hired for development
    c. The website is updated on a regular basis
    d. Commonly phone-shopped fees are listed on the website

19. One of the financial tasks that many practices won't do on their own is
    a. Establish KPIs
    b. Determine profitability
    c. Calculate the practice's net worth
    d. Prepare a yearly tax return

20. A financial report that lists a practice's assets and liabilities is called a(n)
    a. Balance sheet
    b. Net worth statement
    c. Profit and loss statement
    d. Income statement

21. A financial report that is used to evaluate the financial performance of a practice for a specified period of time is called a(n)
    a. Profitability statement
    b. Cash flow statement
    c. Net revenue statement
    d. Income statement

22. When determining the financial success of a veterinary practice, the _____ is the most important indicator.
    a. Average transaction charge
    b. Gross revenue
    c. Profitability
    d. Net revenue

23. One of the main reasons for why inventory management is so important in a veterinary practice is because
    a. Inventory is a significant expense for a practice
    b. Inventory accounts for most of the revenue generated by a practice
    c. Extra inventory must be kept on hand to insure the practice never runs out of anything
    d. Most items kept in inventory have a slim profit margin

EXERCISE 2.8 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 2.9 CASE STUDY #1: VETERINARY PRACTICE MANAGEMENT

You are the head credentialed veterinary technician in a small animal private practice and are in charge of supervising all of the veterinary assistants. This includes hiring, training, and disciplining the veterinary assistants that you supervise. The practice has only been open for a year and business has grown steadily to the point where some members of the staff are becoming overwhelmed. Because of this, you go to the hospital administrator to talk about adding an additional veterinary assistant position. The hospital administrator is supportive of this idea and charges you with the task of creating a job description for the new veterinary assistant position.

1. Create a short job description for a new veterinary assistant employee making sure that you include all six components of a well-written job description.

2. Now that you have a job description for the position, describe how you will go about attracting applicants.

3. You have invited several applicants to come in for a face-to-face interview. What three things should you obtain from the applicants when they come in for an interview that will help you obtain more detailed information about the applicant's skills and experience?

   Item #1 _____

   Item #2 _____

   Item #3 _____

4. As you are preparing to interview the applicants, you know there are some questions that are illegal to ask during a job interview. Give two examples of questions that cannot be asked of an applicant during the job interview.

5. Congratulations! After going through the application and interview process a decision was made to hire Jane Doe as the new veterinary assistant. Jane starts out great at the new clinic and seems to be really catching on, but after she has been there for about six months, you notice her attitude start to change from good to bad and she is starting to take too many days off work. She also seems to "fly off the handle" any time something doesn't go exactly as planned. What do you think could be the problem with Jane and how might you go about dealing with this problem?

EXERCISE 2.10 CASE STUDY #2: DIFFUSING ANGER

Cutie, a 12-year-old, female, spayed poodle mix was presented for a dental cleaning. A minimum patient database was acquired, and Cutie was prepared for the dental cleaning in a routine manner. The dental cleaning was performed, and during the course of the procedure, 15 teeth had to be extracted because of the advanced state of the periodontal disease. The client was not informed because the possibility of extractions was discussed at the pre-op interview.

When the owner found out about how many teeth had been removed, he became agitated and very angry, and said things like "she will never be able to eat normally now! It is all your fault!"

1. What could you do to diffuse this client's anger in this situation?

EXERCISE 2.8 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. There are six major areas in which practice management responsibilities can be divided. List four of these areas and give one example of a responsibility or task for each.

   Major area #1 _____

   Example _____

   Major area #2 _____

   Example _____

   Major area #3 _____

   Example _____

   Major area #4 _____

   Example _____

2. Jane is a credentialed veterinary technician who has worked at The Dog and Cat Veterinary Hospital for almost 10 years. Recently, the owner approached Jane about moving into a practice management position. Describe the possible advantages and disadvantages to Jane moving into this position.

   Advantages: _____

   _____

   _____

   _____

   Disadvantages: _____

   _____

   _____

   _____

3. Explain why it is so important to use correct titles in veterinary practice, especially when it comes to calling all animal care personnel "vet techs" regardless of their education, credential status, and skills.

   _____

   _____

   _____

   _____

   _____

   _____

4. List the four main areas in which professional activities within a hospital can be grouped and give one example of a specific part of the hospital that would be included in each main area.

   Main area #1 _____

   Specific parts of main area #1 _____

   _____

   Main area #2 _____

   Specific parts of main area #2 _____

   _____

   Main area #3 _____

   Specific parts of main area #3 _____

   _____

   Main area #4 _____

   Specific parts of main area #4 _____

   _____

5. The treatment area is sometimes referred to as the central hub of the hospital.

   a. Explain why this is the case: _____

   _____

   b. Give some examples of procedures typically performed in the treatment area:

   _____

   _____

   _____

   _____

6. To reduce the amount of dust and debris that enters the operating room, the air handling system should:

   _____

7. Sometimes prospective veterinary technician students pursue a degree in veterinary technology because they would "rather work with animals than people." Explain why this is not a valid rationale for pursuing such as degree.

   _____

   _____

   _____

8. Consider these statements: (1) Good communication with clients takes too much time to be worth the effort. (2) I've got lots of experience talking with clients, and so don't need to learn how. (3) There is no use trying to learn how to communicate well because you either have it or you don't. What is wrong with each of these statements?

   Statement #1: _____

   Statement #2: _____

   Statement #3: _____

9. Give one specific example of how a veterinary technician could effectively implement the communication components listed below when talking with a client or a co-worker.

   Clarity: _____

   Courtesy: _____

   Positive nonverbal communication: _____

   Open-ended inquiry: _____

Reflective listening: _____

Empathy: _____

10. Attention to each of the following tasks is important for good financial and practice management. Briefly indicate why each is important.

Bookkeeping and accounting: _____

Management analysis: _____

Budgeting: _____

Setting prices: _____

11. Explain why the ongoing management of practice employees is said to be a "two-way street."

12. Explain what "key performance indicators" (KPIs) are and why a practice uses them. Identify three specific key performance indicators and describe how a veterinary practice calculates them and uses them for practice assessment.

i. _____

ii. _____

iii. _____

13. Identify an item that is most likely to be stolen by practice employees and describe safeguards that the practice can put in place to deter employees from stealing inventory from the practice.

An item most likely to be stolen: _____

Safeguards against employee theft: _____

14. Discuss the ways in which use of a practice information management system (PIMS) improves practice efficiency and productivity in each of the following areas.

a. Medical records: _____

b. Patient scheduling: _____

c. Reminders: _____

d. Billing: _____

e. Inventory: _____

f. Accounts receivable: _____

g. Doctor production: _____

3 Veterinary Medical Records

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all Key Terms within this chapter.
2. List and describe the primary and secondary purposes of the medical record.
3. Explain the legal issues related to ownership of medical records, release of medical information, and maintenance of medical records.
4. Describe methods for formatting medical records and explain their respective advantages and disadvantages.
5. List and describe each component of the problem-oriented veterinary medical record (POVMR).
6. Explain each portion of the technician SOAP note, the types of information included in each portion, and describe how each portion correlates to the steps in the veterinary technician practice model (presented in Chapter 1).
7. Describe the importance of cage cards, discharge instructions, and summary and MAOR forms and why they are valuable in organizing the care of hospitalized veterinary patients.
8. Compare and contrast the types of filing systems commonly used for paper medical records.
9. List and describe the types of paper-based forms and logs commonly used in veterinary practice.
10. Explain the advantages and disadvantages of electronic medical record keeping.
11. Describe methods for collecting and storing medical information in ambulatory veterinary medical practices.
12. Explain how veterinary medical databases support the advancement of research in veterinary medicine.

EXERCISE 3.1 FILL-IN-THE-BLANK: KEY TERMS AND DEFINITIONS

Instructions: Fill in each of the spaces provided with the missing key term or definition that completes the sentence. Acronyms may be used when appropriate.

1. The physical folder for each veterinary patient and the total body of information that comprises each animal's health history is called the _____ _____.

2. Interaction between veterinarians and their clients and patients is conducted under the _____ _____ _____ _____, and medical records must be maintained for all patients with whom this relationship exists.

3. Through the use of the _____ veterinary medical record, an organized approach to clinical veterinary care is achieved, as information is grouped by problem, and each problem is assigned a number and addressed individually.

4. The _____ _____ veterinary medical record is a medical record format in which patient information is grouped by subject matter, clinical observations are entered as they become evident, and progress note paragraphs are written in chronologic order.

5. The _____ refers to the collective information that identifies an individual patient, such as the species, breed, gender, reproductive status, age, color, and distinctive markings.

6. Recorded information, such as a patient's date of birth, preventive medicine program, behavior, previous conditions, and known allergies, are included as part of the _____ _____ in a comprehensive medical record.

7. A structured system of documenting patient evaluation and assessment in the progress notes is called the _____ format.

8. Patient information, such as presenting complaint, current medications, location and character of problems, treatment efforts, and recent changes in the environment, may be included as part of the _____ _____ in a comprehensive medical record.

9. Major medical disorders experienced by a patient during its lifetime are included in the _____ _____ list, which serves as an index to the patient's medical history.

10. Veterinary practices will often use the _____ _____ list to assist the veterinary health-care team when working through current patient problems.

11. The ongoing daily management of hospitalized patients is documented in _____ _____ so that therapeutic treatment and plans may be evaluated and adjusted accordingly.

12. Hypothermia, altered mentation, inappropriate elimination, and risk of infection are examples of _____ _____ according to the veterinary technician practice model.

13. To ensure that a hospitalized patient is given the treatments, diagnostic tests, and diet requested by the veterinarian, the _____ or ward treatment sheet is used.

14. A national data bank, called the _____ _____ _____, contains computerized veterinary medical data supplied by 24 veterinary schools in the United States and Canada for studies of national trends in various animal diseases.

EXERCISE 3.2 MATCHING #1: TECHNICIAN SOAP NOTES

Instructions: Match each set of patient information with the appropriate component of technician SOAP progress notes by writing the appropriate letter in the space provided. Note that each answer can be used more than once.

Column A

1. _____ Temperature, weight, capillary refill time
2. _____ Awake, standing, wagging tail
3. _____ Limited daily exercise, cold compresses to injury
4. _____ Heart rate, respiratory rate, skin retraction time
5. _____ Cardiac insufficiency, hypotension, decreased perfusion
6. _____ Antibiotics prescribed, hypoallergenic diet, follow-up appointment
7. _____ Anxiety, acute pain, reduced mobility
8. _____ Lethargic, not eating well, lying in right lateral recumbency

Column B

A. Subjective
B. Objective
C. Assessment
D. Plan

EXERCISE 3.3 MATCHING #2: TECHNICIAN EVALUATIONS

Instructions: Match the clinical observations/assessments of a canine patient in column A with the appropriate Physiologic Need based on the Hierarchy of Patient's Physiologic Needs in column B.

Column A

1. _____ Bleeding gingiva, halitosis, difficulty chewing
2. _____ Body temperature of 94°F, acute abdominal pain, chemistry panel K+ = 1.2 mmol/L
3. _____ Anxious, fearful, displays submissive urination
4. _____ Deep sores caused by licking, scratching at ears; owner won't use an Elizabethan collar as directed
5. _____ Restless at night, gets up slowly, pants heavily when exercised
6. _____ Dyspnea, blue mucous membranes, oxygen level 89% on pulse oximetry
7. _____ Delayed recovery of skin tenting, weak peripheral pulse, tacky mucous membranes
8. _____ Moaning frequently, reluctant to move, tail tucked between legs
9. _____ Urinating in the house, urinating more frequently, unable to hold urine overnight

Column B

A. Priority 1 – Oxygenation
B. Priority 2 – Critical Safety and/or Severe Pain
C. Priority 3 – Hydration
D. Priority 4 – Elimination
E. Priority 5 – Nutrition
F. Priority 6 – Noncritical Safety
G. Priority 7 – Chronic Pain or Mild-Moderate Acute Pain
H. Priority 8 – Activity
I. Priority 9 – Utility

EXERCISE 3.4 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ The medical record can be used as a legal document in a court of law and can be of critical importance in defending against malpractice suits.

2. _____ Completed consent and authorization forms provide veterinary practices with legal evidence of informed consent and can be signed by a pet owner of any age.

3. _____ Entries in written records may be corrected using correction fluid, provided the entry is signed and dated by the person who made the error, with a brief explanation of the correction.

4. _____ Only approved, standard abbreviations should be used in medical record keeping.

5. _____ Veterinary medical records are the property of the pet owner because the client purchased the veterinary services that generated the medical information.

6. _____ The owner of an animal should not be required to sign an authorization form to obtain a copy of his or her pet's record for himself or herself.

7. _____ If a veterinarian diagnoses a reportable disease, permission from the client to release the patient's record must be obtained prior to alerting local, state, and federal agencies.

8. _____ When using source-oriented veterinary medical records, clinical observations are entered as they become evident so that the most recent information is located last.

9. _____ The American Animal Hospital Association (AAHA) endorses the use of problem-oriented medical record keeping for practices seeking AAHA certification.

10. _____ When recording physical examination results, abbreviations such as "BAR" and "WNL" should not be used because they may be interpreted differently by other veterinary health-care providers.

11. _____ The POVMR working problem list helps veterinarians and veterinary technicians think critically, identify and prioritize problems, and formulate an understanding of the patient's reactions to an illness.

12. _____ Medication administration/order records should include the patient's full name, patient I.D. number and/or signalment, and any known allergies that the patient may have.

13. _____ When documenting treatments on an MAOR, an "X" should be placed in the appropriate column at the time that the medication is administered to the patient.

14. _____ Medications given during surgical or anesthetic procedures should be entered on the MAOR along with all other medications that the patient receives.

15. _____ When using the alphabetic system of medical record filing, a major disadvantage is that a client cross-reference list must be generated and maintained.

16. _____ The American Animal Hospital Association requires that paper records for each patient should be stored in standard 8 × 10 inch folders.

17. _____ The primary medical record collection should include active records covering a 3-year period.

18. _____ A recommended practice for purging files is to remove and shred all records that have been inactive for 4 years or more.

19. _____ According to the Federal Comprehensive Drug Abuse and Control Act, an inventory of all controlled substances must be made on an annual basis.

20. _____ Controlled drugs that are considered the most addictive are in the Schedule V category.

21. _____ A necropsy log contains data regarding an animal's death, including the owner's name, species, name of the veterinarian performing the necropsy, histopathology, and gross findings.

22. _____ According to DEA regulations, Schedule II controlled drugs must be maintained in a separate inventory record.

23. _____ Records for Schedules III, IV, and V drugs may be combined into one log, but must be stored separate from other practice records.

24. _____ Electronic record entries made within the first 24 to 48 hours of patient care are regarded as the primary document.

25. _____ An accepted medical record-keeping practice for ambulatory practitioners is to make handwritten notes on carbonized invoice sheets that are loaded into a sturdy metal dispenser.

EXERCISE 3.5 SHORT ANSWER #1: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 3.6 SHORT ANSWER #2: PROBLEM-ORIENTED VETERINARY MEDICAL RECORDS (POVMR)

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 3.7 CASE STUDY: MUFFY—THE SHETLAND SHEEPDOG

Please read the Case Presentation 3-1 in the main textbook about "Muffy," the Shetland sheepdog, and answer the following questions regarding the progress notes and the discharge instructions.

1. Examine Dr. Feather's notes from August 1st. Summarize Dr. Feather's findings using language a client could understand.

2. On the day Muffy was admitted to the hospital for surgery, had her health changed since the previous week? How do you know?

3. What general observations did the CVT Sarah Pace have about Muffy later in the day?

4. Compare and contrast Dr. Feather's findings and Sarah's findings on August 7th. How could these two perspectives be used to maximize the quality of Muffy's care?

5. Topic for Discussion: Finally, look at the discharge instructions from the client's perspective. Is there enough detail so that you would know exactly what to do to care for Muffy until her sutures are removed? Do you understand the reasons for each aspect of the homecare plan? Are there any suggestions you would have for changing the instructions?

EXERCISE 3.5 SHORT ANSWER #1: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. The Institute of Medicine has organized the functions of the medical record into two broad categories or "purposes." The two primary purposes of the medical record are (a) to support excellent medical care, and (b) to document communication with clients.

   a. In what ways does a medical record support excellent medical care? Give several specific examples.

   b. Why is it important to document communications with a client?

   c. What are the two secondary purposes of the medical record?

      i. _____

      ii. _____

2. Why is it important legally for a veterinary practice to keep medical records that are complete, accurate, and legible?

3. Pet owners often complain that veterinary services were delivered without authorization, or were authorized but misunderstood. To avoid this, it is important for practices to demonstrate "informed consent."

   a. What is required for consent to be considered "informed"? In other words, about what specific points must the client be informed?

b. How should you document client consent given over the phone?

4. Consent and authorization forms provide written documentation that an understanding exists between veterinary practices and pet owners. Why is it important to obtain completed authorization or consent forms during situations such as client emergencies and/or euthanasia?

5a. Describe the appropriate method of making a handwritten entry into a medical record so that it is clear, complete, and accurate.

5b. What should you do if, while completing an entry in a medical record, you make an error?

6. A veterinary client makes a written request for a copy of their pet's medical record to be released to a third party.

   a. What document should be obtained from the owner prior to releasing the information?

   b. Who should authorize the release of information contained in the medical record?

7. Compare and contrast the alphabetical filing system with the numerical filing system commonly used in veterinary practices for paper medical records. Include information about color coding, and the problems of misfiling and duplicate records.

   Alphabetical filing systems:

Numerical filing systems: _____

8. Explain how the management of livestock medical records by food animal veterinarians differs from management of small animal medical records.

9. In addition to documents contained in the patient medical record, other medical information is continuously maintained using logs located throughout the hospital. What are the two purposes of using logs?

   a. _____

   b. _____

10. Explain why a radiology log is particularly helpful for veterinary technicians when performing radiographs.

11. Which two types of veterinary logs contain similar information and are often combined into one log?

12. What are five advantages that electronic medical record keeping offers over standard paper-based record keeping?

    a. _____

    b. _____

    c. _____

    d. _____

    e. _____

EXERCISE 3.6 SHORT ANSWER #2: PROBLEM-ORIENTED VETERINARY MEDICAL RECORDS (POVMR)

Instructions: Provide a short answer to each of the following questions in the space provided.

1. In what way does the POVMR provide a more organized approach to clinical veterinary care than a SOVMR?

2. Although the POVMR includes SOAP notes that may be written by both veterinarians and veterinary technicians, the focus of their assessments is different. How does the focus of these assessments differ?

3. What are the four general components most commonly included in the POVMR?

   i. _____

   ii. _____

   iii. _____

   iv. _____

4. The working problem list is an important component of the POVMR that helps the veterinary health-care team work through current problems. Explain the difference between the master problem list and the working problem list.

5. Why is the working problem list helpful to the veterinarian and veterinary technician?

6. The POVMR may include a Medication Administration/Order record (MAOR) to assist the veterinary health-care team carry out treatment orders of hospitalized patients efficiently. Describe the general format used and summarize the types of information that should be included on MAORs.

7. The plan for patient care is an accumulation of interventions developed by the veterinary technician for each evaluation listed in the assessment portion of the SOAP.

   a. What is the ultimate goal of developing a patient care plan?

   b. Give several examples of the general types of interventions that would be considered part of the care plan.

8. POVMR discharge instructions provide pet owners with the information and resources to continue any prescribed homecare and monitoring of their pet. Summarize the information and procedures that should be included when discharging a hospitalized patient, so that a desirable outcome for both the patient and owner may be achieved.

4 Occupational Health and Safety in Veterinary Hospitals

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, spell, and define all Key Terms in the chapter.
2. Do the following regarding safety in the veterinary hospital:
   - Explain the acronym OSHA and describe the role it plays in the development of safety programs in veterinary practices.
   - List the safety rights and responsibilities of *employees* in the workplace.
   - List the safety rights and responsibilities of workplace *leaders*.
3. List common workplace hazards in a veterinary facility and describe precautions that can be taken to reduce the risk of these hazards. Also do the following:
   - Explain proper methods for lifting objects and animals.
   - List hazards associated with the use of ethylene oxide, formalin, glutaraldehyde, anesthetic gases, and compressed gases.
   - Describe the requirements of the OSHA "right to know" law.
   - Explain the acronym MSDS and describe the components of an MSDS.
4. Do the following regarding medical and animal-related hazards:
   - List hazards related to the capture and restraint of small and large animals.
   - Explain risks associated with excessive noise and methods taken to minimize these risks.
   - Describe hazards related to bathing and dipping animals and explain methods to minimize these risks.
   - Define the term *zoonotic disease* and list zoonotic and nonzoonotic diseases commonly encountered in veterinary practices.
5. Explain the importance of wearing goggles, gloves, and a surgical mask when performing dental procedures on animals.
6. List methods to minimize the risks associated with exposure to radiation, anesthetic gases, and medical waste.
7. List the equipment and supplies needed to protect veterinary personnel when handling hazardous pharmaceuticals such as chemotherapeutic drugs and describe methods for safely handling contaminated bedding and waste from oncology patients.

EXERCISE 4.1 MATCHING #1: KEY TERMS – INFECTIOUS AGENTS

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ *Giardia*
2. _____ Lyme disease
3. _____ Panleukopenia
4. _____ Parvoviral enteritis
5. _____ Rabies
6. _____ Ringworm
7. _____ Sarcoptic mange
8. _____ Toxoplasmosis

Column B

A. A zoonotic viral disease that can affect any warmblooded animal; spread by contact with saliva.

B. A condition of dogs caused by a highly infectious agent.

C. A tick-transmitted condition caused by *Borrelia burgdorferi*.

D. This zoonosis can cause hydrocephalus and mental retardation by affecting the human fetus.

E. A protozoan; can be contracted by drinking contaminated water.

F. A skin condition caused by a mite of zoonotic concern.

G. A highly contagious viral disease that infects cats but not dogs.

H. A zoonotic skin condition caused by the agent *Microsporum* sp.

EXERCISE 4.2 MATCHING #2: KEY TERMS – ACRONYMS

Instructions: Match each acronym in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ CDs
2. _____ MSDS
3. _____ OSHA
4. _____ PPE
5. _____ WAGS

Column B

A. Federal agency; helps ensure safety for American workers.
B. Risks associated with long-term exposure to these substances can be reduced by utilizing scavenging systems.
C. Contains sections covering the health risks, protective equipment, and disposal requirements for products.
D. Pharmaceutical agents used to treat cancer.
E. Appropriate items that should be worn when working with hazardous materials.

EXERCISE 4.3 MATCHING #3: KEY TERMS – CONDITIONS

Instructions: Match each condition in column A with the correct associated statement in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Carpal tunnel syndrome
2. _____ Cutaneous larval migrans
3. _____ Visceral larval migrans
4. _____ Diarrhea and cramping
5. _____ Toxoplasmosis

Column B

A. May result in blindness if the cyst caused by this condition develops in the eye.
B. Condition characterized by red itchy lines on the skin.
C. May be transmitted by eating raw or undercooked meat.
D. An ergonomic injury.
E. Caused by the subclass of protozoal agents known as coccidia.

EXERCISE 4.4 MATCHING #4: CLASSIFICATION OF MEDICAL WASTE

Instructions: Match each item in column A with the appropriate classification in column B by writing an "A" (for medical waste) or a "B" (for normal trash) in the space provided.

Column A

1. _____ A needle used to draw blood for a heartworm test.
2. _____ Waste from a patient infected with canine distemper virus.
3. _____ Bloody gauze sponges used on a patient infected with brucellosis.
4. _____ A bacterial culture plate used to culture *Pseudomonas* spp.
5. _____ An IV catheter used to deliver a chemotherapy drug.
6. _____ Tissues from a rabies suspect prior to receipt of test results.
7. _____ Urine and feces from a patient that received a chemotherapy agent earlier in the day.
8. _____ The uterus and ovaries of a patient that was spayed that day.
9. _____ A scalpel blade used to remove a fatty tumor from a dog.
10. _____ A blood tube used to draw blood for a thyroid hormone assay in a cat.

Column B

A. Medical waste
B. Normal trash

EXERCISE 4.5 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words from the following list that complete the sentence.

Use the following key terms to fill in the blanks

A. Ergonomic injury
B. Hazardous chemical
C. Ground-fault circuit interrupter
D. Hazardous materials plan
E. Hospital Safety Manual
F. Right to know law

1. The _____ contains instructions on how the practice will maintain hazardous material documents and proper protective policies within the clinic.

2. Enforced by OSHA, the _____ requires that the employee wear all appropriate PPE when utilizing hazardous chemicals.

3. Repetitive action can lead to a(n) _____, so technicians should vary their position and posture often.

4. Safety-related policies that are adopted by a clinic are combined into a collection called the _____.

5. Drugs and medications can be considered a type of _____.

6. When working around a wet area, any electrical appliances should be plugged into a _____.

EXERCISE 4.6 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ An employee is required to admit an OSHA inspector regardless of whether the practice owner is present or not.

2. _____ It is appropriate to plug an autoclave into a surge suppressor to protect it from electrical fluctuations.

3. _____ When disposing of a fluorescent light bulb that is too long to fit in the trash, it is acceptable to wrap it in a protective wrap such as brown paper, and break it as long as the pieces are kept in a confined area.

4. _____ Flammable material should be stored a minimum of 3 feet from a water heater.

5. _____ Never attempt to fight a fire, regardless of its size, if you are unsure how to properly use the fire extinguisher.

6. _____ If you are confronted by an armed person attempting to steal controlled drugs, you should never open the controlled substance cabinet, but should instead try to escape and call the police.

7. _____ Whereas a clinic is required to provide safety equipment, it is the employee's decision as to whether or not to wear it.

8. _____ Water should be added to the concentrate when making a cleaning solution.

9. _____ Unless the MSDS sheet indicates otherwise, use a detergent when cleaning up a spill.

10. _____ Ethylene oxide, although a potential carcinogen, is an excellent cold sterilization solution.

11. _____ For optimal safety, an animal restrainer should focus her or his attention on the procedure being performed.

12. _____ Glutaraldehyde is a cold-sterilization solution used to sterilize instruments without the use of steam.

13. _____ The most common type of injury in the veterinary setting is animal-related.

14. _____ Noise from barking is irritating and frustrating, but will not damage your hearing.

15. _____ The spray attachment on the tub should be used as an emergency eye flush because it offers more control.

16. _____ Ringworm is a zoonotic parasite.

17. _____ Roundworm eggs in the soil can remain viable for long periods of time.

18. _____ Pregnant women should be advised to avoid contact with cats to prevent contracting toxoplasmosis.

19. _____ Panleukopenia has zoonotic potential.

20. _____ It is possible to carry pathogens home to personal pets.

21. _____ Long-term exposure to low doses of radiation is considered relatively safe.

22. _____ Sunlight can cause false dosimetry badge readings.

23. _____ Portable x-ray units are considered less dangerous because of their limited power.

24. _____ It is permissible to dispose of used x-ray developing chemicals down the drain.

25. _____ You should wear your dosimetry badge at all times during your shift.

26. _____ The best method to reduce the amount of WAG exposure is to utilize a proper scavenging system.

27. _____ An absorption waste anesthetic gas scavenging canister should be checked for saturation by weighing it.

28. _____ Compressed gas cylinders can be stored anywhere in the clinic as long as they are empty.

29. _____ Used soda lime crystals should be disposed of as medical waste.

30. _____ Needles should be removed from syringes before depositing them in the sharps container to prevent overfilling.

31. _____ A biologic safety cabinet should be used when preparing chemotherapy drugs.

EXERCISE 4.7 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. OSHA's "right to know" law requires all of the following EXCEPT:
   a. Employees to be informed of all chemicals they may be exposed to
   b. Employer to eliminate all hazards in the workplace
   c. Employees to wear all PPE prescribed by the manufacturer
   d. Employer to provided PPE at no cost to all employees

2. If your clinic has more than 10 employees you are entitled to all the following except to
   a. See data that applies to your safety
   b. Be informed about the types of accidents that occurred in the clinic
   c. Be informed about information regarding other staff members
   d. View a summary of work injuries/illnesses

3. Which of the following is considered an acceptable method of providing clinic-specific training to employees?
   a. Staff meetings
   b. Continuing education course
   c. On-the-job training
   d. All of the above

4. Flammable materials should always be stored at least _____ feet away from a furnace or other ignition source.
   a. 3
   b. 5
   c. 6
   d. 8

5. The _____ includes instructions for organizing and maintaining the clinic's "right to know" documents.
   a. OSHA poster
   b. Hazardous Material Plan
   c. Material Safety Data Sheet
   d. Centers for Disease Control and Prevention website

6. The chemical formalin is primarily used for
   a. Tissue preservation
   b. Disinfection
   c. Antisepsis
   d. Gas sterilization

7. The most common type of injury in a veterinary clinic is
   a. Strained/sprained back from improper lifting
   b. Carpal tunnel syndrome
   c. Slip and fall
   d. Animal related

8. The best way to protect yourself from animal-related injuries is to
   a. Show you are not afraid
   b. Get training and practice
   c. Use force
   d. Try to outwit the animal

9. A zoonotic disease that is associated with joint pain and fever is
   a. Rabies
   b. *Toxoplasmosis*
   c. Lyme disease
   d. *Giardiasis*

10. _____ larva can migrate to virtually any organ and develop into visceral larval migrans.
    a. Roundworm
    b. Hookworm
    c. Protozoa
    d. Sarcoptic mange

11. *Toxoplasma* eggs sporulate and become infectious _____ after they are passed.
    a. Immediately
    b. 2 to 4 hours
    c. 2 to 4 days
    d. 2 to 4 weeks

12. This parasite can cause cutaneous larval migrans in humans:
    a. Roundworm
    b. Hookworm
    c. Protozoa
    d. Sarcoptic mange

13. A zoonotic pathogen that can be acquired by drinking contaminated water is
    a. Ringworm
    b. Roundworm
    c. *Giardia*
    d. *Toxoplasma*

14. A pathogen found in the mouth of animals that can lead to cardiac and pulmonary problems in both humans and animals is
    a. *Pasteurella multocida*
    b. *Escherichia coli*
    c. *Toxoplasma gondii*
    d. *Borrelia burgdorferi*

15. When taking a diagnostic radiograph, the x-ray beam should be collimated to
    a. The size of the whole area of interest
    b. The size of the cassette
    c. Larger than the size of the cassette
    d. Smaller than the size of the cassette

16. When taking diagnostic radiographs, the dosimetry badge should be worn
    a. On your collar under the apron
    b. On your collar outside the apron
    c. On the waist tie outside the apron
    d. On your belt under the apron

17. According to OSHA, the level of waste halogenated anesthetic agents in the clinical air should not exceed
    a. 2 parts per million
    b. 2 pounds per square inch
    c. 2 cm of water
    d. 2%

18. The source of the majority of anesthetic gas in the room during a procedure is
    a. Animal exhalation
    b. Leaks in the endotracheal tube
    c. Leaks in the machine
    d. Improper ventilation in the room

19. Which type of scavenging system requires weighing and replacement of components?
    a. Passive exhaust
    b. Active removal
    c. Absorption
    d. Accumulation

20. To prevent unnecessary exposure to WAGs when recovering a patient, you should do all of the following except
    a. Keep the number of recovering animals in one room to a minimum
    b. Keep your face away from the animal's face
    c. "Flush" the system prior to extubation
    d. Extubate the animal as quickly as possible

21. Which of the following materials is considered hazardous?
    a. IV catheter removed after a spay procedure
    b. Bandaging from a declaw procedure
    c. Scalpel blade used for a celiotomy
    d. Blood tubes from a dog infected with parvovirus

EXERCISE 4.8 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 4.9 CASE STUDY #1: FIRE AND EVACUATION

It is a busy Monday morning at the hospital where you work. The phones are ringing off the hook, the doctors are in rounds, appointments are about ready to start, and the other technicians are busy treating patients. Suddenly you smell smoke, and notice it is coming from the laundry area. Apparently lint has clogged the outlet hose of the clothes dryer and caught on fire from the heat generated by the dryer. Smoke is billowing out into the room, and you can see flames through the glass door of the dryer. The fire does not appear to have spread or to involve the building, and at this point you do have a means of escape.

1. List the steps you should take to ensure everyone's safety. Keep the following in mind:
   - Your clinic does not have an automated fire alarm system.
   - You know where the fire extinguishers are located and have been trained on their use.

EXERCISE 4.10 CASE STUDY #2: RIGHTS AND RESPONSIBILITIES UNDER OSHA

The Monday afternoon is just as busy as the morning was *(see case study #1)*. You have been asked to perform a variety of diagnostic tests, treat the hospitalized patients, and prepare several patients for release. In the process of taking thoracic radiographs on a patient, you notice that the lead glove on your left hand has a hole in it. The patient you are imaging is a wiggly, little terrier that is very hard to hold. You decide to take off the lead gloves so you can hold it more easily. In the process of taking the radiographs, the patient bites you on the right forefinger producing a painful bleeding wound.

1. Considering your rights and responsibilities under Occupational Safety and Health Act, what are you obligated to do as an employee of the practice under these circumstances?

2. What is your employer required to do under the Occupational Safety and Health Act?

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EXERCISE 4.8 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. Federal laws enforced by the Occupational Safety and Health Administration (OSHA) require all employers to have a safety program designed to help ensure a safe work environment. What three general components must be included as a part of a workplace safety program?

   i. _____

   ii. _____

   iii. _____

2. Back injuries are said to account for one in every five workplace injuries. In a busy practice, you will often lift heavy animals and equipment. What can you do to minimize the risk of injuring your back?

   _____

   _____

   _____

3. You have been asked to put away a shipment of supplies that has just been delivered. Utilizing the safety tips outlined in the chapter, describe how you will store each of the following items and why.

   a. Cleaning chemicals in gallon jugs: _____

   _____

   b. Vaccines: _____

   _____

   c. X-ray developing/fix chemicals: _____

   _____

   d. 50 lb bags of dog food: _____

   _____

4. Consider the following scenario: You are giving a hospitalized dog a quick bath prior to going home. You will be using a cage dryer. What are some of the precautions you should take to ensure that you are not injured by the fan inside the dryer?

   _____

   _____

   _____

5. List some of the equipment in a veterinary hospital that produce heat and therefore are a burn and fire risk.

   _____

   _____

   _____

6. Sensitive electronics, like computers, should be plugged into a surge suppressor to prevent damage from electrical surges. What electrical devices should NOT be plugged into a surge suppressor? Why is this the case?

7. Every hospital must maintain a MSDS library. What type of safety information can be found in these documents?

8. When utilizing ethylene oxide, safety precautions must be followed. Please describe them and indicate why it is important to follow them.

9. Formalin is used in clinics to preserve samples. If you were responsible for designing a safety protocol for this chemical, what would you include in this document?

10. You need to give a dog a medicated bath. What precautions do you need to take to keep both yourself and the dog safe?

11. You are working in a practice during the day shift, and you are filling a bottle with 70% isopropyl alcohol. Some of the alcohol splashes in your right eye causing severe pain that makes you cry out. What should you do in this situation?

12. You are given the task of explaining possible hazards to a new employee. One of the topics you need to cover is exposure to pathogens. Please detail common routes of exposure and ways to prevent exposure.

13. Describe the equipment you should use to protect yourself from the effects of ionizing radiation while taking diagnostic radiographs.

14. How does use of a technique chart reduce your exposure to ionizing radiation?

15. While filling the anesthetic machine at the end of your shift, you accidently drop and break the bottle. What steps do you need to take to clean up the spill?

16. Significant exposure to waste anesthetic gases can occur when monitoring recovering patients.

    a. Where does this waste gas come from?

    b. What steps can be taken to reduce this exposure?

17. When you need to recap a needle care must be taken to avoid needle sticks. Describe the "one-handed method" of recapping needles.

18. Explain why it is important to use protective equipment when cleaning up the waste from an animal that has received chemotherapy.

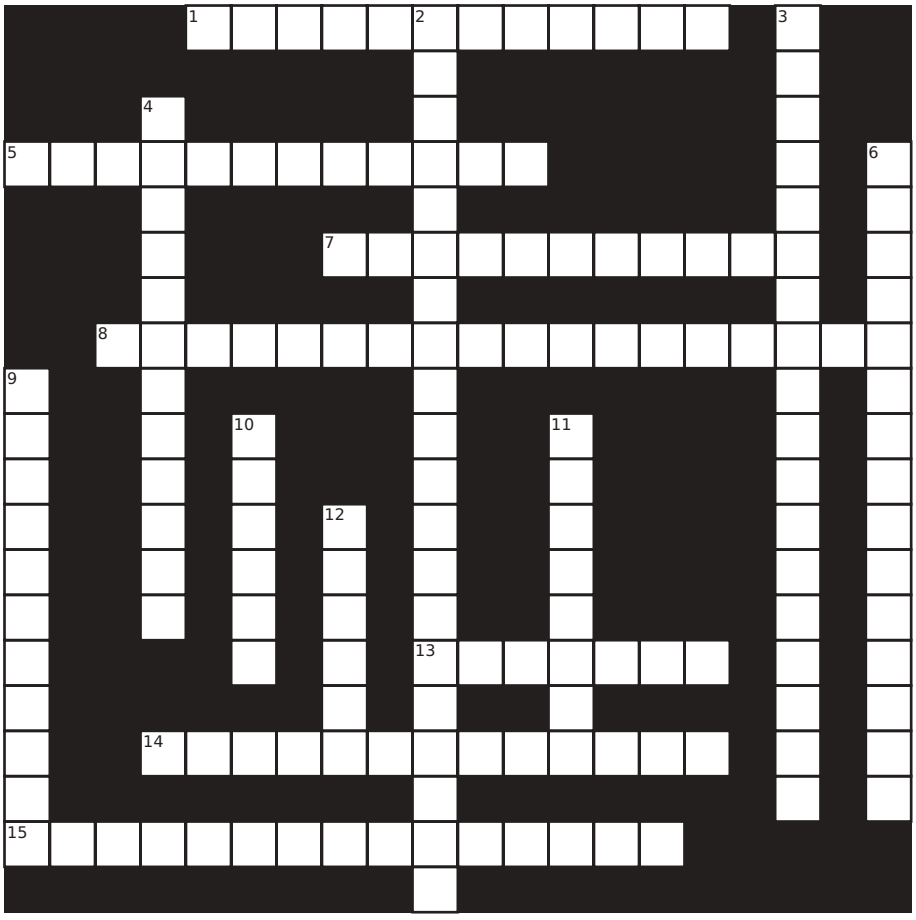
5 Animal Behavior

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, spell, and define all Key Terms in the chapter.
2. Explain why behavior problems can be life-threatening to pets.
3. Summarize the veterinary technician's role in supporting behavioral health.
4. List steps taken when gathering information for a behavioral history.
5. Do the following regarding learning and animal behavior modification:
   - Explain how animals learn and whether or not their behavior, like that of humans, is based on a moral code of conduct.
   - Differentiate between positive reinforcement, positive punishment, negative reinforcement, and negative punishment.
   - Explain the relationship between operant behaviors and continuous and intermittent reinforcement.
   - Describe why extinction of a behavior is difficult to achieve.
   - Differentiate between the following: desensitization, counter-conditioning, counter-commanding, and flooding.
6. Do the following regarding preventing behavior problems:
   - Describe each step in the Five-Step Positive Proaction Plan. List the criteria required for effective discipline.
   - Explain the importance of habituating young animals to handling.
   - Explain some of the challenges in habituating older animals to handling.
   - Describe ways in which a veterinary technician can assist a client in selecting a pet.
   - Describe the role medication plays in treating behavior problems.
7. Do the following regarding canine and feline development and behavior:
   - Describe the four stages of canine and feline development.
   - List important canine and feline behaviors that owners should be able to interpret correctly.
   - Explain how a veterinary technician's understanding of animal behavior can create a safer environment for workers, pet owners, and pets.
   - Describe methods for introducing a new dog or cat to existing pets.
   - List common behavior problems in dogs and cats and describe methods for addressing them.
   - Describe common circumstances in the dog and cat in which aggression can be problematic for the pet owner.
8. Do the following regarding equine behavior:
   - Explain how being a prey species influences the behavior of horses and their desire to be in a herd.
   - Describe how hierarchy affects the behavior of individual animals within a herd of horses.
   - Describe normal sexual behavior in mares and stallions.
   - Describe the behavior of mares with foal and explain why foal rejection is a behavior emergency.
   - List three common stable vices in horses.
9. Do the following regarding cattle and small ruminant behavior:
   - Describe how hierarchy affects the behavior of individual animals within a herd of cattle, sheep, or goats.
   - Describe how aggression commonly manifests in cattle, sheep, and goats.
   - Describe normal sexual and maternal behaviors in farm animals.
   - Describe common behavior problems in domestic livestock.

EXERCISE 5.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

1 A superior position in a rank order or social hierarchy. (2 words)
5 Grooming performed by one animal upon another of the same species.
7 Having given birth only one time or being pregnant for the first time.
8 Occurs when an animal is highly motivated to perform a particular behavior but is for some reason prevented from doing so. (2 words)
13 This emotional response leads to a physiologic response similar to that of fear.
14 Providing a puppy with pleasant experiences with people, situations, and other animals.
15 A wolf pack will form this, but free-ranging dogs generally do not. (2 words)

Down

2 Cheek and tail rubbing in cats are two examples of these. (2 words)
3 A dog that is acting as if it is sorry for its actions is exhibiting this. (2 words)
4 Two dogs, two sheep, and two horses are three examples of these.
6 A lower position in a rank order or social hierarchy. (2 words)
9 Having given birth more than one time.
10 May lead to weight loss, changes in the white blood cell counts, and decreased immunity to disease.
11 Occurs when an individual is motivated to perform two opposing behaviors.
12 A fear of thunder is an example of this.

EXERCISE 5.2: SHORT ANSWER: TERMS AND DEFINITIONS

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 5.3 MATCHING #1: TERMS AND DEFINITIONS

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Affiliative Behaviors
2. _____ Conflict
3. _____ Frustration
4. _____ Stress
5. _____ Social hierarchy

Column B

A. Seen in herd animals
B. Can lead to immune suppression
C. Animal is in a situation in which it is prevented from performing a behavior that it is highly motivated to perform
D. Behaviors performed by two individuals, such as grooming
E. When an individual is motivated to perform two opposing behaviors

EXERCISE 5.4 MATCHING #2: TYPES OF AGGRESSION

Instructions: Match each term in column A with its corresponding statement in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Idiopathic aggression
2. _____ Food-related aggression
3. _____ Irritable aggression
4. _____ Maternal aggression
5. _____ Predatory aggression
6. _____ Interdog aggression
7. _____ Territorial aggression

Column B

A. More common in older dogs
B. Unpredictable
C. Only seen in unspayed females
D. May be related to infant aggression
E. Occurs only in the presence of a high-value item
F. May result from changing the hierarchy in a household
G. Demonstrated only in a particular area

EXERCISE 5.5 PHOTO QUIZ : DOG AND CAT BEHAVIORS

Instructions: Answer the questions about each photo.

1. a. Which of the dogs in this photo is exhibiting a dominant role? What is typical behavior of a dog assuming a dominant role?

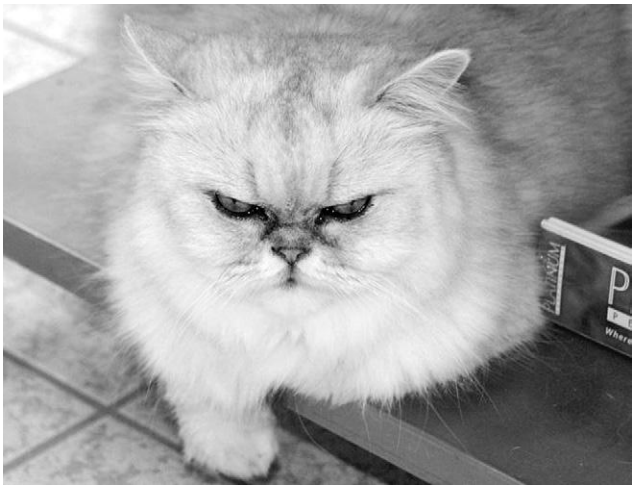
   b. Which of the dogs in this photo is exhibiting a submissive role? What behavior is typical of a dog assuming a submissive role?

2. What behavior is this dog exhibiting? How do you know?

3. What behavior is this dog exhibiting? How do you know?

4. Is this dog exhibiting fear-related aggression or dominance aggression? How do you know?

5. Is this cat relaxed or aggressive? How do you know?



6. a. Is this cat relaxed or aggressive? How do you know?

b. How does this behavior differ from fearful behavior?

EXERCISE 5.6 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Questions about pet behavior should be included on any client history form.
2. _____ Client education about pet behavior problems is vital to preventing problems.
3. _____ A Veterinary Technician Specialty in Behavior does not currently exist.
4. _____ Dogs do have a strong sense of "right" and "wrong," which affects their behavior.
5. _____ Punishment and negative reinforcement are the same thing.
6. _____ Flooding is a technique used to treat fearful behavior.
7. _____ If food rewards are used to train a dog, they must be used forever.
8. _____ Chewing is a behavior that is self-reinforcing.
9. _____ Providing adequate exercise is important in preventing unwanted dog behaviors.
10. _____ A dog that has defecated in the house and looks guilty when you come home, knows it did wrong.
11. _____ Used alone, medications rarely solve behavior problems.
12. _____ During the socialization period, puppies develop a substrate preference for elimination.
13. _____ Selegiline should not be given with fluoxetine.
14. _____ Dogs become sexually and socially mature by 6 months of age.

15. _____ When puppies are presented to the clinic, you should take time to praise and provide food rewards for good behavior.

16. _____ Choke collars are very useful for training a large dog to walk on a leash.

17. _____ The best initial response to a dog exhibiting fear is to prevent its exposure to any of the things that cause the fear.

18. _____ A dog with a thunderstorm phobia may become very destructive or injure itself.

19. _____ All dog aggression is considered abnormal.

20. _____ Neutering will produce a dramatic decrease in all types of canine aggression.

21. _____ Any breed of dog may develop aggression.

22. _____ A female dog may also lift her leg to urinate.

23. _____ Aggression is very common when a new cat is added to a household with a resident cat.

24. _____ The cat carrier should not be taken out of the closet until the very minute it will be needed to take the cat to the veterinary clinic.

25. _____ Food rewards can be used to make cats more comfortable in the veterinary clinic.

26. _____ Declawing cats is cruel and painful and should never be performed.

27. _____ Even when no fighting occurs, when one cat in a household spends the majority of its time hiding from the other cat, it is a sign that the cats are not getting along.

28. _____ While sitting on their owner's lap and being petted, cats will sometimes bite.

29. _____ Redirected aggression is a rare and unimportant problem in cats.

30. _____ A cat that dislikes its litter will neither defecate nor urinate in the box.

31. _____ Older cats that vocalize in a random and purposeless way may be exhibiting signs of feline cognitive dysfunction.

32. _____ The main advantage of a hierarchy in social animals is that it allows them to gang up on predators.

33. _____ A frightened horse may injure its handler.

34. _____ Visual cues are the primary means by which mare and foal recognize each other.

35. _____ Cribbing is not seen in free ranging horses.

36. _____ When fighting, horses may kick out with both front legs.

37. _____ Most equine aggression toward humans is a learned response related to fear.

38. _____ When approaching sheep in a pen, the most dominant animal will be at the front of the flock.

39. _____ Dairy bulls are notoriously aggressive toward humans.

EXERCISE 5.7 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. Which term refers to the process by which an association between two events is broken?
   a. Punishment
   b. Negative reinforcement
   c. Extinction
   d. Intermittent

2. What is the term for changing an animal's emotional response to a stimulus?
   a. Counter conditioning
   b. Systematic desensitization
   c. Negative reinforcement
   d. Classical conditioning

3. What is the process called in which you substitute an alternative behavior that is incompatible with the problem behavior?
   a. Counter conditioning
   b. Systematic desensitization
   c. Classical conditioning
   d. Positive reinforcement

4. Learned helplessness may result from which training technique?
   a. Systematic desensitization
   b. Negative reinforcement
   c. Counter conditioning
   d. Flooding

5. Exposing an animal frequently to nonthreatening stimuli, such as strangers, nail trimming, grooming, and handling, is an example of which process?
   a. Counter conditioning
   b. Operant conditioning
   c. Habituation
   d. Systematic desensitization

6. Giving a dog a food reward after each nail is trimmed is an example of which process?
   a. Operant conditioning
   b. Classical conditioning
   c. Flooding
   d. Systematic desensitization

7. Which of the following is classified as a tricyclic antidepressant (TCA)?
   a. Clomicalm®
   b. Valium®
   c. Reconcile®
   d. Anipryl®

8. How long does the neonatal period last in puppies?
   a. 8 weeks
   b. 6 weeks
   c. 4 weeks
   d. 2 weeks

9. At what age does the socialization period start in puppies?
   a. 8 weeks
   b. 6 weeks
   c. 4 weeks
   d. 2 weeks

10. A dog in your clinic that is lip licking, yawning, and looking away from you is exhibiting behavior indicating that it is _____.
    a. Sleepy
    b. Anxious
    c. Aggressive
    d. Hungry

11. Most problem behaviors seen in the clinic are caused by which of the following?
    a. Disease
    b. Lack of training
    c. Fear
    d. Learned aggression

12. When a healthy dog refuses a highly palatable food treat it is usually because the dog is _____.
    a. Not hungry
    b. Fearful
    c. Aggressive
    d. Car sick

13. When playing with a dog, the second its teeth contact your skin, the owner should _____.
    a. Walk away from the dog
    b. Pin it to the ground and growl
    c. Smack it on the face
    d. Throw a toy in another direction

14. Which best describes the Gentle Leader?
    a. Choke collar
    b. Body harness
    c. Stiff leash
    d. Head halter

15. Fears are best treated by using which of the following?
    a. Cognitive dysfunction
    b. Classical conditioning
    c. Systematic desensitization
    d. Flooding

16. Which drug is FDA approved for the treatment of separation anxiety in dogs?
    a. Reconcile®
    b. Valium®
    c. Anipryl®
    d. Ovaban®

17. Which drug is FDA approved for the treatment of canine cognitive dysfunction?
    a. Reconcile®
    b. Valium®
    c. Anipryl®
    d. Ovaban®

18. When is the sensitive period for socialization in the kitten during which daily handling will result in friendlier kittens?
    a. Weeks 2 to 7
    b. Weeks 4 to 16
    c. Weeks 8 to 10
    d. Weeks 12 to 18

19. A cat with its body arched, tail erect, and ears flattened to its head is exhibiting which behavior?
    a. Predatory aggression
    b. Greeting
    c. Dominant aggression
    d. Fear aggression

20. Two cats staring at one another from 3 feet apart are exhibiting which behavior?
    a. Aggression
    b. Fear
    c. Greeting
    d. Acceptance

21. When two cats are interacting and one hisses, the hissing cat is exhibiting which behavior toward the other cat?
    a. Submission
    b. Aggression
    c. Fear
    d. Acceptance

22. What is the position of the ears in an aggressive horse?
    a. Erect and forward
    b. Pinned back facing outward
    c. Swiveling front and back
    d. Rotated backwards

23. Which of the following is a greeting call used by the horse?
    a. Snort
    b. Squeal
    c. Nicker
    d. Whinny

24. The vomeronasal organ is involved in which behavior in the horse.
    a. Aggression
    b. Olfaction
    c. Vision
    d. Touch

25. The horse hierarchy in a pasture is mostly determined by which factor?
    a. Individual temperament
    b. Size
    c. Age
    d. Sex

26. What is it called when mares do not show behavioral signs of estrus?
    a. False heat
    b. Anestrus
    c. Silent heat
    d. Pseudocyesis

27. Self-mutilation is a behavior problem that occurs most commonly in _____.
    a. Geldings
    b. Mares
    c. Foals
    d. Stallions

28. Today's management practices usually result in the foal being weaned at what age?
    a. 8 to 9 months
    b. 4 to 6 months
    c. 6 to 8 weeks
    d. 4 to 6 weeks

EXERCISE 5.8 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 5.9 CASE STUDY #1: HOUSETRAINING A PUPPY

Mrs. Benjamin Franklin and her three children, ages 14, 8, and 6 years, have brought their 16-week-old male Springer Spaniel puppy to your veterinary clinic for its final booster vaccination. You ask how housebreaking is progressing and she starts to cry. She is thinking of getting rid of the pup because it continues to poop and pee in the house. They brought the pup home 6 weeks ago from the breeder. They feed it free choice and it has constant access to water. They let it out in the yard four times a day, including just before bedtime. When Ben finds an accident in the house he rubs the pup's face in it and screams "bad dog." The pup is closed up in the kitchen overnight and has also begun chewing the legs on the kitchen chairs.

1. What is she doing wrong? What advice do you have for her on fixing this situation?

EXERCISE 5.10 CASE STUDY #2: INAPPROPRIATE URINATION IN A MULTICAT HOUSEHOLD

Mrs. Davis has a 3-year-old neutered male cat named Moony. Recently, she got married and her new husband moved in with his 4-year-old spayed female cat, Sunny. Initially she locked Moony in a bedroom and gave Sunny run of the house. Two weeks ago she let Moony into the rest of the house. The two cats initially ignored one another. Sunny hid most of the time once Moony started roaming the house although no hissing or fighting was seen. Recently, Mrs. Davis started finding small amounts of urine running down the umbrella stand, coat rack, drapes, and walls. The single litter box in the bathroom is still being used. She has no idea which cat is no longer using the litter box.

1. She is very unhappy and wants your advice. What should you tell her to do?

EXERCISE 5.11 CASE STUDY #3: CHOOSING A NEW PET

Mr. Thomson and his family have come to the clinic with their dog, Victoria, for a routine visit. During the course of the visit, he informs you that they would like to get a companion for Victoria, but are unsure where to begin. One way you could help them make this decision, would be to guide them as to what species, breed, and gender might be appropriate for their family.

1. What are some other ways you could assist them so that they can find a healthy pet with behavioral characteristics that are a good fit for their family?

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EXERCISE 5.2: SHORT ANSWER: TERMS AND DEFINITIONS

Instructions: Provide a short answer to each of the queries in the spaces provided.

1. Define each type of aggression listed below and describe the differences among them.

   a. Dominance aggression

   b. Fear-related (defensive) aggression

   c. Pain-related aggression

   d. Redirected aggression

   e. Play-related aggression

   f. Possessive aggression

2. Define anxiety, fear, and phobia, and describe the differences between them.

   a. Anxiety

   b. Fear

   c. Phobia

3. How do negative punishment and negative reinforcement differ?

4. How does operant conditioning differ from classical conditioning?

5. How do positive reinforcement and positive punishment differ?

6. Describe the appearance of submissive behaviors seen in dogs.

EXERCISE 5.8 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. In what way can knowledge of both normal and abnormal animal behavior help the technician keep clients and veterinary personnel safe while handling and carrying out animal care duties?

2. Why should a veterinary practitioner be concerned about a dog or cat exhibiting behavior problems at home?

3. Problem behavior is the most common reason dogs and cats are surrendered to animal shelters. Specifically, how may an owner's expectations and level of knowledge about animal behavior affect their decision to surrender their pet to an animal shelter?

4. Animals commonly learn by associative learning in which an animal forms a learned association between two features or events. The development of these associations depends on contiguity and contingency. What is the meaning of these two terms?

5. Define continuous and intermittent reinforcement and explain how they are used in training an animal.

6. How does an animal often initially respond when you stop rewarding a learned behavior?

7. What are the parts of the Five Step Positive Pro-action Plan for preventing behavior problems?

   i. _____

   ii. _____

   iii. _____

   iv. _____

   v. _____

8. Owners often use punishment incorrectly. Describe the correct way to use punishment to stop an unwanted behavior.

9. What are two examples of remote punishment devices that can be used to correct an unwanted dog behavior?

10. Young animals can be helped to become accustomed to procedures like toenail trims, ear cleaning, and tooth brushing by a process called habituation.

    a. Why is habituation important?

    b. How would you habituate a puppy to having its nails trimmed?

    c. How does age of the patient influence the success of habituation?

11. Animals have stages of development as they grow, just like people do. List the four stages of development, including a brief description of each.

    i.

    ii.

iii. _____

iv. _____

12. There are only three medications that are FDA approved for use in dogs with behavior problems. What is the trade name and generic name of each of them?

i. _____

ii. _____

iii. _____

13. Describe the appearance of a dog exhibiting a fearful response.

14. Describe the preferred technique for introducing a new adult dog to a household with a resident adult dog.

15. What should an owner do to stop a dog from barking to get attention?

16. What are some of the effects of chronic stress on a dog?

17. What is the most important thing the technician can do for the owner of a fearful dog?

18. What are three of the most common behaviors seen in a dog with separation anxiety?

    i. _____

    ii. _____

    iii. _____

19. Neutering affects which canine behaviors?

20. What are the clinical signs seen in a dog with canine cognitive disorder?

21. How has domestication changed the behavior of the domestic cat from that of its wild ancestors?

22. Describe the appearance of an aggressive cat.

23. List five reasons that cats seem to dislike going to the veterinary hospital.

i. _____

ii. _____

iii. _____

iv. _____

v. _____

24. Because we know cats are going to claw objects, what advice should be given to a new cat owner to prevent destruction in the home?

25. Which two intercat behaviors suggest that two or more cats are comfortable with each other?

i. _____

ii. _____

26. An elderly client is given a kitten by her well-meaning daughter. When she brings the 12-week-old kitten in for its booster vaccination you notice she has scratches on her hands, ankles, and the tops of her feet. Assuming the kitten is the culprit, what advice should you give this client?

27. Describe the difference between the behavior of a cat exhibiting marking behavior and the behavior of a cat that is just urinating out of the litter box.

28. Give 10 reasons that a cat may stop using its litter box.

i. _____

ii. _____

iii. _____

iv. _____

v. _____

vi. _____

vii. _____

viii. _____

ix. _____

x. _____

29. Because their eyes are set laterally, horses have a narrow binocular field of vision and a wide monocular field of vision with two blind spots. Where are these blind spots?

i. _____

ii. _____

30. What are the behavioral signs of a mare that is in heat?

_____

_____

_____

_____

_____

31. When the mare rejects its foal, it is considered a behavioral emergency. Why is this?

_____

_____

32. What are three stereotypic behaviors seen in horses?

i. _____

ii. _____

iii. _____

33. What are three behavioral characteristics shared by cattle, sheep, and goats?

    i. _____

    ii. _____

    iii. _____

34. Describe the appearance of a cow threatening aggressively.

    _____

    _____

35. What are two problems associated with hierarchies in cattle?

    i. _____

    ii. _____

36. Describe what you can do to facilitate acceptance of a 2-week-old orphan lamb by a ewe that already is nursing a lamb.

    _____

    _____

    _____

37. How does the behavior of a newborn lamb differ from that seen in newborn kids?

    _____

    _____

    _____

38. What is "buller steer syndrome" and why is it significant in the beef industry?

    _____

    _____

    _____

6 Restraint and Handling of Animals

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, spell, and define all of the Key Terms in this chapter.
2. List three indications for animal restraint and describe methods for approaching dogs and cats before attempting restraint.
3. Do the following regarding canine and feline capture and restraint:
   - List actions taken to diminish stress among dogs and cats during physical examinations and hospitalization.
   - List the equipment and the methods used in capturing and restraining both cooperative and uncooperative dogs and cats.
   - List the advantages and disadvantages of chemical restraint in dogs and cats.
   - Describe various positions for restraining cats and dogs specifically for venipuncture of the jugular, cephalic, and medial saphenous veins and for nail trimming.
4. Do the following regarding equine capture and restraint:
   - Explain the principles that affect equine perception and behavior.
   - Describe the physical abilities of horses and how these affect the ways in which horses are handled.
   - Describe methods for approaching and capturing adult and juvenile equine patients, including using restraint equipment, diversions, and pharmaceutical products, and identify special restraint techniques for horses and the circumstances in which they are used.
5. Do the following regarding capture and restraint of cattle:
   - Describe the principles that affect cattle behavior and list principles used to move cattle and individuals in an effective and low-stress manner.
   - Explain the differences in housing between dairy and beef cattle and describe how these differences affect methods to handle and restrain them.
   - List the type of bulls known to be particularly dangerous to handle.
   - List the equipment used to restrain cattle in general and to restrain specific parts of their body. Also, describe the circumstances of their use.
6. Describe methods for observing and approaching swine of each gender and age group, and discuss methods used to capture and restrain adult and young pigs.
7. Do the following regarding small ruminant capture and restraint:
   - Describe the behavioral tendencies of small ruminants and explain how these influence the approach and capture of herds.
   - List factors that affect levels of aggression in camelids and describe how aggression presents in these species.
   - Describe the approach, capture, and restraint of individual sheep, goats, and camelids.
   - List additional restraint techniques that are used in camelids, but not in sheep or goats.
   - Define cervids and explain methods for their restraint and handling.
8. Describe restraint and handling techniques used with birds, small mammals, and reptiles.

EXERCISE 6.1 TERMS AND DEFINITIONS: ANIMAL RESTRAINT

Instructions: Define each term in your own words.

(Note: Terms #1 through #3 are behaviors seen during approach or capture.)

1. Displacement behavior

2. Fight or flight response

3. Fear biting

(Note: Terms #4 through #6 are equine aggressive behaviors.)

4. Double-barrel kick

5. Cow kick

6. Strike

(Note: Terms #7 through #13 are devices used in horse restraint.)

7. Humane twitch

8. Cross-tie

9. Hobbles

10. Tail tie

11. Stocks

12. Twitch

13. Cradle

EXERCISE 6.2 MATCHING #1: KEY TERMS AND DEFINITIONS

Instructions: Match each term in column A with its appropriate definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Aggression
2. _____ Binocular vision
3. _____ Blind spots
4. _____ Displacement behaviors
5. _____ Diversionary restraint
6. _____ Fear biting
7. _____ Fight-or-flight response
8. _____ Flight zone
9. _____ Point of balance
10. _____ Tortoise
11. _____ Turtle

Column B

A. Vision in which both eyes are used synchronously to produce a single image.

B. A land turtle.

C. Yawning, scratching, and licking lips in a fearful dog represents this.

D. A behavior with intent to harm.

E. Unlike cattle raised for production, pet cattle do not have one of these.

F. Tapping lightly on the horse's head or use of a twitch in a horse represent this.

G. Chasing a dog into a corner may result in this.

H. A marine reptile with a toothless horny beak and a shell of bony dermal plates.

I. A state of alert when a threat is perceived.

J. The areas directly behind them, directly in front of their nose, and between a horse's eyes.

K. The part of an animal that if you took a step in either direction, the animal would move in the opposite direction.

EXERCISE 6.3 MATCHING #2: RESTRAINT TECHNIQUES FOR EXOTIC SPECIES

Instructions: Match each species in column A with the technique used to restrain it in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Raptors
2. _____ Hedgehogs
3. _____ Hamsters
4. _____ Lizards
5. _____ Small- to medium-size psittacine birds
6. _____ Mice
7. _____ Sugar gliders
8. _____ Snakes
9. _____ Rabbits and chinchillas
10. _____ Gerbils
11. _____ Large psittacine birds
12. _____ Turtles
13. _____ Ferrets

Column B

A. Cover the head with a leather hood and restrain the body with leather gloves and a towel.

B. Control the head with the thumb and index finger, being careful not to damage the large eyes.

C. Scruff the neck and dorsum and restrain the tail with the pinky finger.

D. Restrain the head and the torso with one hand, and use the other hand to restrain the tibiotarsus of both legs.

E. Grasp the plastron and carapace with a "sandwich"-type grip with one hand, and grasp the head behind the mandibles with the other hand.

F. Scruff the neck, being careful not to make the skin too taught around the face.

G. Carry like a football with the head in the crook of the arm and one arm supporting the chest and hind limbs.

H. Control the head with one hand, support the trunk with the other hand and forearm, and hold the tail between the arm and body.

I. Gently scruff the neck, hold the body in a vertical position, and stabilize the hind limbs with the other hand.

J. Restrain with leather gloves to avoid injury from the quills.

K. Control the head with the thumb and middle finger with an index finger on top of the head. Control the rest of the body with the other hand.

L. Wrap the torso in a towel so the handler can concentrate on the head, beak, and feet.

M. Control like a hamster, being very careful not to grab the tail.

EXERCISE 6.4 SHORT ANSWER: TERMS AND DEFINITIONS

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

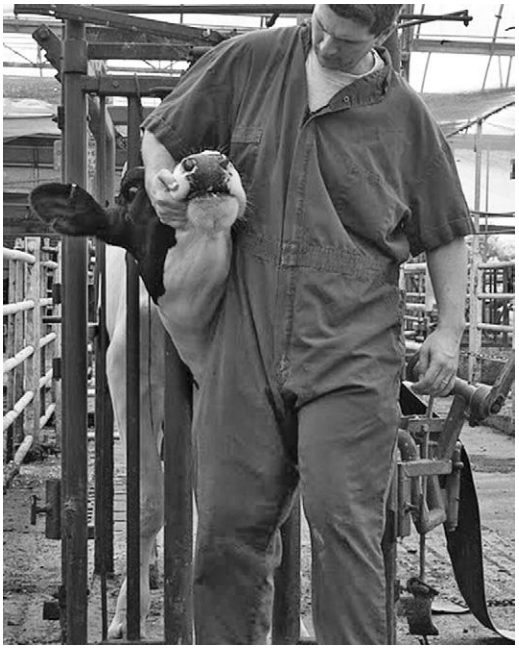
EXERCISE 6.5 PHOTO QUIZ: RESTRAINT TECHNIQUES

Instructions: Answer the questions about each photo.

1. Examine this technician's restraint technique of a dog. Why does she have her arms in these specific locations? What advantages do these positions afford?

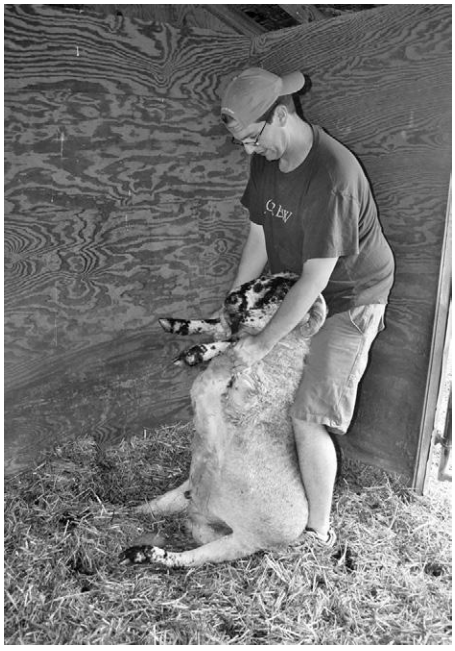
2. When applying a cat muzzle such as this one, what principles must be followed to ensure your safety and the animal's safety?

3. What principles are this technician following when approaching this horse to minimize the risk of injury?



4. Describe the technique being used by this technician to open a cow's mouth for administration of oral fluids or boluses.

5. This technique (holding the pig by its rear legs) is used to restrain larger nursery pigs or for small pigs. What alternative techniques can be used for small pigs?



6. This sheep is being restrained by "flipping." Explain how this is done.

EXERCISE 6.6 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Practice owners are responsible for any injuries incurred by veterinary personnel and clients during the performance of veterinary procedures.
2. _____ Corrective training methods that can improve a pet with dominance aggression can also improve a pet with fear-related aggression.
3. _____ Cats should be acclimated to the carrier prior to being loaded up for a visit to the veterinary clinic.
4. _____ You should ask every owner if his or her pet is "nice" before grabbing it.
5. _____ An animal that freezes when you go to pick it up is no longer stressed.
6. _____ Cats tend to be more stressed on the examination table than in the carrier.
7. _____ Most dogs respond favorably to vocal reassurance.
8. _____ A towel is a useful restraint device for working with cats.
9. _____ Kittens are generally harmless and are easily restrained in a veterinary clinic.
10. _____ Lift tables are very useful for examining large dogs.
11. _____ Because dogs are comfortable with their owners, the owner should be encouraged to hold his or her dog for examination.
12. _____ Many dogs behave better with minimal restraint.
13. _____ When positioning a dog for cephalic venipuncture, it should be in lateral recumbency or sitting.
14. _____ The best position to put a dog in when trimming its nails is lateral recumbency.
15. _____ Race horses may become protective of their stalls and act aggressively when a stranger enters.
16. _____ Horses can kick with both front and hind legs.
17. _____ It is best to enter a stall quickly and grab a horse's halter, before it has a chance to react.
18. _____ The best way to catch a foal is to stand between the mare and the foal.
19. _____ It is recommended that the lead rope be wrapped around the arm to help control the horse.
20. _____ It is counterproductive to attempt any procedures when the twitch is initially applied.
21. _____ The best way to restrain a foal is to place an arm around its chest and hind end and lift it off the ground.
22. _____ Dairy cattle tend to have shorter flight zones than beef cattle.
23. _____ The best way to move cattle is to herd them from behind.
24. _____ Cows do not have upper incisors.
25. _____ When moving pigs in a pen, they can become agitated and may become hyperthermic.

26. _____ After the animal has been moved into a smaller pen, the first step of restraint for all small ruminant species is to control the head.

27. _____ One problem when restraining birds is if they get loose, they may fly into windows and injure themselves.

28. _____ Birds do not have a diaphragm.

29. _____ Rabbits cannot breathe through their mouths like dogs.

30. _____ Hedgehogs can shoot their quills into enemies like a porcupine.

31. _____ Hedgehogs generate frothy sputum, which they lick onto their spines.

32. _____ Restricting the movement of an iguana's thorax will cause it to suffocate.

33. _____ Some turtle species are poisonous.

34. _____ The towel is the preferred method for restraining medium to large lizards.

EXERCISE 6.7 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. Most of the aggressive behaviors seen in dogs and cats in the clinic are a result of which of the following?
   a. Dominance
   b. Fear
   c. Poor training
   d. Disease

2. When a fearful pet displays warnings as you approach its cage, the situation can be improved by doing which of the following?
   a. Backing up
   b. Feeding it
   c. Putting a snare around its neck
   d. Grabbing it with gloves

3. What can be sprayed onto towels, muzzles, and other equipment to make a dog feel more comfortable in the veterinary clinic?
   a. Citronella
   b. Doggieway®
   c. Beef broth
   d. Dog Appeasing Pheromone®

4. A clear, hollow plastic ball that fits over a dog's head is known as the _____.
   a. Air muzzle™
   b. Space helmet™
   c. Birdcage™
   d. Fish bowl

5. When holding off a cephalic vein for venipuncture the holder must do which of the following?
   a. Press down into the jugular furrow
   b. Rotate the vein laterally
   c. Rotate the vein medially
   d. Hold the pet in dorsal recumbency

6. The horse's eyes are located laterally on their head. How much binocular vision do they have?
   a. 360 degrees
   b. 180 degrees
   c. 90 degrees
   d. 60 degrees

7. Most horses are traditionally and typically handled from which direction?
   a. Front
   b. Right side
   c. Left side
   d. Rear

8. What is the normal flight zone for a domestic horse in a field?
   a. 6 to 12 feet
   b. 10 to 30 feet
   c. 20 to 50 feet
   d. Domestic horses do not have a flight zone

9. When capturing a yearling horse, the best initial move is to
   a. Rapidly grasp the halter
   b. Face it and look it in the eye
   c. Put a chain over its nose
   d. Squat down and scratch the withers

10. Which is the best place to initially touch a horse?
    a. Withers
    b. Ears
    c. Muzzle
    d. Butt

11. Physical restraint of the adult equine begins with which piece of equipment?
    a. Stocks
    b. Head chute
    c. Lariat
    d. Halter

12. What is one purpose of using a cradle on a horse?
    a. Prevent kicking
    b. Prevent cribbing
    c. Hold it still
    d. Calm it down

13. What is the point of balance of a cow?
    a. Hip
    b. Head
    c. Shoulder
    d. Flank

14. Which of the following is used to administer a bolus to a dairy cow?
    a. Teat canula
    b. Syringe and needle
    c. Stomach tube
    d. Balling gun

15. If the jugular vein is inaccessible, what other vessel is commonly used for bovine blood collection?
    a. Coccygeal vein
    b. Cephalic vein
    c. Medial saphenous vein
    d. Facial vein

16. Lameness is a common disease of dairy cows and most commonly requires which treatment?
    a. Corrective shoes
    b. Casts
    c. Corrective trimming
    d. Surgery

17. Which of the following has the least herding instinct?
    a. Cattle
    b. Sheep
    c. Horses
    d. Pigs

18. Unlike ruminants, pigs have a genetic predisposition to which of the following?
    a. Anorexia nervosa
    b. Epilepsy
    c. Hyperthermia
    d. Laryngeal spasms

19. Which device is commonly used to restrain adult pigs for blood collection?
    a. Rope
    b. Hobbles
    c. Snare
    d. Gloves

20. Ear protection is necessary when restraining which animal?
    a. Llamas
    b. Sheep
    c. Goats
    d. Pigs

21. Restraint of potbellied pet pigs is most similar to that of
    a. Adult farm pigs
    b. Piglets
    c. Dogs
    d. Sheep

22. What is occurring when llamas and alpacas make a gurgling sound while being captured?
    a. Respiratory distress
    b. Getting ready to spit
    c. Diarrhea
    d. Colic

23. What are camelids doing when they “kush”?
    a. Spitting
    b. Rearing up
    c. Lying down
    d. Herding

24. How does a deer restraint chute differ from the one used with cattle?
    a. It rotates
    b. It is taller
    c. It is brighter
    d. The floor drops out

25. What is the term for the rapid dilating and constricting of a parrot’s pupils?
    a. Pinning
    b. Nystagmus
    c. Strabismus
    d. Miomydriasis

26. Being able to visualize a bird’s keel while being restrained allows what to be observed?
    a. Body temperature
    b. Breathing
    c. Feces
    d. Beak

27. With which animal are leather hoods often used as part of the restraint procedure?
    a. Macaw
    b. Ferret
    c. Alpaca
    d. Falcon

28. Which animal, if improperly restrained, can break its own back while still being held?
    a. Ferret
    b. Guinea pig
    c. Hawk
    d. Rabbit

29. Which rodent is normally most aggressive to handle?
    a. Guinea pig
    b. Ferret
    c. Hamster
    d. Mouse

30. In which animal is fur slip most likely to occur?
    a. Rabbit
    b. Gerbil
    c. Sugar glider
    d. Mouse

31. Snakes often threaten by doing which of the following?
    a. Hissing
    b. Growling
    c. Curling into a ball
    d. Spitting

32. Which of the following has a plastron?
    a. Iguana
    b. Macaw
    c. Box turtle
    d. Python

EXERCISE 6.8 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 6.9 CASE STUDY: RECAPTURING AN ESCAPED DOG

You are walking a newly arrived German Shepherd through the clinic and it slips out of its collar and runs out into the enclosed courtyard to cower in the bushes. Describe what you should do to recapture it.

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EXERCISE 6.4 SHORT ANSWER: TERMS AND DEFINITIONS

Instructions: Provide a short answer to each of the following questions in the space provided.

1. Horses have almost 360-degree vision, but there are a few blind spots. Where are they located and what is their significance in working around horses?

2. What is meant by "diversionary restraint techniques"? Give some examples of diversionary restraint techniques used with horses.

3. Give an example of one animal found in each group:

   a. Passerine _____

   b. Raptorial species _____

   c. Psittacine _____

EXERCISE 6.8 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. What are the three indications or goals of animal restraint?

   i. _____

   ii. _____

   iii. _____

2. Describe four different visual or aural indicators of an animal's state of mind.

   i. _____

   ii. _____

   iii. _____

   iv. _____

3. What is Feliway® and how is it used to make a cat feel more comfortable in the clinic?

_____

_____

_____

_____

_____

4. What are four common human behaviors that can appear hostile or threatening to an unfamiliar dog in the clinic?

   i. _____

   ii. _____

   iii. _____

   iv. _____

5. What are some ways to minimize anxiety for a patient in the hospital?

_____

_____

_____

_____

_____

_____

_____

_____

6. Describe a safe method for removing a dog from a large cage or run.

_____

_____

_____

7. What is the disadvantage of using sedatives to examine a pet?

8. What are two disadvantages of scruffing a cat for restraint?

   i. _____

   ii. _____

9. What is the disadvantage of using gauntlets to restrain an aggressive cat?

10. What are signs of horse aggression?

11. What are the signs of fear shown by a horse?

12. Describe how to apply a tail tie to a horse.

13. What are the primary differences in the way that dairy cows and beef cattle are restrained?

14. Handling livestock such as cattle or swine always involves a degree of danger, but some animals, depending on their signalment or condition, are particularly dangerous to handle. What characteristics warn of the need for even more caution than usual?

15. What are the signs shown by an aggressive bull?

16. Describe the tail tie and the tail jack that are used to restrain cattle.

    a. Tail tie:

    b. Tail jack:

17. If you go into a pen, the pigs may start to chew on your clothes.

    a. What does this mean?

    b. A pig board can be used to minimize this behavior. What is a pig board?

    c. Why does the pig board need to be kept near the ground?

18. Describe the appearance of an aggressive llama.

19. What are some unique problems seen when restraining camelids?

20. In what way does the group behavior of sheep and goats differ from that of cattle?

21. Describe the standard technique for restraining a ewe.

22. Some of the techniques used to restrain camelids are somewhat similar to those used for horses but are not useful for sheep and goats. Describe some of these techniques.

23. How does a deer restraint chute differ from the one used with cattle?

24. What are some signs that a parrot may not want to be handled by someone?

25. What are some of the main differences in the way a small passerine bird, such as a finch, and a large psittacine should be restrained?

26. Describe the appearance of a defensive lizard.

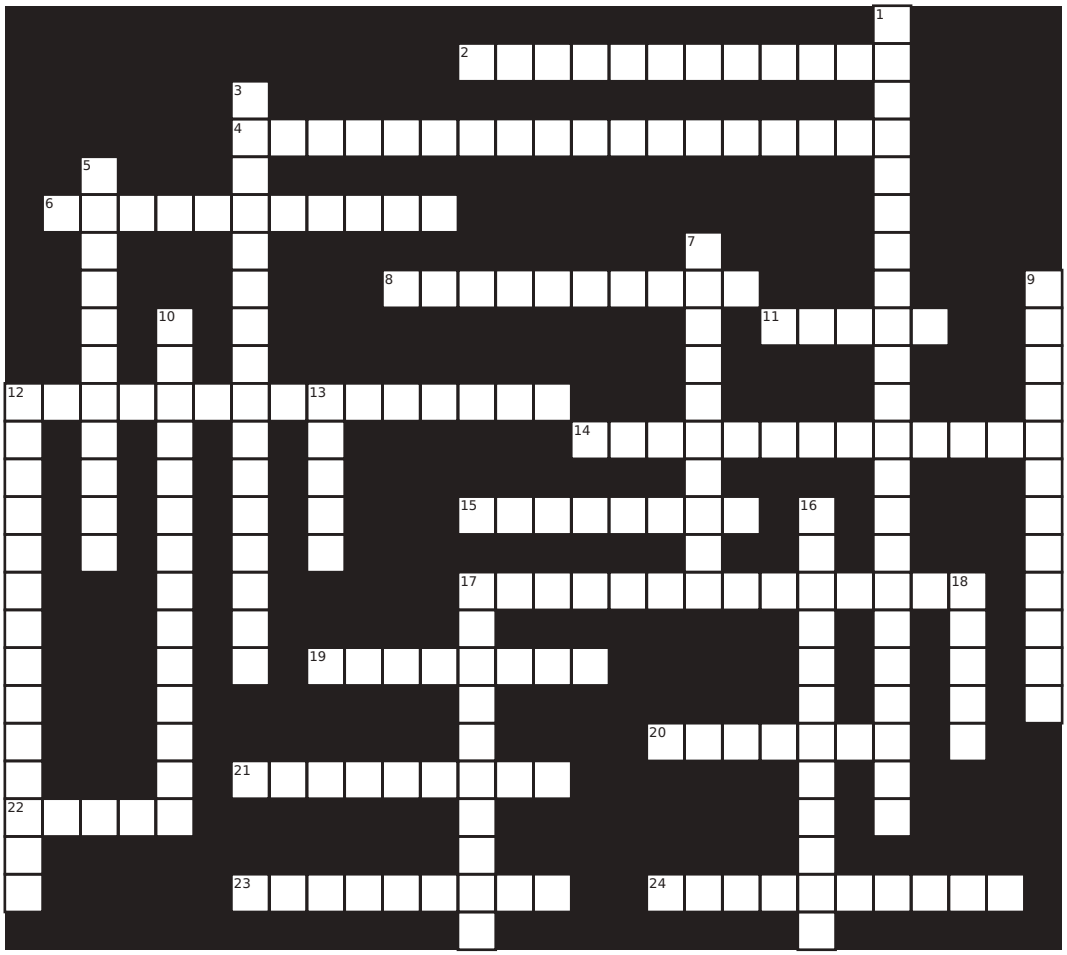
7 History and Physical Examination

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, spell, and define all of the Key Terms in this chapter.
2. Obtain an accurate and complete medical history by:
   - Explaining the role of the veterinary technician in obtaining the patient's medical history.
   - Listing questions commonly used to obtain a dog's or a cat's medical history.
   - Describing what a leading question is, and explaining why asking the owner leading questions can lead to inaccurate historical information.
   - Describing the type of information contained in each section of the patient's medical history for dogs and cats.
   - Explaining what a patient's signalment is and how it relates to patient assessment.
   - Listing six aspects of an animal's origin, background, and past medical history that may be relevant to a presenting complaint.
3. Describe the general procedures used to perform a physical examination in dogs and cats.
4. Discuss methods for performing a comprehensive evaluation of each of the body systems in large animal species.
5. Describe why the process of gathering historical information on herd health differs from taking an individual patient's history.
6. List and describe unique procedures used in the examination of horses and ruminants.

EXERCISE 7.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

2 Occurs when heat-dissipating mechanisms cannot overcome excessive ambient temperatures.
4 A method of evaluating nutritional status. (three words)
6 Decreased circulating blood volume.
8 Enlargement of the kidneys.
11 Decreased perfusion and oxygen delivery to tissues.
12 A condition that causes a lack of lung sounds in the ventral lung fields. (two words)
14 A physical indication of the difference between the systolic and diastolic arterial pressure. (two words)
15 A disease condition that causes an enlarged uterus because of build up of pus.
17 Abnormal fluid build up within the lung tissue. (two words)
19 Referring to the "arm pit."
20 Inflammation of the large bowel.
21 Excessive grooming that damages hair and skin.
22 The nostrils.
23 Mental activity of a patient.
24 The age, sex, breed, color, and reproductive status of an animal.

Down

1 A congenital heart defect that results in "bounding" pulses. (three words)
3 A technique used to detect abdominal gas accumulations. (two words)
5 A result of impaired thermoregulation in any sick animal, such as a cat with chronic renal failure.
7 The presence of sugar in the urine.
9 An audible heartbeat without a pulse. (two words)
10 A heart defect associated with narrowing of the outflow tract of the left ventricle. (two words)
12 Abnormal movement of abdominal contents through the pelvic diaphragm. (two words)
13 Elevated body temperature.
16 A condition that causes a lack of lung sounds in the dorsal lung fields.
17 An adjective indicating increased water consumption.
18 Referring to the ear.

EXERCISE 7.2 MATCHING #1: MEDICAL HISTORY

Instructions: Historical information can be divided into several sections. Match each statement in column A with the corresponding section of the medical history to which it belongs in column B by writing the appropriate letter in the space provided.

Column A

1. _____ I brought her in today because she started vomiting about a week ago.
2. _____ She has no allergies to any medications as far as I am aware.
3. _____ She was feeling well until last Tuesday.
4. _____ I am giving her hairball medicine twice a week.
5. _____ She is 3 years old and was spayed at 6 months of age.
6. _____ I don't see any change in the amount of water she is drinking or the amount of urine in the box.
7. _____ She was vomiting about once a day for a few days, but is now vomiting a couple of times a day.
8. _____ She got an infection 2 years ago from a cat bite and had a cold when she was a baby.

Column B

A. Signalment
B. Background information
C. Past pertinent medical history
D. Presenting complaint
E. Last normal
F. Progression
G. Systems review
H. Medications

EXERCISE 7.3 MATCHING #2: KEY TERMS

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ Ataxia	A. Inspiratory noise similar to snoring
2. _____ Pruritic	B. Intestinal motility sound
3. _____ Borborygmus	C. Skin lesions caused by scratching
4. _____ Icterus	D. Harsh, high-pitched respiratory sound
5. _____ Stridor	E. Foul odor to the breath
6. _____ Alopecia	F. Incoordination
7. _____ Ileus	G. Complete absence of intestinal motility
8. _____ Stertor	H. Itchy
9. _____ Excoriation	I. Hair loss
10. _____ Halitosis	J. Yellow mucous membranes

EXERCISE 7.4 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ The medical record is a legal document.
2. _____ Congenital defects are more likely to be diagnosed in younger patients.
3. _____ There is no need to ask behavior-related questions when obtaining a history about a sick animal.
4. _____ Animals do not suffer from allergic reactions to medications.
5. _____ Pyometra occurs most commonly 2 weeks to 2 months following a heat cycle.
6. _____ Many mammary tumors in dogs are prevented by spaying before the first heat.
7. _____ Medical terminology should be avoided on the medical record.
8. _____ Hypothermia is more common in patients that are young, old, or thin.
9. _____ In a normal animal the heart rate should be twice the pulse rate.
10. _____ The pulse pressure is strong in an animal in hypovolemic shock.
11. _____ Gingivitis is a precursor to periodontal disease.
12. _____ The nictitating membrane is also known as the third eyelid.
13. _____ Normal tracheal airflow is turbulent and the respiratory sounds should be loud and harsh.
14. _____ Hyperemia of the gingiva is usually caused by dehydration.
15. _____ The liver cannot be palpated in a normal animal.
16. _____ The canine uterus cannot be palpated unless it is enlarged.
17. _____ The popliteal lymph nodes are located in the caudal ventral abdomen just medial to the thighs.
18. _____ All of the cranial nerves can be evaluated on a neurologic examination.
19. _____ The pupillary light reflex tests cranial nerves II and III.
20. _____ Equine insurance coverage is common in the United States.
21. _____ It is acceptable to dip the animal thermometer in the horse's water bucket to provide lubrication before inserting it in the rectum.
22. _____ The normal pulse rate in the adult horse at rest is 17 to 27 bpm.
23. _____ Normal horses cannot breathe through the mouth.
24. _____ Most murmurs heard in horses are ejection murmurs and are not signs of valvular abnormalities.
25. _____ A horse's height is measured by hands with one hand equal to six inches.
26. _____ When ruminants breathe through their mouths it is usually considered a sign of distress or heat stress.
27. _____ Pings are normal findings when auscultating a ruminant's abdomen.

EXERCISE 7.5 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. Which term refers to sugar in the urine?
   a. Icterus
   b. Polyuria
   c. Glycosuria
   d. Hyperglycemia

2. What is seen in a polydipsic cat?
   a. Hypovolemia
   b. Increased drinking
   c. Ileus
   d. Increased urination

3. Which term refers to an elevated body temperature?
   a. Ileus
   b. Hypothermia
   c. Hypertension
   d. Hyperthermia

4. A cat with a body temperature of 98ºF is exhibiting which of the following?
   a. Hyperthermia
   b. Hypothermia
   c. Stridor
   d. Hypovolemia

5. Which may be occurring in a cat that resists having a rectal thermometer placed?
   a. Ileus
   b. Polydipsia
   c. Colitis
   d. Icterus

6. Which may be a sign of upper airway disease?
   a. Ileus
   b. Ataxia
   c. Pyometra
   d. Stertor

7. The aural temperature is taken from which site?
   a. Rectum
   b. Ear
   c. Mouth
   d. Vagina

8. From which vessel is the pulse generally taken in a dog or cat?
   a. Jugular vein
   b. Carotid artery
   c. Femoral artery
   d. Cephalic vein

9. A pulse deficit occurs in which situation?
   a. When the heart rate is less than the pulse rate
   b. When the heart rate exceeds the pulse rate
   c. Whenever the pulse slows down
   d. Whenever the pulse is weaker than normal

10. Which is caused by a cardiovascular problem?
    a. Glycosuria
    b. Stertor
    c. Colitis
    d. Shock

11. Which may cause a weak peripheral pulse?
    a. Hypovolemia
    b. Stertor
    c. Hypothermia
    d. Ileus

12. The rolling of the lower eyelid in toward the eye is known as _____.
    a. Ectropion
    b. Entropion
    c. Hypyon
    d. Miosis

13. If the eyeball feels firm on palpation, what is occurring?
    a. Mucocele
    b. Ophthalmitis
    c. Glaucoma
    d. Retinitis

14. What is the medical term for pupils of different sizes?
    a. Heterotropia
    b. Cataract
    c. Mydriasis
    d. Anisocoria

15. Petechiation inside the pinna may be a sign of which disorder?
    a. Thrombocytopenia
    b. Otitis externa
    c. Hematoma
    d. Otitis media

16. Stenotic nares are commonly seen in _____.
    a. Aortic stenosis
    b. Brachycephalic breeds
    c. Dolichocephalic breeds
    d. Arabian horses

17. Which device is used for auscultation?
    a. Otoscope
    b. Ophthalmoscope
    c. X-ray machine
    d. Stethoscope

18. Which term refers to increased fluid in the thoracic cavity?
    a. Pleural effusion
    b. Colitis
    c. Pyometra
    d. Ascites

19. Capillary refill time is used to assess which condition?
    a. Anemia
    b. Dehydration
    c. Perfusion
    d. Heart rate

20. What does a sinus arrhythmia indicate in a dog?
    a. A normal rhythm
    b. Cardiomyopathy
    c. Congestive heart failure
    d. Shock

21. What causes the jugular veins to be distended all the way up the neck?
    a. Hypotension
    b. Increased central venous pressure
    c. Dehydration
    d. Anemia

22. Which is a sign of a bacterial skin infection?
    a. A nodule
    b. Broken hairs
    c. Pustules
    d. A mass

23. What is seen in an animal that is obtunded?
    a. Hyperactivity
    b. Head tilt and circling
    c. Weak in the rear end
    d. Not interested in surroundings

24. Nystagmus often suggests that the lesion is located where in the patient?
    a. Vestibulocochlear nerve (cranial nerve VIII)
    b. Optic nerve (cranial nerve II)
    c. Sciatic nerve
    d. Nasal passage

25. Which disorder is associated with a gray coat color in the horse?
    a. Obstructive urolithiasis
    b. β-Mannosidase deficiency
    c. Neonatal isoerythrolysis
    d. Melanoma

26. Black walnut shavings may cause what problem in horses?
    a. Colic
    b. Laminitis
    c. Thrush
    d. Asthma

27. What is the normal rectal temperature for an adult thoroughbred horse?
    a. 98ºF to 99ºF
    b. 99ºF to 101.5ºF
    c. 100.5ºF to 103ºF
    d. 102ºF to 104.5ºF

28. From which vessel is the pulse most commonly felt in the horse?
    a. Femoral artery
    b. Carotid artery
    c. Facial artery
    d. Jugular vein

29. Which term refers to the absence of intestinal sounds and may be noted in the horse?
    a. Borborygmus
    b. Icterus
    c. Ileus
    d. Colitis

30. What is the normal eructation rate in a normal cow?
    a. 6 per hour
    b. 12 per hour
    c. 18 per hour
    d. 24 per hour

EXERCISE 7.6 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 7.7 CASE STUDY: HISTORY AND PHYSICAL EXAMINATION FINDINGS

A 16-year-old, spayed, female, Burmese cat named Coco presents for vomiting of 4 days duration. Coco's vaccinations are current and she is strictly an indoor cat. This is Coco's first visit to your hospital. The doctor has asked you to take a history, perform an initial physical examination, and give him the results, so that a decision can be made regarding next steps. You ask all the standard questions required at your clinic including each of the questions below.

1. Briefly explain why each question is important.

   a. Are there any other cats in the house?

   b. Can you describe the vomitus?

   c. When does she vomit?

   d. What, when, and how often do you feed her?

   e. When was the last time she was normal?

   f. Do you keep the windows open at home?

   g. Has there been a change in her appetite or water consumption?

h. What toys does she play with?

Coco is quiet and depressed, but purrs as you begin your physical examination. The pertinent physical findings are as follows:

- Body temperature of 97.5°F
- Heart rate of 260 beats per minute
- Poor pulse quality
- Pale, dry mucous membranes
- Normal respiratory effort
- No abnormal lung sounds noted
- Prolonged capillary refill time
- Body condition score of 4/9
- Prolonged response to the "skin pinch" test
- Cool extremities
- Severe halitosis
- Poor dentition
- Vomit stains under chin and sternum
- Oral ulcerations along gingiva

2. Which of these physical findings suggest poor perfusion? Why?

3. Which physical findings suggest dehydration?

4. Is this an emergency case that needs immediate attention? Why or why not?

5. Coco is tachycardic with a heart rate of 260 beats per minute. What physical findings could be linked to the tachycardia?

6. The owner inquires about her halitosis, and tells you that it was noticed several months ago. What other physical examination findings listed above are possibly linked to the bad breath?

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EXERCISE 7.6 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1a. Where do you find the signalment and what does it include?

1b. Why is it important to know the signalment?

2. How do you get a patient history from an owner who talks incessantly about unrelated topics?

3. How do you establish rapport with a first-time client?

4a. How does an open-ended question differ from a leading question?

4b. Which type of question do we prefer when obtaining a history from the client and why?

5. What principles must be followed when documenting historical information on the patient's medical record?

6. Each of the following is a component of the background information that must be gathered when taking a history. Give at least two examples of the specific points that should be included in each component.

   a. General management

      i. _____

      ii. _____

   b. Preventive medicine

      i. _____

      ii. _____

   c. Behavioral information

      i. _____

      ii. _____

   d. Household information

      i. _____

      ii. _____

   e. Allergy history

      i. _____

      ii. _____

   f. Reproductive history

      i. _____

      ii. _____

7. Why is it important to approach a physical examination systematically?

_____

_____

_____

8a. What is meant by "observing a patient's mentation"?

_____

8b. What are the different states that represent normal and abnormal mentation, and what does each state signify?

_____

_____

_____

9. Name five conditions that will cause hyperthermia.

   i. _____

   ii. _____

   iii. _____

   iv. _____

   v. _____

10. What is the normal TPR of a dog and cat?

    a. Dog—Temperature: _____; Pulse: _____; Respiratory rate: _____

    b. Cat—Temperature: _____; Pulse: _____; Respiratory rate: _____

11. Name three lesions that may be observed under an animal's tongue, and give one example of each.

    i. _____

    ii. _____

    iii. _____

12. Name some common clinical signs seen in animals with diseases of the oral cavity.

    _____

    _____

13. Increased lens opacity in dogs may be caused by one of two things. Name these causes and indicate the significance of each.

    i. _____

    ii. _____

14a. Describe the appearance of a normal eardrum as seen through an otoscope.

    _____

14b. Now describe common abnormalities that should be noted.

    _____

    _____

15. The chest piece of a typical stethoscope has two sides. Name them and describe how each is used.

    Side #1: _____

    _____

    Side #2: _____

    _____

16. What does each of the following suggest if present on auscultation of the lungs?

    a. Wheezes _____

    b. Crackles _____

    c. No sounds _____

17. What causes heart murmurs to occur?

    _____

18. Define each of the following as they relate to an examination of the cardiovascular system.

    a. Systolic murmur _____

    b. Diastolic murmur _____

    c. Grade IV murmur _____

19. Describe the location of the anal sacs in the dog.

    _____

20. Describe the location and characteristics of a normal prostate gland on a rectal exam.

    Location: _____

    Characteristics: _____

21. When alopecia is noted on a dog or cat, how should it be more completely described?

    _____

    _____

    _____

    _____

    _____

22. What are five general possibilities for a palpable mass in the skin? In other words, if you palpate a mass, what are five possible causes?

    i. _____

    ii. _____

    iii. _____

    iv. _____

    v. _____

23. How does the feel of the mandibular lymph nodes on palpation differ from the feel of the nearby salivary glands?

24. On palpation, how do abnormal lymph nodes feel as opposed to normal ones?

    Normal lymph nodes: _____

    Abnormal lymph nodes: _____

25. What are four clinical signs seen in animals with musculoskeletal system problems?

    i. _____

    ii. _____

    iii. _____

    iv. _____

26. How do you determine which limb is affected when watching a lame animal move?

27. List at least six clinical signs seen in dogs and cats that are referable to the nervous system.

    i. _____

    ii. _____

    iii. _____

    iv. _____

    v. _____

    vi. _____

28. What is the doll's-eye reflex and what does it assess?

29. How do you test conscious proprioception and how does it appear in a normal patient?

30. How is the withdrawal reflex performed and what is the appearance of a normal response?

How it is performed:

Normal response:

31. A horse may have three different types of insurance coverage. What are they?

i.

ii.

iii.

32. The basic approach to effective history taking is the same for both large- and small-animal patients. However, when taking a history for a large-animal patient, it is important to get information about the health of the entire herd.

a. What specific information about the herd is important to know?

b. Why is this information necessary?

33. What are two common problems associated with taking a rectal temperature from a horse and what is done to prevent them from occurring?

    i. _____

    _____

    ii. _____

    _____

    Prevention: _____

    _____

34. Where is the best place to auscultate abdominal sounds in the horse?

    _____

35. What is the cause of each of the following abnormal colors or appearances of the mucous membranes in the horse?

    a. Cyanosis _____

    b. Purple gums _____

    c. Yellow gums _____

    d. Petechiae _____

    e. Brick red _____

36. What are the two most common causes of a prolonged capillary refill time in the horse?

    i. _____

    ii. _____

37. As scales are often not available on a farm, describe how the weight is determined for a horse.

    _____

    _____

    _____

38. Describe the method used to assess the rumen in a cow and indicate what is considered normal.

    _____

    _____

39. Describe the appearance of bloat in a ruminant.

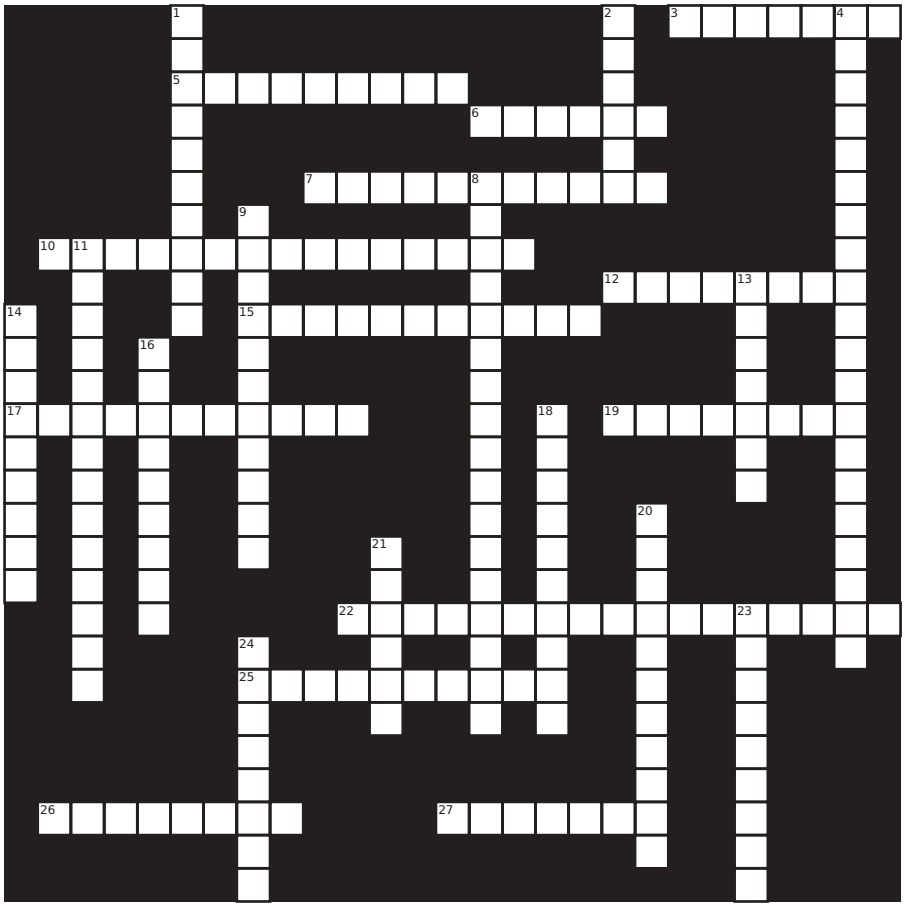
8 Preventive Health Programs

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Define, pronounce and spell all of the Key Terms.
2. Compare and contrast the issues and information discussed during wellness visits at various life stages of a dog or cat (puppy/kitten, adult, senior/geriatric).
3. Do the following regarding immunity in cats and dogs:
   - Differentiate between active and passive immunity, and discuss why it is necessary to administer a series of vaccinations to young puppies and kittens.
   - Differentiate between noninfectious and infectious types of vaccines, and explain the purpose of adjuvants.
   - Describe the storage, handling, reconstitution, and dosing of animal vaccines.
   - List the recommended administration locations for various canine and feline vaccinations.
   - Distinguish between core and noncore vaccines, and explain what is meant by duration of immunity.
   - Identify core and noncore vaccines for dogs and cats.
   - Describe potential adverse vaccine events and how to deal with various adverse events should they occur.
4. Explain the importance of discussing potential canine and feline parasitic infections with owners, and describe general preventive measures that can be taken.
5. Describe a routine preventive health program for horses including physical examination, vaccinations, prevention of parasitic infections, dental and hoof care, and nutrition.
6. Describe vaccines and other preventive measures that can be used during various life stages of pigs, cattle, sheep, and goats.

EXERCISE 8.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

3 Test for equine infectious anemia.
5 Produced by hyperimmunization of donor horses with tetanus toxoid.
6 Purified, inactivated toxin of Clostridium tetani is an example of this.
7 Freeze dried.
10 Induced by transfer of antibodies via the placenta, colostrum, or intravenous infusion of plasma. (2 words)
12 Substance that helps stimulate a stronger immune response to antigens in a vaccine.
15 Severe allergic or hypersensitivity response to a foreign substance.
17 Canine teeth of the piglet trimmed in the first week of life. (2 words)
19 Infection of the mammary gland.
22 Contains an altered pathogen that can infect an animal's cells to stimulate immunity. (2 words)
25 Low white blood cell count.
26 Adjective indicating a disease transferred between animals and man.
27 Used to reconstitute lyophilized infectious vaccine.

Down

1 Intended to prevent new animals from spreading disease to animals in an established herd.
2 Contaminated inanimate object such as a feeding utensil.
4 Contains whole killed pathogens or subunits that are capable of initiating immunity but not causing disease. (2 words)
8 Designed to stimulate local immunity. (2 words)
9 A deciduous premolar that fails to fall out in the horse. (2 words)
11 Induced when the immune system produces antibodies in response to antigens. (2 words)
13 Contains antigen used to induce an active immune response.
14 Benign inflammatory mass that may develop at the site of vaccination administration.
16 Small, pointed rudimentary first premolars that interfere with the bit. (2 words)
18 A defect present from birth that may lead to a serious condition is said to be
20 Protocol to prevent introduction of disease organisms onto the farm.
21 Animal in the last 25% of its anticipated life span.
23 Antibody-rich mammary secretion ingested by newborn in first 24 hours of life.
24 Removal of enamel points from horse cheek teeth by rasping.

EXERCISE 8.2 MATCHING: ABBREVIATIONS RELATED TO PREVENTIVE HEALTH PROGRAMS FOR DOGS AND CATS

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ T_4	A. Highly contagious virus in dogs that produces vomiting, diarrhea, leukopenia, and fever.
2. _____ FVRCP	B. Combination vaccine for cats, including herpesvirus, calicivirus, and panleukopenia.
3. _____ FeLV	C. Lentivirus that causes immunosuppression in cats.
4. _____ FHV-1	D. Retrovirus that causes immunosuppression, anemia, and lymphoma in the cat.
5. _____ FCV	E. Upper respiratory disease in cats that causes oral ulcerations.
6. _____ FPV	F. Combination vaccine for dogs, including distemper, parvovirus, adenovirus type 2, and parainfluenza.
7. _____ FIV	G. Serum hormone that may be high in senior cats and low in senior dogs.
8. _____ CDV	H. Herpesvirus that causes sneezing, ocular, and nasal discharge and fever.
9. _____ CAV-2	I. Paramyxovirus that causes fever, respiratory disease, vomiting, diarrhea, anorexia, dehydration, seizures, ataxia, and paresis in dogs.
10. _____ CPV-2	J. Parvovirus in cats that causes leukopenia, fever, lethargy, anorexia, dehydration, vomiting, and diarrhea.
11. _____ DA_2PP	K. One of the causes of canine infectious tracheobronchitis that gives cross-immunity for infectious canine hepatitis.

EXERCISE 8.3 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. Young children exposed to roundworm eggs from puppies and kittens may develop _____ _____ _____.

2. Puppies and kittens are vaccinated every 3 to 4 weeks until they are 16 weeks old to stimulate an _____ immune response once _____ immunity declines.

3. Vaccines should be injected within _____ _____ of reconstitution.

4. Vaccines recommended for all animals to protect against highly contagious pathogens are called _____ vaccines.

5. _____ vaccines are recommended for animals at high risk to develop disease.

6. "_____ of _____" is the length of time an animal is considered to be immune from developing disease after exposure to a pathogen.

7. Kittens that are infected with feline panleukopenia can develop _____ _____ in utero or shortly after birth.

8. The trivalent vaccine for equine encephalomyelitis protects against _____, _____, and _____ viruses.

9. Heavy parasite loads in horses lead to decreased _____ and _____ performance plus weight loss and colic.

10. Fecal examinations in horses that show ova after deworming indicate that _____ has developed to the agent and egg counts of _____ eggs per gram before deworming, indicate that treatment intervals are too long.

11. To minimize the risk of that disease will spread, the _____ pigs are worked with before the _____ pigs.

12. Swine operations do not routinely deworm because pigs are not housed _____.

13. A virus that causes reproductive failure, respiratory disease, and chronic infections in pigs is called porcine _____ and _____ syndrome virus.

14. Beef calves are weaned at _____ months of age by removing the calf from the dam, whereas dairy calves are raised away from their dams so weaning is a _____ adjustment and not as stressful.

15. Cattle vaccinated against brucellosis are identified with a(n) _____ ear tag and tattoo in the _____ ear.

16. Cattle vaccines are administered in the _____ region to preserve _____ quality.

17. Deficiency of _____ causes white muscle disease in lambs.

18. To dehorn goats at a young age, the horn bud is destroyed by a _____ _____ instrument.

EXERCISE 8.4 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Neutering eliminates intermale aggression, separation anxiety, enlargement of the prostate, and testicular cancer.

2. _____ Serum thyroxine levels are frequently measured in senior pets to rule out hyperthyroidism in dogs and hypothyroidism in cats.

3. _____ Dogs that regularly swim are prone to excessive nail growth and will need more frequent nail trims.

4. _____ Active immunity can only be stimulated by an antigen injected in the form of a vaccine.

5. _____ Foals that fail to ingest colostrum at birth are vaccinated with core vaccines within 24 hours of birth.

6. _____ Immune competence is when an animal is capable of mounting an active immune response in the face of declining maternal antibody levels.

7. _____ Noninfectious vaccines are more likely to cause hypersensitivity reactions than infectious vaccines.

8. _____ Administering an intranasal vaccine subcutaneously or intramuscularly may cause serious side effects.

9. _____ Sites for canine vaccination are not standardized, but the rabies vaccination is frequently administered in the left hind leg and the DA_2PP in the left front leg in keeping with feline recommendations.

10. _____ Cats will test positive on the antibody-based FeLV screening test after vaccination.

11. _____ Minor side effects to vaccines include lethargy, soreness at injection site, and decreased appetite.

12. _____ Conditions that may be adverse reactions to vaccination include immune-mediated thrombocytopenia, immune-mediated hemolytic anemia, and thyroiditis.

13. _____ *Clostridium tetani* causes muscular weakness and horses should be vaccinated for it annually.

14. _____ Wolf teeth are removed under general anesthesia at 6 months of age in the horse to avoid problems with the bit when the training regime is begun.

15. _____ Thrush occurs on the sole of the horse foot as a result of a moist environment and dirt accumulation allowing bacterial growth.

16. _____ Preventative medicine is important in livestock species to maintain herd productivity.

17. _____ Kids and lambs born to unvaccinated does and ewes are vaccinated at 6 and 10 weeks of age.

18. _____ The barber pole worm causes anemia in sheep by attaching to their abomasum and this parasitism is a major issue in small ruminants.

19. _____ Horses are wormed for bots and tapeworms in the spring with either moxidectin or ivermectin and with praziquantel.

20. _____ Core vaccination in cattle protects them from leptospirosis, campylobacteriosis, rotavirus, and coronavirus.

EXERCISE 8.5 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer for each of the following questions.

1. Spaying before the second heat cycle in cats and dogs decreases
   a. Aggression
   b. Vaccine induced sarcoma
   c. Lymphoma
   d. Mammary carcinoma

2. Older dogs may require more frequent nail trims because of decreased exercise associated with
   a. Kidney disease
   b. Cognitive dysfunction
   c. Degenerative joint disease
   d. Hyperthyroidism

3. Passive immunity in the puppy and kitten primarily occurs
   a. When antibodies pass to the offspring in utero via the placenta
   b. By vaccination within 24 hours of birth
   c. By ingestion of colostrum within 24 hours of birth
   d. With intravenous infusion of antibody-rich plasma at birth

4. To maximize the chance of successful treatment in the event that a vaccine-induced sarcoma develops, it is now recommended that feline vaccines be administered
   a. Distal to the shoulder or hip
   b. Proximal to the shoulder or hip
   c. In the intrascapular region
   d. Intranasally

5. Core vaccines for the cat are
   a. Feline leukemia, panleukopenia, calicivirus, and rabies
   b. Feline leukemia, feline immunodeficiency virus, panleukopenia, and rabies
   c. Feline viral rhinotracheitis, calicivirus, panleukopenia, and rabies
   d. Feline viral rhinotracheitis, *Chlamydophila felis*, panleukopenia, and rabies

6. Core vaccines in the dog protect against
   a. Parvovirus, adenovirus-2, leptospirosis, and rabies
   b. Distemper, parvovirus, *Bordetella*, and rabies
   c. Distemper, parvovirus, leptospirosis, and rabies
   d. Parvovirus, distemper, adenovirus-2, and rabies

7. Many of the core feline combination and canine combination vaccines are administered every
   a. Year
   b. 2 years
   c. 3 years
   d. 5 years

8. Cats should test negative before vaccination against
   a. Feline immunodeficiency virus
   b. Feline panleukopenia
   c. *Chlamydophila felis*
   d. Calicivirus

9. Which noncore feline vaccination is recommended for multicat households with a past history of bacterial upper respiratory infections?
   a. Feline leukemia
   b. Feline immunodeficiency virus
   c. *Chlamydophila felis*
   d. *Giardia*

10. Disease process in dogs that manifests as a dry, honking cough and that is transmitted dog to dog through respiratory secretions is caused by
    a. Canine distemper virus
    b. Canine coronavirus
    c. *Bordetella bronchiseptica*
    d. Canine parvovirus

11. Veterinary assistance should be sought if, following vaccination, the animal exhibits
    a. Mild fever and decreased appetite
    b. Soreness at the injection site
    c. Sneezing after an intranasal vaccine
    d. Facial swelling and difficulty breathing

12. For most core vaccines, a recommended length of time between initial and booster vaccines during the initial vaccine series in dogs, cats, livestock, and horses is generally
    a. 2 weeks
    b. 4 weeks
    c. 6 weeks
    d. 8 weeks

13. Foals born to unvaccinated mares are routinely vaccinated at what age
    a. 1 to 2 months
    b. 3 to 4 months
    c. 5 to 6 months
    d. 7 to 8 months

14. Head tossing, excessive chewing of the bit and bucking in the horse can be signs of
    a. Tick infestation
    b. Internal parasitism
    c. Nutritional deficiency
    d. Dental issues

15. Young horses and horses with dental issues should have dental exams
    a. Every 6 months
    b. Once a year
    c. Every 2 years
    d. Every 3 years

16. Upper cheek teeth in the horse can be removed by driving the tooth root into the oral cavity from the
    a. Frontal sinus
    b. Nasal sinus
    c. Maxillary sinus
    d. Orbit

17. To maintain proper balance and avoid problems with lameness in the horse, hooves should be trimmed
    a. Every 2 to 4 weeks
    b. Every 4 to 6 weeks
    c. Every 6 to 8 weeks
    d. Every 8 to 10 weeks

18. Thrush is treated by frequent cleaning of the sole of the foot and application of
    a. Copper- or iodine-based solutions
    b. Moxidectin or ivermectin
    c. Praziquantel
    d. Fenbendazole or oxibendazole

19. Anemia is prevented in piglets with supplementation of
    a. Selenium
    b. Magnesium
    c. Iron
    d. Calcium

20. Piglet tails are docked to prevent
    a. Chewing by other piglets
    b. Fecal contamination
    c. Maggot infestation
    d. Increased price of meat

21. Before entering the breeding herd, pigs are vaccinated for
    a. Parvovirus, erysipelas, and leptospirosis
    b. Parvovirus, brucellosis, and pseudorabies
    c. Leptospirosis, pseudorabies, and brucellosis
    d. Brucellosis, pseudorabies, and erysipelas

22. To prevent disease transmission, newly acquired pigs are not introduced to the rest of the herd for
    a. 10 days
    b. 14 days
    c. 21 days
    d. 30 days

23. Passive immunity blocks active immune response in calves that are vaccinated when younger than
    a. 3 months of age
    b. 4 months of age
    c. 5 months of age
    d. 6 months of age

24. Bovine leukosis virus in cattle causes
    a. Cancer
    b. Reproductive failure
    c. Respiratory disease
    d. Corkscrew hooves

25. Dairy cows are vaccinated against mastitis caused by
    a. *Clostridium perfringens*
    b. *Escherichia coli*
    c. *Streptococcus equi*
    d. *Campylobacter fetus*

26. Dairy cows should have their hooves trimmed
    a. Every 3 months
    b. Every 6 months
    c. Once a year
    d. Every 2 years

27. During the first few weeks of life, either tail docking or castration in sheep can be performed by
    a. Using a hot metal instrument to burn tissue off
    b. Applying a tight elastic band around the tail or to the scrotum
    c. Surgical removal
    d. Using an emasculatome

28. Diarrhea in sheep and goats is caused by single-celled parasites called
    a. *Leptospira pomona*
    b. *Clostridium perfringens* type C and D
    c. *Haemonchus contortus*
    d. Coccidia

29. Sheep and goats can be rapidly screened for anemia by checking the
    a. Conjunctiva
    b. Red blood cell count
    c. Mouth
    d. Capillary refill time

30. Core vaccination in sheep and goats protects against
    a. Rabies
    b. *Haemonchus contortus*
    c. *Clostridium perfringens* and *Clostridium tetani*
    d. Contagious ecthyma

EXERCISE 8.6 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 8.7 WORD SEARCH: PREVENTIVE HEALTH PROGRAMS FOR HORSES AND LIVESTOCK

Instructions: Find the words that are identified by the clues given below. The words may be located horizontally, vertically, or diagonally and may be reversed.

S R S C O T P I R A I X O N I L I A L S N
A T E I P E B R U C E L L O S I S I C I U
A Z R V L O Z L C I M R E A R R L O E T Q
L M N A E I E R R G T C I S E R K O L I N
M E S E N F H S A A Y E S R R X R O S L S
N S K R U G E J O H N E S D I S E A S E A
I S I S I L L S O R U S R T B U N J I Y O
S O E L A N F E R R P R S P R T S B O M T
U R A N U S B N S O N F T D H T A T D O E
R E C A E T E O I M H T Z R I R P I T L Z
I M R S I S O I R E T C A B O L Y P M A C
V O V I I I I B B H N X A D N C Y E E H L
E U E O U E S S E A R I U M R M M E R P O
L T F U V T T I S R R E U H O R I S Y E S
I H S U H U U S U U S L A Q O T N D S C T
N E L S I S O R I P S O T P E L O A I N R
T N S T T U Y A O R M V B V S H T P P E I
S I T I V I T C N U J N O C O T A R E K D
E Q U I N E H E R P E S V I R U S S L E I
W E I R X V L A U S R P I I A E I A A N U
R O L R A R P S U P R R L G A I S A S R M

Strangles
PotomacHorseFever
Johnesdisease
Purpurahemorrhagica
Rabies
Encephalomyelitis
SoreMouth
Campylobacteriosis
Brucellosis
Leptospirosis
Clostridium
WestNileVirus
Erysipelas
EquineHerpesvirus
Pseudorabies
EquineInfluenza
Botulism
Anthrax
Keratoconjunctivitis

EXERCISE 8.8 CASE STUDY: FELINE PREVENTATIVE HEALTH

Lily, a calico, female, domestic shorthair cat of unknown age presents for a check-up and vaccinations. According to the client, Ms. Rose, she found Lily wandering the neighborhood and decided to bring her into her home. As the veterinary technician, you take Ms. Rose and Lily back to an examination room and obtain the following information about Lily.

Weight and Vital Signs: Weight: 4 lbs; Heart Rate: 180 bpm; Respiratory Rate: 32 bpm; Temperature: 101.8°F.

Recent History: Lily has been in the neighborhood for about 4 weeks, since the neighbor on the corner moved away. Ms. Rose believes the neighbor that moved left Lily behind. Ms. Rose has been feeding Lily for the last 2 weeks and she appears to eat well but not gain weight. She has no information as to urinations or bowel movements as Lily is outside. She has decided to bring her inside with her two indoor cats, Petunia and Violet. She is concerned about Lily's introduction into the home and wants to make sure her other cats are not exposed to any diseases. She is also concerned that Lily may not acclimate to being an indoor-only cat since she has lived outdoors for a while.

Physical Examination Findings: Lily's adult canine teeth are erupted, indicating she is 6 months old. Lily is thin and black specks are noticed in her hair coat. The rest of her physical examination findings are unremarkable. A spay scar cannot be palpated on the ventral midline. It is expected that she may not be spayed.

Instructions: Answer the following questions based on the case above with regard to the best preventative health program for Lily and Ms. Rose considering the home and the environmental situation.

1. Because Lily has been an outdoor cat with no known vaccination history, what are the first diagnostic tests Lily should receive based on current recommendations?

2a. How could you explain the black specks in Lily's hair coat? What external parasite might they indicate?

2b. What is a commonly recommended treatment protocol that could be used for Lily to treat this parasite, including both eggs and adults?

2c. How could Petunia and Violet be protected from this problem?

3a. Assuming the diagnostics in #1 are negative, discuss the core vaccinations Lily should receive, including the site of injection for each.

3b. How often should each vaccine be boostered, assuming Lily will be living exclusively indoors?

4a. Describe potential adverse effects to the vaccines that you will have Ms. Rose monitor for.

4b. Which of the adverse effects listed above warrants immediate notification of the veterinary practice if it occurs?

5. If Lily exhibits any of the more serious side effects, what steps might the veterinarian take to minimize the likelihood of these effects in the future?

6a. If Lily develops a lump at the site of a vaccine injection, what are some possible reasons for this?

6b. Explain this to Ms. Rose using language she can understand.

6c. What might be done by the attending veterinarian to differentiate these causes?

7. Discuss a surgical procedure that would keep Lily from having an unwanted pregnancy and describe the other health benefits this procedure provides.

8a. If after surgery, Lily will not stay indoors, discuss the noncore vaccines she should receive, including the recommended injection site for each.

8b. How often should each vaccine be boostered?

8c. How might this change in Lily's activity affect the vaccines given to Violet and Petunia?

EXERCISE 8.6 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. Good client education is a very important part of any animal's preventive care visit. Issues that need to be discussed with the client change as the patient moves from one life stage to another, therefore the emphasis of the discussion changes. Please indicate the major points that would need to be emphasized for each of the following animals at the time of its wellness exam.

   a. An 8-week-old mixed-breed puppy in for its first visit.

   b. A 5-year-old adult cocker spaniel in for a yearly checkup.

c. A 13-year old West Highland terrier in for routine care.

2. What is the purpose for an adjuvant?

3. How should vaccines be stored, mixed, and handled prior to administering them?

Storage:

Mixing:

Handling:

4a. What is meant by “duration of immunity”?

4b. In general, which has a longer duration of immunity: infectious or noninfectious vaccines?

5. Horses have unique dental and hoof care needs.

   a. How often should their teeth be examined, and what is the nature of the dental care that they need?

   b. How often should their hooves be trimmed, and what is the nature of other hoof care that they need?

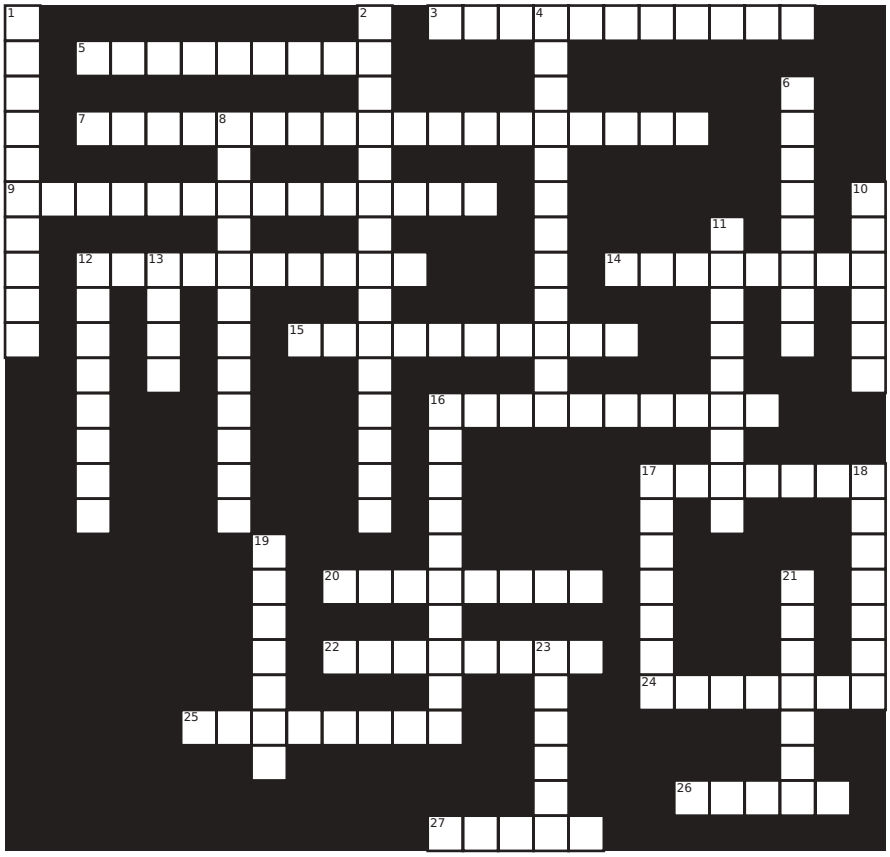
9 Small Animal Clinical Nutrition

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Define, pronounce, and spell all of the Key Terms.
2. List the macronutrients and micronutrients found in pet food. Explain what building-block molecules compose these nutrients, if any.
3. Compare and contrast the concepts of energy units, energy partitioning, metabolizable energy measurement, Atwater factors, energy density, and measurements of energy expenditure.
4. Discuss the requirements for protein, fat, carbohydrates, fiber, vitamins, and minerals in the diet of dogs and cats.
5. Explain various aspects regarding commercial pet food, including the following:
   - Describe how commercial pet food manufacturing has developed since the late nineteentth century and compare the different types of pet food available today.
   - Describe which marketing language bears little nutritional significance and explain how veterinary therapeutic diets may be used appropriately and inappropriately.
   - Explain how pet food manufacturing is regulated in the United States and identify the government agencies and organizations involved in the regulation of pet food.
   - List the components of pet food labels and explain how the information provided in each component should be interpreted.
6. Compare and contrast the reasons why clients might feed home-cooked diets to their pets.
7. Describe feeding protocols for healthy dogs and cats at each stage of life, including pregnant and lactating bitches.
8. Explain the principles of clinical nutrition.
9. Describe methods of providing therapeutic enteral and parenteral nutrition.
10. Describe a safe and effective weight-loss program for dogs and cats.

EXERCISE 9.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

3 The remaining parts of an animal carcass after processing that may be an ingredient in a pet food.
5 Proteins, fats, carbohydrates, vitamins, and minerals are examples of these.
7 Evaluated periodically to assess weight gain or loss. (3 words)
9 Assigned energy values of the macronutrients. (2 words)
12 The building blocks of proteins. (2 words)
14 This nutrient regulates absorption and mobilization of calcium in the body. (2 words)
15 Method of feeding in which the animal's bowl is kept full of food. (2 words)
16 Not through the intestine. For example, nutrition provided via the intravenous route.
17 A macromineral that is required in higher amounts during the growth stage.
20 Loss of lean body mass that may occur in a severely ill animal.
22 Poor or absent appetite.
24 Referring to the intestine. Providing nutrition directly to the gastrointestinal tract.
25 These nutrients may be water-soluble or fat-soluble.
26 The most important nutrient. Supports nutrient transport, temperature regulation, and organ structure.
27 A nutrient that passes through the stomach and small intestine unchanged.

Down

1 The building blocks of fats. (2 words)
2 The name of a type of nutritional support that should be started within 3 days of the onset of anorexia in stable, ill patients. (2 words)
4 Inhibits or slows the growth of microorganisms in a pet food.
6 This nutrient is administered to treat anticoagulant rodenticide poisoning. (2 words)
8 Sugar and starch are examples of this nutrient.
10 The primary function of this macromineral is to regulate body water and acid-base balance.
11 This word means "tasty and acceptable."
12 A nonfood substance such as flavoring or coloring.
13 This micromineral functions to bind and transport oxygen.
16 The second most abundant mineral, found mostly in the bone.
17 Unit of energy.
18 Inorganic element that makes up "ash" in a pet food.
19 The most common nutritional problem in dogs and cats.
21 Essential amino acid required in the diet of cats.
23 Deficiency or excess of this micromineral affects thyroid gland function.

EXERCISE 9.2 MATCHING #1: KEY TERMS

Instructions: Match each key term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Calorie
2. _____ Nutrient
3. _____ Energy density
4. _____ Amino acids
5. _____ Metabolizable (maintenance) energy requirement
6. _____ Palatability
7. _____ Atwater factors
8. _____ Assisted feeding
9. _____ Resting energy requirement
10. _____ Fatty acid
11. _____ Metabolizable energy
12. _____ Body condition score
13. _____ Lipid
14. _____ Kilojoule

Column B

A. Something essential that a plant or animal obtains from the environment for growth and maintenance of life.

B. The small molecules that are the building blocks of proteins.

C. Molecules that provide and store energy, make up cell membrane structure, and act as signaling agents and hormones.

D. A component of triglycerides that may be synthesized by the body or required in the diet of an animal.

E. A measure of energy defined as the energy needed to move a 1 kilogram weight 1 meter by 1 Newton.

F. The energy needed to increase the temperature of 1 gram (g) of water from 14.5°C to 15.5°C.

G. Result of subtracting the energy lost in urine and gases produced by the body from the digestible energy (DE) of a food or diet.

H. The estimated energy (caloric) content assigned to the three macronutrients.

I. The kcal per unit of a food ingredient or pet food.

J. A widely used estimate of energy expenditure by a normal animal at rest.

K. An estimated daily energy requirement for a healthy animal with daily activity and exercise.

L. A method used regularly to assess the weight gain or weight loss of an animal.

M. Refers to the tasty and acceptable properties of a dog food.

N. Providing nutritional support to a sick, injured, or hospitalized pet.

EXERCISE 9.3 MATCHING #2: ENERGY PARTITIONING

Instructions: Match each abbreviation in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ kcal
2. _____ kJ
3. _____ ME
4. _____ RER
5. _____ MER
6. _____ DE
7. _____ GE
8. _____ NE
9. _____ EE

Column B

A. Used to estimate how much to feed an overweight dog or cat or a hospitalized patient.
B. Energy burned for normal body functions and increased energy demands, such as exercise.
C. The energy from a diet available after digestion and absorption of nutrients.
D. Equal to kcal/0.239.
E. The total potential energy available in a food or diet provided to an animal.
F. The standard measurement for energy that is also referred to as "calories" to an animal owner.
G. The energy available to an animal after some energy from the diet is lost in the feces.
H. Energy (kcal) available from pet foods for the animal to use for normal body functions, such as digestion.
I. Used to estimate how much to feed a healthy, active dog or cat. This measurement may be altered by level of activity or reproductive status of the animal.

EXERCISE 9.4 MATCHING #3: PET FOOD LABELS

Instructions: A client presents a bag of food to you with the following information. Help the client understand this information by matching each piece of information with the section of the food label that it is listed in from column B by writing the appropriate letter in the space provided.

Column A

1. _____ Purina Dog Chow
2. _____ Crude Protein 42% (minimum)
3. _____ Chicken, brewers rice, corn gluten meal
4. _____ Adult Maintenance
5. _____ Feed 1–1½ cups per 5–10 lb dog
6. _____ 3 lbs. (1.36 kg)
7. _____ Best before Jun 30 2013

Column B

A. Net weight
B. Guaranteed analysis
C. Feeding directions
D. Ingredient statement
E. Information panel and freshness date
F. Principal display panel
G. Statement of nutritional adequacy

EXERCISE 9.5 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Nutrients are most commonly listed in kilogram (kg) units on a pet food label.
2. _____ Many animals will consume more water than is necessary for daily functions with the excess being excreted in the feces.
3. _____ Animals and humans are composed of approximately 30% water by weight.
4. _____ Proteins are made from amino acids and stored in the muscle.
5. _____ The essential fatty acids, including linoleic acid, are required in the diet of dogs and cats.
6. _____ Carbohydrates are broken down into glycogen and stored in the pancreas as glucose.
7. _____ Cats and guinea pigs require vitamin C in their diet.
8. _____ Vitamin requirements in the diet vary between different species of animals.
9. _____ The expressions "as-fed," "dry matter," and "metabolizable energy" refer to measurements of a nutrient in a diet and are interchangeable with each other.
10. _____ "AAFCO-Approved" pet foods contain high-quality ingredients and are formulated for feeding during all life stages.
11. _____ Raw meat diets are balanced and appropriate to feed during any life stage.
12. _____ Neonatal puppies should never be tube fed as there is a great risk for aspiration.
13. _____ At weaning age, puppies can be offered a gruel-type diet that consists of canned food blended with water.
14. _____ Spayed or neutered animals often have higher energy needs than intact animals.
15. _____ Cats, in general, have higher protein requirements than dogs.
16. _____ Adult, intact cats tend to lose their appetite inhibition and easily gain weight.
17. _____ High "ash" diets have been proven to cause lower urinary tract disease in cats.
18. _____ A sick, hospitalized patient should not be fed in order to allow the GI tract to "rest."
19. _____ TPN, total parenteral nutrition, is administered through a central intravenous catheter because of the high osmolality of the solution.
20. _____ Force feeding or syringe feeding a sick animal is the best method for providing enteral nutrition.

EXERCISE 9.6 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. All of the following components are legally required on a pet food label, except:
   a. Ingredient statement
   b. Net weight
   c. Freshness date
   d. Feeding directions

2. The nutrients that supply energy to an animal include
   a. Vitamins, carbohydrates, and fats
   b. Fats, protein, and minerals
   c. Protein, carbohydrates, and fats
   d. Carbohydrates, vitamins, and minerals

3. Each of the following is a major function of proteins except
   a. Provide structure to organs and tissues
   b. Act as enzymes for certain reactions
   c. Regulate water balance
   d. Carry oxygen to tissues

4. Fatty acids
   a. Are short, saturated molecules
   b. Are building blocks of triglycerides
   c. Are all nonessential and do not need to be supplied in the diet
   d. Are only utilized by fat cells

5. Carbohydrates in the diet
   a. Are broken down into glucose in the intestinal tract
   b. Are stored in liver and muscle as glycogen
   c. Do not provide energy to the animal
   d. A and B

6. Which of the following items is optional in a Guaranteed Analysis on a pet food label?
   a. Crude protein
   b. Moisture
   c. Calcium
   d. Crude fiber

7. Fiber is often a component of dog or cat foods and
   a. Is an essential nutrient
   b. Comes from protein found in animal tissues
   c. Is broken down by the body into glucose
   d. Resists digestion in the gastrointestinal tract

8. An adult dog weighing 25 kg should be offered _____ (amount) of protein per day in the diet.
   a. 30 g
   b. 40 g
   c. 50 g
   d. 60 g

9. Anemia is caused by a deficiency of
   a. Fat
   b. Carbohydrate
   c. Protein
   d. Calcium

10. Dogs and cats have minimum dietary requirements for all of the following nutrients except
    a. Protein
    b. Fat
    c. Carbohydrate
    d. Vitamins and minerals

11. The essential nutrients required in the diet of cats include all of the following, except
    a. Taurine
    b. Arachidonic acid
    c. Vitamin C
    d. Calcium

12. Raw meat diet recipes
    a. Contain adequate levels of calcium and phosphorus to support growth
    b. Are safe for people to handle and for animals to eat
    c. Rarely cause GI upset as the ingredients do not contain preservatives
    d. May include bones, which can obstruct or perforate the GI tract

13. Consider this scenario: An outbreak of *Salmonella* has been traced to a facility that manufactures several brands of dog food. These contaminated products will be recalled through a mandate by the
    a. AAFCO
    b. USDA
    c. FDA-CVM
    d. FTC

14. AAFCO, an important organization in the pet food industry,
    a. Is a government agency that ensures the safety of all pet food ingredients and products
    b. Publishes the *Nutrient Requirements of Dogs and Cats* with guidelines for formulating dog and cat foods
    c. Establishes protocols for animal feeding tests with various pet food products
    d. Performs feeding tests on dogs and cats using a variety of products in a laboratory setting

15. Poor-quality pet foods, if fed, will result in
    a. Dull, dry hair coat
    b. Reduced fecal production
    c. Weight gain
    d. Increased activity level

16. When caring for a neonatal puppy or kitten, one should
    a. Measure the body weight weekly to assess adequate nutritional intake
    b. Microwave milk replacer to 120°F before feeding
    c. Use a commercial milk replacer instead of cow's milk when needed
    d. Watch for voluntary urination and defecation following feeding

17. Puppies during the growth phase will require
    a. The same amount of energy on a dry-matter basis as an adult dog
    b. Higher levels of calcium and phosphorus than an adult dog
    c. Higher levels of EPA and DHA than an adult dog
    d. Lower levels of protein than an adult dog

18. The owner of a 5-month-old, intact male Labrador wants to know how much to feed his dog per day. The most appropriate recommendation is
    a. Feed the dog *ad libitum* until he reaches 12 months of age
    b. Calculate the RER for this dog and feed that amount per day
    c. Use the feeding instructions on the dog food bag and monitor BCS frequently
    d. Feed the dog 4 cups of food

19. "Fluffy," a sedentary, 5-year-old, spayed female mixed-breed dog weighs 25 kg. Her calculated RER (kcal/day) would be
    a. 534
    b. 662
    c. 783
    d. 897

20. "Chance," a 3-kg, active, 7-month-old, male, domestic short-hair feline would require approximately how much energy supplied by the diet (kcal/day)?
    a. 160 to 320 kcal/day
    b. 320 to 480 kcal/day
    c. 480 to 640 kcal/day
    d. 640 to 800 kcal/day

21. Predisposing factors for obesity in pets include all of the following except
    a. High fat content in the diet
    b. Overfeeding
    c. High fiber content in the diet
    d. Sedentary lifestyle

22. Kittens during the growth stage need to be routinely monitored for all of the following, except
    a. Excessive weight gain
    b. Developmental orthopedic disease
    c. Water intake
    d. Overeating

23. Fiber in a feline diet
    a. Is an essential nutrient required by the species
    b. Is useful for thin animals to improve weight gain
    c. Can improve GI function and prevent hairballs
    d. Reduces fecal quantity

24. Adult cats
    a. Require taurine as an essential amino acid
    b. Should be fed free choice
    c. Are often sedentary and do not need more than RER
    d. All of the above
    e. A and C

25. Short-term enteral nutrition (for 3 weeks or less) can best be provided by placing a
    a. Central IV catheter into the jugular vein
    b. G-tube percutaneously into the stomach
    c. N-E tube through the nasal passage into the distal esophagus
    d. J-tube surgically into the intestine

26. Parenteral nutrition is administered
    a. In a peripheral vein because the osmolality of these formulations is high
    b. To patients that may be vomiting and at risk for aspiration
    c. To provide nutritional support for any hospitalized patient
    d. Via a nasoesophageal or esophagostomy tube

27. When administering TPN, the patient requires 24-hour monitoring by all members of the veterinary team. Complications that need immediate attention include all of the following except
    a. Alterations in laboratory values such as glucose or potassium
    b. Redness, at the IV catheter site
    c. Serum or plasma that is a clear, straw color
    d. A blockage in the TPN administration line

28. To measure the body condition score of an animal, you will
    a. Put the animal on a scale and record its weight in kilograms
    b. Measure the circumference of the animal's chest just behind the elbow
    c. Use calipers to measure the thickness of a skin fold
    d. Feel along the rib cage and check for a waist and abdominal tuck

29. An ideal body condition score (BCS) is 5/9. If an animal has a BCS of 7/9, approximately what percentage of body weight should this animal lose to reach ideal condition?
    a. 10% to 15%
    b. 20% to 30%
    c. 30% to 45%
    d. Greater than 45%

30. An appropriate weight loss plan for a canine should
    a. Include vigorous exercise and induce weight loss of 5% per week
    b. Include a 20% reduction in the amount of the current diet being fed
    c. Transition the animal to an all-purpose diet once ideal weight is achieved
    d. Occur with the use of an energy-restricted diet with weight loss at 1% to 2% per week

EXERCISE 9.7 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces with the missing word or words that complete the sentence.

1. Macronutrients consist of _____, _____, and _____ and are used by the body to produce _____.
2. _____ is an important nutrient that contributes to 50% to 70% of an animal's body weight. Deficiencies of this nutrient lead to a state of _____ in the body.
3. Proteins are composed of amino acids but may also be bound to other molecules such as _____ and _____.
4. Proteins can be _____ from amino acids, but not _____, and therefore must be consumed in the diet.
5. Essential fatty acids are required in the diets of animals that cannot synthesize them. _____ _____ and _____ _____ are fatty acids essential to both dogs and cats.
6. Carbohydrates in the diet can be broken down into _____ which is used for _____ and is stored in the form of _____.
7. _____ are organic molecules used for certain metabolic processes in the body and are considered a micronutrient. These nutrients are required in the diets of dogs and cats in different amounts.
8. Minerals are _____ molecules supplied in the diet that may result in disease if the levels are _____ or _____.
9. Soluble fiber is an example of a complex carbohydrate that may be present in an animal diet. The term "soluble" means that the carbohydrate can be _____ by bacteria in the _____ intestine.
10. _____ are a category of dietary supplements that may delay or prevent oxidative processes in the body and have potential health benefits.
11. Feline diets have a higher _____ density than canine diets.
12. A home-cooked diet may be beneficial to an animal with a food _____ or _____ as the ingredients can be limited.

13. Raw meat diets predispose growing animals to _____ disorders.

14. A nutrient that has a lower digestibility will need to be fed in _____ amounts.

15. The nutrient requirements of dogs and cats are based on _____ and _____ publications *(names of two organizations)*.

EXERCISE 9.8 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 9.9 CASE STUDY #1: WEIGHT LOSS

"Suzie," a 5-year-old, spayed, female mixed-breed dog presents to your clinic, as the owners are concerned about her excessive weight gain over a 4-month period. After obtaining a good history, it is learned that there is a toddler in the family and the recent addition of a new baby. The feeding of Suzie has become inconsistent as the new baby is quite a distraction and exercise is limited to short walks around the neighborhood. Suzie spends much of her time indoors following the toddler around and cleaning up the messes from dropped food. On physical examination, Suzie weighs 65 lbs with a BCS of 8/9. All other examination findings were unremarkable. CBC, chemistry, and thyroid hormone levels were also unremarkable.

1. Discuss a logical approach to beginning a weight-loss program for Suzie.

2. What factors from Suzie's history may be affecting and/or increasing her energy intake?

3. Because it is difficult to measure Suzie's actual energy intake, you will use her RER at her current body weight to start her weight-loss program. Estimate her RER in the space below.

4. By what percentage can her intake be reduced safely? How many kcal/day should she then receive on her new weight-loss plan?

   _____ kcal/day

5. Should her normal maintenance diet be used in her weight-loss plan? Why or why not?

6. How many pounds per week would be appropriate for Suzie to lose?

_____ pounds/week

7. If an ideal weight for Suzie is 45 lbs, how many weeks can her owner expect it to take for the weight loss to occur?

_____ weeks

EXERCISE 9.10 CASE STUDY #2: HOSPITALIZED PATIENT

"Stubby," an 8-year-old, neutered, male, domestic short-haired cat presents to your clinic with a 3-day history of anorexia and acute vomiting. Physical examination revealed a string foreign body under his tongue, a painful abdomen, approximately 7% dehydration, and a current body weight of 5 kg. Abdominal radiography supports the presence of an intestinal foreign body. Stubby is stabilized with intravenous fluids and taken to surgery for removal of the foreign body. The plan is to provide some nutritional support to Stubby as he has been anorexic for more than 72 hours.

1. What routes could be used to provide nutrition to this patient?

2. Discuss the factors that should be considered to determine the appropriate route for this patient.

It was decided at the time of surgery to place a 5-French jejunostomy tube (J-tube). The plan is to begin providing nutritional support using an infusion pump and administering EnteralCare MLP slowly at 33% RER on day 1, 66% RER on day 2, and 100% RER on day 3. This diet has an energy density of 1.20 kcal/mL.

3. Calculate the RER for Stubby at his current body weight of 5 kg (11 lbs).

_____ kcal/day

4. Calculate the infusion pump setting to administer EnteralCare MLP on day 1, day 2, and day 3.

   Day 1: _____ mL/hour

   Day 2: _____ mL/hour

   Day 3: _____ mL/hour

5. What are some potential complications of having this J-tube placed?

6. What parameters need to be monitored closely while Stubby is receiving enteral nutrition?

7. What is an important complication that can occur when reintroducing food to an anorexic or starved animal? What findings are seen with this condition?

8. Stubby is bright and alert 3 days after surgery and is looking for food in his cage. Is he ready to have the tube removed and be sent home?

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EXERCISE 9.8 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the spaces provided.

1. Many vitamins are required in the diets of animals in varying amounts. Some vitamins can be synthesized in the body whereas others need to be supplied in the diet.

   a. Explain the difference between water-soluble vitamins and fat-soluble vitamins.

   b. Which vitamins fit into each category?

      Water-soluble: _____

      Fat-soluble: _____

   c. What factors affect absorption and storage of these nutrients?

2. Briefly discuss the composition of dog diets before 1900.

3. Briefly discuss the development of commercial pet foods after 1900.

4. Pet foods are now available in dry, canned, semi-moist, refrigerated, and frozen preparations.

   a. Compare and contrast the manufacturing and preservation methods of dry and canned pet foods.

b. During the manufacturing process, some nutrients can be altered or even destroyed as a consequence of the high temperatures of cooking. What measures do pet food companies take to ensure that the finished product meets nutritional needs?

5. Briefly discuss the difference in diet preferences of dogs and cats.

6. Pet food companies use several types of marketing claims to sell their pet food products. Some of these claims are directly related to the nutritional value of the diet, whereas others are meant to appeal to certain target markets. *In the box below, place an "X" in the box that supports the claim as having nutritional importance or used strictly for marketing purpose.*

Marketing Claim	**Nutritional Importance**	**Used for Marketing Only**
All-Purpose		
Specific-Purpose		
Value (e.g. "This food is a bargain")		
Organic		
Ingredients (e.g. "contains real chicken")		
Natural		
Holistic		
People Food (e.g. "looks like real meat with gravy")		

7. You are working as a technician in a practice that focuses heavily on client education. Your practice manager asks you to develop a brochure to educate clients about certain pet food ingredients that cause concern to owners, including chemicals, preservatives, and by-products. Outline the key points that owners should understand about these three components.

   a. Chemicals: _____

   b. Preservatives: _____

   c. By-products: _____

8. Animals with certain diseases, such as chronic renal failure, pancreatitis, and inflammatory bowel disease, often have special dietary requirements. Veterinary therapeutic diets may be beneficial for these animals.

   a. Discuss the context in which these diets should be used.

   b. Are there consequences to feeding a veterinary therapeutic diet to a healthy animal?

   c. How about to an animal with a medical issue?

9. The pet food industry is regulated by several government agencies and organizations to ensure that pet foods are formulated appropriately and are safe to feed. In the box below, describe the role of each agency in the pet food industry.

Food and Drug Administration–Center for Veterinary Medicine (FDA-CVM)	
The United States Department of Agriculture (USDA)	
Association of American Feed Control Officials (AAFCO)	
National Research Council (NRC)	
Federal Trade Commission (FTC)	

10. As the human–animal bond has strengthened between owners and their pets, some prefer to feed their pets "human" foods in place of commercially produced products. Summarize the reasons that some owners prefer to provide home-cooked meals for their animals.

11. What are some potential negative consequences of using and feeding home-cooked recipes?

12. "Sasha," a 4-year-old, intact, female Boxer is pregnant with her first litter of puppies.

    a. Explain how her dietary needs will change over the course of her gestational period.

    b. "Sasha" has now delivered five healthy puppies. What is happening now that will drastically change her dietary needs? What modifications will need to be made to her feeding plan?

13. Explain the dietary needs of a pregnant queen during gestation and lactation, including a discussion on the peak energy-demanding periods. What diet formulation is appropriate for feeding during this stage of life?

14. A 10-kg, moderately active, 5-year-old, spayed, female dog is being offered an adult maintenance diet that supplies 420 kcal/cup. How many cups of this food should she receive to meet her energy needs?

_____ cups/day

10 Large Animal Nutrition

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, spell, and define each of the Key Terms in the chapter.
2. Do the following regarding nutrients:
   - Explain the relationship between nutrition, productivity, and profitability in livestock production.
   - List the building-block molecules that make up proteins, fats, and carbohydrates.
   - List two ways in which carbohydrates are digested in horses.
   - List the energy-producing and non–energy-producing components of food.
   - List the variables affecting energy requirements of livestock and factors affecting water intake of livestock.
   - Differentiate between microminerals and macrominerals and give examples of each.
   - Explain the importance of water in metabolic reactions.
3. Describe the two commonly used feeding systems for dairy cattle.
4. Compare and contrast the special considerations and protocols employed when feeding dairy cattle, beef cattle, sheep, and swine. Also do the following:
   - Describe how the nutritional requirements of each of these species are affected by the animal's stage of life and by its energy expenditure (maintenance, growth, finishing, lactation, work, or wool).
   - List advantages and disadvantages of pasture feeding of livestock.
5. Do the following regarding nutrition in horses:
   - Explain the importance of grass and hays in the equine diet.
   - Describe how pregnancy and lactation alter a mare's nutritional requirements.
   - List steps taken to provide appropriate nutrition to foals and young, growing horses.
   - Describe how work levels are classified in working horses and how these levels affect water, energy, and mineral requirements.
   - Describe general guidelines for feeding sick and postoperative horses.

EXERCISE 10.1 MATCHING #1: TERMS AND DEFINITIONS

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Amino acids
2. _____ Biologic value
3. _____ Concentrates
4. _____ Digestible energy
5. _____ Digestion
6. _____ Forage
7. _____ Gross energy
8. _____ Maintenance nutrient requirements (MNRs)
9. _____ Metabolizable energy
10. _____ Net energy
11. _____ Protein efficiency ratio
12. _____ Total digestible nutrients (TDNs)

Column B

A. Subtraction of the energy lost in the feces from the consumed GE.
B. The number of grams of body weight gain per unit of protein consumed.
C. Percentage of true absorbed protein that is available for productive body functions.
D. A general measure of the nutritive value of a feed.
E. The building blocks of proteins.
F. The actual portion of energy available to the animal for use in maintaining body tissues or during pregnancy or lactation.
G. The process of protein, carbohydrate, and fat breakdown into absorbable nutrients.
H. The total energy potentially available in a feed consumed by an animal.
I. Grains or high-starch compounds.
J. The levels of nutrients needed to sustain body weight without gain or loss.
K. Grass, legumes, and hays.
L. Energy available to the animal after energy from feces, urine, and combustible gases have been subtracted from gross energy.

EXERCISE 10.2 MATCHING #2: BREEDS OF SHEEP

Instructions: Indicate whether each breed in column A is a wool breed, meat breed, or combination breed by writing the appropriate letter in the space provided. Note that each response can be used more than once.

Column A

1. _____ Cheviot
2. _____ Columbia
3. _____ Debouillet
4. _____ Dorset
5. _____ Hampshire
6. _____ Leicester
7. _____ Merino
8. _____ Oxford
9. _____ Polypay
10. _____ Rambouillet
11. _____ Southdown
12. _____ Shropshire
13. _____ Suffolk
14. _____ Targhee
15. _____ Texel
16. _____ Tunis

Column B

A. Wool
B. Meat
C. Combination

EXERCISE 10.3 MATCHING #3: EQUINE BODY CONDITION SCORE

Instructions: Match each equine body condition score in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Poor
2. _____ Very thin
3. _____ Thin
4. _____ Moderately thin
5. _____ Moderate
6. _____ Moderately fleshy
7. _____ Fleshy
8. _____ Fat
9. _____ Extremely fat

Column B

A. Fat built about halfway on spinous processes, transverse processes cannot be felt. Slight fat cover over the ribs. Spinous processes and ribs easily discernible. Tailhead prominent, but individual vertebrae cannot be visually identified. Tuber coxae appear rounded, but easily discernible. Tuber ischii not distinguishable. Withers, shoulders, and neck accentuated.

B. May have crease down back. Individual ribs can be felt, but noticeable filling between ribs with fat. Fat around tailhead is soft. Fat deposited along withers, behind shoulders, and along neck.

C. Animal extremely emaciated. Spinous processes, ribs, tailhead, tuber coxae, and ischii projecting prominently. Bone structure of withers, shoulders, and neck easily noticeable. No fatty tissue can be felt.

D. Obvious crease down back. Patchy fat appearing over ribs. Bulging fat around tailhead, around withers, behind shoulders, and along neck. Fat along inner thighs may rub together. Flank filled with fat.

E. Negative crease along back. Faint outline of ribs discernible. Tailhead prominence depends on conformation, fat can be felt around it. Tuber coxae not discernible. Withers, shoulders, and neck not obviously thin.

F. Back level. Ribs cannot be visually distinguished but can easily be felt. Fat around tailhead beginning to feel spongy. Withers appear rounded over spinous processes. Shoulders and neck blend smoothly into body.

G. Animal emaciated. Slight fat covering over base of spinous processes, transverse processes of lumbar vertebrae feel rounded. Spinous processes, ribs, tailhead, tuber coxae, and ischii prominent. Withers, shoulders, and neck structures faintly discernible.

H. Crease down back. Difficult to feel ribs. Fat around tailhead very soft. Area behind shoulder filled with fat. Noticeable thickening of neck. Fat deposited along inner thighs.

I. May have crease down back. Fat over ribs feels spongy. Fat around tailhead feels soft. Fat beginning to be deposited along side of the withers, behind the shoulders, and along the sides of the neck.

EXERCISE 10.4 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Most livestock producers will need the help of a veterinary technician to formulate proper diets for their herds.

2. _____ It is not the alfalfa hay, corn, or oats that are used by cells, but the amino acids, simple sugars, fatty acids, minerals, and vitamins.

3. _____ Combining different types of proteins has no effect on the biologic value.

4. _____ The measurement called "total digestible nutrients" is a useful measurement of energy available to the animal for use in maintaining body tissues.

5. _____ Ruminants have the ability to break down fiber content to be used as energy and this allows them to utilize feed that other animals cannot use.

6. _____ Lactating dairy cattle cannot consume enough forage to meet their nutritional requirements and, therefore, are supplemented with concentrated feeds.

7. _____ It is important to restrict protein during lactation so that the milk produced is not too protein concentrated.

8. _____ The calf benefits the most from colostrum within the first 24 hours of life.

9. _____ Colostrum should not be frozen as it loses all efficacy.

10. _____ Beef cows need little to no feed supplementation from grain, if they are on high-quality forage or pasture.

11. _____ Finishing cattle are fed high-fiber diets to increase weight gain and improve the carcass characteristics.

12. _____ Young cattle require a higher percentage of protein than older cattle.

13. _____ Cow's milk will work well as milk replacement for lambs.

14. _____ Lambs older than 2 months can be vaccinated for enterotoxemia.

15. _____ A sow must have 5 to 7 litters per year for the swine producer to realize a profit.

16. _____ A lactating sow should be fed 4 to 5 lb of the base ration plus 1 additional pound for every pig she is nursing.

17. _____ When feeding swine, the producer is more concerned about the amino acid levels of the feed than about the protein content.

18. _____ Horses should not have access to salt as an overdose can lead to toxicity.

19. _____ Protein should be restricted in lactating mares or the foal will grow too quickly.

20. _____ Growing horses should not be fed above energy requirements, as it increases the risk for developmental orthopedic disease.

21. _____ Exercising horses require additional protein for muscle development and repair.

EXERCISE 10.5 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. Protein is made up of _____ that are linked in a chain.
   a. Fatty acids
   b. Minerals
   c. Amino acids
   d. Simple sugars

2. Amino acids consist of
   a. Nitrogen, carbon, oxygen, and sulfur
   b. Nitrogen, hydrogen, oxygen, and sulfur
   c. Helium, carbon, oxygen, and sulfur
   d. Nitrogen, carbon, oxygen, and selenium

3. Fat has _____ times more energy per gram that protein or carbohydrates.
   a. 0.225
   b. 2.55
   c. 22.5
   d. 2.25

4. What is the primary energy source used in livestock rations?
   a. Proteins
   b. Fat
   c. Carbohydrates
   d. Minerals

5. What two measures of feed energy value are used most widely in equine nutrition?
   a. DE and TDN
   b. DE and ME
   c. GE and TDN
   d. TDN and ME

6. What measure of feed energy value is used most widely in beef, dairy, and sheep nutrition?
   a. NE
   b. CE
   c. DE
   d. ME

7. What measure of feed energy value is used in swine and poultry nutrition?
   a. NE
   b. CE
   c. DE
   d. ME

8. What nutrient is the cheapest and most abundant?
   a. Carbohydrate
   b. Water
   c. Protein
   d. Vitamins and minerals

9. Water makes up what percent of an animal's body at maturity?
   a. 35% to 50%
   b. 45% to 60%
   c. 65% to 70%
   d. 65% to 85%

10. What factor most determines the productivity of lactating dairy cattle?
    a. Water intake
    b. Vitamins and minerals
    c. Feeding
    d. Environment

11. Carbohydrates constitute what percentage of energy on a dry-matter basis for forage and grain?
    a. 20% to 50%
    b. 30% to 60%
    c. 40% to 70%
    d. 50% to 80%

12. Newborn calves require colostrum in the first _____ hours after they are born.
    a. 72
    b. 48
    c. 36
    d. 24

13. Feeding represents almost _____ of the cost of beef production.
    a. 75%
    b. 50%
    c. 25%
    d. 10%

14. A finished steer will be _____ year(s) old and weigh more than_____ pounds.
    a. 6 months to 1; 500
    b. 6 months to 1; 1000
    c. 1 to 2; 500
    d. 1 to 2; 1000

15. Sheep are more susceptible to toxicity from this mineral than other species.
    a. Zinc
    b. Copper
    c. Iron
    d. Magnesium

16. Milk replacement for lambs should contain _____ fat.
    a. 5% to 10%
    b. 15% to 20%
    c. 25% to 30%
    d. 40% to 55%

17. What percentage of the cost of raising swine is the cost of feed?
    a. 60% to 70%
    b. 50% to 60%
    c. 40% to 50%
    d. 30% to 40%

18. Forage should be at least _____ % of the horses diet.
    a. 40
    b. 50
    c. 60
    d. 70

19. What nutrient is the most important in the horse's diet?
    a. Roughage
    b. Carbohydrates
    c. Protein
    d. Water

20. The body score of a mare at breeding should be:
    a. 3 to 4
    b. 4 to 5
    c. 5 to 6
    d. 6 to 7

EXERCISE 10.6 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 10.7 CASE STUDY #1: IRON-DEFICIENCY ANEMIA IN PIGS

You have a client whose daughter is thinking about farrowing pigs as a part of an FFA project. Your client has heard that baby pigs need extra iron. She asks why this is the case and then asks you to explain some things she can do to prevent iron-deficiency anemia in baby pigs.

1. Please respond to this client's query.

EXERCISE 10.8 CASE STUDY #2: COLIC IN A HORSE

Mrs. Ratcliff's favorite gelding, Red, was admitted to the clinic as an emergency several days ago for colic. He had surgery and has been recovering well. Mrs. Ratcliff came to see Red today and was very upset about the tube sticking out of Red's nose. She wanted to know why the hay and grain she had sent up with her farm manager was NOT being used for Red. "He will only eat the best!" she declares.

1. The barn attendant brings her to you for an explanation. What do you tell her?

EXERCISE 10.6 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. Explain the relationship between nutrition, profitability, and productivity in livestock production.

2. Nutrients that have been ingested by an animal are processed by the body in one of two ways. What are the two ways that the body processes nutrients?

   i. _____

   ii. _____

3. There are a number of factors that can influence livestock's nutritional requirements, including breed and body size. List five additional factors.

   i. _____

   ii. _____

   iii. _____

   iv. _____

   v. _____

4. Protein, fats, and carbohydrates are the main nutrients in any animal's diet. What are the main functions of each nutrient, and what are its basic building blocks?

   a. Main functions of proteins: _____

      Building blocks of proteins: _____

   b. Main functions of fats: _____

      Building blocks of fats: _____

   c. Main functions of carbohydrates: _____

      Building blocks of carbohydrates: _____

5a. What is the difference between essential and nonessential amino acids?

5b. Explain why essential amino acids must be supplied in a patient's diet.

6. Explain why evaluating the biologic value of a protein is important.

7. How does the rumen digestion process change the ingested proteins in poor to moderate quality feed into usable protein?

8. Why are animal proteins from ruminant species not allowed to be used in the formation of diets for ruminants?

9. List the three classifications of carbohydrates.

   i. _____

   ii. _____

   iii. _____

10. Explain how the equine stomach breaks down complex carbohydrates into simple sugars.

11. Carbohydrates can be classified as hydrolysable or fermentable.

    a. Give an example of a hydrolysable carbohydrate.

    _____

    b. Give an example of a fermentable carbohydrate.

    _____

12. List three variables that can affect energy requirements.

    i. _____

    ii. _____

    iii. _____

13. Salt is classified as a macromineral.

    a. What is the chemical name for salt?

    _____

    b. List three other minerals that are classified as macrominerals.

    i. _____

    ii. _____

    iii. _____

14. Zinc is classified as a micromineral. List four other minerals that are classified as microminerals.

    i. _____

    ii. _____

    iii. _____

    iv. _____

15. In many ways, water is the most important nutrient.

    a. Explain this statement.

    _____

    _____

    _____

    b. Water is obtained by drinking or from foodstuffs. What is the third source of water?

    _____

    _____

c. List four factors that can affect water intake.

i. _____

ii. _____

iii. _____

iv. _____

16. Explain the two feeding programs used most commonly with dairy cattle.

i. _____

_____

ii. _____

_____

17. Describe two reasons water is important in the dairy cow.

i. _____

ii. _____

18. Besides body size, what other factors that affect dry-matter intake in the dairy cow?

_____

_____

_____

19. What are the two primary areas of beef production?

i. _____

ii. _____

20. What is the goal for the cow-calf producer and how can the producer help to ensure this goal is met?

_____

_____

_____

21. Describe three signs of under nutrition in the beef cow.

i. _____

ii. _____

iii. _____

22. Describe two signs of protein deficiency in the beef cow.

    i. _____

    ii. _____

23. Explain the three rules of salt use in beef cattle.

    i. _____

    ii. _____

    iii. _____

24. List the two principal areas of sheep production.

    i. _____

    ii. _____

25. List the two "cash crops" generated by sheep.

    i. _____

    ii. _____

26. Explain the reason for the change in feeding of the ewe during pregnancy.

    _____

    _____

27. The availability of good pasture and hays is an important component of adequate nutrition.

    a. Explain three advantages to pasture-feeding livestock.

        i. _____

        ii. _____

        iii. _____

    b. Explain two disadvantages to pasture-feeding livestock.

        i. _____

        ii. _____

28. What is the least expensive way to avoid pregnancy disease in the sheep?

    _____

    _____

29a. What is a common condition that can occur in ewes if they are not properly fed while pregnant?

    _____

29b. What are some of the signs of this condition?

30. List three factors that may influence energy intake in sheep?

i.

ii.

iii.

31. What factors can affect protein requirements in sheep?

32a. What is the common name for enterotoxemia?

32b. What is the organism responsible for enterotoxemia?

33. Explain the formula for estimating the weight, in pounds, of a horse.

34a. Explain the importance of grass and hay in the horse's diet.

34b. How much of a horse's diet should be grass and hay?

35. Explain how a horse's water, energy, and mineral requirements are affected by work level.

    a. Water: _____

    _____

    _____

    b. Energy: _____

    _____

    _____

    c. Minerals: _____

    _____

    _____

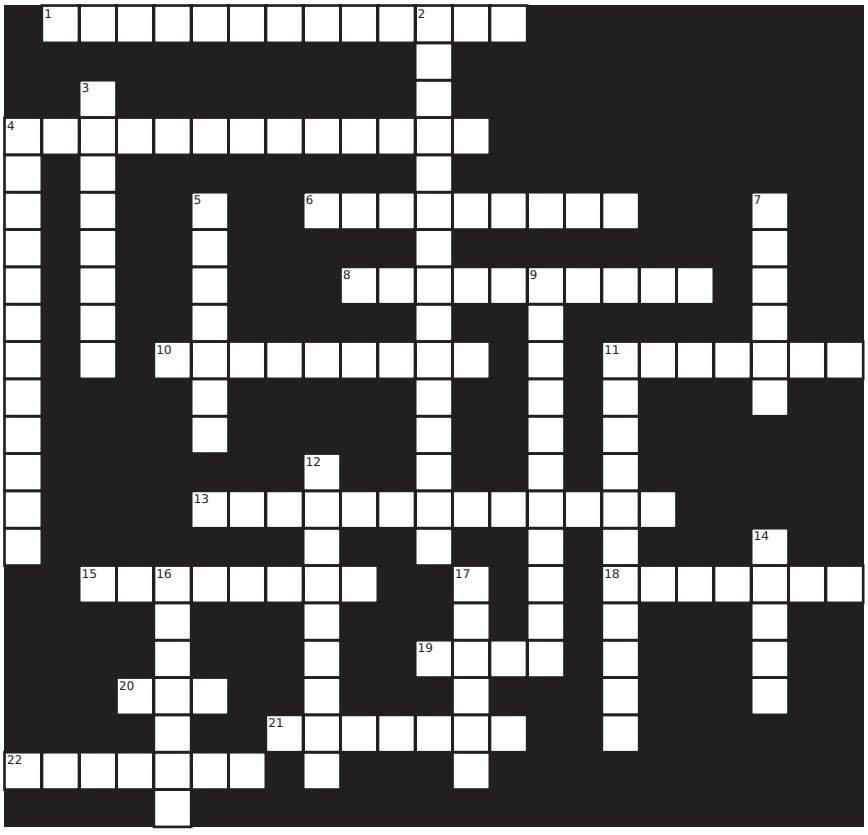
11 Animal Reproduction

LEARNING OBJECTIVES

When you have completed this chapter you will be able to:

1. Pronounce, define, and spell each of the Key Terms in this chapter.
2. Do the following regarding reproduction:
   - Locate the anatomic parts of the reproductive system, including endocrine organs in the cranium.
   - Describe hormonal changes that occur during the estrous cycle and pregnancy.
   - Compare and contrast the processes of oogenesis and spermatogenesis.
   - Explain the process of fertilization and embryo development, including the anatomic locations of these events.
3. Compare and contrast canine, feline and equine estrous cycles, gestation and parturition. Also do the following:
   - Describe the collection process and interpretation of canine vaginal cells, and state the importance of vaginal cytologic examination in breeding dogs.
4. Compare and contrast the bovine, ovine, caprine, and camelid estrous cycles,gestation and parturition.
5. Identify and put in order the important aspects of a breeding soundness examination in a male.
6. Identify and put in order the important aspects of a breeding soundness examination in a female.

EXERCISE 11.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

1 The initial differentiated sperm cells are referred to as primary _____, which undergo the first meiotic division.
4 The name of the cells that give a rise to mature sperm.
6 The term used to describe parturition in the camelid species.
8 The estrous cycle of the mare is divided into the _____ phase and the luteal phase.
10 The tail of the spermatid is referred to as a _____.
11 The term used to describe the life stage at which a given species is capable of reproduction.
13 When semen is frozen in liquid nitrogen for preservation it is said to be _____.
15 The term for the delivery of fetuses in the canine species.
18 The word used to describe a system that utilizes actual physical contact of the stallion and the mare to help determine the presence physiologic estrus in the mares that do not exhibit signs of heat.
19 The term for the male of the canine species.
20 The term for the male of the feline species.
21 The word, when used as an adjective, relates to the "kind" of cycle.
22 The term for canine offspring.

Down

2 The name of the thick tunic that covers the ovary in the mare. (2 words)
3 The term used for a foal at 1 year of age or by January 1st of the next year.
4 The term used to describe a sperm cell that is fully differentiated.
5 The term for the oviductal entry into the uterus.
7 The placentation type of the bitch indicating a narrow band of attachment of the chorioallantoic membrane to the endometrium.
9 The term used for male species if one or both testes have not descended into the scrotum.
11 The equine species is a seasonally _____ animal, thereby influenced greatly by increasing amounts of light in the spring of the year.
12 The breeding _____ examination is performed on all male species before used for breeding.
14 The term for the female of the canine species.
16 The type of pregnancy that occurs only in the primate species, where the fetus develops outside of the uterus.
17 The noun that describes the period of time the female is in "heat" or sexually receptive.

EXERCISE 11.2 TERMS AND DEFINITIONS

Instructions: Define each term in your own words.

1. Ovulation: _____

2. Ampulla (in the female): _____

3. Fertilization: _____

4. Isthmus: _____

5. Puberty (in the female): _____

6. Anestrus: _____

7. Mare: _____

8. Stallion: _____

9. Foaling: _____

10. Gelding: _____

11. Ovariectomized mare: _____

12. Foal heat: _____

13. Queening: _____

14. Ewe: _____

15. Wether: _____

16. Ewe lambs: _____

17. Ram lambs: _____

18. Doe: _____

19. Buck: _____

20. Kids: _____

21. Heifer: _____

22. Cow: _____

23. Bull: _____

24. Steer: _____

25. Calf: _____

26. Cria: _____

EXERCISE 11.3 MATCHING #1: TERMS AND DEFINITIONS

Instructions: Match each definition in column A with its corresponding word in column B by writing the appropriate letter in the space provided.

Column A

1. _____ The study of reproduction in animals.
2. _____ Cells that cover the ovum upon being released from the follicle.
3. _____ Multiple fathers of a given litter.
4. _____ When a pregnant dam ovulates and conceives again while pregnant.
5. _____ Members of the order of mammals in which sexual "receptivity" or interest is primarily driven by nonhormonal factors.
6. _____ The surrounding structure of the oocyte, which is penetrated by sperm during conception.
7. _____ The multicell structure that hatches upon zona pellucida degeneration.
8. _____ The term for uterine lining where the placenta attaches.
9. _____ The term for a bitch if the uterus and gonads have been removed.
10. _____ The hormone that influences early development of the follicle and estrogen production in the canine species.
11. _____ The name of an ergot product used to induce fertile estrus in the bitch.
12. _____ The process that occurs during proestrus in the canine species characterized by enlargement and neovascularization of the endometrium resulting in the leakage of blood through the vessel walls.
13. _____ The behavior of the bitch where the tail is raised and held to one side for the male.
14. _____ Bitches in physiologic estrus may never show signs of _____ heat.
15. _____ A natural substance frequently used to lyse a corpus luteum in the canine species.
16. _____ To cause regress.
17. _____ The term for a young mare that usually implies she is younger than 3 years of age.
18. _____ The term used for a newborn equine species.
19. _____ When relating to the equine species, the onset of estrus is initiated by production and release of _____.

Column B

A. Zona pellucida
B. Cabergoline
C. Filly
D. Cumulus
E. Standing
F. Spayed
G. Superfecundation
H. GnRH
I. Theriogenology
J. Primates
K. Diapedesis
L. Prostaglandin $F_2\alpha$
M. Endometrium
N. Flag
O. Superfetation
P. Foal
Q. FSH
R. Lyse
S. Blastocyst

EXERCISE 11.4 MATCHING #2: TERMS AND DEFINITIONS

Instructions: Match each definition in column A with its corresponding word in column B by writing the appropriate letter in the space provided.

Column A

1. _____ The presence of a CL under the influence of progesterone in the equine species will occur during this phase of the estrous cycle.
2. _____ The gland that is effected by the use of artificial lighting to induce early estrus in the mare.
3. _____ The structure that must be present on the ovary in order for prostaglandin $F_2\alpha$ to successfully bring a mare into heat.
4. _____ The substance produced within a mare after the fetal membrane embeds itself in the endometrium.
5. _____ The substance commonly used to induce parturition.
6. _____ The membrane expected to rupture during stage 2 of parturition in the equine.
7. _____ The ovarian condition recognized in aging mares where all ova are utilized and eventually gone.
8. _____ The term used the female of the feline species.
9. _____ The hormone produced and released by the mating stimulus within the feline.
10. _____ The type of placentation noted in the feline.
11. _____ The term used for the delivery of fetuses in the sheep.
12. _____ A ewe with a low body-condition score that has had its nutrition increased prior to breeding is said to have been _____.
13. _____ The term used for the birthing process in the goat.
14. _____ The term used for the birthing process in the bovine.
15. _____ The device that utilizes a dye packet to detect mounting when breeding cows.
16. _____ The name of the former site of the follicle once metestrus has taken place and corpus hemorrhagicum occurs.
17. _____ The structure similar in appearance to a mushroom which protrudes from the endometrium in pregnant cows.
18. _____ The first secretion of a cow's udder which is important for calves to consume by means of nursing.
19. _____ An example of a polyestrous species.
20. _____ The device typically used to count sperm for determining concentration levels.

Column B

A. Zonary
B. Camelids
C. Chorioallantoic
D. Heat detector patches
E. Pineal
F. Caruncle
G. Equine chorionic gonadotropin
H. Flushed
I. Hemocytometer
J. Queen
K. Kidding
L. Lambing
M. Diestrus
N. Luteinizing
O. Calving
P. Colostrum
Q. CL
R. Senility
S. Oxytocin
T. Ovulation depression

EXERCISE 11.5 ORDERING: BREEDING SOUNDNESS EXAMINATION IN THE MALE

Instructions: Place the eight parts of the breeding soundness examination in the proper order (from first to last) by placing the appropriate letter in the space provided.

Column A	Column B
1. _____	A. Examination of sperm motility.
2. _____	B. A detailed examination of the external and internal genitalia.
3. _____	C. Other tests as necessary.
4. _____	D. Identification of the patient (ideally through a microchip, tattoo, or brand).
5. _____	E. Examination of sperm morphology.
6. _____	F. A thorough history focusing on the reproductive system.
7. _____	G. Determination of a sperm count.
8. _____	H. Semen collection.

EXERCISE 11.6 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Although the follicle matures as ovulation approaches, the ovum within only matures following ovulation.
2. _____ If ovulation has not occurred within a normal period of time, the ovum is often not released and deteriorates within the follicle.
3. _____ Regression of the corpus luteum is accompanied by a rapid drop in progesterone.
4. _____ Superfetation may occur in any species but is most commonly seen in primates.
5. _____ Once the zona pellucida that surrounds the oocyte is penetrated by a spermatozoon, additional sperm may enter the oocyte.
6. _____ The general body temperature is higher than that of the testes.
7. _____ The production of sperm is cyclical.
8. _____ Capacitation is a process by which an ovum is made ready for fertilization.
9. _____ The castrated male canine is referred to as a neutered male.
10. _____ The canine estrous cycle does not include the stage of anestrus.
11. _____ During canine estrus, the bitch may play with the male in the beginning of "courtship" to establish a friendly behavioral relationship.
12. _____ The ova in the bitch can be fertilized at the time of ovulation.
13. _____ Parturition in the bitch occurs during the diestrus period of the estrous cycle.
14. _____ Parturition takes place in the bitch within approximately 24 hours after the CL is no longer functional.
15. _____ Progesterone and luteinizing hormone levels can be used to predict when a bitch should be bred.
16. _____ Frozen semen has the shortest lifespan of all semen sources once it is thawed.

17. _____ Frozen semen can be potentially stored for thousands of years in liquid nitrogen.

18. _____ When using fresh semen, canine insemination should be performed two to three times to insure fertilization takes place.

19. _____ Vaginal cytology is used for predicting insemination time in the bitch after progesterone assay concentrations have reached greater than 10 ng/mL.

20. _____ Radiography used to evaluate pregnancy in the bitch is most informative when performed 2 to 4 days prior to expected due date.

21. _____ The drop in body temperature that occurs in the canine before stage II of whelping is related to a decrease in estrogen.

22. _____ During whelping it is normal to see a blackish-green vaginal discharge.

23. _____ A female feline that has had its gonads removed is referred to as ovariectomized or spayed.

24. _____ The queen is a seasonally polyestrous animal.

25. _____ The anatomy of the reproductive tract of the queen is similar to that of the bitch.

26. _____ The queen is an induced ovulator.

27. _____ The queen is no longer fertile after approximately 14 years of age.

28. _____ Increased vocalization during estrus in the queen is a normal occurrence.

29. _____ Vulvar discharge in the queen should occur during the estrus stage of the heat cycle.

30. _____ Prostaglandin $F_2\alpha$ has the ability to induce abortion in the queen and in the bitch.

31. _____ Transuterine migration of fertilized eggs occurs in all multiparous species.

32. _____ Ultrasonographic imaging starting at approximately day 15 postbreeding is an excellent resource for diagnosing pregnancy in the queen.

33. _____ Failure to deliver fetuses within 2 to 3 hours of parturition will result poor survival rates in the queen.

34. _____ The uterine size will take weeks to reduce to a normal size after stage III parturition has occurred in the queen.

35. _____ Dystocia is a common occurrence in the queen.

36. _____ A newborn foal is not referred to as a yearling until after 12 months of age.

37. _____ It is common to call ovariectomized mares “spayed.”

38. _____ When a filly reaches puberty, the reproductive tract is mature.

39. _____ Signs of estrus in the filly may appear before puberty is reached.

40. _____ Draft horses will typically reach puberty before miniature horses as a consequence of the difference in size.

41. _____ Humidity is not considered to have effect on the estrual activity in the horse.

42. _____ The length of heat in the mare may vary from fewer than 2 to 9 days.

43. _____ Mares will always exhibit signs of heat during physiologic estrus.

44. _____ Some mares will exhibit signs of estrus even when not in physiologic estrus.

45. _____ Twin ovulation is very rare in the equine.

46. _____ The ovum in equine requires no additional time for maturation once released, allowing fertilization to occur immediately if the sperm are present.

47. _____ The CL is fully functional within approximately 5 days postovulation in the equine.

48. _____ At 30 days postovulation, progesterone concentration in the equine begins to decrease.

49. _____ Foals born December 31st are considered 1 year old the next day.

50. _____ Artificial lighting is not of significance when it pertains to the estrus cycle in mares.

51. _____ Examination of the anatomical conformation of the vulva in the mare is a very important part of a reproductive tract evaluation.

52. _____ The use of surgical scrub to prepare for vaginal examination of the mare is highly recommended to reduce contamination during the procedure.

53. _____ The cervix and vaginal wall should be easily visible once the vaginal speculum has entered the vagina during examination of the mare.

54. _____ A "deep" intrauterine insemination technique is the usual method for performing artificial insemination in the mare.

55. _____ Equine chorionic gonadotropin is also known as pregnant mare serum gonadotropin.

56. _____ After the second trimester of equine pregnancy, the progesterone hormone will decrease and no longer be responsible for maintaining pregnancy in the mare.

57. _____ The most accurate method of diagnosing pregnancy in the equine is palpation of the reproductive tract via rectal examination.

58. _____ The age of puberty in bovine is determined by body size.

59. _____ Angus will typically reach puberty later than that of Zebu and Zebu-crossed breeds.

60. _____ The cow is a seasonally polyestrous animal.

61. _____ A sign of estrus in the cow may include the presence of clear mucous vulvar discharge.

62. _____ Although the approximate estrous cycle length of a cow is 21 days, a range from 18 to 24 days is considered normal.

63. _____ The cow has an average of 75 to 120 uterine caruncles, which are irreplaceable once damaged or destroyed.

64. _____ Pregnancy in the cow is primarily determined with the use of ultrasonographic examination.

65. _____ Sheep are seasonally polyestrous animals.

66. _____ The onset of puberty in sheep is solely influenced by body weight.

67. _____ The primary breeding season is September through December in the ovine species.

68. _____ The flushing of ewes with a body condition score above 2.5 is highly recommended.

69. _____ The ewe will only seek out the ram while in estrus.

70. _____ The semen deposited during breeding by the ram at the beginning of a ewe's heat cycle will still have the capability to fertilize oocytes.

71. _____ A yearling ram is capable of servicing (breeding) up to 10 to 15 naturally cycling ewes under appropriate pasture conditions.

72. _____ Nonsynchronized ewes usually have a lambing season of 4 to 5 weeks.

73. _____ Abortion in sheep is a common occurrence.

74. _____ Pregnancy determination may be performed via ultrasonographic rectal examination in the ewe at 25 days into gestation.

75. _____ Goats will go into anestrus during the shorter days of the year.

76. _____ Mating that has occurred in the absence of a mature follicle in camelids will not result in ovulation.

77. _____ Camelid species are induced ovulators.

78. _____ Pregnancies in camelids occur predominately in the left horn.

79. _____ The size of the testes or the scrotum is important information to obtain during the breeding soundness examination of a male animal.

80. _____ The horse is the only domestic species in which the penis is cleansed prior to the collection of semen.

81. _____ The sperm of most species move rapidly forward in a straight line.

82. _____ The head of a sperm cell is characterized as rounded, not flat.

83. _____ During a breeding soundness examination, the motility of sperm is assessed before the morphologic examination is performed.

84. _____ Uterine cultures are more easily obtained on smaller animals.

85. _____ The uterine lumen is sterile in all species.

86. _____ The mare and cow are the only species in which endometrial biopsies may be obtained through the vaginal lumen.

87. _____ Cultures of the reproductive tract of the bitch should be obtained by the use of a conventional culture swab.

EXERCISE 11.7 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. The inner cell mass of the blastocyst is composed of
   a. Endoderm
   b. Mesoderm
   c. Ectoderm
   d. All of the above

2. Ectopic pregnancies only occur in which of the following animals?
   a. Canine
   b. Bovine
   c. Porcine
   d. Primate

3. Within the testis, developing sperm cells are surrounded by
   a. Sertoli cells
   b. A layer of mucous
   c. Interstitial cells
   d. Primordial germ cells

4. The hormone that acts on Sertoli cells to increase primordial sperm cell division and release more sperm cells is
   a. Testosterone
   b. FSH
   c. GnRH
   d. LH

5. After release of sperm cells, they attain motility and the ability to fertilize in the
   a. Seminiferous tubules
   b. Epididymis
   c. Tunica albuginea
   d. Female reproductive tract

6. The length of time required from the initiation of sperm development until formation of a mature sperm cell is approximately
   a. 25 days
   b. 30 days
   c. 55 days
   d. 60 days

7. The age at which puberty is reached in the bitch is approximately
   a. 4 to 6 months
   b. 6 to 12 months
   c. 6 to 24 months
   d. 24 to 42 months

8. The time at which the bitch will reach puberty depends primarily on the
   a. Adult size of bitch
   b. Time of year she was born
   c. Breed of bitch
   d. Climate

9. Which of the following choices represents the proper order of the canine estrous cycle?
   a. Anestrus, proestrus, estrus, and diestrus
   b. Proestrus, anestrus, estrus, and diestrus
   c. Estrus, diestrus, proestrus, and anestrus
   d. Estrus, proestrus, anestrus, diestrus

10. The approximate length of the canine estrous cycle is
    a. 2 months
    b. 4 months
    c. 6 months
    d. 8 months

11. Both the proestrus and estrus stages of the bitch will each last approximately
    a. 3 days
    b. 5 days
    c. 7 days
    d. 9 days

12. In most canine breeds, anestrus will last approximately
    a. 2 months
    b. 4 months
    c. 6 months
    d. 8 months

13. The release of ova from the ovaries in the bitch will occur at approximately _____ days following the LH spike:
    a. 1
    b. 2
    c. 4
    d. 5

14. Once released and mature, the ova of the bitch will remain fertilizable for
    a. 3 days
    b. 6 days
    c. 9 days
    d. 12 days

15. During the natural breeding process of the canine species, the male and female will be "locked together" for up to _____ minutes.
    a. 15
    b. 30
    c. 45
    d. 50

16. The period of least reproductive activity in bitch will occur during
    a. Estrus
    b. Proestrus
    c. Diestrus
    d. Anestrus

17. The temperature required to store frozen semen in liquid nitrogen would be
    a. 0°C
    b. −55°C
    c. −105°C
    d. −196°C

18. Because of its short lifespan, once frozen semen has thawed, fertilization should occur within
    a. 6 hours
    b. 8 hours
    c. 12 hours
    d. 15 hours

19. Examination for pregnancy in the bitch by palpation is possible in most bitches between _____ and _____ days of gestation.
    a. 12, 25
    b. 15, 38
    c. 21, 30
    d. 30, 36

20. In the bitch, the length of gestation from the point of fertilization is approximately
    a. 48 days
    b. 60 days
    c. 72 days
    d. 84 days

21. A drop in body temperature to 99°F in a near-term pregnant bitch signals that whelping is imminent. This change generally occurs about _____ hours before stage II.
    a. 8
    b. 12
    c. 24
    d. 48

22. Young female felines should have an estrus cycle by
    a. 6 months of age
    b. 12 months of age
    c. 18 months of age
    d. 24 months of age

23. The approximate weight at which the queen will reach puberty is
    a. 1.5 kg
    b. 2.5 kg
    c. 3.0 kg
    d. 3.5 kg

24. The average estrous cycle length in the queen is
    a. 2 to 15 days
    b. 4 to 30 days
    c. 10 to 25 days
    d. 14 to 19 days

25. The estrus stage in the queen will last approximately
    a. 5 days
    b. 10 days
    c. 15 days
    d. 30 days

26. Less than _____ of all queens will ovulate with a single mating.
    a. 15%
    b. 25%
    c. 35%
    d. 50%

27. The average duration of pregnancy in the queen following breeding is
    a. 55 days
    b. 65 days
    c. 75 days
    d. 82 days

28. What stage of parturition in the queen is characterized by lactational secretion, increased fetal movements and relaxation around the perineal area?
    a. Stage I
    b. Stage II
    c. Stage III

29. What is the only commonly seen animal in a veterinary practice that can assist itself with a dystocia?
    a. Feline
    b. Canine
    c. Equine
    d. Porcine

30. The endometrium of the equine species consists of approximately _____ folds, which permit expansion of the uterus and attachment of the placenta during pregnancy.
    a. 5
    b. 10
    c. 13
    d. 16

31. The approximate age range at which the estrous cycle is initiated in the filly is
    a. 6 to 12 months
    b. 12 to 24 months
    c. 24 to 48 months
    d. 48 to 60 months

32. The peak of estrous activity in the equine species occurs near which of the following dates?
    a. June 21st
    b. August 21st
    c. December 21st
    d. May 21st

33. The average length of heat in the mare is
    a. 5 days
    b. 6 days
    c. 7 days
    d. 9 days

34. The average length of the estrous cycle in the equine is
    a. 16 days
    b. 21 days
    c. 24 days
    d. 36 days

35. Which behavior is not related to estrus in the equine?
    a. Frequent urination
    b. Raised tail
    c. Frequent opening and closing of the vulva exposing the clitoris
    d. Increased tendency to kick

36. As their reproductive tract is not yet mature, fillies that are younger than 2 years old can have an abortion rate as high as
    a. 5%
    b. 25%
    c. 50%
    d. 85%

37. Sperm of the equine species usually have a high fertilizing lifespan of
    a. 12 hours
    b. 24 hours
    c. 48 hours
    d. 72 hours

38. Postovulation insemination performed in the equine species is highly successful when performed within
    a. 6 hours
    b. 8 hours
    c. 12 hours
    d. 16 hours

39. In the equine species, the approximate natural breeding season is
    a. January 1st to June 1st
    b. April 1st to September 1st
    c. July 1st to December 1st
    d. October 1st to March 1st

40. To ensure survival, once the chorioallantoic membrane ruptures during Stage II parturition in the equine, the fetus must be outside of the birth canal within _____ minutes.
    a. 20
    b. 45
    c. 60
    d. 70

41. The desired age for first calving in the cow is approximately
    a. 2 years of age
    b. 3 years of age
    c. 4 years of age
    d. 7 years of age

42. Pregnancy must occur at which of the following ages in order for a first calving to occur at the desired time?
    a. 10 months
    b. 15 months
    c. 20 months
    d. 24 months

43. The estrous cycle length of the cow is approximately
    a. 18 days
    b. 21 days
    c. 24 days
    d. 32 days

44. Ovulation in the cow will occur about _____ hours after the end of standing heat.
    a. 4 to 6
    b. 6 to 8
    c. 8 to 12
    d. 12 to 16

45. The gestation length of the cow is approximately
    a. 256 to 259 days
    b. 265 to 269 days
    c. 279 to 283 days
    d. 341 to 345 days

46. The length of the estrous cycle in the ewe is approximately
    a. 10.5 days
    b. 13.5 days
    c. 16.5 days
    d. 19.5 days

47. The estrous cycle length in the goat is
    a. 21 days
    b. 28 days
    c. 32 days
    d. 34 days

48. The estrus stage of the goat estrous cycle lasts approximately
    a. 1 to 1.5 days
    b. 2 to 3 days
    c. 4 to 5 days
    d. 5 to 10 days

49. The female camelid will reach puberty at the approximate age of
    a. 6 to 10 months
    b. 10 to 12 months
    c. 12 to 18 months
    d. 18 to 24 months

50. The length of estrus in a camelid is between
    a. 1 and 10 days
    b. 1 and 15 days
    c. 1 and 30 days
    d. 1 and 45 days

51. The approximate pregnancy length of the camelid is
    a. 290 to 310 days
    b. 310 to 330 days
    c. 330 to 350 days
    d. 350 to 370 days

52. In the camelid, ovulation and fertility will return postpartum at approximately
    a. 5 days
    b. 10 days
    c. 15 days
    d. 20 days

EXERCISE 11.8 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. The corpus hemorrhagicum may also be referred to as the _____ _____.
2. The _____ contains half the genetic material of the future offspring and the _____ contains the other half.
3. Fertilization occurs near the junction of the _____ and the _____ of the oviduct.
4. The estrous cycle is determined by the functional interrelationship of the _____ gland, hypothalamus, _____ gland, gonads, and _____.
5. Except in primates, sexual receptivity in animals is brought about by the ratio of _____ to progesterone.
6. The oocyte is surrounded by a structure called the _____ _____, which must be penetrated by the sperm for fertilization to occur.
7. The ectoderm of the blastocyst will develop into the hair, skin, and _____ system.
8. In the male, testosterone is produced by the _____ cells of the testis.
9. The testis is covered by a capsule known as the _____ _____.
10. The word _____ refers to an animal in which one or both testes are not in the scrotum.
11. Production of testosterone in initiated by the release of _____-_____ hormone from the hypothalamus, and the subsequent release of _____ hormone from the anterior pituitary.
12. In the male, the changes in blood flow that initiate an erection are mediated by the _____ branch of the autonomic nervous system. In contrast, ejaculation is mediated by the _____ branch of the autonomic nervous system.
13. The female canine that has had the _____ removed is referred to as an ovariectomized bitch.
14. The canine estrous cycle consists of _____, _____, _____, and anestrus.
15. The beginning of proestrus in the bitch is indicated by the commencement of a _____ vulvar discharge.
16. During proestrus in the bitch, the endometrium becomes highly _____ and the vessels reach the surface and leak blood through the vessel walls.
17. One of the most commonly used clinical tests to determine the reproductive stage and health of the bitch is _____ _____.
18. During Stage II parturition in the bitch, it takes approximately _____ to _____ minutes for each puppy to the born, with no more than _____ hours between each puppy.
19. Uterine involution following whelping or in the nonpregnant bitch, is not complete until approximately 120 days following _____.

20. The queen is an induced ovulator, although spontaneous ovulation may occur if triggered by the proper _____ or _____ cues.

21. The foal may also be called a _____ following separation from its mother or reaching 2 to 3 months of age.

22. Ovulation can be induced in the equine when a nearly mature follicle is present by the administration of _____ or _____.

23. The findings on genital palpation of a mare in heat include a decrease in _____ tone, relaxation of the _____, and an increase in size of the follicles present.

24. Secondary CL's maintain the _____ in the mare until day 100 and then are no longer required.

25. Equine chorionic gonadotropin is produced by the _____ cups.

26. Foal heat occurs between 2 and 18 days following _____ and can be a fertile heat in many mares.

27. The cow has year-round estrous cycles with minimal seasonal influence, and therefore is considered to be _____.

28. In the ruminant, ovulation occurs from anywhere on the surface of the _____.

29. The _____ reflex is a mechanism whereby the dilation of the cervical lumen stimulates a neural response that increases _____ release, which further dilates the cervix.

30. Cows may be in _____ or _____ recumbency at the time of delivery.

31. Rams that have been _____ are frequently used as part of an artificial breeding program.

32. The ewe's pregnancy is maintained by the production of progesterone from the _____ after the initial beginning of the CL production of progesterone.

33. Mating of camelids occurs in a _____ recumbent position.

34. The placenta of the camelid should be passed within 6 hours, and if retained, the patient should be treated with _____.

35. Although spermatogenesis is completed in the testis, the spermatozoa must pass through the _____ for maturation to occur.

36. Scrotal circumference is primarily used to evaluate the size of the testes or the scrotum in _____.

37. The _____ gland is the only accessory sex gland present in the dog.

38. Any vaginal examination or diagnostic technique in the mare should be preceded by a thorough cleansing of the _____ area.

39. The _____ is the portion of the uterus most involved with pregnancy maintenance.

EXERCISE 11.9 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 11.10 SHORT ANSWER: ESTROUS CYCLES

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 11.11 CASE STUDY: PARTURITION

Ms. Allen, a long-time client, calls your hospital asking for advice. She has several feral cats living under her porch. Although she has worked with a local humane organization to have all of the cats trapped, neutered, and released, a new female (who she named "Emily") showed up just a few weeks ago.

Emily is tame enough that Ms. Allen was able to coax her into the garage, and was even able to handle her a little bit. Emily seems very healthy, but appears to be pregnant. Ms. Allen is calling today to make an appointment to bring her in for a check-up, pregnancy check, and any other care she might need, but would like some information concerning what to expect when the kittens are born (assuming Emily is pregnant as Ms. Allen suspects).

1. Answer her question by describing the series of events that takes place during parturition in the queen starting from stage I to birth of the kittens, as well as the likelihood of dystocia in the queen.

EXERCISE 11.12 – WORD SEARCH: TERMS

Find the words that are defined by the clues given below. The words may be located horizontally, vertically, or diagonally and may be reversed.

N	G	A	I	N	I	C	H	P	T	E	P	O	T	L
K	E	N	I	T	P	I	R	C	O	M	O	R	B	S
S	E	T	I	L	N	T	R	G	E	S	S	R	H	B
P	V	R	T	T	L	S	O	P	R	E	T	P	T	R
Z	I	U	A	O	A	A	D	M	T	T	P	P	I	R
E	T	M	C	A	S	L	I	C	K	S	A	R	T	I
G	C	C	C	E	P	B	L	A	R	E	R	I	U	O
U	U	S	M	E	I	O	T	I	C	T	T	L	U	T
A	D	T	E	O	I	H	S	R	C	S	U	A	M	N
R	O	T	E	P	C	P	N	I	N	S	M	O	R	O
D	R	T	O	O	T	O	S	E	R	T	O	L	I	P
E	P	T	L	A	I	R	T	E	M	O	D	N	E	I
D	E	Z	I	M	O	T	C	E	I	R	A	V	O	C
E	R	T	I	V	I	G	M	O	C	R	R	E	N	S
O	T	S	C	K	H	T	C	I	O	C	L	T	A	L

Trophoblastic
Bromocriptine
Colt
Reproductive
Antrum
Caslicks
Kittens
Ovariectomized
Sertoli
Postpartum
Meiotic
Testes
Oscillating
Guarded
Endometrial

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EXERCISE 11.9 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. List the primary anatomical structures in the brain involved in the reproductive processes of all mammalian species in addition to gonads and tubular genitalia of the male or female.

2. After ovulation, the tissue that makes up the corpus luteum causes a rapid increase in what hormone?

3. If ovulation does not occur within the normal period of time in a given species, what will happen to the ovum contained within the follicle?

4. Explain the importance of cumulus cells during the period of time that the ovum is held within the follicle and then released.

5. What body systems will the mesoderm, which is part of the inner cell mass of the blastocyst, develop into?

6. If a fetus is found outside of the uterus in domestic species, how does this happen, and what is the outlook for the fetus?

7. Explain why a bilaterally cryptorchid animal (with both testicles retained in the abdomen) will be sterile, but will still exhibit masculine behavior.

8. What is the difference between sperm cells and semen?

9. In the canine species, during which part of the estrous cycle does release of GnRH from the hypothalamus and the release of FSH from the pituitary gland take place?

10. Which canine breeds will have an anestrus period lasting more than twice as long as the 4-month duration seen in most other breeds?

11. How long does it take for released ova to become mature enough for fertilization to occur in the bitch?

12. The decrease of what hormone causes the rapid decrease in vulvar edema that may occur during estrus in the bitch?

_____

13. What is the stimulus for the end of diestrus both in the pregnant and in the nonpregnant bitch?

_____

14. What are two methods of insemination used in the bitch?

i. _____

ii. _____

15. How long will canine fresh semen (except from substerile males) that is delivered by natural service or artificial insemination remain capable of fertilizing the oocyte?

_____

16. When should natural insemination occur in the bitch?

_____

17. What disadvantage is associated with performing LH assays to help predict the correct time a bitch should be bred?

_____

18. What is another assay in addition to LH used for prediction of insemination time in the bitch?

_____

19. What important information does radiography give the attending veterinarian when performed on the bitch 2 to 4 days prior to expected delivery date?

_____

20. Describe the behavior of a bitch during Stage I of whelping.

_____

_____

21. How will exposure to constant daylight affect the queen's estrous cycle?

_____

22. When is breeding recommended in the queen to achieve the best probability of success?

_____

23. Explain the function of relaxin and how it is produced.

_____

24. At what time are fetuses of the queen considered to be premature?

_____

25. During what stage of parturition in the queen will the placentas completely pass and the uterus return to normal?

26. Explain why removal of the uterus is not commonly performed in the mare?

27. Why does light greatly influence the estrous cycle in the equine species?

28. Explain the effect extreme cold may have on the estrual activity in the mare.

29. What is the purpose for "teasing" in the equine species?

30. What is the purpose for the flehmen response in the equine species?

31. Why it is best for sperm to be present within the equine oviduct before ovulation occurs?

32. When should the breeding season of the equine species occur in North America and why?

33. What effects will a decrease in normal conformation of the vulva have in the mare?

34. Explain why approximately 2.5 cc of air is placed in the syringe containing semen during the process of artificial insemination.

35. Describe the diffuse attachment of the placenta in the equine species.

36. Describe the meaning of the term *epitheliochorial* as it pertains to the equine placenta.

37. Explain why inducing parturition in the mare should never be based on length of gestation alone?

38. What is the major complication seen in fetuses of the equine species that are delivered before proper maturation has occurred?

39. Which stage of parturition in the mare is the shortest?

40. What species of animal is known to have the shortest estrus period?

41. What is another name for the estrus stage of the estrous cycle?

42. What substance produced by the female cow during heat functions to attract a mate?

43. Describe the mating behavior of bulls.

44. Explain why teaser bulls are utilized more in beef operations than in dairy operations.

45. Why does the metestrus period have its own designation in the cow?

46. What effect does the release of melatonin have on ewes?

47. When do lambs reach puberty?

48. Explain the reason why many ewe lambs are bred to lamb at approximately 1 year of age.

49. Explain the reason for noting the body condition score of the ewe prior to breeding.

50. What signs are indicative of estrus in sheep?

51. Hyperemia of the vulva and surrounded areas during estrus may be noted in sheep of what color?

52. At what point of the estrous cycle will the female goat ovulate?

53. The presence of the CL and increased progesterone concentrations occur during which stage of the estrous cycle in the goat?

54. What are the scent glands around the base of a buck's horns used for?

EXERCISE 11.10 SHORT ANSWER: ESTROUS CYCLES

Instructions: Respond to each of the following questions in the space provided.

1. List the stages of the canine estrous cycle in the proper order and provide a brief description of what occurs during each stage.

2. Explain the term *seasonally polyestrous* and discuss the importance of light as it pertains to breeding in the equine species.

3a. Describe the difference between the primary purpose for a breeding soundness examination in the male and the primary purpose for a breeding soundness examination in the female.

3b. What are the parts of a breeding soundness examination of the female?

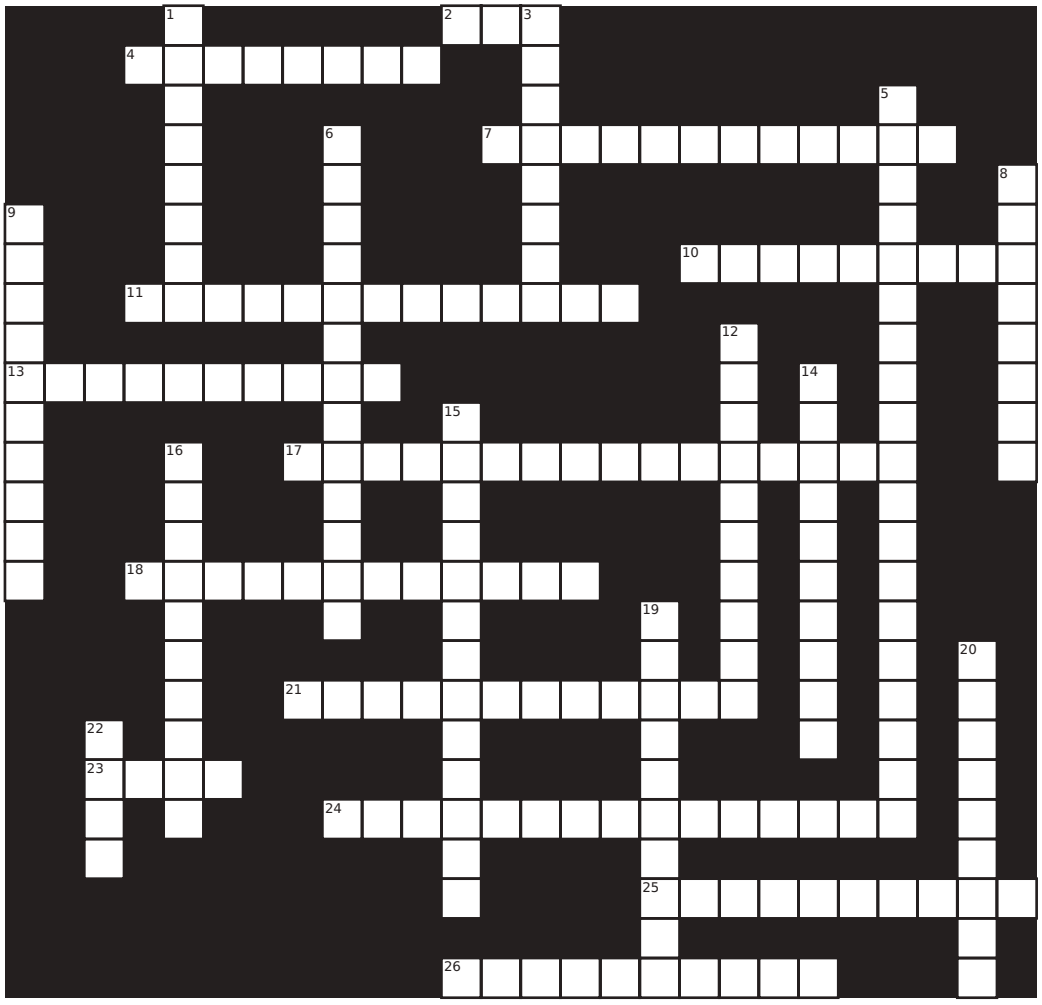
12 Hematology and Cytology

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, spell, and define all of the key terms.
2. Describe proper collection techniques, handling of blood samples, and components of a complete blood count (CBC).
3. Describe advantages, disadvantages, and capabilities of automated hematology analyzers.
4. Do the following regarding blood counts:
   - Compare and contrast procedures used to determine red blood cell mass (packed cell volume [PCV], hematocrit [HCT], hemoglobin, and red blood cell [RBC] count), and discuss the causes and significance of abnormal values.
   - Describe methods used to calculate RBC indices and red cell distribution width (RDW), and discuss the causes and significance of abnormal values.
   - Describe methods used to determine plasma protein concentration, and discuss the causes and significance of abnormal values.
   - Describe methods used to determine the white blood cell (WBC) count and the platelet count.
5. Do the following regarding blood smears:
   - Describe the technique used to prepare a stained blood smear, list factors that influence the quality of the smear, and discuss the process used to evaluate a blood smear.
   - Describe normal and abnormal morphology of RBCs, WBCs, and platelets in each species as they appear on a blood smear.
   - Discuss the causes and significance of RBC, WBC, and platelet abnormalities commonly observed on a blood smear.
   - Describe the procedure used to perform a differential WBC count, and calculate absolute values.
6. Do the following regarding coagulation testing:
   - Explain normal primary and secondary hemostasis, including intrinsic, extrinsic, and common pathways.
   - Discuss bleeding time, activated clotting time (ACT), activated partial thromboplastin time (APTT), and prothrombin time (PT) and the uses and significance of each.
   - Discuss tests used to evaluate fibrinolysis, including fibrin(ogen) degradation products (FDPs), D-dimer tests, and fibrinogen tests.
7. Do the following regarding cytology:
   - Explain uses for and limitations of cytology.
   - Describe procedures used to evaluate the cytology of solid tissue masses, enlarged organs, thoracic and abdominal effusions, and synovial fluid.
   - Discuss procedures used to submit cytology samples to a reference laboratory.
   - Describe collection and preparation of otic cytology samples, and identify common findings on normal and abnormal otic cytology preparations.

EXERCISE 12.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

2 A test that gives information about the numbers and types of circulating cells.
4 Stacking of red blood cells.
7 Vacuolization, Döhle bodies, and cytoplasmic basophilia in neutrophils. (2 words)
10 Nonnucleated fragments of cytoplasm released from megakaryocytes.
11 A nucleated red blood cell.
13 Falsely decreased in patients with red blood cell agglutination.
17 Percentage of RBCs in a specific volume of blood. (3 words)
18 Large in some poodles, very small in goats, and oval in camels. (3 words)
21 Variation in cell size.
23 A test that evaluates the intrinsic pathway of the coagulation cascade.
24 The term "leukopenia" means decreased numbers of these. (3 words)
25 The most abundant granulocyte in rabbits.
26 In most species, this is approximately equal to the PCV divided by 3.

Down

1 Becomes a macrophage in the tissues.
3 Used to evaluate exfoliated tissue cells.
5 MCV, MCHC, and MCH. (4 words)
6 This change in RBC distribution occurs in patients with immune-mediated hemolytic anemia (IHA).
8 Normally very few in circulation, but may be the most abundant leukocyte in some species of turtles.
9 The predominant circulating white blood cell in cattle, sheep, and goats.
12 Evaluated by the PT and ACT.
14 May contain Döhle bodies.
15 Counted to differentiate regenerative from nonregenerative anemia.
16 A red blood cell that has lost a portion of its membrane.
19 In cats, this cell contains numerous small, rod-shaped granules.
20 An increased number of circulating bands. (2 words)
22 An immature neutrophil.

EXERCISE 12.2 MATCHING #1: ABBREVIATIONS RELATED TO HEMATOLOGY AND COAGULATION

Instructions: Match each abbreviation related to hematology and coagulation in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ MCV
2. _____ MCHC
3. _____ FDP
4. _____ PT
5. _____ MCH
6. _____ RDW
7. _____ HCT
8. _____ APTT

Column B

A. An indicator of variation in red cell size.
B. The average amount of hemoglobin in each RBC.
C. The average amount of hemoglobin in a specific volume of blood.
D. Evaluates the extrinsic and common pathways of the coagulation cascade.
E. Evaluates the intrinsic and common pathways of the coagulation cascade.
F. A measure of fibrinolysis.
G. A measure of red blood cell mass.
H. The average size of the RBCs

EXERCISE 12.3 MATCHING #2: NUCLEATED CELLS SEEN ON A BLOOD SMEAR EXAM

Instructions: Match each cell type in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Neutrophils
2. _____ Band neutrophils
3. _____ Hypersegmented nuclei
4. _____ Pelger-Huet anomaly
5. _____ Eosinophils
6. _____ Basophils
7. _____ Lymphocytes
8. _____ Reactive lymphocytes
9. _____ Neoplastic lymphocytes
10. _____ Monocytes
11. _____ Mast cells

Column B

A. Have more basophilic cytoplasm and may have a perinuclear clear area.
B. The predominant circulating white blood cell in dogs, cats, and horses.
C. Have a twisted or irregular nucleus in dogs.
D. Contain numerous purple granules and a round nucleus.
E. Also called “stabs.”
F. May be intermediate to large size in cows.
G. These cells have prominent nucleoli.
H. An incidental finding in dogs.
I. Have abundant gray-blue cytoplasm, possibly with clear vacuoles.
J. Contain numerous, large, brightly staining, granules in horses.
K. Caused by high circulating corticosteroids.

EXERCISE 12.4 MATCHING #3: HEMOSTASIS

Instructions: Match each term related to hemostasis in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Activated clotting time (ACT)
2. _____ Blood smear
3. _____ Coagulation cascade
4. _____ D-Dimers
5. _____ Fibrin degradation products (FDP)
6. _____ Fibrinolysis
7. _____ Hemocytometer
8. _____ Plasmin
9. _____ Prothrombin time (PT)
10. _____ Refractometer

Column B

A. Results in secondary hemostasis.
B. Evaluates the extrinsic and common pathways.
C. Products of fibrin proteolysis that are considered to be reflective of active degradation of clots.
D. A device used in the measurement of fibrinogen.
E. This test requires use of a special tube that contains diatomaceous earth.
F. Breakdown of the protein product of the coagulation cascade.
G. Form when fibrin undergoes proteolysis by plasmin.
H. Used to evaluate platelet morphology.
I. Causes proteolysis of fibrin.
J. A device that can be used to count platelets.

EXERCISE 12.5 MATCHING #4: ABNORMAL BODY CAVITY FLUIDS AND ASSOCIATED CAUSES

Instructions: Normal thoracic and abdominal fluid is clear and colorless in small animals but may have a yellow tint in large animals. Disease states can cause one of a number of color changes that give clues as to the nature of the problem. Match each description of the appearance of abnormal body fluids in column A with the common associated causes in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Red or pink
2. _____ White or tan
3. _____ Brown
4. _____ Green
5. _____ Yellow

Column B

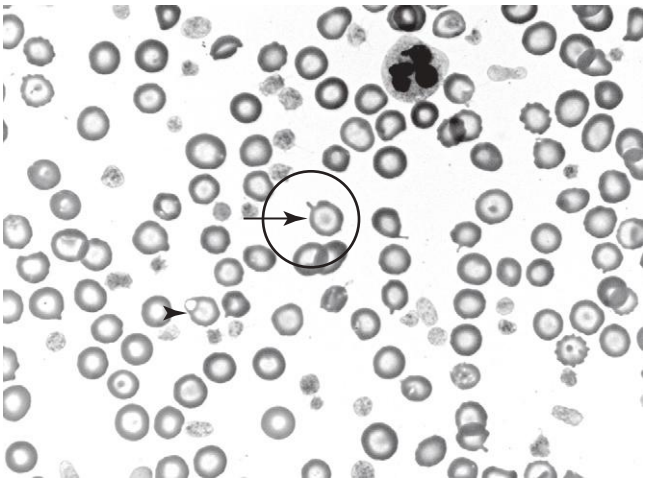
A. Hemolysis and icterus, previous hemorrhage, or ruptured bladder.
B. Previous hemorrhage or leakage of bowel contents.
C. Ruptured bile duct.
D. Internal hemorrhage.
E. Lipid or high numbers of cells.

EXERCISE 12.6 PHOTO QUIZ: PHOTOGRAPHS OF RED BLOOD CELLS WITH SHAPE CHANGES

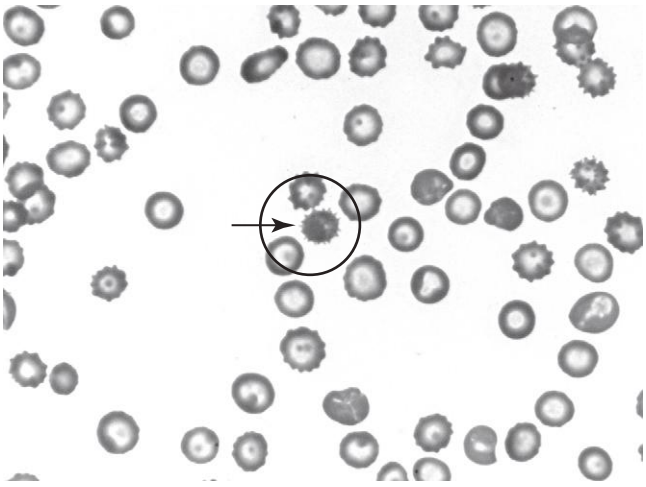
Instructions: Match each red blood cell circled with the letter corresponding to the morphologic change.

Names

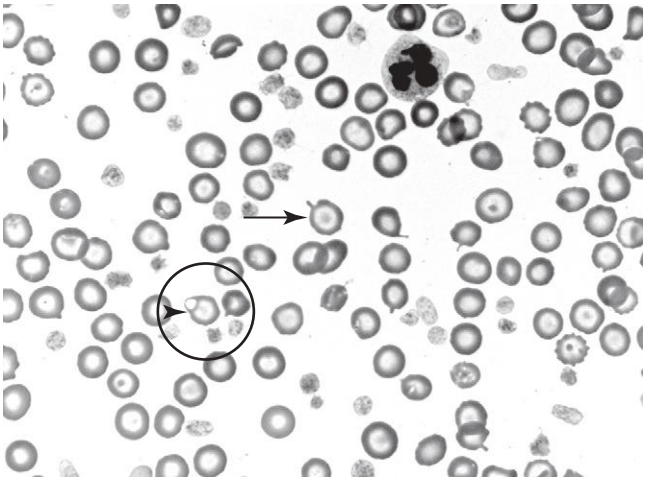
A. Acanthocyte
B. Eccentrocyte
C. Echinocyte
D. Cell with a Heinz body
E. Keratocyte
F. Apple stem cell
G. Schistocytes
H. Spherocyte



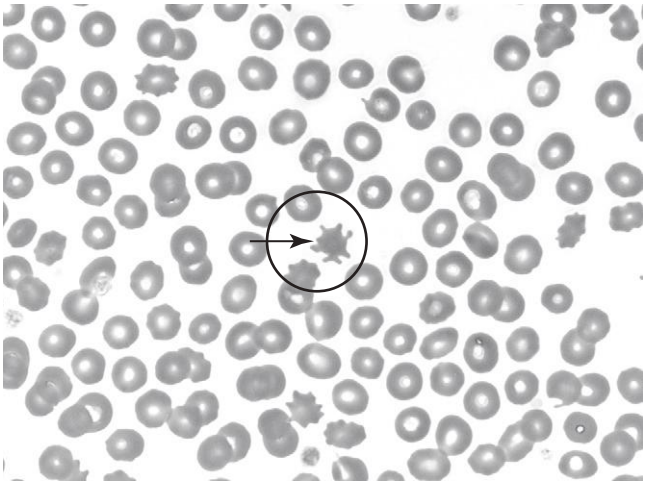
1. _____



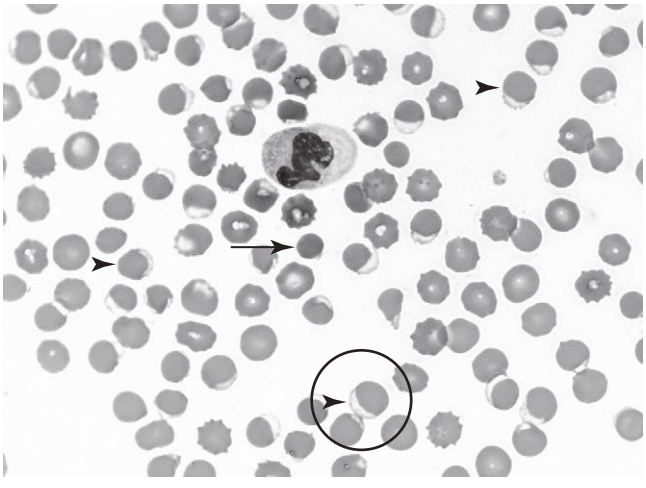
4. _____



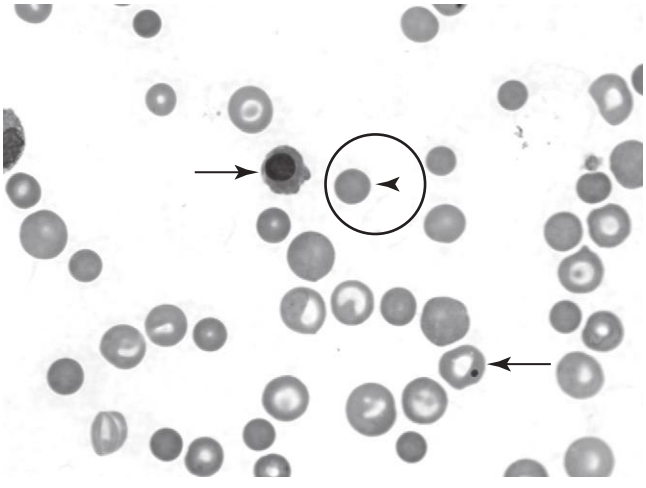
2. _____



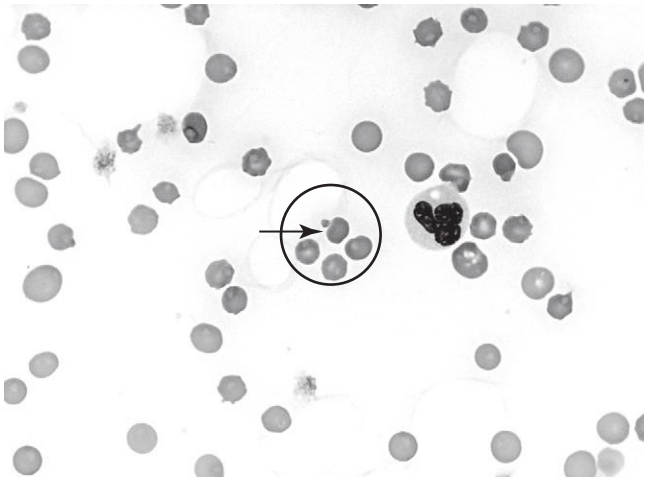
5. _____



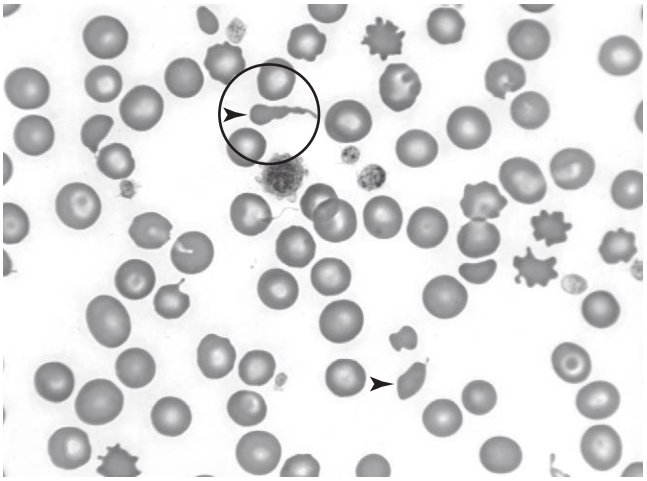
3. _____



6. _____



7. _____



8. _____

EXERCISE 12.7 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Automated hematology analyzers designed for human samples will not generate accurate results for a sample from a cat because the cells in these two species are of different sizes.
2. _____ A PCV is determined by a mathematical calculation.
3. _____ A hematology analyzer utilizing impedance methodology uses an electrical current to count blood cells and determine their size.
4. _____ WBCs are heavier than both RBCs and blood plasma, and thus are found on the bottom of a microhematocrit tube following centrifugation.
5. _____ Changes in the hemoglobin concentration are generally proportional to changes in the WBC count.
6. _____ An increased red cell distribution width (RDW) indicates anisocytosis.
7. _____ Platelet clumps occur most commonly in dogs.
8. _____ Ideally, a blood smear should be stained within 24 hours.
9. _____ The substage condenser of the microscope should be in a relatively high position when evaluating a blood smear or cytology prep.
10. _____ Target cells, when noted on a blood smear, are usually seen in animals with hemangiosarcoma or heartworm disease.
11. _____ Echinocytes are most often seen in animals with lymphoma (cancer of the lymph nodes).
12. _____ Normal RBCs often look like spherocytes near the feathered edge.
13. _____ The presence of any metarubricytes on a blood smear is abnormal.

14. _____ In normal animals, up to 10% of the RBCs are polychromatophils.

15. _____ The blood parasite *Anaplasma marginale* is easily mistaken for stain precipitate.

16. _____ A metamyelocyte is an immature neutrophil sometimes released into the circulation in the face of intense inflammatory reactions.

17. _____ A neutrophil has a higher nuclear-to-cytoplasmic ratio than a lymphocyte.

18. _____ When performing a differential cell count, broken cells should not be counted.

19. _____ Plasma samples for APTT and PT testing should be kept frozen until arrival at the reference lab.

20. _____ The mucin clot test is used to evaluate blood coagulation.

EXERCISE 12.8 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. Citrate is the anticoagulant contained in a
   a. Lavender top tube
   b. Red top tube
   c. Green top tube
   d. Blue top tube

2. Which one of the following tests does not indicate the oxygen carrying capacity of blood?
   a. RBC count
   b. HCT
   c. PDW
   d. PCV

3. Automated hematology analyzers determine the HCT by
   a. Direct measurement
   b. Multiplying the RBC count by the MCV
   c. Dividing the PCV by the RBC count
   d. Dividing the PCV by 3

4. MCV is often increased in patients with
   a. Inflammation
   b. Chronic renal failure
   c. Primary bone marrow disease
   d. Blood loss

5. Red blood cells in an animal with a decreased MCHC are called
   a. Hypochromic
   b. Microcytic
   c. Normochromic
   d. Macrocytic

6. Plasma is often clear and light yellow in
   a. Horses and cats
   b. Dogs and cows
   c. Cats and dogs
   d. Cows and horses

7. Rouleaux formation is most common in
   a. Horses and cats
   b. Dogs and cows
   c. Cats and dogs
   d. Cows and horses

8. Agglutination refers to irregular, variable-sized clumps of RBCs that occur most commonly in animals with
   a. Liver disease
   b. Immune-mediated hemolytic anemia
   c. Lead poisoning
   d. Blood loss

9. In which species do platelets not tend to stain as well as in other species on a blood smear?
   a. Dogs
   b. Cats
   c. Horses
   d. Cattle

10. Macroplatelets may be normal in
    a. Akitas
    b. Cavalier King Charles spaniels
    c. Greyhounds
    d. Poodles

11. The central pallor in RBCs is most prominent in the normal RBCs of
    a. Dogs
    b. Cats
    c. Horses
    d. Cattle

12. Anisocytosis tends to be greatest in _____ and least in _____.
    a. Dogs and horses
    b. Horses and cats
    c. Cats and cows
    d. Cows and dogs

13. Animals with immune-mediated hemolytic anemia often have _____ on the blood smear.
    a. Spherocytes
    b. Apple-stem cells
    c. Eccentrocytes
    d. Heinz bodies

14. Howell-Jolly bodies are often increased in patients with
    a. Liver disease
    b. Bone marrow suppression
    c. Iron-deficiency anemia
    d. Regenerative anemia

15. A reticulocyte count is used to determine if
    a. An anemia is regenerative or nonregenerative
    b. An anemia will get better or not
    c. The severity of an anemia
    d. An anemia is longstanding

16. Segmented neutrophils have a segmented nucleus with an average of
    a. 2 to 3 lobes
    b. 3 to 5 lobes
    c. 4 to 6 lobes
    d. 5 to 7 lobes

17. This in-house coagulation test may be used to detect abnormal platelet function.
    a. Activated clotting time
    b. Prothrombin time
    c. Bleeding time
    d. Activated partial thromboplastin time

18. This value is calculated as the TP of an unheated plasma sample minus the TP of a heated sample
    a. Fibrinogen
    b. D-dimers
    c. PT
    d. FDPs

19. Cytologic examination of tissue masses enables evaluation of
    a. Surgical margins
    b. Vascular invasion
    c. Morphology of isolated cells
    d. Association of abnormal cells with normal tissues

20. When preparing thoracic or abdominal effusion samples for cytologic examination, direct smears are often made, but some samples require concentration of the cells. Which of the following fluids is most likely to require cell concentration?
    a. Bloody fluid
    b. Fluid with a high cell count
    c. Clear fluid
    d. Turbid fluid

EXERCISE 12.9 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. EDTA prevents blood clotting by binding _____.

2. Serum protein is usually a little lower than plasma protein, because there is no _____ in it.

3. The presence of increased numbers of circulating nucleated red blood cells may occur with a markedly regenerative anemia. When it occurs in the absence of anemia and is accompanied by basophilic stippling, it may indicate _____ _____.

4. A blood smear may be too thick if, when preparing the smear, the drop of blood is too _____, the spreader slide is pushed too _____, or if the angle of the spreader slide is too _____.

5. The three areas of the blood smear, in order from nearest the drop to furthest away, are the _____, the _____ _____, and the _____ _____.

6. Regarding the shape of nuclei of WBC: The nucleus of a neutrophil is segmented with three to five lobes, whereas the nucleus of a monocyte is round, _____, _____, or _____ in shape, and the nucleus of a lymphocyte is generally _____ in shape.

7. The RBCs of birds and reptiles differ from those of mammals in that they contain a _____ and are _____ in shape.

8. Automatic cell counters may erroneously count nRBCs as WBCs. This error will cause the WBC count to be falsely _____. A WBC count that includes nRBCs should be referred to as a total _____ cell count.

9. The differential WBC count is performed by identifying and counting a minimum of _____ cells consecutively encountered in the monolayer.

10. A state in which the number of bands exceeds the number of segmented neutrophils is referred to as a _____ left shift.

11. Primary hemostasis refers to formation of the _____ _____ _____.

12. Blood for a platelet count should be drawn in a tube containing _____ anticoagulant.

13. To determine viscosity of joint fluid, place a wooden applicator stick in the fluid and slowly withdraw it. If viscosity is normal a strand _____ to _____ cm long should form.

EXERCISE 12.10 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 12.11 CASE STUDY: IMMUNE-MEDIATED HEMOLYTIC ANEMIA (IHA) AND THROMBOCYTOPENIA (ITP)

Signalment: 6-year-old, spayed female Collie

History: Acute onset of severe lethargy

Physical Examination: Pale, icteric mucous membranes; tachypnea; enlarged spleen

Please examine the following CBC results *(taken from the case presentation in the text)* and answer the questions below:

CBC	***Patient***		***Reference Interval***
Plasma protein (g/dL)	7.6	H	5.7 – 7.2
Plasma appeared clear and moderately yellow.			
HCT (%)	17	L	36 – 54
RBCs ($\times 10^{12}$/L)	2.2	L	4.9 – 8.2
MCV (fl)	80	H	64 – 75
MCHC (g/dL)	29.1	L	32.9 – 35.2
RDW	19.1	H	13.4 – 17.0
Reticulocytes ($\times 10^9$/L)	477.5	H	$<$ 60
RBC morphology: There is marked agglutination that did not disperse with saline. Moderate anisocytosis, marked polychromasia, and numerous spherocytes are observed. There are increased numbers of Howell-Jolly bodies and nRBCs.			
Platelets ($\times 10^9$/L)	94	L	106 – 424
WBCs ($\times 10^9$/L)	34.6	H	4.1 – 15.2
nRBCs ($\times 10^9$/L)	10.9	H	0
Band neutrophils ($\times 10^9$/L)	8.2	H	0 – 0.1
Segmented neutrophils ($\times 10^9$/L)	28.2	H	3.0 – 10.4
Lymphocytes ($\times 10^9$/L)	1.8		1.0 – 4.6
Monocytes ($\times 10^9$/L)	7.3	H	0.0 – 1.2
Eosinophils ($\times 10^9$/L)	0		0 – 1.2
WBC morphology: There are moderate numbers of Döhle bodies, and moderate cytoplasmic basophilia and vacuolation, interpreted as toxic change.			

1. What blood collection tube would you select for this blood draw, and what anticoagulant (if any) does this tube contain?

Test:	Tube top color	Anticoagulant (N/A if none)
CBC and platelet count	_____	_____

2. The hemoglobin concentration of any patient is usually proportional to the PCV or hematocrit. Using the technique for estimating hemoglobin you learned in this chapter, please estimate this patient's hemoglobin concentration in g/dL.

   Hemoglobin = _____ g/dL

3a. Are this patient's RBCs normal in size?

_____

3b. How do you know this by looking at the CBC?

_____

4. What is the term used to describe RBCs that are too large?

_____

5. Polychromasia is marked on the blood smear examination. What does this mean?

_____

6. How are polychromatophils recognized on a blood smear?

_____

_____

7. On the blood smear, there were also about 5 platelets/100× field. This correlates to an estimated platelet count of

   _____ platelets/μL.

8. This patient had increased nRBCs. When performing a manual cell count, the presence of many nRBCs will falsely increase the total WBC count because nRBCs cannot be differentiated from other nucleated cells. The WBC count can be mathematically corrected, however.

   Assume that a patient you were performing a CBC on had a total WBC count of 23,000 cell/μL, and 35 nRBCs were noted while performing the differential cell count. Using the formula you learned in this chapter, correct this patient's WBC count.

   Corrected WBC count _____ cells/μL

9. This patient also had markedly increased numbers of reticulocytes (477.5×10^9/L). What is the significance of this increase?

_____

_____

10. Calculating absolute values. ***Consider the following scenario:*** You have performed a manual white blood cell count and a 100-cell differential on a patient. The results are as follows:
    Total WBC Count: 25,000 cell/uL
    2% band neutrophils
    55% segmented neutrophils
    35% lymphocytes
    5% monocytes
    3% eosinophils
    Please calculate the absolute numbers of each cell.

    Band neutrophils: _____ cells/μL
    Segmented neutrophils: _____ cells/μL
    Lymphocytes: _____ cells/μL
    Monocytes: _____ cells/μL
    Eosinophils: _____ cells/μL

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EXERCISE 12.10 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the spaces provided.

1. When collecting blood for hematology, ethylenediaminetetraacetic acid (EDTA), is the preferred anticoagulant for mammals and most nonmammalian species. However, heparin is preferred for some nonmammalian species. Please answer the following questions regarding use of anticoagulants:

   a. Why is EDTA preferred over heparin in most species?

   b. Why is heparin preferred in some nonmammalian species?

   c. When collecting blood in a heparin tube, what technique can be used to minimize changes in cell morphology on the blood film caused by heparin?

2. Many hematology analyzers are easy to use and provide reliable results in most cases. However, in some laboratories, a blood smear is always evaluated by a person and reported along with the machine-generated results. Why is this the case?

3. Even though the terms PCV and HCT are often used interchangeably, there is a difference between these two tests in that a PCV is determined by measuring the percentage of RBCs in a specific volume of blood, but the HCT is calculated from the RBC count and the MCV.

   a. List one circumstance under which the PCV would be more accurate than a HCT, including the reason for this difference in accuracy.

   b. Now list one circumstance in which the HCT would be more accurate than the PCV, including the reason for this difference.

4a. List four ways the WBCs can be counted or estimated.

i. _____

ii. _____

iii. _____

iv. _____

4b. Which of these is most accurate and why? _____

_____

_____

5. Platelet counts as determined by a cell counter are usually accurate, except for one common domestic species under some circumstances. Which species is it, and under what circumstances is it not as accurate in this species?

_____

_____

6. List two factors relating to the way a blood smear is handled that will adversely affect staining.

i. _____

ii. _____

7. There are three areas to the blood smear. The body, the counting area, and the feathered edge.

a. Why is it impossible to identify cells or evaluate cell morphology effectively in the body of the smear?

_____

_____

b. Although cells can be counted in the feathered edge, it is best not to, and cell morphology should not be evaluated here. Why is this true?

_____

_____

8a. What is the difference between the microscopic appearance of rouleaux and agglutination?

_____

_____

8b. What is each of these changes in cell distribution caused by?

_____

_____

8c. What test can you do to differentiate the two?

9. Spherocytes are a shape change in RBCs seen commonly in dogs.

   a. What condition causes spherocytes to form?

   b. What is the mechanism for this change (what physically happens to the cell)?

   c. Why are spherocytes easy to recognize in dogs, but not in horses or cats?

10. A WBC count may be erroneously elevated in animals with high circulating nRBCs. Why is this the case?

11. Regenerative anemia is one in which the bone marrow responds by releasing immature RBCs.

   a. List two ways you can tell that the bone marrow response is appropriately regenerative in cases of anemia.

      i.

      ii.

   b. How does the way this count is performed differ between dogs and cats?

12. When performing a differential cell count, 100 leukocytes are enumerated in the counting area of the smear.

    a. Name the six categories (general cell types) into which these cells should be classified.

        i. _____

        ii. _____

        iii. _____

        iv. _____

        v. _____

        vi. _____

    b. Which of these cell types are classified as "granulocytes"?

    _____

    c. Why are they called granulocytes?

    _____

    _____

13a. What is a "left shift"?

_____

_____

13b. What is the clinical significance of a left shift in terms of what is happening in the bone marrow?

_____

_____

13c. What is the difference between a degenerative left shift and a left shift?

_____

_____

14. Intermediate to large lymphocytes are normal in cattle, or may be seen in response to antigenic stimulation in many species, in which case they are referred to as reactive lymphocytes. How can you differentiate normal large lymphocytes from reactive lymphocytes by their appearance on a blood smear?

_____

_____

15. Describe the difference between the shape of the nucleus in a neutrophil and the shape of the nucleus in a monocyte.

_____

_____

16. What kind of cells and other significant findings are often observed in the feathered edge?

17a. What is the difference between primary and secondary hemostasis?

17b. Why are both necessary for normal blood coagulation?

18. When drawing blood for activated partial thromboplastin time (APTT) and prothrombin time (PT), it is very important that great care is taken in the way that the blood is drawn and handled prior to transport to the lab. What are some of the factors that must be observed when drawing and preparing these samples?

19. Cytology is a technique that is helpful to establish a provisional or definitive diagnosis of abnormal tissues. What are some of the important advantages and disadvantages of this technique?

20. Samples from subcutaneous and cutaneous nodules, lymph node, organs, and internal masses can be sampled for cytologic exam using a fine needle aspiration technique. The material collected this way is then expelled onto clean glass slides and smears are made.

    a. Briefly describe the technique used to make these smears.

b. What will happen if not enough or too much pressure is used when preparing the slides that may make them unsuitable for examination?

21. When submitting a tissue mass to an outside laboratory for cytologic evaluation, the location that is was taken from should be indicated on the submission form. List four other characteristics of the mass that should be included on the submission form.

i. _____

ii. _____

iii. _____

iv. _____

22. Evaluation of otic cytology is a diagnostic technique frequently used to discern the cause of otitis externa.

a. Describe the technique used to obtain and prepare an otic cytology sample.

b. Describe the expected microscopic findings on a cytologic prep from a normal ear.

c. What microscopic findings indicate an abnormal ear canal?

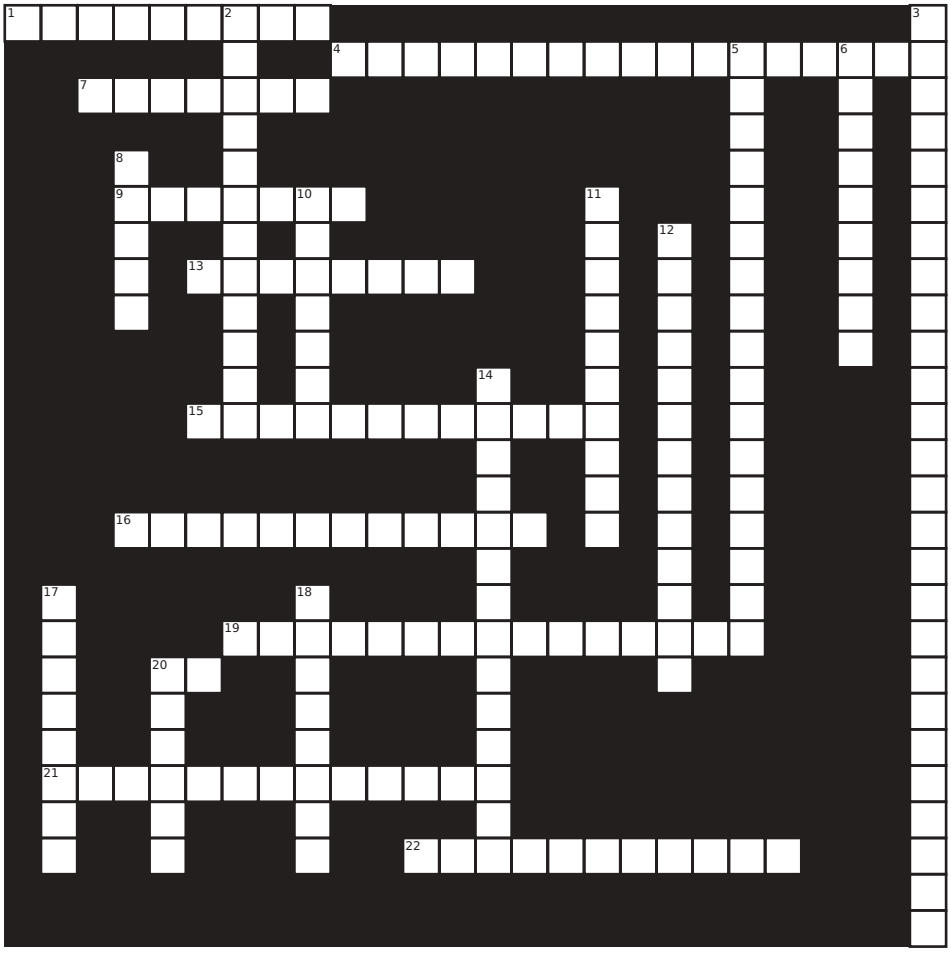
13 Clinical Chemistry, Serology, and Urinalysis

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, spell, and define all of the Key Terms.
2. Do the following regarding clinical chemistry:
   - Explain the purpose of the clinical chemistry profile and list the preanalytic and analytic factors that can affect clinical chemistry testing.
   - Compare and contrast the use of chemistry analyzers in veterinary and human medicine.
   - Define a calibrator and a control, and describe how they are used in quality control.
3. Describe the general principles of serologic testing, and discuss the most common methods of serologic testing.
4. Do the following regarding urinalysis:
   - Describe proper collection techniques and handling of urine samples.
   - List and describe methods for the physical and biochemical evaluation of urine.
   - Describe the preparation of urine for microscopic evaluation, list the cellular elements that can be found in the urine sediment, and identify the three most common urine crystals.

EXERCISE 13.1 CROSSWORD PUZZLE: TERMS



Across

1 Destruction of RBCs that may result from improper handling of the blood.
4 A graph with a chronological record of control test results. (2 words)
7 Material that contains a known quantity of the analyte that is being tested.
9 The presence of circulating triglycerides.
13 Increased blood urea nitrogen (BUN) and serum creatinine (SC).
15 A urine specific gravity between 1.008 and 1.012.
16 May be associated with a risk for urolithiasis.
19 A measure of the ability of the kidney to concentrate urine. (2 words)
20 This will increase in a urine sample over time due to loss of CO_2.
21 Measures the bending of light as it passes through a solution.
22 Increased number of casts in urine.

Down

2 Chemicals in the liquid portion of clotted blood that are released from damaged cells, and used to detect liver damage, muscle damage, or cholestasis. (2 words)
3 Detailed step-by-step description for performing a test and operating an instrument. (3 words)
5 A method of measuring chemistries based on light transmission through a liquid.
6 This term is used to describe a urine sample with a pH of 8.
8 The snap test uses this technology to detect antigens. (acronym)
10 Caused by increased serum bilirubin.
11 A standardized material that contains a known amount of reference material.
12 The preferred urine collection method for bacterial culture.
14 Procedures necessary to produce accurate and reliable results. (2 words)
17 This term means increased hydrogen ions in the urine.
18 The detection of antigens by using antibodies.
20 Increased numbers of leukocytes in the urine.

EXERCISE 13.2 MATCHING #1: THE APPEARANCE OF NORMAL AND ABNORMAL BLOOD SERUM

Instructions: Match each description of the appearance of blood serum in column A with its associated significance in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ Milky	A. Normal in large animals.
2. _____ Red	B. Normal in small animals.
3. _____ Clear and colorless	C. Concurrent hemolysis and lipemia.
4. _____ Light yellow	D. From rough transfer of the blood to the collection tube.
5. _____ Pink, milky	E. Bilirubin in the serum.
6. _____ Orange	F. Increase serum triglycerides (lipemia).

EXERCISE 13.3 MATCHING #2: ELISA SEROLOGY ASSAY

Instructions: Match each item associated with the ELISA test designed to test for patient antigens in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ Antibody	A. Captured by the matrix-bound antibody.
2. _____ Patient sample	B. Acted on by the enzyme in the enzyme-labeled antibody.
3. _____ Enzyme-labeled antigen/ antibody complex	C. Bound to a solid matrix.
4. _____ Unbound antigen and enzyme-labeled antibody	D. In the patient sample.
5. _____ Colorless chemical substrate	E. Mixed with reagent containing an enzyme-labeled antibody.
6. _____ Antigen of interest	F. Washed away during a washing step.

EXERCISE 13.4 MATCHING #3: THE SIGNIFICANCE OF SPECIFIC GRAVITY VALUES

Instructions: Match each specific gravity in column A with its corresponding description of the significance of each value in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ 1.000	A. Indicates normal kidney function in a dehydrated cat.
2. _____ 1.005	B. The SG should be at or above this level if a dog is dehydrated.
3. _____ 1.010	C. Indicates kidneys are able to dilute the urine.
4. _____ 1.025	D. The SG of distilled water.
5. _____ 1.030	E. A minimal SG level expected in a dehydrated cow.
6. _____ 1.035	F. Indicates the urine is neither being concentrated nor diluted by the kidneys.

EXERCISE 13.5 MATCHING #4: CHEMICAL EVALUATION OF URINE

Instructions: Match each chemical constituents found on urine chemistry reagent strips in column A with the corresponding statement that applies to each in column B by writing the appropriate letter in the space provided.

Column A

1. _____ pH
2. _____ Protein
3. _____ Glucose
4. _____ Ketones
5. _____ Bilirubin
6. _____ Blood

Column B

A. Male dogs may have small amounts in concentrated urine, but not cats.
B. May be false negative when the urine is exposed to formaldehyde.
C. May change from positive to negative if the urine is centrifuged.
D. May increase as a result of loss of carbon dioxide as urine stands.
E. May appear in the urine as a consequence of glomerular disease.
F. May be present in the urine in animals with starvation.

EXERCISE 13.6 MATCHING #5: CONSTITUENTS OF A ROUTINE CHEMISTRY PANEL

Instructions: Match each constituent of a routine chemistry panel in column A with the corresponding statement in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Glucose
2. _____ Electrolytes
3. _____ Creatinine
4. _____ Alanine aminotransferase
5. _____ Sorbitol dehydrogenase
6. _____ Creatine kinase
7. _____ Alkaline phosphatase
8. _____ Immunoglobulins
9. _____ Aspartate aminotransferase

Column B

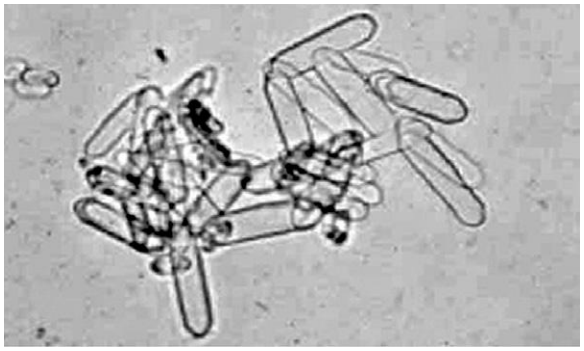
A. May increase in patients with impaired kidney function.
B. Increased levels indicate hepatocellular damage in large animals.
C. Increased levels indicate either hepatocellular or muscle damage.
D. Increases in the presence of inflammation**.**
E. May decrease if the clot is left in contact with the serum for more than 1 hour.
F. Increased levels indicate hepatocellular damage in small animals.
G. Increased levels indicate muscle damage.
H. Play(s) a role in regulating water balance and acid–base status.
I. Increased from cholestasis or induced by corticosteroids**.**

EXERCISE 13.7 PHOTO QUIZ: PHOTOGRAPHS OF URINE CRYSTALS

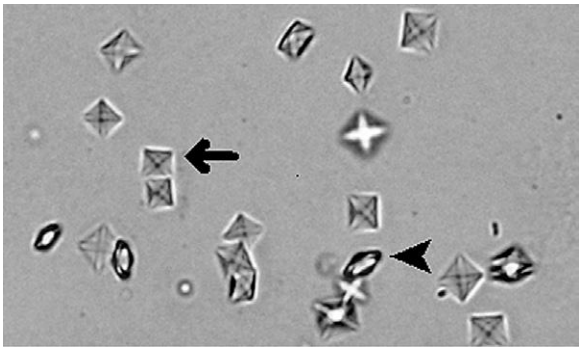
Instructions: Match each urine crystal (indicated by the arrow) with the name corresponding to the crystal type.

Names

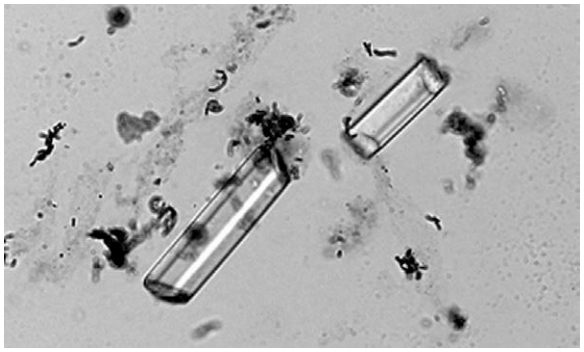
A. Ammonium biurate
B. Calcium carbonate
C. Bilirubin
D. Struvite
E. Calcium oxalate dihydrate
F. Cystine
G. Calcium oxalate monohydrate



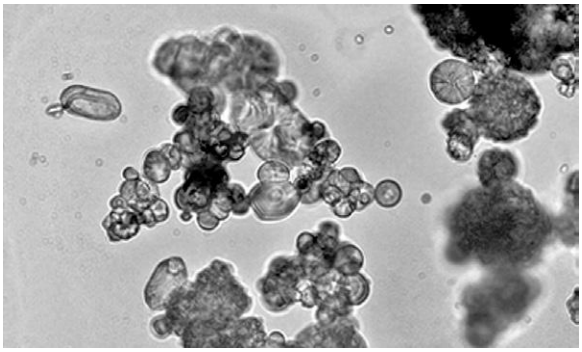
1. _____



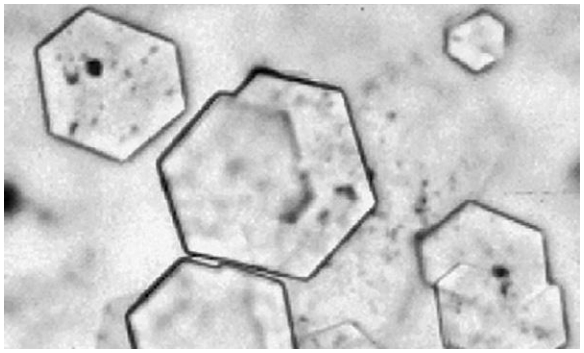
5. _____



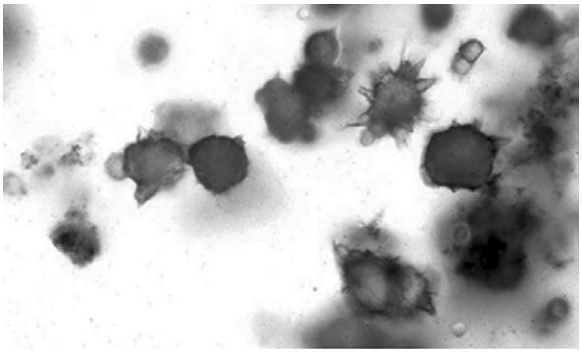
2. _____



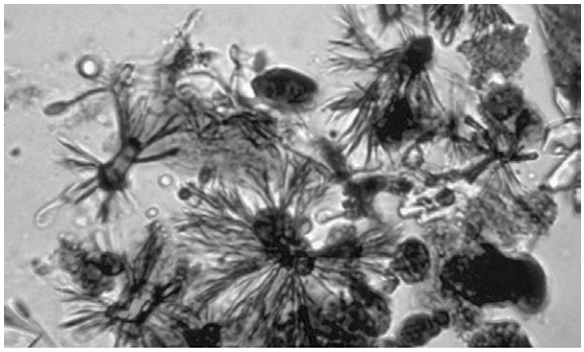
6. _____



3. _____



7. _____



4. _____

EXERCISE 13.8 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ The function of organs such as the liver can be measured using a routine chemistry panel.
2. _____ Increased serum bilirubin specifically indicates cholestatic disease.
3. _____ Serum calcium concentration may not accurately reflect total body content of calcium.
4. _____ Fasting is required in all domestic species prior to sample collection for a chemistry panel.
5. _____ The breed and age of a patient may affect what is considered a normal amount of each analyte in the blood.
6. _____ A disadvantage of dry reagent chemistry systems is that they are more sensitive to interference by lipemia, hemolysis, and icterus than liquid reagent systems.
7. _____ Point-of-care chemistry instruments like the iSTAT (Abaxis, Union City, CA) that use single-use self-contained cartridges do not require in-house calibration.
8. _____ It takes approximately 1 to 3 weeks for a patient to develop an antibody response to an active infection.
9. _____ If a patient is actively infected with a pathogen, the antibody titer is expected to double over a period of 2 to 3 weeks.
10. _____ ELISA serologic tests can be used to test for either antigens or antibodies.
11. _____ A urine container must be tightly capped to prevent loss of protein.
12. _____ Catheterization is the preferred way of obtaining urine samples for bacterial culture.
13. _____ Specific gravity is an indicator of the concentrating ability of the kidney.
14. _____ If the kidneys are healthy, urine will be diluted in a dehydrated patient, or concentrated when the patient is overhydrated.
15. _____ The presence of urease-positive bacteria in urine can cause the urine pH to decrease.
16. _____ Normal urine should not contain glucose.
17. _____ Interpretation of the significance of blood in the urine is affected by the method of collection.
18. _____ Transitional epithelial cells are larger than other cells seen in urine.
19. _____ Urinary casts form in the glomeruli of the kidneys.
20. _____ Urinary crystals may form in response to changes in the diet.

EXERCISE 13.9 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. Which of the following constituents of a routine chemistry panel is a calculated value?
   a. Alanine aminotransferase (ALT)
   b. Albumin
   c. Anion gap
   d. Potassium

2. Increased serum creatinine (SC) indicates azotemia, and can be caused by impaired kidney function or dehydration. To differentiate these causes, the SC must be interpreted along with
   a. Albumin
   b. Urine specific gravity (SG)
   c. Blood urea nitrogen (BUN)
   d. Alanine aminotransferase (ALT)

3. Each of the following is a serum electrolyte except
   a. Chloride
   b. Bicarbonate
   c. Creatinine
   d. Phosphorus

4. The serum protein normally present in the highest concentrations is
   a. Albumin
   b. Globulin
   c. Fibrinogen
   d. Prothrombin

5. To avoid serum lipemia, dogs and cats should be
   a. Fed
   b. Fasted for 4 hours
   c. Fasted for 8 hours
   d. Fasted for 12 hours

6. With the exception of birds and other small pets, when sending blood to an outside lab, serum samples should be collected in a tube containing
   a. Sodium citrate anticoagulant
   b. EDTA anticoagulant
   c. No anticoagulant
   d. Lithium heparin anticoagulant

7. In reference to chemistry analyzers, the term *throughput* refers to the
   a. Number of tests that can be performed at once
   b. Speed of sample processing
   c. Accuracy of the test results
   d. Process of putting the sample into the machine

8. In reference to quality control, a "SOP" is a
   a. Sample of the material used to calibrate the machine
   b. Graph used to track control results
   c. Step-by-step description for performing a test
   d. Measure of test result trends

9. Controls must be run routinely as an integral part of good quality control. In small and large labs, they should be run at least
   a. Twice a day
   b. Once a day
   c. Once every other day
   d. Once a week

10. When running controls, an acceptable variation is within ± 2 standard deviations of the mean. This means that the control may be slightly out of the acceptable range less than
    a. 2% of the time
    b. 5% of the time
    c. Two times out of 10
    d. Every other time it is run

11. Over time, control results may gradually progress toward the upper or lower acceptable limits. This would most likely happen if
    a. The wrong reagent is being used
    b. The technician's technique for performing the test is incorrect
    c. An instrument component is deteriorating
    d. The samples are not being processed properly

12. Serology is not commonly used to test for
    a. Drugs
    b. Hormones
    c. Infectious agents
    d. Enzymes

13. A single positive serologic test for antibodies to a pathogen indicates that the patient
    a. Is actively infected by the pathogen
    b. Has been exposed to the pathogen either currently or in the past
    c. Has never been exposed to the pathogen
    d. Is sick from exposure to the pathogen

14. Which of the following is NOT an example of a serologic test?
    a. IRMA
    b. GGT
    c. ELISA
    d. AGID

15. Exposure of urine to UV light, may cause deterioration of
    a. Ketones
    b. Protein
    c. Bilirubin
    d. Glucose

16. Urine samples least likely to be contaminated with squamous epithelial cells are those collected by
    a. Midstream void
    b. Urinary catheter
    c. Manual compression
    d. Cystcentesis

17. The presence of hematuria, hemoglobinuria, or myoglobinuria in the urine may cause it to be
    a. Yellow-brown in color
    b. Amber in color
    c. Light yellow in color
    d. Reddish-brown in color

18. Normal urine should be clear in the common domestic species of animals, except for
    a. Dogs
    b. Cats
    c. Cattle
    d. Horses

19. Reagent test pads that do not work in animals and so should not be used are the
    a. Ketone and leukocyte pads
    b. Leukocyte and specific gravity pads
    c. Specific gravity and bilirubin pads
    d. Bilirubin and ketone pads

20. The protein pad on a reagent strip is most sensitive to
    a. Globulins
    b. Myoglobin
    c. Albumin
    d. Mucoproteins

21. Squamous epithelial cells come from the
    a. Kidney tubules
    b. Renal pelvis and ureters
    c. Bladder
    d. Urethra, vagina, and prepuce

22. These cells may appear in clusters or rafts in a urine sample
    a. RBCs
    b. WBCs
    c. Transitional cells
    d. Squamous cells

23. The following urinary casts are normal in very low numbers (1 or fewer/LPF)
    a. Waxy and hyaline
    b. Hyaline and granular
    c. Granular and cellular
    d. Cellular and waxy

24. The following crystal is not expected in the urine of normal dogs and cats
    a. Hippuric acid-like calcium oxalate monohydrate
    b. Struvite
    c. Calcium phosphate
    d. Calcium oxalate dihydrate

25. Normal horses have which of the following urinary crystals in their urine?
    a. Calcium oxylate monohydrate
    b. Struvite
    c. Calcium phosphate
    d. Calcium carbonate

EXERCISE 13.10 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. Corticosteroids can induce increases in the cholestatic serum enzyme _____ _____ especially in dogs.

2. Hypoalbuminemia (decreased albumin) can cause a decrease in blood _____ because this electrolyte binds to albumin in the blood.

3. Inflammatory diseases and some lymphoid cancers may cause the blood protein _____ to increase.

4. Use of an incorrect needle size for blood collection, or excessive pressure on the syringe can result in _____.
5. When preparing a serum sample for a chemistry profile, the blood should be allowed to clot for _____ to _____ minutes at _____ temperature, then centrifuged for _____ minutes at _____ to _____ g.
6. A SNAP test is a serologic screening test, designed to detect infectious agents, that uses _____ technology.
7. Urine should be at _____ temperature when analyzed, and should be examined within _____ hour of collection.
8. Collection of urine by _____ _____ may damage or even rupture a fragile, diseased bladder.
9. A special urine collection technique for acquiring samples from bladder masses is _____ _____.
10. Urine that is colored red or reddish-brown indicates the presence of _____, _____, or _____ in the urine.
11. When using a medical refractometer to determine the urine SG in a cat, a conversion scale must be used, because the actual SG of cat urine is _____ than the reading on the scale.
12. Uncentrifuged urine should be used for biochemical testing unless the urine is _____.
13. The protein pad on a reagent strip may be false _____ when the urine is alkaline.
14. Glucosuria occurs when blood glucose level exceeds the _____ _____.
15. The blood pad on the reagent test strip is sometimes alternatively labeled _____.
16. When preparing urine samples for microscopic examination, _____ to _____ mL of urine should be centrifuged in a conical centrifuge tube at _____ to _____ rpm for _____ minutes. The supernatant should be removed by pipetting or decanting, until only _____ mL of supernatant is left with the pellet.
17. Squamous cells in urine sediment are _____ in shape and of no clinical significance.
18. Ammonium biurate crystals may be see in the urine of _____ (a dog breed).

EXERCISE 13.11 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 13.12 SHORT ANSWER: CHEMISTRY ANALYZERS

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 13.13 CASE STUDY: PRESURGICAL PANEL ON A YOUNG DOG

Signalment: 10-month-old, mixed-breed, male dog

History: A presurgical chemistry panel was run prior to orthopedic surgery for hip dysplasia.

Examine the following presurgical chemistry panel *(modified from the case presentation in the text)* and answer the questions below:

	Units	Sample 2		Reference Interval
BUN	mg/dL	13		5–20
Creatinine	mg/dL	0.9		0.6–1.6
Phosphorus	mg/dL	6.4		3.2–8.1
Calcium	mg/dL	11.5		9.3–11.6
Sodium	mEq/L	152		143–153
Potassium	mEq/L	4.7		4.2–5.4
Chloride	mEq/L	111		109–120
Anion gap	mEq/L	21		15–25
Osmolality (calculated)	mOsm/kg	303		285–304
Bicarbonate	mmol/L	25		16–25
ALT	IU/L	25		10–55
AST	IU/L	28		12–40
ALP	IU/L	35		15–120
CK	IU/L	131		50–400
Cholesterol	mg/dL	166		80–315
Total bilirubin	mg/dL	0.4		0.1–0.4
Total protein	g/dL	5.4		5.1–7.1
Albumin	g/dL	3.6		2.9–4.2
Globulin	g/dL	1.8	L	2.2–2.9
A:G ratio		2.0		0.8–2.2
Glucose	mg/dL	112		77–126

A:G, albumin-to-globulin; ALP, alkaline phosphatase; ALT, alanine aminotransferase; AST, aspartate aminotransferase; BUN, blood urea nitrogen; CK, creatine kinase.

1a. What are the two main constituents of total serum protein?

i. _____

ii. _____

1b. How are albumin and globulins measured?

1c. What disease condition(s) typically cause both albumin and globulins to decrease?

1d. What disease condition(s) can cause hypoalbuminemia with normal globulins?

1e. What disease condition(s) typically cause both albumin and globulins to increase?

1f. What disease condition(s) can cause globulins to increase with no increase in albumin?

2. Which of the analytes indicate increased nitrogenous wastes in the blood?

3. Which analyte is generally increased in patients with diabetes mellitus and is used to diagnose this condition?

4a. Which analytes are enzymes that indicate hepatocellular damage in small animals?

4b. Why does aspartate aminotransferase (AST) have to be interpreted along with creatine kinase (CK) to accurately screen for hepatocellular damage?

4c. What other enzyme is measured to screen for hepatocellular damage in large animals?

5. Which of the analytes are electrolytes?

6a. What is cholestatic disease?

6b. Which analytes indicate cholestatic disease?

6c. Which analyte is not specific for cholestasis because it can also be increased by hemolysis?

EXERCISE 13.11 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. A clinical chemistry profile is an essential part of the patient database and is used for a variety of reasons, such as screening for disease, arriving at a diagnosis, or monitoring progress. Read the following scenarios, and in each instance, indicate the specific reason or reasons that the chemistry profile (alone or with other blood work) is being performed using appropriate medical terminology.

   a. Katie, a 3-year-old, intact female, dachshund is presented with a fever. The attending doctor orders a CBC and chemistry profile to determine whether the fever is the result of an inflammatory disease, an infection, or some other cause. What is the primary reason or reasons this CBC and profile are being performed?

   _____

   b. Victoria, an 11-year-old, spayed female, lab mix is presented for a recheck following a diagnosis of renal disease. She has been on several therapies, and the attending doctor orders a repeat chemistry profile about once a month primarily to see if the creatinine and BUN are going up, going down, or staying the same. What is the primary reason or reasons this profile is being performed?

   _____

   c. Mary, a 6-year-old, intact female, DSH is presented for a spay and removal of a mammary tumor. The attending doctor orders a presurgical CBC and profile. What is the primary reason or reasons this CBC and profile are being performed?

   _____

   d. Herbie, a 13-year-old, castrated male, mix breed dog is presented for a routine wellness check and vaccine boosters. The owner reports no problems, and the physical examination is normal. The doctor orders a CBC and chemistry profile to "see how things look" with the various organ systems. What is the primary reason or reasons this CBC and profile are being performed?

   _____

   e. Teddy, a 5-year-old, castrated male, terrier mix is hospitalized after ingesting a known nephrotoxic substance. Initial tests performed upon presentation indicated impaired kidney function, so an initial treatment plan was developed and implemented based on the information the attending doctor had at the time. Now she has ordered a complete profile, as well as other diagnostic tests to further assess the kidneys, because she wants to get more information about how severe the damage is, so that she can discuss the outlook with the owner. What is the primary reason or reasons this profile is being performed?

   _____

2a. List three main reasons that serum glucose may be increased.

   i. _____

   ii. _____

   iii. _____

2b. Indicate two distinct ways you could differentiate between these causes.

   i. _____

   ii. _____

3. The technician must have an understanding of factors that affect the ability to provide reproducible and accurate test results. These factors are classified as preanalytic or analytic. What is the difference between preanalytic and analytic factors in respect to when they occur in the process of collecting and processing the sample?

4. Refrigeration of a blood sample during clotting is not recommended because it will delay clot formation. Why is this a concern?

5. What three general problems can result if the serum is left on the clot for a prolonged period (longer than 1 hour)?

   i. _____

   ii. _____

   iii. _____

6. Sometimes it is preferred to collect blood in a green-top tube. Why is this an advantage in birds and other small pets?

7. Why do hemolysis, lipemia, and bilirubinemia interfere with and adversely affect the results of chemistry tests processed in large, high throughput analyzers found in reference laboratories?

8. Why is quality control important in terms of patient care? What might happen if a good quality control program is not maintained?

9. A positive equine infectious anemia (EIA) serology test result indicates infection with the virus. This may not be true of a foal. Explain why this is the case.

10. When performing a serology test to evaluate an antibody response, paired samples are often taken 1 to 3 weeks apart. Explain how these results are used to differentiate an active infection from past exposure to an infectious agent.

11. RIA, IRMA, or ELISA tests are all serologic tests that can be used to measure hormones. Explain what is common about the way these tests work.

12. Red colored urine can indicate hematuria, hemoglobinuria, or myoglobinuria. Describe the techniques used to tell these three things apart.

13. The pH pad of a reagent strip measures the concentration of hydrogen ions in the urine.

    a. Which common domestic species have acid to slightly alkaline urine? What do these species have in common?

    b. Which common domestic species have alkaline urine? What do these species have in common?

14. Urine concentration can change the size or integrity of RBCs in urine. Explain how urine concentration and RBC size and integrity are related, and explain why this happens.

EXERCISE 13.12 SHORT ANSWER: CHEMISTRY ANALYZERS

Instructions: Respond to each of the following questions in the space provided.

1. Chemistry analyzers come in three basic types: (a) high-throughput analyzers found in reference laboratories; (b) low-throughput analyzers designed for use in veterinary practices; and (c) blood gas analyzers and portable, point-of-care analyzers (those designed for use at the bedside). Each of these systems uses one or more of the following four methods for analyzing samples: (i) spectrophotometry; (ii) reflectance photometry; (iii) potentiometry; (iv) amperometry. Match the analyzer type with the method used to analyze samples. Then give a brief explanation of the way each system works.

    a. High-throughput analyzers found in reference laboratories:

b. Low-throughput analyzers designed for use in veterinary practices:

c. Blood gas analyzers and portable, point-of-care analyzers:

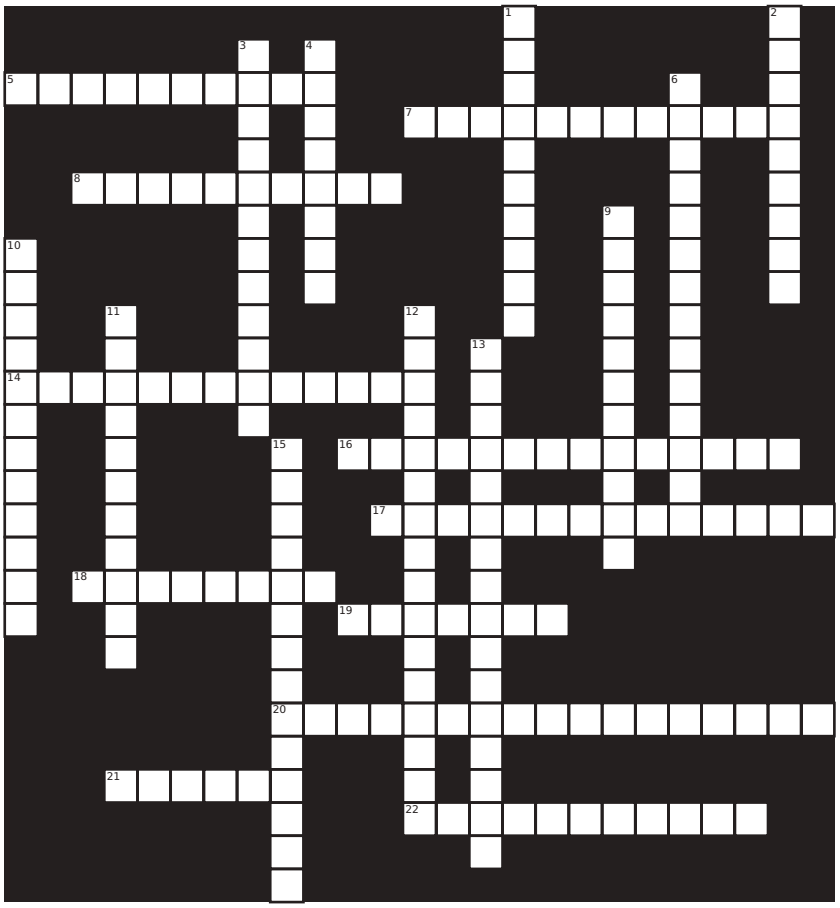
14 Parasitology

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all Key Terms in this chapter.
2. Identify the common name, affected species, key clinical signs, methods of diagnosis, life cycle, zoonotic potential, treatment, prevention, and control of the digenetic flukes of zoonotic importance.
3. Identify the common name, affected species, key clinical signs, methods of diagnosis, life cycle, zoonotic potential, treatment, prevention, and control of the cestodes and metacestodes of zoonotic importance.
4. Identify the common name, affected species, key clinical signs, methods of diagnosis, life cycle, zoonotic potential, treatment, prevention, and control of the nematodes (roundworms) of zoonotic importance. Also do the following regarding nematodes:
   - Describe the origin and clinical signs of *visceral larva migrans, ocular larva migrans, neurologic larva migrans,* and *cutaneous larva migrans,* including risk factors for and methods of preventing these zoonotic diseases.
   - Identify the common name, affected species, key clinical signs, methods of diagnosis, life cycle, zoonotic potential, treatment, prevention, and control of *Dirofilaria immitis* (heartworms).
5. Identify the common name, affected species, key clinical signs, methods of diagnosis, life cycle, zoonotic potential, treatment, prevention, and control of the arthropods of zoonotic importance.
6. Identify the common names, affected species, key clinical signs, methods of diagnosis, life cycle, zoonotic potential, treatment, prevention, and control of the protozoans of zoonotic importance.
7. Identify the common names, affected species, key clinical signs, methods of diagnosis, life cycle, zoonotic potential, treatment, prevention, and control of the pentastomes of zoonotic importance.
8. Do the following regarding collection and examination of fecal samples for the diagnosis of endoparasitism:
   - Describe the principles of collection, storage, and examination of fecal samples, including safety precautions that must be observed.
   - Describe indications for and procedures used to examine feces by direct fecal smear, fecal flotation, and sedimentation.
9. Do the following additional tasks regarding diagnosis of endoparasitism:
   - List the special procedures used to detect the coccidian parasites *Giardia, Cryptosporidium* spp., and *Cystoisospora* spp.
   - Describe how necropsy findings are used to diagnose parasitism after death.
   - Explain how samples are prepared and shipped to an outside laboratory for diagnosis of parasitism.
   - Explain how the Baermann technique is used to detect nematode larvae in feces and tissues.
   - Compare and contrast the blood examination and concentration techniques used to diagnose *Dirofilaria immitis.*

EXERCISE 14.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

5 A slowly replicating stage of development of the parasite *Toxoplasma gondii.*
7 A parasite that lives on the exterior of another organism.
8 A segment that comprises the body of a cestode.
14 A host in which a parasite does not undergo further development, but in which it remains encysted. (2 words)
16 A word used to describe a living organism that contains complete functioning sets of both male and female reproductive organs.
17 The host that harbors the adult, sexual, or mature stages of a parasite. (2 words)
18 A soft, moist, adhesive mass that is usually heated, spread on cloth, and applied to warm, moisten, or stimulate an aching or inflamed part of the body.
19 A parasite that is either a mite or a tick.
20 The type of roundworm larval migration that occurs in puppies younger than 3 months old where the larvae eventually reach the lungs, are coughed up and swallowed, and end up maturing in the host's small intestines. (2 words)
21 Pregnant; carrying fertilized eggs or a fetus.
22 A fast-growing developmental stage that occurs in cysts in the life cycle of *Giardia.*

Down

1 A state of arrested development of a parasite larva.
2 A life cycle that utilizes a first and second intermediate host along with a definitive host.
3 The motile, prelarval stage of filarial parasites.
4 A roundworm.
6 An object that is not a parasite but one that can be mistaken for a parasite; an example would be pollen grain because it is similar in size, shape, and color to a parasite egg.
9 A disease caused by the ingestion and harboring of the plerocercoid stage of the zipper tapeworm.
10 A parasite that lives inside another organism.
11 Any host organism from which a parasite cannot escape to continue its life cycle. (2 words)
12 The host that harbors the immature, asexual, or larval stages of a parasite. (2 words)
13 The type of roundworm larval migration that occurs in puppies older than 3 months of age where the second stage larvae encyst extraintestinally in the host's body. (2 words)
15 A parasite egg that contains an operculum – a "lid" or "door" that can be found on some parasite eggs—through which the larvae escapes. (2 words)

EXERCISE 14.2 DEFINING KEY TERMS

Instructions: Define each term in your own words.

1. Heterogonic cycle:

2. One-host tick:

3. Unilocular hydatid cyst:

4. Three-host tick:

5. Visceral larva migrans:

6. Multilocular hydatid cyst:

7. Homogonic cycle:

8. Many-host tick:

9. Ocular larva migrans:

10. Two-host tick:

EXERCISE 14.3 MATCHING #1: TERMS AND DEFINITIONS

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Oocyst
2. _____ Merozoite
3. _____ Schistosome
4. _____ Cestode
5. _____ Acariasis
6. _____ Tachyzoite
7. _____ Parthenogenesis
8. _____ Brood capsule
9. _____ Hexacanth embryo
10. _____ Proscolex
11. _____ Neurologic larva migrans
12. _____ Cutaneous larva migrans

Column B

A. A fast growing developmental stage that occurs in cysts in the life cycle of *Toxoplasma gondii.*

B. A blood fluke.

C. A skin disease in humans caused by the larvae of hookworm parasites that leave migratory tracks in the skin.

D. A protozoan cell that arises from the multiple fission (schizogony) of parent sporozoans and may enter either the asexual or sexual phase of the life cycle.

E. Tapeworm eggs that are usually produced by taeniid-type tapeworms.

F. A disease, usually of the skin, caused by infestation with mites.

G. A condition caused by the migration of the larval stage of *Baylisascaris procyonis* through the brain and spinal cord of avian or mammalian paratenic hosts, including humans.

H. The parasitic stage produced by the sporozoites of *Cryptosporidium parvum.*

I. The adult stage of a tapeworm.

J. A type of nonsexual reproduction in which an organism develops from an unfertilized ovum.

K. An early larval form of a cestode worm.

L. A structure that is formed from the germinal membrane of a hydatid cyst.

EXERCISE 14.4 MATCHING #2: TERMS AND DEFINITIONS

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Egg packet
2. _____ Aberrant parasite
3. _____ Otoacariasis
4. _____ Protozoan
5. _____ Simian
6. _____ Metacercaria
7. _____ Procercoid
8. _____ Germinal membrane
9. _____ Pseudotapeworms
10. _____ Miracidium

Column B

A. The infective stage of a digenic fluke.
B. A single-cell organism.
C. The innermost lining of a hydatid cyst.
D. A parasite found in a location in which it does not normally live.
E. Pertaining to or resembling an ape or a monkey.
F. The ciliated, motile stage that emerges from the operculated egg of a digenetic fluke.
G. The developmental stage in the lifecycle of a pseudotapeworm that parasitizes the first intermediate host.
H. These members of the order *Cotyloidea* include Spirometra mansonoides.
I. What is typically passed in the feces in an animal infected with *Dipylidium caninum* when a gravid proglottid is ruptured during defecation.
J. Infestation of the ear with mites.

EXERCISE 14.5 MATCHING #3: TERMS AND DEFINITIONS

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Cercaria
2. _____ Dioecious
3. _____ Gynecophoric canal
4. _____ Plerocercoid
5. _____ Metacestode
6. _____ Schistosome cercarial dermatitis
7. _____ Cyst
8. _____ Arthropod
9. _____ Trematode
10. _____ Cysticercoid

Column B

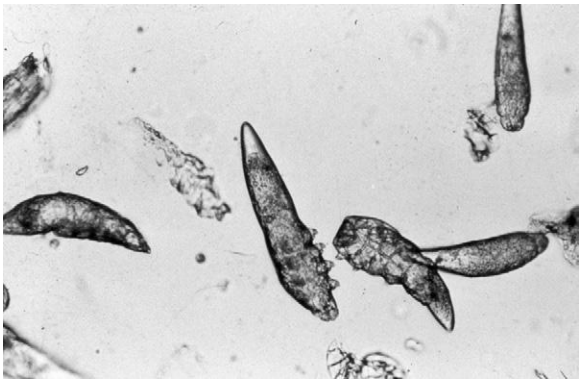
A. The infective developmental stage that parasitizes the second intermediate host in the life cycle of a pseudotapeworm.
B. The noninfective stage of *Giardia* that is resistant to both heat and cold and to drying out.
C. A fluke.
D. The larval stage of a tapeworm.
E. The infective stage of the tapeworm.
F. Denoting species in which male and female genitals do not occur in the same individual; sexually distinct.
G. A ventral groove running the length of male schistosome flukes, into which the thread-like female worm fits.
H. Sometimes referred to as swimmer's itch.
I. The free-swimming trematode larva that emerges from its host snail.
J. Any animals of the phylum that includes insects, crustaceans, arachnids, and myriapods.

EXERCISE 14.6 PHOTO QUIZ: PHOTOGRAPHS OF PARASITES

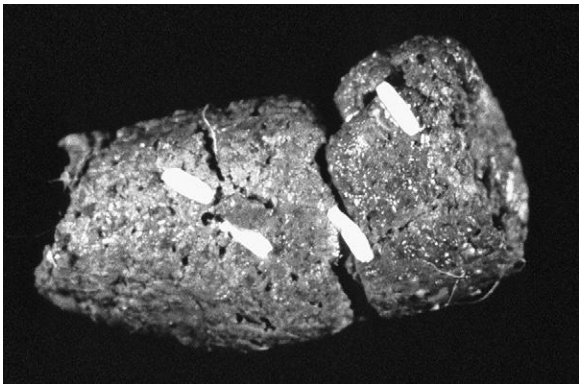
Instructions: Match each parasite with its corresponding name.

Names

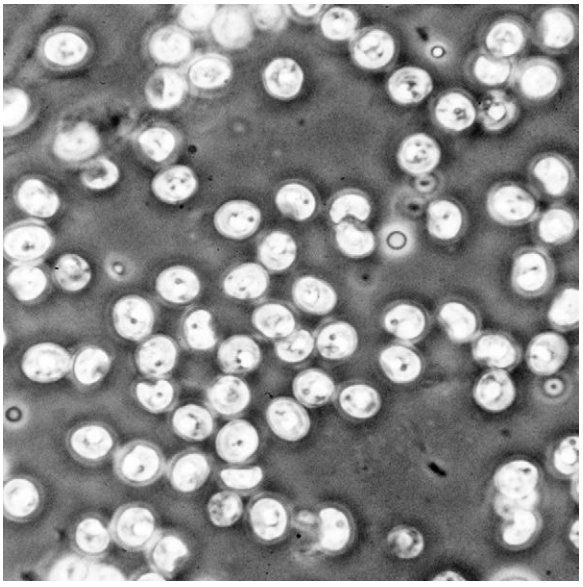
A. *Paragonimus kellicotti egg*
B. *Dipylidium caninum* proglottids
C. Adult *Otodectes cyanotis* mite
D. Adult *Cheyletiella parasitivorax* mite
E. *Toxoplasma gondii* oocyst
F. Adult *Sarcoptes scabei* mite
G. *Toxascaris leonina* egg
H. *Spirometra mansonoides* egg
I. *Trichuris vulpis* egg
J. Adult *Demodex canis* mite
K. *Dipylidium caninum* egg packet
L. *Giardia* cyst
M. *Ancylostoma caninum* egg
N. Oocysts of *Cryptosporidium parvum*
O. Typical taeniid-type egg



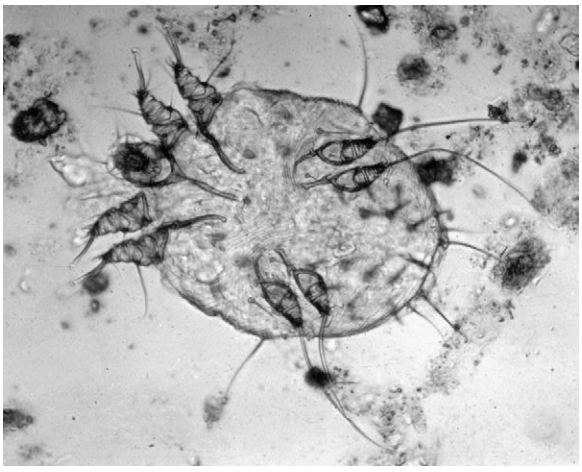
1. _____



3. _____

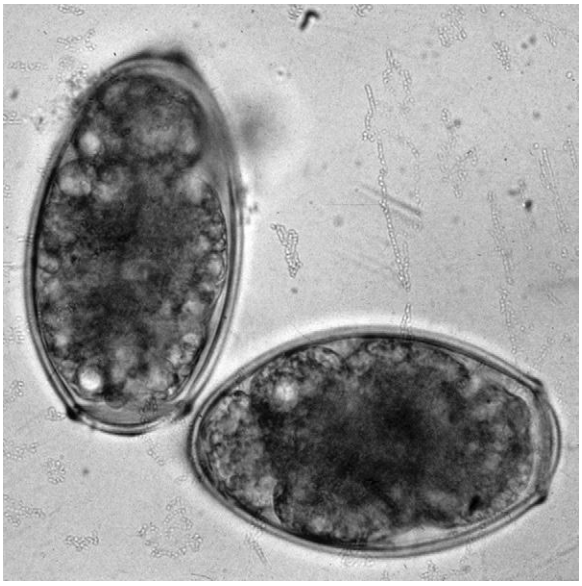


2. _____



4. _____

5. _____



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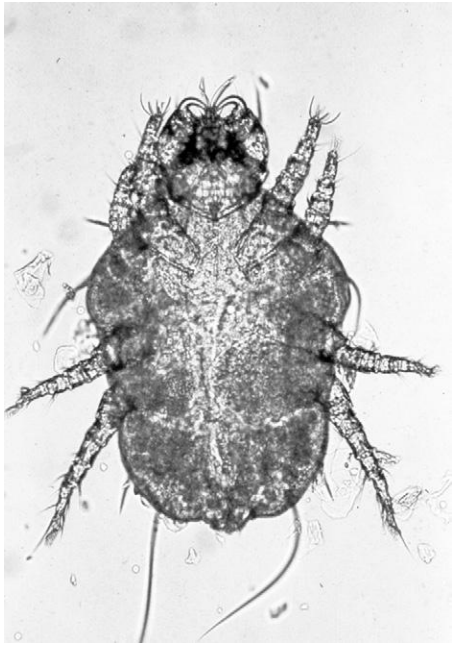

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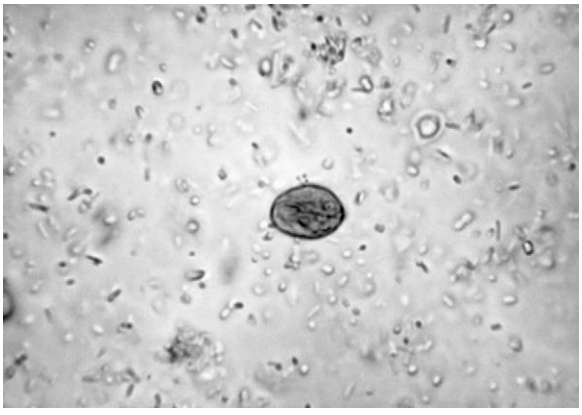

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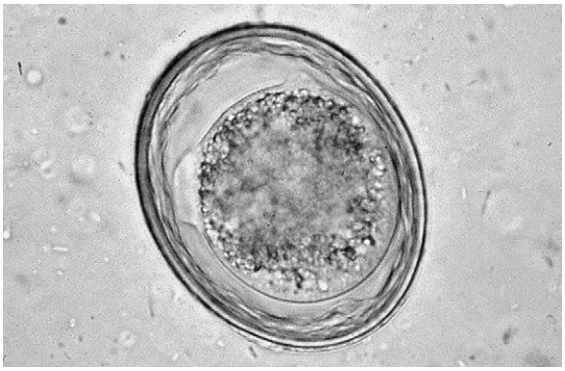

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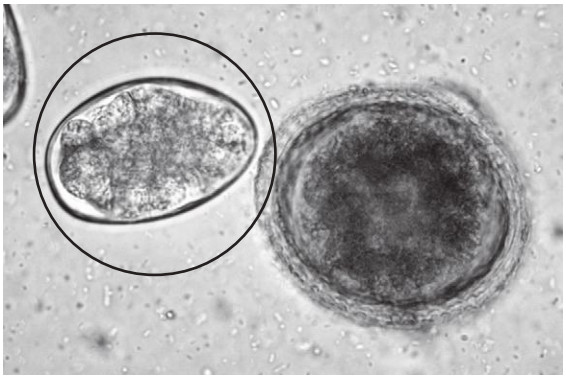
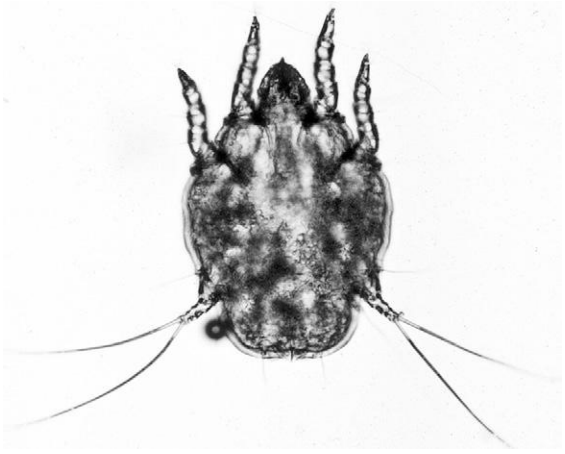
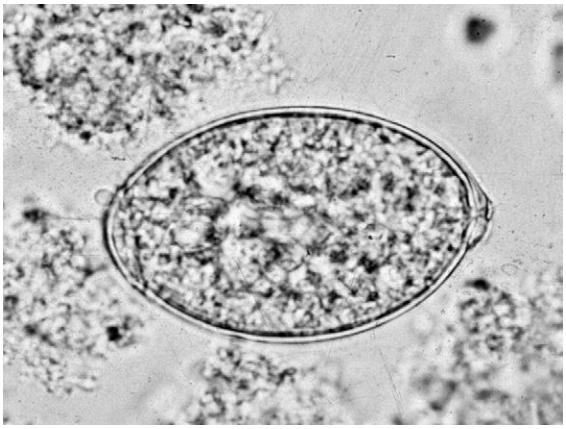


12. _____



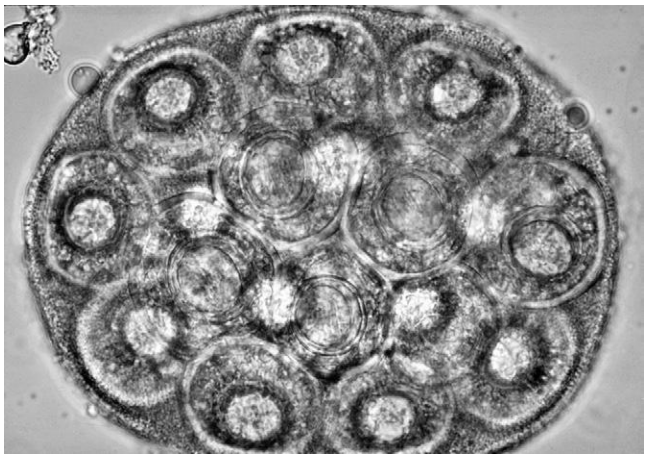
10. _____

13. _____



11. _____

14. _____



15. _____

EXERCISE 14.7 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Parasite infections are usually most severe in animals older than 10 years of age.
2. _____ Human infection with *Paragonimus kellicotti* is a rare occurrence.
3. _____ The eggs of *Paragonimus kellicotti* usually exit the host in coughed up sputum.
4. _____ Humans become infected with *Schistosome cercarial dermatitis* when the cercarial stage penetrates their skin.
5. _____ The intermediate host for *Dipylidium caninum* is the mosquito.
6. _____ When a dog or cat is infected with *Echinococcus granulosus* or *Echinococcus multilocularis* they usually do not show any clinical signs.
7. _____ Humans are considered the definitive host for both *Echinococcus granulosus* and *Echinococcus multilocularis*.
8. _____ *Spirometra mansonoides* eggs are usually voided in the external environment via gravid proglottids passed in the feces.
9. _____ When the eggs of *Toxocara canis* are passed in the feces, they are immediately infective.
10. _____ Puppies can be infected with *Toxocara canis* while nursing.
11. _____ If a dog ingests a paratenic host infected with *Toxocara canis*, somatic migration will take place in the dog.
12. _____ *Baylisascaris procyonis* usually causes clinical disease in dogs and cats.
13. _____ Hookworms can be a cause of anemia in young puppies.
14. _____ Humans are typically infected with hookworms via ingestion of infective larvae.
15. _____ The eggs of *Trichuris vulpis* can survive in the environment for years.
16. _____ Intestinal threadworms are best diagnosed using fecal flotation.
17. _____ Heartworm microfilariae that are circulating in a dog's peripheral blood will eventually mature to adult heartworms.

18. _____ Most species of mammals have their own variety of *Sarcoptes scabei*.

19. _____ Lesions associated with *Cheyletiella* are usually moist and inflamed in appearance.

20. _____ The parasite *Demodex canis* usually lives in the hair follicles of animals it infests.

21. _____ Chiggers typically burrow into the skin of infested hosts.

22. _____ *Giardia* is capable of infecting many different species of animals, including humans.

23. _____ The feline is the only animal that can serve as the intermediate host for *Toxoplasma gondii*.

24. _____ *Toxoplasma gondii* infection is typically diagnosed by fecal flotation.

25. _____ A healthy host will usually be able to fight off a *Cryptosporidium* infection on its own.

26. _____ A good way for veterinary practices to save money is to reuse vials and filters used to perform fecal flotations.

EXERCISE 14.8 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. Once an infected dog produces a *Paragonimus kellicotti* egg, what must happen before the life cycle can advance?
   a. The egg must be ingested by another intermediate host.
   b. The egg must penetrate the skin of another animal.
   c. The egg must go through parthenogenesis.
   d. The egg must come into contact with water.

2. *Paragonimus kellicotti* is also known by the common name
   a. Whipworm
   b. Lung fluke
   c. Blood fluke
   d. Intestinal threadworm

3. The life cycle of *Paragonimus kellicotti* utilizes _____ intermediate host(s).
   a. 0
   b. 1
   c. 2
   d. 3

4. An accurate and economical way to diagnose a *Paragonimus kellicotti* infection is to perform a
   a. Fecal flotation
   b. Fecal sedimentation
   c. Direct smear
   d. Baermann technique

5. The primary definitive host for *Schistosome cercarial dermatitis* is
   a. Humans younger than the age of 12 years
   b. Aquatic, migratory birds
   c. Raccoons
   d. Aquatic crustaceans

6. If an owner is reporting that their dog is dragging its anus across the floor on a frequent basis, this could be a sign of
   a. Hookworm infection
   b. Whipworm infection
   c. Tapeworm infection
   d. Roundworm infection

7. A client has just dropped off a fresh fecal sample on which you find several proglottids. Upon examining these proglottids under the microscope, you notice there is a pair of genital pores, which leads you to believe that these are _____ proglottids.
   a. *Multiceps*
   b. *Echinococcus*
   c. *Taenia*
   d. *Dipylidium*

8. One of the best ways to prevent *Echinococcus granulosus* infection in dogs is to
   a. Prevent them from ingesting rodents
   b. Prevent them from ingesting sheep viscera
   c. Prevent them from ingesting crayfish
   d. Use a monthly flea preventative

9. The typical life cycle of *Spirometra mansonoides* utilizes _____ intermediate hosts.
   a. 0
   b. 1
   c. 2
   d. 3

10. Typically, if a dog younger than 3 months of age ingests a *Toxocara canis* egg containing the second-stage larva, the larva will go through
    a. Tracheal migration
    b. Somatic migration
    c. Visceral migration
    d. Ocular migration

11. The best way to diagnose ascarid infections in dogs and cats is
    a. Direct smear
    b. Fecal flotation
    c. Fecal sedimentation
    d. Baermann technique

12. Neurologic larval migrans is a condition that can occur when a paratenic host ingests the larval stage of
    a. *Toxocara canis*
    b. *Baylisascaris procyonis*
    c. *Echinococcus multilocularis*
    d. *Ancylostoma caninum*

13. There are two main ways a dog can become infected with *Ancylostoma caninum*. One way is ingestion of infective larvae and the other is
    a. Coitus
    b. Inhalation
    c. Ingestion of an intermediate host
    d. Skin penetration

14. Whipworm is the common name for which one of the following parasites?
    a. *Trichuris vulpis*
    b. *Spirometra mansonoides*
    c. *Paragonimus kellicotti*
    d. *Uncinaria stenocephala*

15. From the time a dog ingests a whipworm egg containing the second stage larva to the time that the larva is a mature, egg-producing adult is approximately
    a. 9 weeks
    b. 10 weeks
    c. 11 weeks
    d. 12 weeks

16. One of the unique aspects of intestinal threadworms is that
    a. The adult worms can live in the lungs or intestines of the host
    b. The eggs are immediately infective when passed in feces
    c. Only the females are parasitic
    d. Only the males are parasitic

17. In dogs and cats, adult heartworms are typically found in the
    a. Pulmonary veins and left ventricle
    b. Pulmonary arteries and right ventricle
    c. Aorta and vena cava
    d. Left and right ventricles

18. The intermediate host that is utilized during the life cycle of *Dirofilaria immitis* is the
    a. Fly
    b. Tick
    c. Mosquito
    d. Flea

19. The extreme pruritus associated with a *Sarcoptes scabei* infestation is caused by the mite
    a. Chewing on the host's skin debris
    b. Piercing the host's skin with its proboscis
    c. Cementing eggs to hair shafts on the host's skin
    d. Tunneling into the host's epidermis

20. With the *Trombicula* species, only the _____ stage of the life cycle is parasitic.
    a. Pupal
    b. Larval
    c. Nymph
    d. Adult

21. For an animal or human to become infected with *Cryptosporidium*, a(n) _____ must be ingested.
    a. Oocyst
    b. Merozoite
    c. Sporozoite
    d. Egg

22. Adult *pentastomes* are always associated with
    a. The lymph nodes
    b. The gastrointestinal tract
    c. The urogenital tract
    d. The respiratory tract

23. When asking a client to bring in a fecal sample from his or her dog, the client should be instructed to bring approximately _____ of feces in to be examined.
    a. 1 teaspoon
    b. 2 teaspoons
    c. 1 tablespoon
    d. 2 tablespoons

24. When using a microscope to examine fecal specimens, the _____ objective is the one that is most commonly used.
    a. 4×
    b. 10×
    c. 40×
    d. 100×

25. Which one of the following flotation solutions corrodes lab equipment and can severely distort parasite eggs?
    a. Sugar solution
    b. Zinc sulfate solution
    c. Sodium nitrate solution
    d. Saturated sodium chloride solution

26. Fecal sedimentation is typically performed when _____ eggs are suspected as they are too heavy to float in flotation solution.
    a. Hookworm
    b. Roundworm
    c. Fluke
    d. Protozoan

27. Sometimes parasite larvae are recovered from feces or tissues instead of eggs. The procedure that allows for the recovery of parasite larvae is the
    a. McMaster technique
    b. Baermann technique
    c. Acid-fast technique
    d. Modified Knott technique

EXERCISE 14.9 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 14.10 CASE STUDY: PARASITE INFECTION IN A PUPPY

A client who has just obtained a new 10-week-old Golden Retriever puppy contacts the practice at which you are working as a credentialed veterinary technician. The breeder gave the puppy some dewormer when it was 6 weeks old, but the puppy has not yet been to a veterinarian to be examined. The owner indicates to you that the puppy is having some vomiting and diarrhea and also seems to have a "pot-bellied" appearance. You tell the owner that it would be a good idea to bring the puppy in to be examined by the DVM and that the owner should bring a stool sample to be examined for parasites. Answer the following series of questions about dealing with this owner and his puppy.

1. What information should you give the owner over the phone about obtaining a fecal sample from his puppy that will result in the most accurate diagnosis?

2. Unfortunately, the owner arrived at the clinic and forgot to bring in a stool sample. What are two possible ways that a fecal sample could be collected at the clinic?

   i. _____

   ii. _____

3. Before performing any diagnostic tests on the sample, what type of examination should be done on the sample and what should be recorded and reported to the veterinarian?

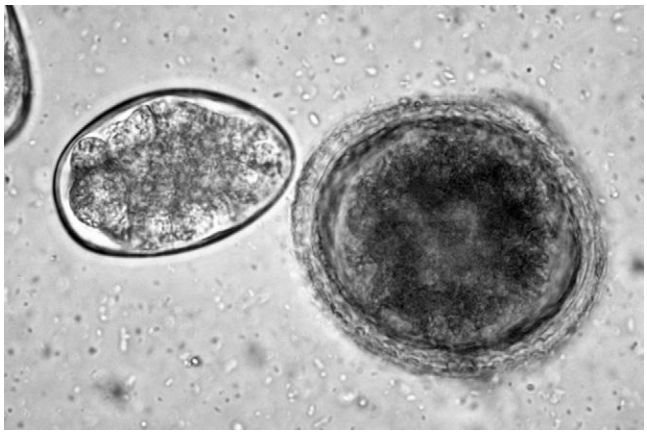
4. You have decided to use a concentration method to examine the feces for the presence of parasite eggs. What are the two biggest advantages of using a concentration method?

   i. _____

   ii. _____

5. The clinic at which you work uses sodium nitrate as its fecal flotation solution. Other than expense, what could be possible disadvantages of using sodium nitrate?

6. When looking at the fecal sample under the microscope, you see eggs that look like the one on the right side in the picture below. Identify the genus and species of the parasite that produced this egg.



_____

7. When you inform the owner that his Golden Retriever puppy has intestinal parasites, the owner is confused because the puppy was dewormed once when it was 6 weeks old. What would you tell the owner?

8. The owner then tells you that there are small children in the home and asks if the children are at risk of becoming infected with *Toxocara canis*. What would you tell the owner?

EXERCISE 14.9 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. Describe the life cycle of *Paragonimus kellicotti* from the time the egg makes contact with water to a dog or cat passing eggs into the environment.

2. Explain why a pet dog or cat that is diagnosed with *Dipylidium caninum* should also be treated for fleas.

3. Describe how a human might become infected with *Dipylidium caninum*.

4. Describe the difference in cyst formation within an intermediate host that is infected with *Echinococcus granulosus* compared to an intermediate host infected with *Echinococcus multilocularis*.

5. Explain what proliferative sparganosis is and describe how this can occur in a dog.

6. Explain why a paratenic host that ingests a *Baylisascaris procyonis* egg containing the second-stage larva is usually considered to be a dead-end host.

7. Identify where adult *Trichuris vulpis* worms live in the host and describe the way in which *Trichuris vulpis* causes disease in an infected canine.

8. Describe how the environmental conditions into which *Strongyloides* eggs are passed can affect which life cycle will occur.

9. Briefly explain why it is important for members of the veterinary team to be familiar with the parasite *Enterobius vermicularis*.

10. The cellophane tape technique is often used to detect pinworms. Explain why this technique is effective.

11. A client's dog has just been diagnosed with *Sarcoptes scabei* at your clinic. The doctor has to rush off to take care of an emergency and asks you to talk to the client about the zoonotic aspects of scabies and whether or not the other pets in the household are at risk (the client owns several other dogs and a cat). What would you tell this owner?

12. Identify the four development stages in the life cycle of the tick and describe, in general (not specific to any certain species of tick), the life cycle of a three-host tick.

13. There are two different stages of the *Giardia* life cycle that could be found in the feces of an infected host. Name these two life stages.

    a. _____ b. _____

14. A client's dog has just been diagnosed with *Giardia* and the client asks you if there is any potential that he could become infected as well as the other dog and cat at his house. Provide an answer to this client's question and then explain how to prevent *Giardia* infection in the future.

    _____

    _____

    _____

    _____

15. Identify the two most common ways for animals and humans to become infected with *Toxoplasma gondii*.

    i. _____

    ii. _____

16. Explain how a dog typically becomes infected with adult pentastomes.

    _____

    _____

17. Explain the importance of examining fecal samples when they are fresh.

    _____

    _____

18. Describe one advantage and one disadvantage to performing a direct fecal smear.

    _____

    _____

    _____

19. Identify the procedure that is best used to detect protozoal trophozoites and explain why this is the best procedure to use.

    _____

    _____

    _____

    _____

20. The coccidian parasites *Giardia* and *Cryptosporidium* spp. are difficult or impossible to identify using conventional concentration and flotation techniques, and so require the use of special techniques.

    a. What three techniques can be used to detect *Giardia*?

        i. _____

        ii. _____

        iii. _____

    b. What criteria would you use to differentiate *Giardia* trophozoites from those of trichomonads on a direct fecal smear?

    _____

    _____

    _____

    c. What type of sample is required to perform the acid-fast staining technique for identification of *Cryptosporidium* spp.

    _____

    d. What form of the organism should you look for on a sample stained using this technique?

    _____

21. When sending samples to an outside laboratory, procedures must be followed to ensure that the specimen arrives in good condition and to prevent exposure of personnel who are handling the specimens. All specimen containers should be labeled and placed in a shockproof shipping container to prevent breakage during shipping.

    a. What two agents may be used to preserve parasitologic specimens (such as adult worms or larvae) harvested from live animals or at the time of necropsy?

        i. _____

        ii. _____

    b. How should feces be preserved?

    _____

22. *Dirofilaria immitis*, the canine heartworm, can be detected by using ELISA-based serologic tests to check for heartworm antigens in the blood. Microfilaria can be detected using one of a number of blood examination and concentration techniques including direct examination of whole blood, examination of the buffy coat, and the modified Knott's technique. Summarize the advantages and disadvantages of each of these techniques.

    a. Direct examination of whole blood:

    Advantages: _____

    _____

    _____

Disadvantages: _____

_____

_____

b. The buffy coat examination:

Advantages: _____

_____

_____

Disadvantages: _____

_____

_____

c. The modified Knott's technique:

Advantages: _____

_____

_____

Disadvantages: _____

_____

_____

15 Microbiology

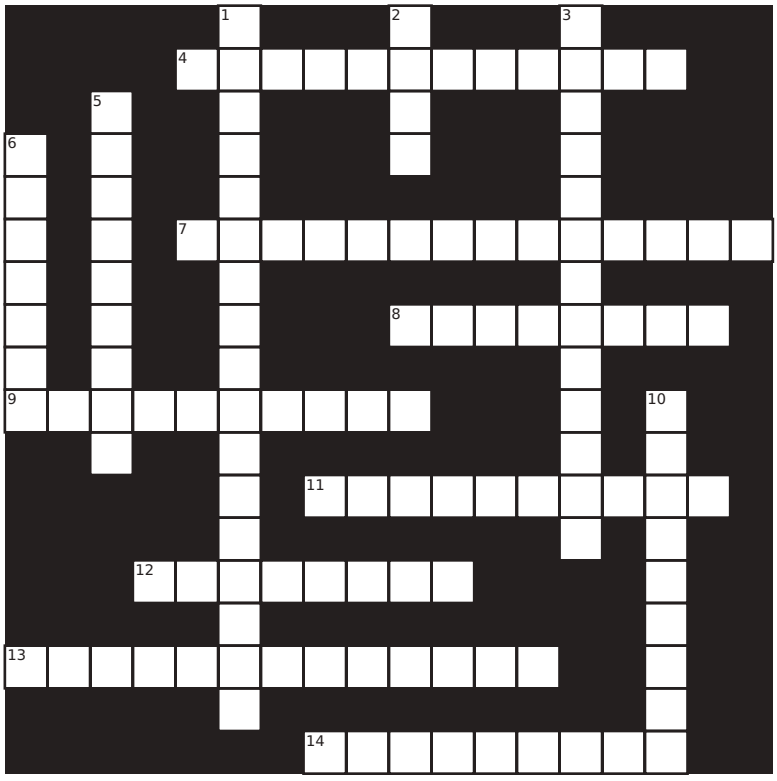
LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all Key Terms in the chapter.
2. Identify circumstances under which dangerous microorganisms (including those classified as "select") should not be cultured in a private practice setting.
3. Do the following regarding the collection of samples:
   - Describe factors that must be considered to ensure that quality bacterial culture samples are obtained.
   - List the indigenous flora and pathogens commonly recovered from specific anatomic sites, and describe methods used to collect representative samples.
   - Describe the special collection and handling procedures used to culture samples from tissues, urine, the respiratory tract, blood, joints, milk, and feces.
   - Identify appropriate transport media and conditions that must be met for safe transport of culture samples to an outside laboratory.
4. Do the following regarding sample processing:
   - Identify primary stains used to prepare samples for direct microscopic examination and specific organisms identified by each.
   - Describe the procedure for preparing and staining a sample with Gram stain, acid-fast stain, or modified acid-fast stain, including the appearance of positive and negative reactions for each.
5. Do the following regarding bacterial culture and identification:
   - Describe the principles of bacterial culture, including options for safe disposal of microbiologic laboratory waste and basic equipment required to perform routine microbiologic cultures.
   - Describe the differences between nutrient, enrichment, selective, and differential media, and identify commonly used plate and tube media in each category.
   - Describe the information derived from the results of biochemical testing with (a) triple sugar iron agar slant, (b) lysine iron agar slant, (c) Christensen urea agar slant, (d) motility media, (e) indole test media, and (f) citrate test media.
   - Describe the procedures used to inoculate a culture plate for isolation and tube media for biochemical testing.
   - Identify media used for primary isolation of bacterial pathogens and conditions required for incubation of aerobic and anaerobic bacteria.
   - Explain how examination of growth on a culture plate is used to identify pathogens and guide decisions regarding further testing.
   - Describe the roles that catalase, oxidase, and coagulase biochemical tests, as well as hemolysis patterns, play in preliminary grouping of Gram-positive and Gram-negative bacteria.
   - Describe the procedure used to perform, interpret, and report results of a quantified urine culture.
6. List common bacterial flora and pathogens and identify the classification of each, as well as the associated diseases caused by each agent.
7. Do the following regarding antimicrobial susceptibility testing:
   - Explain the reasons for susceptibility testing and the guidelines set by the Clinical Laboratory Standards Institute (CLSI) for performing and interpreting antimicrobial susceptibility tests.
   - Describe the procedures for and principles of interpretation of the broth dilution test and the disc diffusion test.
8. Describe the principles of quality control testing.

9. Do the following regarding fungal culture (mycology):
   - Describe the methods used to collect dermatophytes, to inoculate dermatophyte test medium and Sabouraud dextrose agar, and to interpret culture results.
   - List common pathogenic yeasts and dimorphic fungi and associated diseases caused by each agent.
10. Do the following regarding the molecular detection of pathogens:
   - List the methods commonly used to detect viral pathogens in patient samples.
   - Explain principles underlying each of the following methods: enzyme-linked immunosorbent assay (ELISA) testing, virus isolation, electron microscopy, immunohistochemical staining.
   - Explain the difference between monoclonal and polyclonal antibodies as it relates to their use in detecting viral pathogens.
   - Explain the uses for and principles of the polymerase chain reaction test and DNA sequencing.
11. Do the following regarding nosocomial infections:
   - Explain why an understanding of the nature of nosocomial infections is crucial to a veterinary technician's ability to provide quality patient care.
   - List the agents commonly associated with nosocomial infections, factors that predispose a patient to these infections, and methods used to control and prevent them.

EXERCISE 15.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

4 Media that detects and discriminates between two organisms based on the results of a biochemical reaction.
7 The antimicrobial _____ test is used to determine whether an antimicrobial agent will kill or inhibit growth of a particular organism.
8 A stain that distinguishes bacteria that have mycolic acid incorporated in their cell walls.
9 Culture medium used to enhance the growth of specific bacteria.
11 Antibodies that recognize a single antigen.
12 Biochemical test used to differentiate *Staphyloccocus* spp. from *Streptococcus* spp.
13 DNA that is evolutionarily very similar among bacterial species but is usually different enough to identify a specific species. (2 words)
14 Culture medium that reduces the growth of unwanted bacteria to allow the growth of other bacteria.

Down

1 The lowest concentration of antimicrobial required to slow bacterial growth. (2 words)
2 Stain used to differentiate bacteria based on the composition of their cell wall.
3 Another name for the Kirby-Bauer susceptibility test. (2 words)
5 Medium that maintains bacteria in original concentrations without encouraging growth or causing death of the bacteria.
6 Biochemical test used to differentiate and identify Gram-negative bacteria.
10 Biochemical test used to differentiate pathogenic *Streptococcus* spp. and nonpathogenic *Streptococcus* spp.

EXERCISE 15.2 TERMS AND DEFINITIONS: INFECTIOUS AGENTS

Instructions: Define each term in your own words.

1. Abscess _____

2. Aerobe _____

3. Anaerobe _____

4. Dermatophyte _____

5. Fastidious _____

6. Hemolysis _____

7. Indigenous flora _____

8. Mycosis _____

9. Nosocomial infection _____

10. Opportunistic infection _____

11. Yeast _____

EXERCISE 15.3 MATCHING #1: CULTURE MEDIA

Instructions: Match each media in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Blood agar plate
2. _____ Indole test media
3. _____ Hektoen enteric agar
4. _____ Selenite or tetrathionate broth
5. _____ Lysine iron agar slant
6. _____ Brucella blood agar plate
7. _____ Salt mannitol agar
8. _____ Motility media
9. _____ MacConkey agar plate
10. _____ Christensen urea agar slant
11. _____ Citrate test media
12. _____ Triple sugar iron agar slant

Column B

A. Used for direct isolation of *Salmonella* spp. from feces.

B. For determining whether an organism has and is able to use flagella.

C. This media is used for the primary isolation of organisms and for subculture of organisms.

D. Primary isolation medium for selection of Gram-negative organisms.

E. For determining the ability of organisms to utilize glucose, sucrose, and lactose, and to produce hydrogen sulfide.

F. Media used to enrich samples for the detection of *Salmonella* spp.

G. The results of this test is determined by observing for a purple or port-wine color in the slant and a purple color in the butt.

H. When this biochemical test is positive, the media turns blue, whereas a negative reaction leaves the media green.

I. Primarily used to differentiate species of *Staphylococcus* based on fermentation.

J. These plates provide a rich media for the culture of anaerobic organisms.

K. When this biochemical test is positive, a red color forms within seconds of the addition of the Kovac reagent.

L. A tube medium used to determine whether an organism produces urease.

EXERCISE 15.4 MATCHING #2: GRAM-POSITIVE ORGANISMS

Instructions: Match each Gram-positive organism in column A with the disease that it causes in column B by writing the appropriate letter in the space provided.

Column A

1. _____ *Staphylococcus aureus*
2. _____ *Erysipelothrix rhusiopathiae*
3. _____ *Corynebacterium pseudotuberculosis*
4. _____ *Arcanobacterium pyogenes*
5. _____ *Actinomyces* spp.
6. _____ *Rhodococcus equi*
7. _____ *Bacillus anthracis*
8. _____ *Streptococcus* spp.
9. _____ *Corynebacterium renale*
10. _____ *Staphylococcus pseudointermedius*
11. _____ *Listeria monocytogenes*

Column B

A. A cause of bony lesions of the head and neck of ruminants.

B. A cause of septicemia in neonatal animals, abortion, and encephalitis in ruminants.

C. The cause of anthrax. Classified as a select agent.

D. A cause of the serious zoonosis, necrotizing fasciitis.

E. A cause of pneumonia in foals.

F. Pleomorphic Gram-positive rod. A cause of pyelonephritis in cattle.

G. The cause of caseous lymphadenitis in sheep and goats.

H. A cause of disease in swine, turkeys, and marine mammals, including diamond skin disease.

I. Catalase-positive cocci that are normal inhabitants of the skin of dogs.

J. A Gram-positive rod that is an inhabitant of the skin and mucous membranes of cattle and other ruminants.

K. A catalase-positive Gram-positive cocci that is a normal inhabitant of skin of large animals and an opportunistic cause of mastitis.

EXERCISE 15.5 MATCHING #3: GRAM-NEGATIVE ORGANISMS

Instructions: Match each Gram-negative organism in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ *Escherichia coli*
2. _____ *Proteus* spp.
3. _____ *Actinobacillus* spp.
4. _____ *Bordetella bronchiseptica*
5. _____ *Pasteurella multocida*
6. _____ *Brucella abortus*
7. _____ *Aeromonas* spp.
8. _____ *Salmonella* spp.

Column B

A. A bacterial select agent that is a cause of abortion and reproductive failure in ruminants.

B. An important cause of diarrhea and septicemia in a variety of animal species and commonly isolated from feces of reptiles and amphibians.

C. A cause of infections in aquatic animals, including fish and amphibians.

D. An oxidase-positive, short, fat rod that causes a rapidly progressing cellulitis in people who have been bitten by cats.

E. The causative agent of canine tracheobronchitis.

F. An opportunistic urinary pathogen that swarms on culture plates.

G. Typically grow on MacConkey agar. Often isolated from foals with septicemia or joint infections.

H. An oxidase-negative member of the family *Enterobacteriaceae*, and a cause of opportunistic infections of the urine and wounds.

EXERCISE 15.6 ORDERING: ELISA TEST FOR A VIRAL PROTEIN OR ANTIGEN

Instructions: Match the steps of performing an ELISA antigen test in the proper order by placing the appropriate number (1 through 5) in the space provided.

A. _____ Add an enzyme-labeled secondary antibody to the well or membrane and incubate as directed.

B. _____ Read the color change.

C. _____ Wash the well or membrane as directed.

D. _____ Place a patient sample in the well or on the membrane and incubate for the recommended time.

E. _____ Wash the well or membrane and add the substrate for the enzyme.

EXERCISE 15.7 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ When a patient has an infection, it is best to start the patient on antibiotics right away to treat the infection, and then to collect a sample for culture and sensitivity.

2. _____ When collecting microbiologic samples from an abscess, the purulent material in the abscess (pus) is the best source of material for bacterial culture.

3. _____ Urine samples collected by free-catch typically have bacteria in them from the external genitalia and skin.

4. _____ The stain used specifically to identify *Mycobacterium* spp. is the acid-fast stain.

5. _____ Acid-fast organisms stain dark blue, whereas non–acid-fast organisms and the background should stain pink.

6. _____ Broth is typically used for initial isolation of organisms as opposed to solid agar.

7. _____ Plate media should be incubated overnight, right-side up at 35°C to 37.5°C.

8. _____ When culturing a sample from a site like the GI tract, you should attempt to identify every organism.

9. _____ The catalase test is most commonly used to differentiate staphylococci from streptococci and enterococci.

10. _____ Gram-negative bacteria in the family *Enterobacteriaceae* are generally oxidase-positive.

11. _____ The organism *Listeria monocytogenes* is the causative agent of strangles in horses.

12. _____ *Mycobacterium* spp. organisms are often challenging to culture because they sometimes take weeks to grow.

13. _____ The causative agent of Lyme disease is the spirochete *Borrelia burgdorferi*.

14. _____ The yeast *Cryptococcus neoformans* is often present in samples from the respiratory and gastrointestinal tract of birds.

15. _____ The pathogen in question (bacteria or virus) must be cultured and isolated before performing PCR testing.

16. _____ DNA sequencing is a way to definitively identify most organisms.

17. _____ A fomite is a term for an animal that is capable of transmitting a nosocomial agent.

18. _____ A person can get a zoonotic infection from a patient, but a patient cannot get one from a person.

19. _____ Bacteria are the most common cause, and viruses are the second most common cause, of nosocomial infections.

20. _____ *Streptococcus equi* subsp. *equi (S. equi)* is frequently implicated as a nosocomial infection in veterinary patients.

EXERCISE 15.8 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. This fungal agent is designated as a "fungal select agent."
   a. *Malassezia pachydermatis*
   b. *Blastomyces dermatitidis*
   c. *Candida albicans*
   d. *Sporothrix schenckii*

2. Most anticoagulants will interfere with bacterial culture and so cannot be used when collecting samples for culture. When collecting samples that are at risk for clotting, which of the following anticoagulants may be used because it will not interfere with bacterial culture?
   a. EDTA
   b. Sodium citrate
   c. Polyanethol sulfonate
   d. Lithium heparin

3. Which of the following organisms is a common cause of diarrhea?
   a. *Campylobacter jejuni*
   b. *Pasteurella multocida*
   c. *Bordetella bronchiseptica*
   d. *Brucella abortus*

4. Which of the following samples may be frozen prior to bacterial culture?
   a. Urine
   b. Milk
   c. Joint fluid
   d. Transtracheal wash samples

5. The stain used to identify *Nocardia* spp. is
   a. Gram stain
   b. Hematoxylin-eosin stain
   c. Kinyoun modified Ziehl-Nielsen acid-fast stain
   d. Acid-fast stain

6. MacConkey agar is an example of a
   a. Selective media
   b. Differential media
   c. Enrichment media
   d. Selective and differential media

7. The two media most commonly used for initial inoculation and isolation of bacteria are
   a. Mueller-Hinton and TSA
   b. TSA and MacConkey
   c. MacConkey and blood agar
   d. Blood agar and Mueller-Hinton

8. Gram-negative and Gram-positive organisms are _____ and _____ in color respectively.
   a. Pink and green
   b. Green and pink
   c. Pink and purple
   d. Purple and pink

9. Coagulase-positive, Gram-positive cocci are generally
   a. Pathogenic *Streptococcus* spp.
   b. *Streptococcus* spp. that are indigenous flora
   c. Pathogenic *Staphylococcus* spp.
   d. *Staphylococcus* spp. that are indigenous flora

10. In addition to *Salmonella*, *Campylobacter*, and *Clostridium*, another causative agent of diarrhea isolated from fecal culture is
    a. *Mycobacterium avium* subsp. *paratuberculosis*
    b. *Streptococcus agalactia*
    c. *Staphylococcus aureus*
    d. *Pseudomonas aeruginosa*

11. When culturing urine, the colonies must be counted by performing a quantified culture. What other sample must be handled in this manner?
    a. Joint fluid
    b. Cerebral spinal fluid
    c. Blood
    d. Milk

12. Which of the following organisms is an agent of contagious mastitis in cattle?
    a. *Clostridium perfringens*
    b. *Listeria monocytogenes*
    c. *Streptococcus agalactiae*
    d. *Mycoplasma* spp.

13. Which of the following organisms are catalase-negative, Gram-positive cocci that in rare, but serious cases, causes necrotizing fasciitis?
    a. *Erysipelothrix* spp.
    b. *Streptococcus* spp.
    c. *Bordetella* spp.
    d. *Brucella* spp.

14. The Gram-positive, pleomorphic rod, *Corynebacterium pseudotuberculosis* is the cause of _____ in sheep and goats.
    a. Diamond skin disease
    b. Pigeon fever
    c. Contagious foot rot
    d. Caseous lymphadenitis

15. Pneumonia in foals is caused by the aerobic, CAMP-positive, Gram-positive rod,
    a. *Erysipelothrix rhusiopathiae*
    b. *Rhodococcus equi*
    c. *Actinomyces* spp.
    d. *Clostridium perfringens*

16. The partially acid-fast organisms *Nocardia* spp. appear on microscopic examination as
    a. Seagull-shaped spiral organisms
    b. Short, fat coccobacilli
    c. Rods with a "beaded" appearance
    d. Club-shaped rods

17. An organism that is frequently isolated from fish and amphibians with infections is
    a. *Actinobacillus* spp.
    b. *Rhodococcus equi*
    c. *Campylobacter* spp.
    d. *Aeromonas* spp.

18. The colonies of which organism are often hemolytic on blood agar, secrete a green pigment into the surrounding media, and have a metallic appearance?
    a. *Pseudomonas* spp.
    b. *Escherichia coli*
    c. *Staphylococcus* spp.
    d. *Malassezia* spp.

19. The reproductive pathogens *Brucella* spp. are a group of small, oxidase-positive
    a. Gram-positive rods
    b. Gram-negative coccobacilli
    c. Gram-positive cocci
    d. Gram-positive spore-forming rods

20. Some important pathogens and GI indigenous flora are Gram-negative anaerobic rods. Which of the following organisms is not a Gram-negative anaerobic rod?
    a. *Bacteroides* spp.
    b. *Fusobacterium* spp.
    c. *Prevotella* spp.
    d. *Clostridium* spp.

21. Which of the following organisms is a cause of renal disease, abortion, and infertility?
    a. *Leptospira* spp.
    b. *Borrelia burgdorferi*
    c. *Brachyspira hyodysenteriae*
    d. *Campylobacter* spp.

22. The organism *Mycoplasma* spp. is
    a. Gram-positive
    b. Gram-negative
    c. Acid-fast–positive
    d. Not visible on Gram stain

23. Which of the following organisms is NOT an obligate intracellular organism?
    a. *Mycoplasma*
    b. *Neorickettsia*
    c. *Chlamydia*
    d. *Ehrlichia*

24. The McFarland standard is used to
    a. Set hospital policy regarding exposure to infectious agents
    b. Determine which antibiotic to use
    c. Estimate bacterial numbers
    d. Evaluate hemolytic reactions

25. The media used to culture dermatophytes are
    a. Sabouraud dextrose agar and salt mannitol agar
    b. Salt mannitol agar and blood agar
    c. Blood agar and DTM
    d. DTM and Sabouraud dextrose agar

26. The pathogenic yeast that is a common cause of otitis externa is
    a. *Coccidioides immitis*
    b. *Malassezia pachydermatis*
    c. *Blastomyces dermatitidis*
    d. *Cryptococcus neoformans*

27. In the polymerase chain reaction (PCR) test, a series of three steps is repeated approximately 40 times to amplify DNA. Which of the following represents the correct order for these steps?
    a. Annealing, denaturing, extension
    b. Extension, denaturing, annealing
    c. Denaturing, annealing, extension
    d. Annealing, extension, denaturing

EXERCISE 15.9 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. Bacterial agents that are highly infectious and dangerous to the degree that they have potential use as biologic weapons are classified by the government as _____ agents, and must be reported to the _____ if identified in the lab.
2. When submitting urine for bacterial culture, a minimum of _____ mL should be collected by _____, and submitted in a blood tube with a top that is _____ in color.
3. A _____ infection is an infection that affects two or more organs or organ systems at the same time.
4. The part of the bacterium that is different in structure between Gram-negative and Gram-positive organisms, which therefore takes up stain differently, is the _____ _____.
5. Partially acid-fast organisms stain the color _____, whereas non–acid-fast organisms and the background stain _____.
6. When attempting to identify a bacterium isolated on a culture plate, the first step is to determine its _____ and _____ as observed on a Gram stain.
7. The catalase test determines the presence or absence of this enzyme based on the ability of a bacterial organism to convert _____ to _____ and _____.
8. Hemolytic patterns are used to determine the pathogenicity of *Streptococcus* organisms. *Streptococcus* isolates that are indigenous flora are generally _____-hemolytic, whereas pathogenic *Streptococcus* isolates are generally _____-hemolytic.
9. Diarrhea caused by *Clostridium perfringens* and *Clostridium difficile* correlates with the presence of toxins rather than the presence of the organisms themselves. The toxins are typically detected with a(n) _____ test.
10. Each species of animal has characteristic and unique indigenous flora. Whereas the Gram-positive organism *Staphylococcus* _____ is a member of the indigenous skin flora of dogs, in cats and large animals *Staphylococcus* _____ is a normal skin inhabitant.
11. The Gram-positive spore-forming rod, *Bacillus anthracis* is the causative agent of the dangerous zoonotic disease _____, and is classified as a _____ agent by the U.S. government.
12. Members of the family *Enterobacteriaceae*, such as *Escherichia coli, Klebsiella,* and *Salmonella,* are typically oxidase-_____.
13. An organism often associated with progressive infections in people with cat bites is _____ _____.
14. The small, Gram-negative coccobacillus, _____ _____ is the causative agent of kennel cough, a disease also known as _____ _____.
15. A _____ agar plate is used to perform a disc diffusion susceptibility test.

16. The only fungal cultures that are routinely performed in-house are _____ cultures.

17. A _____ lamp is sometimes used to examine suspect dermatophyte lesions because some of these organisms (<50%) will _____ when exposed to long-wavelength ultraviolet light.

18. Oligonucleotides are short segments of _____ that are used as _____ in the PCR test.

19. An infection that a hospitalized patient acquires from the hospital environment or another patient is called a _____ infection. An infection that a patient is incubating at the time of admission, but which becomes apparent while the patient is in the hospital is called a _____ - _____ infection.

EXERCISE 15.10 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 15.11 SHORT ANSWER: CULTURE AND SENSITIVITY

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 15.12 CASE STUDY: PERFORMING A QUANTIFIED URINE CULTURE

Tanya, a 3-year-old female Collie, was presented for urinating in the house. The owner reported that during the previous few days, Tanya urinated in the house several times and when she was outside to "potty," she would often go four or five times in a row. Physical examination revealed no significant findings. The bladder was empty at the time of the examination. Acute cystitis with a possible bacterial infection was suspected and urine was collected by cystocentesis for urinalysis, a quantified urine culture, and sensitivity testing. The urine was blood tinged and the urinalysis indicated the presence of leukocytes, red blood cells, and bacteria. Antibiotics were prescribed for 7 days while waiting for culture results.

1. Explain the procedure used to inoculate a plate for a quantified urine culture using both 1 μL and 10 μL loops.

2. The plates were incubated at 37°C overnight and the colonies were counted the next day. *Staphylococcus pseudointermedius* was isolated. The 1:1000 plate had approximately 90 colonies and the 1:100 plate was covered with growth. Calculate the number of colony-forming units found on the 1:1000 plate, and explain the significance of these results.

EXERCISE 15.10 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1a. What is meant by the term *select agent* as it applies to bacterial and fungal pathogens?

_____

1b. Why is it advisable not to culture these agents in an in-house practice lab?

_____

1c. Name three bacterial pathogens and three fungal pathogens that are classified as select.

Select bacterial agents	Select fungal agents
i. _____	i. _____
ii. _____	ii. _____
iii. _____	iii. _____

2a. Name the body areas or regions that are inhabited by indigenous flora.

_____

_____

2b. Many of these agents are "opportunistic pathogens." What does this mean regarding their ability to cause infections?

_____

_____

3. Blood and joint fluid samples are often submitted to the laboratory in blood culture bottles that contain broth. Why is this done (as opposed to submitting it on a culture swab)?

_____

_____

_____

4. Bacteremias are infections of the blood. These infections are often transient.

   a. Describe the collection technique used to increase the chance that the bacteria will be successfully cultured.

   _____

   _____

   b. Why are samples collected this way often taken from different veins?

   _____

   _____

5. Why do microbiology lab incubators provide a 5% carbon dioxide atmosphere?

6. Briefly summarize the difference between selective, enrichment, and differential media. Give an example of each type.

   a. Selective media:

   b. Enrichment media:

   c. Differential media:

7. Preliminary evaluation of a culture plate requires interpretation of the significance of the growth. Sometimes a single colony is important and sometimes it is not. Explain this statement.

8. Why is it best to use a cotton swab or plastic instrument to pick the bacterial colonies off of the plate when performing the oxidase test?

9. The organism *Campylobacter jejuni* can be difficult to culture. List the special atmospheric and temperature requirements needed to grow this organism.

10. The GI system pathogen *Salmonella* spp. is commonly isolated from the feces of reptiles and amphibians. List two reasons for a high level of concern when handling samples suspected of harboring this organism.

11. Pathogenic spirochetes are difficult to culture and potentially zoonotic.

    a. Because they are difficult to culture, what diagnostic methods are used to detect them?

    _____

    b. Name two bacteria that belong in this group.

    i. _____

    ii. _____

12. Obligate intracellular bacteria will not grow on standard culture media. How are these organisms cultured?

    _____

13. What is the purpose of quality control testing and quality assurance in the context of microbiology?

    _____

    _____

14. The following antibody-based tests for detecting viruses all work by producing a visible change in the sample that indicates the presence of the virus in question. Describe the visible change that occurs with each test.

    a. ELISA test _____

    b. Virus isolation by cell culture _____

    c. Electron microscopy _____

    d. Immunohistochemical staining _____

15a. What is the primary difference between a monoclonal antibody and a polyclonal antibody in terms of the way they are produced?

    _____

    _____

15b. Which antibody type (monoclonal or polyclonal) is typically preferred for virus detection and why?

    _____

    _____

16. The advent of PCR testing has revolutionized pathogen detection.

    a. Why is this methodology an improvement over standard culture techniques for obligate intracellular bacteria?

    _____

    _____

b. In what way does PCR technique increase safety when handling dangerous bacteria?

c. How does PCR technique help when trying to identify slow-growing bacteria?

17. List three factors that increase a patient's susceptibility to nosocomial infections.

i.

ii.

iii.

18. Discuss ways that an animal-care professional can reduce transmission of a zoonotic pathogen.

EXERCISE 15.11 SHORT ANSWER: CULTURE AND SENSITIVITY

Instructions: Respond to each of the following questions in the space provided.

1. Two test methods for determining antimicrobial susceptibility are the microbroth dilution and the disk diffusion (Kirby-Bauer method). Briefly describe each method, including the necessary equipment, sample preparation and handling, reading the test, and what the results mean. Also include the information that each test gives you.

a. The broth dilution (microbroth dilution) method:

i. Equipment needed:

ii. Sample preparation and handling:

iii. Reading the test: _____

iv. What the results mean: _____

b. The disk diffusion (Kirby-Bauer) method:

i. Equipment needed: _____

ii. Sample preparation and handling: _____

iii. Reading the test: _____

iv. What the results mean: _____

2. Describe the process used to culture dermatophytes concerning sample collection, media inoculation, incubation, and reading the results.

   i. Sample collection: _____

   ii. Inoculation: _____

   iii. Incubation: _____

   iv. Reading results: _____

16 Diagnostic Imaging

LEARNING OBJECTIVES

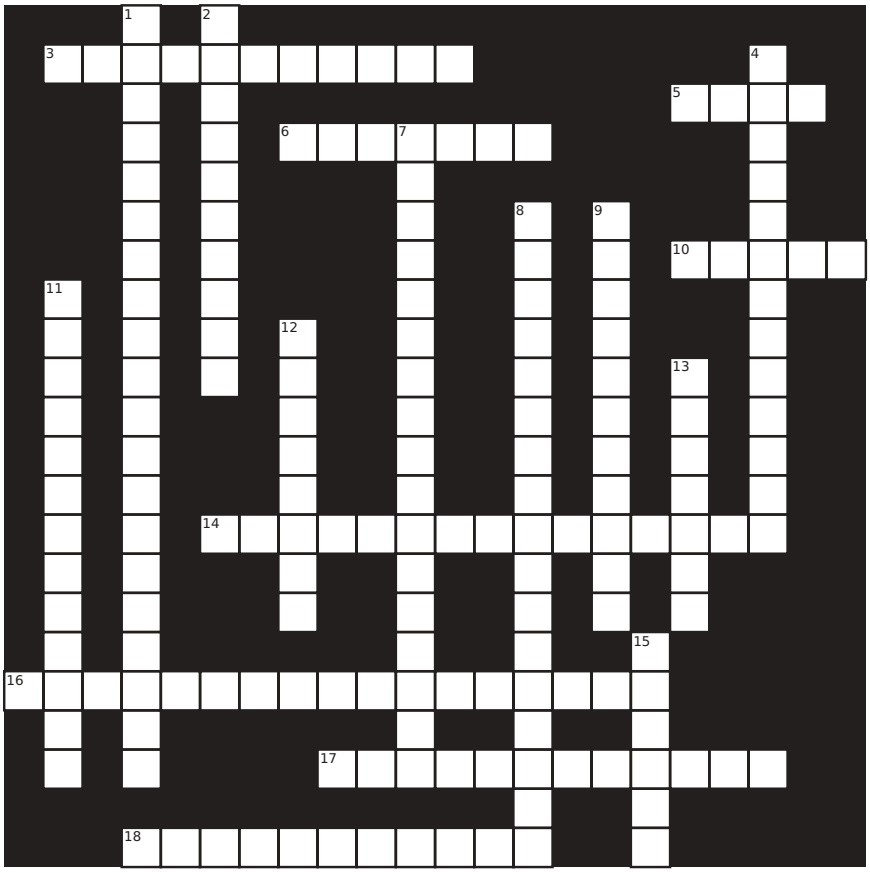
When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all Key Terms in this chapter.
2. List and describe methods for labeling and filing radiographic films.
3. Do the following regarding the production of x-rays:
   - Describe the properties of x-radiation.
   - Describe the parts of the x-ray tube and machine, and discuss the role each part plays in generation of x-radiation.
   - Explain the production of the useful x-ray beam and scatter radiation, and discuss the negative consequences of scatter radiation.
4. Do the following regarding x-ray equipment:
   - Describe the features of and uses for portable, mobile, stationary, and fluoroscopic x-ray equipment.
   - Describe the features, advantages and disadvantages of, and uses for computed radiography and digital radiography equipment.
5. Do the following regarding image quality and exposure factors:
   - Describe common digital radiography artifacts, including how to identify and prevent each one.
   - Define *DICOM, PACS, RIS,* and *teleradiography,* and explain the role of each in the production and management of digital radiographs.
   - Define *milliamperage, exposure time, kilovoltage*, and *focal-film distance*, and explain how each of these exposure factors is set to produce a quality diagnostic radiograph.
   - Explain the purpose of a technique chart, and describe the procedure used to formulate a technique chart.
6. Do the following regarding image formation with film-screen systems:
   - Explain the principles of image formation using nonscreen x-ray film and film-screen cassette-based systems.
   - Describe the structure and characteristics of grids and the Potter-Bucky diaphragm, and explain the roles they play in the production of a diagnostic image.
7. Do the following regarding film processing and radiographic film quality:
   - Discuss the design, features, and organization of an x-ray darkroom.
   - Describe use and maintenance of the equipment used to process x-ray film, including operation of the automatic processor.
   - Define *radiographic detail, contrast,* and *density,* and explain how these factors are controlled by changing milliamperage and kilovoltage to optimize image quality.
   - List common technical errors and artifacts, and the steps that can be taken to minimize them.
8. Do the following regarding radiation safety:
   - Describe the hazards of x-radiation, and explain the role of beam filtration in minimizing its damaging effects.
   - Discuss the units of measurement used to quantify x-radiation, and the methods used to monitor x-radiation exposure.
   - Define *maximum permissible dose*, and explain the principles and practices used to minimize exposure to x-radiation, including the use of personal protective equipment.
9. Do the following regarding radiographic contrast agents:
   - List commonly used positive and negative radiographic contrast agents, and explain how they are used in the production of a diagnostic contrast study.
   - Describe the contrast procedures used to image the gastrointestinal system, urinary system, and spinal cord.
10. Explain the principles of patient positioning for radiographic studies, including the importance of appropriate restraint.
11. Do the following regarding ultrasonography:
    - Describe the indications for and characteristics of ultrasonography in diagnostic imaging.
    - Describe the basic principles of production of an ultrasound image, including the appearance of various tissues and organs on a finished image.

- Describe how a patient is prepared for ultrasound imaging, and the procedure used to conduct an ultrasound examination.
- Discuss the equipment used to produce a B-mode, M-mode, or Doppler ultrasound image.
- Describe the appearance of an ultrasound image, as well as the appearance and cause of common artifacts.

12. Describe indications for and characteristics of therapeutic and diagnostic nuclear medicine, computed tomography, and magnetic resonance imaging.

EXERCISE 16.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

3 The source of the x-ray beam in an x-ray tube. (2 words)
5 A device used to decrease scatter radiation.
6 The general amount of blackness in a radiographic image.
10 Electromagnetic radiation of shorter wavelength than light.
14 The specific type of the part that serves as the source of the x-rays in a dental or portable x-ray machine. (2 words)
16 The distance between the source of the x-rays and the image receptor. (2 words)
17 Defines of the number of shades of gray that can be represented in a digital image. (2 words)
18 Weakening of sound waves as they travel through the body.

Down

1 A device used to make grid lines invisible. (2 words)
2 Decrease in the strength of the x-ray beam near the anode. (2 words)
4 The current applied to the cathode filament.
7 The ability to distinguish two adjacent structures on an x-ray image. (2 words)
8 Energy that breaks chemical bonds and damages DNA. (2 words)
9 Controls the speed of travel of the electrons in an x-ray tube.
11 The specific type of the part that serves as the source of the x-rays in a stationary x-ray machine. (2 words)
12 The difference between blacks and whites in a radiographic image.
13 The source of electrons in an x-ray tube.
15 The sharpness of a radiographic image.

EXERCISE 16.2 MATCHING #1: TERMS AND DEFINITIONS

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Anechoic
2. _____ A-mode
3. _____ B-mode
4. _____ Computed radiography
5. _____ DICOM
6. _____ Digital radiography
7. _____ Fluoroscopy
8. _____ Hyperechoic
9. _____ Hz
10. _____ Isoechoic
11. _____ M-mode
12. _____ PACS
13. _____ Rad
14. _____ Rem
15. _____ Teleradiology

Column B

A. A diagnostic technique used to image moving structures.
B. The computer system used to store and transmit digital x-ray images.
C. An imaging technique that uses cassettes to produce a digital image.
D. A dark structure on an ultrasound image is said to be _____.
E. A structure that has the same brightness as adjacent structures on an ultrasound image is said to be _____.
F. A type of ultrasound display not used in practice.
G. A measurement of absorbed radiation that takes into account biologic effectiveness of radiation.
H. A universal format or standard for digital image storage, display, manipulation, and retrieval.
I. Allows transmission of x-ray images across the Internet to referral facilities.
J. Also known as "brightness mode."
K. A structure that produces more echoes than adjacent structures is said to be _____.
L. The unit of absorbed dose of ionizing radiation.
M. A measurement of sound frequency.
N. An imaging technique that doesn't require use of film.
O. An ultrasound display used primarily for heart exams.

EXERCISE 16.3 MATCHING #2: SCREEN SPEED AND CHARACTERISTICS

Instructions: Match each characteristic in column A with its corresponding screen speed in column B by writing the appropriate letter in the space provided. Note that responses may be used more than once.

Column A

1. _____ Requires less radiation.
2. _____ Produces poorer detail.
3. _____ Also called "fine screens."
4. _____ Has larger crystals.
5. _____ Emits less light.
6. _____ Also called "detail screens."
7. _____ Best for imaging small exotic animals.

Column B

A. Fast screens
B. Slow screens

EXERCISE 16.4 MATCHING #3: FACTORS THAT AFFECT RADIOGRAPHIC DENSITY

Instructions: Match each action in column A (assuming no other changes are made) with the way it will affect radiographic density in column B by writing the appropriate letter in the space provided. Note that responses may be used more than once.

Column A

1. _____ Changing the kVp from 50 to 60
2. _____ Changing the object-film distance from 6 inches to 12 inches
3. _____ Changing mA from 300 to 200
4. _____ Changing the exposure time from ½ second to ¼ second
5. _____ Changing from detail screens to fast screens
6. _____ Changing the focal-film distance from 40 inches to 30 inches
7. _____ Removing the grid

Column B

A. Increases radiographic density.
B. Decreases radiographic density.
C. Does not change radiographic density.

EXERCISE 16.5 MATCHING #4: CONTRAST AGENTS AND CONTRAST STUDIES

Instructions: Match each contrast study listed in column A with the agent(s) used for the study in column B by writing the appropriate letter in the space provided. Note that there may be more than one correct response and that each response may be used more than once.

Column A

1. _____ Double-contrast gastrogram
2. _____ Double-contrast cystogram
3. _____ Pneumoperitoneography
4. _____ Upper GI exam
5. _____ Lower GI exam
6. _____ Venous and arterial study
7. _____ Excretory urogram
8. _____ Positive-contrast cystogram and urethrogram
9. _____ Negative-contrast cystogram and urethrogram
10. _____ Myelogram
11. _____ Arthrogram

Column B

A. Radiolucent gas
B. Barium sulfate
C. Soluble ionic radiopaque medium
D. Soluble nonionic radiopaque medium

EXERCISE 16.6 MATCHING #5: ULTRASOUND ARTIFACTS AND INTERPRETATIONS

Instructions: Match each artifact listed in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Reverberation artifact
2. _____ Shadowing
3. _____ Acoustic enhancement
4. _____ Edge artifact
5. _____ Mirror-image artifact
6. _____ Slice-thickness artifact

Column B

A. Dark bands at the margins of an early pregnancy vesicle.
B. Caused when the beam encounters intestinal gas.
C. Duplication of the gallbladder on the far side of the diaphragm.
D. Caused when the beam encounters a bladder stone.
E. The urinary bladder appears to contain debris.
F. The tissue deep to the gallbladder appears brighter than adjacent tissue.

EXERCISE 16.7 MATCHING #6: X-RAY RADIOGRAPHIC ARTIFACTS AND TECHNICAL ERRORS

Instructions: Match each of the radiographic technical errors listed in column A with its resulting artifact in column B by writing the appropriate letter in the space provided. Note that each response may be used more than once and that more than one answer may be correct.

Column A

1. _____ mAs or kV setting too high
2. _____ Dirt or debris between the film and screen
3. _____ Focal-film distance too short
4. _____ Contrast medium on tabletop, skin, or cassette
5. _____ mAs or kV setting too low
6. _____ Failure to use a grid
7. _____ Focal-film distance too long
8. _____ Defective cassette that does not close properly, exposing margins of film to light
9. _____ Anatomic part undermeasured
10. _____ Outdated film
11. _____ Crescent mark from rough handling
12. _____ Static electricity
13. _____ Anatomic part overmeasured
14. _____ Grid out of focal range or upside-down
15. _____ Defect or crack in screen
16. _____ Speed of intensifying screen too slow
17. _____ Film exposed to scatter radiation
18. _____ Film stored in hot or humid environment
19. _____ Speed of intensifying screen too fast
20. _____ Gridlines

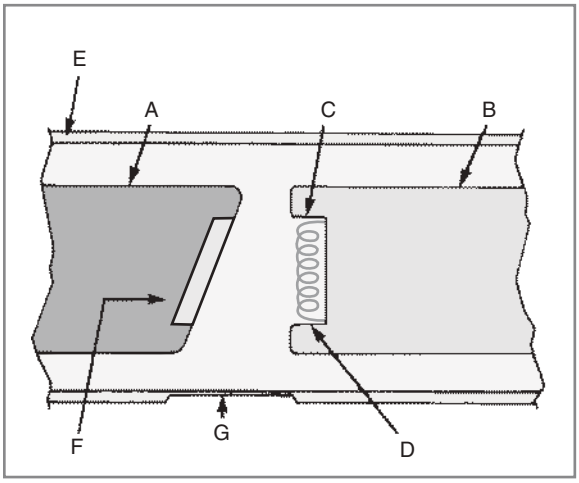
Column B

A. Increased film density
B. Decreased film density
C. Black marks
D. White marks
E. Gray film (film fog)
F. Parallel lines

EXERCISE 16.8 PHOTO QUIZ: PARTS OF THE X-RAY TUBE

Instructions: Identify each part of an x-ray tube with the appropriate description from the list below by writing the appropriate letter in the space to the left, then name the part by writing the name in the space to the right.

Letter corresponding with the part



Description Name of the Part

1. _____ The part through which the x-rays exit the tube: _____.
2. _____ This part produces an electron cloud when current is applied: _____.
3. _____ The high-voltage circuit controls the electrical potential between the cathode and this part: _____.
4. _____ The part that encases the other parts of the tube: _____ _____.
5. _____ The x-rays do not emanate from this negatively charged pole: _____.
6. _____ This part directs the electrons toward the anode: _____ _____.
7. _____ The electrons directly impact this part to produce x-rays: _____ _____.

EXERCISE 16.9 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Radiographs are considered to be a part of a patient's legal medical record.
2. _____ X-rays are a type of electromagnetic radiation with a lower frequency than visible light, radio signals, and TV signals.
3. _____ Rotating anodes are generally used in dental machines and small portable machines.
4. _____ Scatter radiation reduces density.
5. _____ Fluoroscopy is used to study moving structures such as beating of the heart and motility of the esophagus.
6. _____ Computed radiography (CR) and digital radiography (DR) are two names for the same thing.
7. _____ One advantage of digital radiography systems is that they require less radiation to produce a diagnostic image than film/screen systems.
8. _____ CR and DR systems are not as sensitive to under- and overexposures as conventional film/screen systems.
9. _____ A radiology information system (RIS) is a digital imaging device that is used to evaluate blood flow.
10. _____ The exposure time is related to the number of x-ray photons produced—as one goes up, the other does also.
11. _____ Kilovoltage affects radiographic density but not radiographic contrast.

12. _____ The focal-film distance influences radiographic density.

13. _____ A technique chart is used to provide appropriate machine settings, and must be custom-made for each machine.

14. _____ If you get new cassettes or get a new processor, your technique chart will not have to be updated as long as the cassettes are exactly the same type, and the processor is the same brand.

15. _____ Intensifying screens are very durable and don't need to be replaced as long as they are not damaged.

16. _____ X-ray film and intensifying screens must be matched for proper function.

17. _____ The greater the ratio of a grid, the less scatter the grid absorbs.

18. _____ Automatic processors standardize, speed up, and simplify film processing, and decrease the required maintenance.

19. _____ X-ray film is more sensitive after exposure and before development than at any other time.

20. _____ Regarding measurement of x-radiation: Because of the quality factor of x-radiation, 1 "rad" is equal to 10 "rems."

21. _____ Film badges should be stored outside of the x-ray room.

22. _____ Technicians should always remember that x-ray effects are cumulative.

23. _____ Myelograms may be performed with the patient awake or anesthetized.

24. _____ Most radiographic studies require only one view.

25. _____ When x-raying large dogs, it may be necessary to use two films per view to image the entire abdomen.

26. _____ Manual restraint of patients for radiographic studies is routine and not a safety concern as long as protective equipment is used.

27. _____ The ultrasound machine transducer both emits the sound and receives reflected waves.

28. _____ When adjacent tissues are very dissimilar in density, little of the ultrasound wave bounces off the tissue interface.

29. _____ Like radiographic artifacts, ultrasound artifacts do not contribute useful information.

30. _____ The most common use for computed tomography scans in veterinary patients is examination of the central nervous system.

31. _____ Any animal receiving a CT scan should have cotton placed in its ears to protect its hearing from the high decibel noise generated by the CT machine.

EXERCISE 16.10 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. The shorter the wavelength of x-rays, the
   a. Greater the energy and the penetration
   b. Greater the energy, but the lower the penetration
   c. Lower the energy, but the greater the penetration
   d. Lower the energy and the penetration

2. The kilovoltage electrical circuit controls the
   a. Electrical potential across the filament
   b. Number of electrons created
   c. Electrical potential between the cathode and the anode
   d. Number of the x-rays created

3. The "target" in an x-ray tube is the area where the
   a. X-rays impact the anode
   b. Electrons impact the cathode
   c. Electrons impact the anode
   d. X-rays impact the cathode

4. Information regarding the maximum safe exposure time that can be used without damaging the machine may be found on the
   a. Technique chart
   b. Tube rating chart
   c. X-ray log
   d. Safe-operating procedures

5. Which of the following factors does *not* increase scatter radiation?
   a. Thickness of the body part
   b. Size of the x-ray field
   c. Type of cassette
   d. Kilovoltage

6. The three primary machine controls that influence x-ray production are
   a. Focal-film distance, kilovoltage, and milliamperage
   b. Kilovoltage, exposure time, and focal-film distance
   c. Milliamperage, exposure time, and kilovoltage
   d. Milliamperage, focal-film distance, and exposure time

7. Which of the following x-ray machines usually has a maximum mA output of 300 to 2000, and a maximum kVp output of 100 to 150?
   a. Dental machine
   b. Portable machine
   c. Mobile machine
   d. Stationary machine

8. Which machine type is used to image the changing diameter of the trachea during inspiration and expiration?
   a. Mobile machine
   b. Portable machine
   c. Fluoroscope machine
   d. Stationary machine

9. Dynamic range refers to which of the following image characteristics?
   a. The range of sharpness
   b. The size
   c. The general amount of blackness
   d. The number of shades of grey

10. A photostimulable phosphor plate is used to capture the image in this type of x-ray system.
    a. CR
    b. DR
    c. Film/screen
    d. Nonscreen film

11. A digital artifact called Uberschwinger artifact appears as
    a. A grainy appearance to the image
    b. Black spots or dots on the image
    c. Loss of part of the image
    d. A lucent halo around metal implants

12. A universal format or standard for digital image storage, display, manipulation, and retrieval.
    a. DICOM
    b. PACS
    c. RIS
    d. ALARA

13. A computerized system used to move, transmit, and store digital images.
    a. LAN
    b. PACS
    c. RIS
    d. ALARA

14. The images from which of the following digital modalities must be viewed on a high-resolution monitor because the images are inherently high resolution, and so require this type of monitor?
    a. Computed tomography
    b. Magnetic resonance imaging
    c. Ultrasound
    d. Digital radiography

15. If the kilovoltage setting is increased, the
    a. Radiographic density and contrast will increase
    b. Radiographic density will increase, but the contrast will decrease
    c. Radiographic density will decrease, but the contrast will increase
    d. Radiographic density and contrast will decrease

16. As compared with screen film, nonscreen film
    a. Produces images with less detail
    b. Cannot be used for intraoral dental studies
    c. Requires a much longer exposure time to get a diagnostic image
    d. Requires the use of expensive cassettes

17. When compared with calcium tungstate, rare earth screens
    a. Require less radiation and emit green light
    b. Require less radiation and emit blue light
    c. Require more radiation and emit green light
    d. Require more radiation and emit blue light

18. The light and x-ray–sensitive granules in the emulsion of x-ray film are usually made of
    a. Calcium tungstate
    b. Molybdenum
    c. Silver bromide
    d. Carbon fiber

19. The primary purpose of a grid is to
    a. Decrease the settings needed
    b. Minimize distortion
    c. Decrease radiation exposure
    d. Control scatter radiation

20. Grids are placed
    a. Above the patient
    b. Between the tube and the table
    c. Between the patient and the cassette
    d. Under the cassette

21. A grid should be used when x-raying body parts that are
    a. More than 5 cm thick
    b. Less than 10 cm thick
    c. More than 10 cm thick
    d. More than 20 cm thick

22. Silver can be recovered from
    a. X-ray film and fixer solution
    b. Fixer solution and developer solution
    c. Developer solution and rinse water
    d. Rinse water and x-ray film

23. Radiographic detail is improved by
    a. Using a larger focal spot
    b. Increasing the exposure time
    c. Decreasing the focal-film distance
    d. Minimizing the object-film distance

24. Low-contrast radiographs have many shades of gray. Low contrast is preferred for
    a. Spinal radiographs
    b. Thoracic radiographs
    c. Tibial radiographs
    d. Carpal radiographs

25. The machine setting that has the greatest influence on radiographic contrast is
    a. Milliamperage
    b. Exposure time
    c. Focal-film distance
    d. Kilovoltage

26. A "rad" is a measure of the
    a. Biologic effect of the radiation
    b. Absorbed dose of x-ray energy/unit mass of tissue
    c. Machine output
    d. Maximum permissible dose

27. In recent years, the old units of measurement have been replaced by international units. Which of the following conversions is correct?
    a. 1 rad = 1 milligray
    b. 1 roentgen = approximately 3876 microcoulomb/kg
    c. 1 rem = 10 millisieverts
    d. 1 sievert = 10 rems

28. The maximum permissible dose (MPD) is the dose of radiation a person is allowed to receive from occupational exposure over a certain time. The annual MPD is
    a. 5000 rads
    b. 5000 mrem
    c. 5 mrem
    d. 5 Sv

29. Protective equipment including aprons, thyroid shields, and gloves should have _____ mm lead equivalent minimum.
    a. 0.25
    b. 0.5
    c. 1
    d. 2

30. Barium sulfate is contraindicated
    a. If bowel perforation is suspected
    b. For esophageal studies
    c. For upper GI exams
    d. For lower GI exams

31. Soluble, radiopaque ionic contrast media should not be used for
    a. Esophageal studies
    b. Upper GI studies
    c. Cystograms
    d. Myelograms

32. Which of the following contrast studies requires that images be taken right after barium sulfate contrast is given, and also 15, 30, and 60 minutes after contrast administration?
    a. Positive-contrast cystogram
    b. Upper gastrointestinal series
    c. Barium enema
    d. Myelogram

33. An intravenous pyelogram (IVP) or excretory urogram is used to evaluate the urinary system. This study involves
    a. Administration of barium sulfate intravenously
    b. Administration of air in the bladder
    c. Intravenous administration of an ionic organic iodide
    d. Infusion of an ionic organic iodide into the bladder

34. An ultrasound echo is produced whenever the ultrasound beam crosses a boundary between two tissues of differing acoustic impedance (opposition to flow of the beam). The main factor that influences acoustic impedance is the
    a. Speed of the sound
    b. Density of the tissue
    c. Intensity of the sound
    d. Frequency of the sound

35. Which ultrasound display mode has little value in performing abdominal or cardiac exams, and therefore is not used?
    a. A mode
    b. B mode
    c. M mode
    d. Doppler mode

36. M mode ultrasound is used primarily for
    a. Abdominal ultrasonography
    b. Pregnancy exams
    c. Large animal tendon exams
    d. Echocardiography

37. Linear array ultrasound transducers are not particularly useful for examination of the
    a. Bladder from a transabdominal approach
    b. Heart from an intercostal approach
    c. Small animal uterus from a transabdominal approach
    d. Large animal reproductive tract from a transrectal approach

38. The most appropriate transducer frequency for an ultrasound exam on a cat is
    a. 7.5 MHz
    b. 5 MHz
    c. 3 MHz
    d. 1 MHz

39. A structure on an ultrasound image that is brighter than an adjacent structure is said to be _____ in relationship with the adjacent structure.
    a. Anechoic
    b. Echogenic
    c. Isoechoic
    d. Hyperechoic

40. Ultrasound cannot be used to image which of the following tissues?
    a. Liver
    b. Heart
    c. Brain
    d. Blood vessels

41. What alternative modality is used to treat thyroid tumors?
    a. Magnetic resonance imaging
    b. Nuclear medicine
    c. Computed tomography
    d. Ultrasonography

42. The substance technetium-99m is an agent used to perform which of the following examinations?
    a. Magnetic resonance imaging
    b. Nuclear medicine imaging
    c. Computed tomography
    d. Ultrasonography

43. Which alternative imaging technique produces an image by using a thin x-ray beam to measure x-ray attenuation?
    a. Magnetic resonance imaging
    b. Nuclear medicine imaging
    c. Computed tomography
    d. Ultrasonography

44. Some computed tomography scanners have a "helical scan mode." What is the chief advantage of this capability?
    a. It requires less radiation.
    b. It produces a better image.
    c. It does not require the patient to be still.
    d. It is faster.

45. Both magnetic resonance imaging (MRI) and computed tomography (CT) create cross-sectional views of the patient's anatomy. What is the primary difference between MRI and CT scanning in terms of the way they work?
    a. MRI does not use ionizing radiation
    b. CT does not use x-rays
    c. CT uses radio waves
    d. MRI uses radionuclides

46. Which of the following alternate imaging modalities involves use of a strong magnetic field?
    a. Magnetic resonance imaging
    b. Nuclear medicine imaging
    c. Computed tomography
    d. Ultrasonography

47. Which of the following scans are usually performed once without contrast, and again with contrast?
    a. MRI and nuclear medicine
    b. Nuclear medicine and ultrasound
    c. Ultrasound and CT
    d. CT and MRI

EXERCISE 16.11 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. Information that must be on a diagnostic radiograph in addition to the name of the facility where the study was taken, are the name of the _____, the name of the _____ (or the patient ID #), and the _____.

2. There are two electrical circuits in an x-ray machine. The high voltage circuit (also known as the _____ circuit) controls the penetration of the x-ray beam. The low voltage circuit (also known as the _____ circuit) controls the number of the x-rays created.

3. A cathode with a larger filament produces a larger electron beam, and thus decreases the _____ of the image.

4. Rotating anodes have a "two-step" exposure switch. When the first step is activated, the anode starts _____, and when the second step is activated, _____ are produced.

5. Most of the energy generated by the electrons impacting the anode target is converted into heat. In fact, _____% of the energy is lost as heat, and _____% of the energy is converted to x-ray energy.

6. Scatter radiation is undesirable because it _____ film quality and _____ exposure of personnel.

7. Severe underexposure of a digital image receptor will result in a finished image with a grainy appearance, an effect known as _____ _____ or "noise."

8. When a digital image is overexposed, thin parts of the body may appear _____ in color, and will never be visible, not even after the image density and contrast are adjusted.

9. If dust, hair, or other particles are trapped in a CR cassette, spots will be visible on the finished image that are _____ in color.

10. The exposure factors that must be set on any x-ray machine regardless of age or type are _____, _____, and _____ _____.

11. When milliamperage (mA) is increased, radiographic density increases, or, in other words, the image gets _____. Conversely, when mA is decreased, radiographic density decreases, or the image gets _____.

12. When kilovoltage (kV) is increased, radiographic density _____. This is because the x-rays produced are more penetrating.

13. The effect of focal-film distance on the number of x-rays reaching the image receptor is governed by the "inverse square law." This law predicts that if the focal-film distance is doubled, the number of x-rays reaching the receptor will be reduced by a factor of _____.

14. Grids should be used for tissues that are greater than _____ cm in thickness.

15. The term *screen speed* refers to the ability of an intensifying screen to convert absorbed _____ energy into _____.

16. The artifact produced by using old intensifying screens, which appears as a white speckled pattern, is known as _____ _____.

17. Screen x-ray film is sensitive primarily to _____, whereas nonscreen film is more sensitive to _____.

18. Grids absorb part of the primary x-ray beam, and thus require use of _____ machine settings to produce a given film density.

19. A Potter-Bucky diaphragm moves the grid across the film during the exposure so that the _____ _____ are not visible.

20. When a grid is used, the exposure settings must be increased to compensate for the radiation absorbed by the grid. Either exposure time should be increased by a factor of _____, or the kilovoltage must be increased _____%.

21. The primary machine setting that affects radiographic density is _____.

22. In recent years, the old units of measurement of radiation have been replaced by international units. The "rad" is replaced by the _____; the "roentgen" (R) is replaced by the _____; and the "rem" is replaced by the _____.

23. Positive-contrast agents _____ radiographic opacity, whereas negative-contrast agents _____ radiographic opacity.

24. Carbon dioxide is preferred over room air as a contrast agent because it is less likely to cause _____ _____, a serious, sometimes fatal, complication.

25. When a GI perforation is suspected, ionic or nonionic organic _____ should be used.

26. A lower gastrointestinal positive contrast study is also known as a _____ enema.

27. The frequency of the ultrasound waves emitted by a transducer is used to rate the output. Most transducers have an output of 2.5 to 12 megahertz (MHz). 1 Hertz (Hz) = 1 _____ per _____. Because the prefix "mega" means "million," a 5 MHz transducer emits sound at a frequency of _____ cycles/second.

28. The ultrasound transducer emits sound waves approximately _____% of the time, and receives reflected waves approximately _____% of the time.

29. An ultrasound beam is weakened or _____ by absorption, reflection, scattering, refraction, and diffraction.

30. Ultrasound cannot be used to image through bone or gas because _____% of the beam is reflected off of a fat–bone interface, and 100% of the beam is reflected off of a _____ - _____ interface.

31. A patient receiving an ultrasound examination of the abdomen should be placed in lateral or _____ recumbency, and a patient receiving a cardiac examination should be placed in lateral or _____ recumbency.

32. The ultrasound transducer should be oriented in relationship to the animal's body such that when acquiring a sagittal view, the patient's head should appear on the _____ side of the screen; and when acquiring a transverse view, the patient's left side should appear on the _____ side of the screen.

33. Electromagnetic radiation that originates from radionuclides is referred to as _____ radiation.

EXERCISE 16.12 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 16.13 CASE STUDY #1: DEVELOPING A TECHNIQUE CHART

The practice you work for has purchased a new x-ray machine. The decision was made to delay changing to a digital image-receptor system for a few years, so for now, you are going to be using a rare earth film/screen image-receptor system that the practice bought a few years ago until the upgrade to digital occurs. The doctor has asked you to develop a technique chart for this new x-ray machine.

1. Answer the following questions regarding the steps you will take to develop a variable kVp technique chart for the canine abdomen by following the principles outlined in this chapter.

   a. What machine setting must be checked prior to developing the chart?

   _____

   _____

   b. What would you do to prepare the automatic processor prior to starting?

   _____

   _____

   c. What characteristics would you look for in the animal that will be used for the trial exposures?

   _____

   _____

   d. What kVp setting would you select for the trial exposure?

   _____ kVp

e. It is suggested that you use a setting of 7.5 mAs. The machine you are using has mA stations of 100, 200, and 300. What mA and exposure time settings would you choose to arrive at the desired mAs? Express the exposure time in seconds, milliseconds, and as a fraction.

Milliamperage _____ mA

Exposure time _____ seconds

_____ milliseconds

_____ (expressed as a fraction)

f. You have chosen an animal with a ventrodorsal measurement of 15 cm and a lateral measurement of 15 cm for the trial exposures. The first trial exposure of the ventrodorsal view is overexposed. What kVp setting should you choose for the second trial exposure?

_____ kVp

g. The second trial exposure is slightly overexposed. What kVp setting should you choose for the third trial exposure?

_____ kVp

h. The third trial exposure is optimum in density. Fill out the chart (on the next page) with the settings for this view and thickness.

i. The first trial exposure of the lateral view is also overexposed. What kVp setting should you choose for the second trial exposure?

_____ kVp

j. The second trial exposure is slightly underexposed. What kVp setting should you choose for the third trial exposure?

_____ kVp

k. The third trial exposure is optimum in density. Fill out the chart (on the next page) with the settings for this view and thickness.

l. Continue to fill in the chart (on the next page) according to the principles indicated in the chapter.

EXERCISE 16.14 CASE STUDY #2: MINIMIZING RADIATION EXPOSURE

Your first job following graduation is as a veterinary technician in a small-animal practice. This is a busy multiple doctor practice and you are responsible for acquiring approximately 10 to 15 sets of x-rays a day. As any good technician, you are concerned about your safety and are eager to follow protection practices to minimize your exposure to ALARA (as low as reasonably achievable). While in school you had committed them to memory, and so want to recall these practices in anticipation of minimizing your risk. Review the practices as they relate to each of the following areas.

a. Collimation

b. Use of the technique chart

c. Patient positioning

d. Exposure to the primary beam

e. Use of protective equipment

f. Use of accessory equipment to position the patient

g. Use of chemical restraint

h. Restrictions on personnel involved in the procedure

i. Positioning your body while restraining the patient to limit exposure

CANINE or **FELINE** *Kodak Lanex Medium Rare Earth Screens and T MAT L Film*	**ABDOMEN** _____ mA _____ ms _____ mAs **GRID: YES**	
	kVp	
CM Thickness	**VD**	**LAT**
8		
9		
10		
11		
12		
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EXERCISE 16.12 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. In addition to the required information that is imprinted on an x-ray film or that is part of a digital file, other markers are used to identify orientation of the body part, as well as for other purposes. Briefly indicate the specific way each of the following markers is used.

   a. "R" and "L" markers: _____

   b. Mitchell markers: _____

   c. Timing markers: _____

   d. Front-leg/hind-leg markers: _____

2. There are four x-ray film labeling systems that can be used to imprint the identification information on a finished film-based radiograph.

   a. Briefly describe each system.

      i. _____

      ii. _____

      iii. _____

      iv. _____

   b. How are digital films identified?

3. The heel effect can be used to the radiographer's advantage when imaging certain body parts. What is the heel effect, and how can it be used to one's advantage?

4. What are the two best ways for the technician to decrease exposure from scatter radiation?

   i. _____

   ii. _____

5. Summarize the difference between a computed radiography (CR) system and digital radiography (DR) system in the way each captures an image.

6. Both exposure time and milliamperage (mA) settings affect the number of x-rays produced, so the number of x-rays produced is proportional to the mAs (the product between these values). When setting the machine, it is always best to choose the highest mA setting possible, and the lowest exposure time possible. Why is this?

7. What is the reason that a technique chart should always be used?

8. A technique chart is formulated by taking a series of trial-and-error exposures, and determining the best kV, mA, and time settings for each anatomic area, and tissue thickness. Before taking the trial exposures, a number of factors must be standardized.

   a. What are the factors that must be standardized?

   b. Why must they be standardized?

9. Cassettes must be well cared for, or they can be damaged in a number of ways. If the cassette is dropped or the hinges are damaged, what two problems may result?

   i. _____

   ii. _____

10. The use of intensifying screens dramatically decreases the amount of radiation needed to produce a diagnostic quality film. Why is this?

11. Intensifying screens must be cleaned on a regular basis, and at least monthly. What products should be used to clean screens?

12. Review some of the advantages of rare earth screens as compared with calcium tungstate screens in each of the following areas: (a) exposure time needed, (b) wear and tear on the tube, and (c) patient and operator exposure.

    a. _____

    b. _____

    c. _____

13. Why should patients receiving nonscreen film exposures be anesthetized, and why should no personnel be in the room?

14. What is the difference between a parallel grid and focused grid?

15. An x-ray darkroom does not need to be kept totally dark if a safelight is used. What is a safelight and how does it protect the film from light exposure?

16. Describe the special physical characteristics of a darkroom, including the appropriate size, layout, and general construction, including the door.

    a. The approximate size: _____

    b. The layout: _____

    c. General construction: _____

17. Magnification is a technique used in veterinary teaching hospitals for studies of extremities in small dogs and cats and for skull studies. How is this procedure done?

18. The tissues most affected by ionizing radiation include skin, lymphatics, blood-forming tissues, thyroid, bone growth centers, and gonads. What characteristic do all these tissues have in common that makes them sensitive to ionizing radiation?

19. The x-ray beam is a composite of x-rays of various energy levels. The kVp setting is the highest energy level within the beam, but the beam also contains lower-energy x-rays. The useful portion of the x-ray beam is the upper two-thirds of the energy spectrum. The lower one-third of the energy spectrum is called "soft radiation." What is the danger associated with soft radiation and how is it controlled?

20. A film badge is a monitoring device used to monitor occupational exposure to x-radiation. Where should it be worn?

21. Proper positioning is essential to obtain quality diagnostic radiographs.

    a. How many views should be taken of any area of interest unless told otherwise?

    b. List two exceptions to this rule.

       i. _____

       ii. _____

    c. Why should the x-ray beam be positioned over the lesion if the location is known?

    d. Under what circumstances might it be necessary to acquire two lateral views and two ventrodorsal views of the abdomen?

    e. List two reasons that proper restraint is important when acquiring diagnostic radiographs.

       i. _____

       ii. _____

22. Some body areas, like the GI and urogenital tracts, don't have enough natural contrast to make a diagnosis with plain radiographs. Briefly explain how contrast agents are used to help diagnose disease by describing specifically the effect that positive and negative agents have on the appearance of a finished radiograph.

23. Contrast cystography is a technique used to diagnose a variety of bladder diseases.

    a. What specific condition(s) is(are) positive-contrast cystography used to detect?

    b. What contrast agent is used to perform this procedure?

    c. Now give the same information for double-contrast cystography.

24. List the three characteristics of sound waves and indicate the mathematical relationship that integrates these characteristics.

    i.

    ii.

    iii.

25. Real-time grayscale ultrasonography is based on the "pulse-echo" principle. Short pulses 2 to 3 cycles long are emitted from the transducer. Some of this sound echoes off an echogenic surface, is detected by the transducer, and assembled into an image.

    a. What characteristic of the reflected sound determines the brightness of the returning echoes?

    b. What characteristic of the reflected sound determines the position of the echoes on the screen?

26. Briefly review the procedure used to prepare the patient's skin for an ultrasound examination.

27. What is the time-gain compensation (TGC) control on an ultrasound machine used for?

28. There are many indications for alternative imaging techniques like ultrasonography, diagnostic nuclear medicine, computed tomography, and magnetic resonance imaging. Summarize the main indications for each of these imaging modalities.

    Ultrasonography:

    Diagnostic nuclear medicine:

    Computed tomography:

    Magnetic resonance imaging:

29. When taking part in nuclear medicine imaging examinations and treatments, precautions must be taken to prevent exposure to radiation from a patient that has just had a procedure done. Briefly review the precautions that must be taken when hospitalizing animals after nuclear medicine examinations, including housing requirements, the length of time the animal must be held, and procedures for handling eliminations.

30. Why must a patient undergoing a computed tomography scan be anesthetized?

31. Why must personnel taking part in MRI exams not have a pacemaker or hearing aid?

32. Why are patients undergoing MRI examinations often anesthetized with injectable anesthetic protocols instead of inhalant protocols?

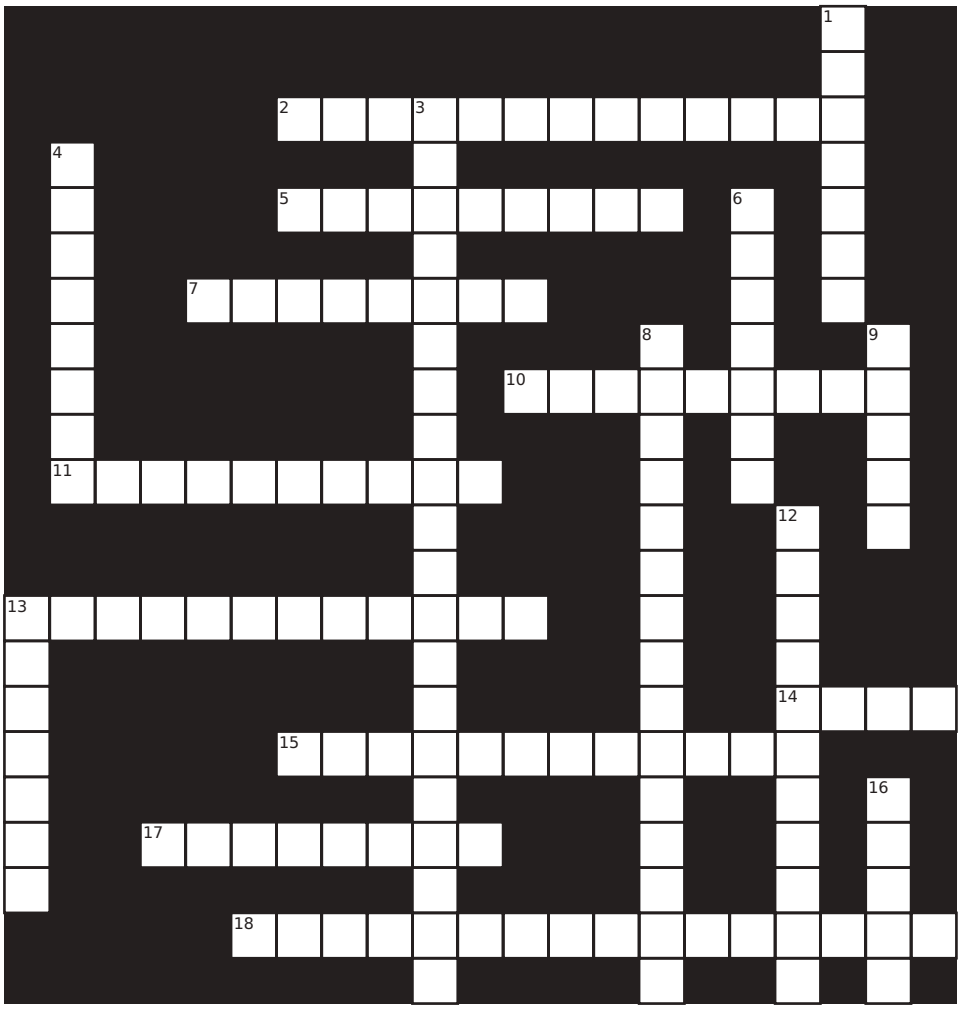
17 Basic Necropsy Procedures

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all Key Terms in the chapter.
2. List the indications for a necropsy.
3. Explain how to prepare for a necropsy, including record keeping and handling of the body.
4. Describe the techniques used to preserve tissues, including specific uses for various tissue fixatives.
5. Describe the facilities, instruments, and supplies needed to perform a necropsy, including protective clothing.
6. Do the following regarding collection of specimens and shipping procedures:
   - Explain the collection techniques and shipping procedures for microbiologic, parasitologic, toxicologic, and cytologic specimens.
   - Explain the special procedures used and precautions observed when performing a necropsy on a rabies suspect.
7. Do the following regarding the necropsy procedure for a small mammal:
   - Describe the procedures used to collect tissues for histologic examination.
   - Explain the principles of tissue dissection, including external examination of the carcass.
   - Describe the initial steps of a necropsy dissection, including reflection of the skin and limbs, and examination of superficial organs and body cavities.
   - Describe the steps for dissection and examination of the skull and brain, neck and thoracic viscera, abdominal cavity, genitourinary tract, intestinal tract, vertebral column, and spinal cord.
8. Do the following regarding necropsy variations:
   - Describe variations in the necropsy procedure specific to ruminants, horses, and pigs, as well as to fetuses and placental tissues.
   - Explain the differences between a complete necropsy and a cosmetic necropsy.
   - Explain the role of the technician in prion disease surveillance.

EXERCISE 17.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

2 The spinal cord exits the skull here. (2 words)
5 Contraction of the _____ causes air to be drawn into the lungs.
7 This structure is located between the stomach and the jejunum.
10 The master gland.
11 The _____ becomes diseased in cardiomyopathy.
13 You must be careful to avoid this structure when giving an IM inection in the rear limb. (2 words)
14 The second cervical vertebra.
15 All parts of the ruminant stomach except for the abomasum.
17 Membranes between the brain and calvarium.
18 The tricuspid valve is an _____ valve.

Down

1 Attachment sites within the hoof.
3 Collective term for the bones of the appendages. (2 words)
4 A cow's true stomach.
6 Part of the mesentery.
8 Takes deoxygenated blood to the lungs. (2 words)
9 The _____ bones have to be cut to remove the tongue and larynx.
12 Contains the trachea, esophagus, and heart inside the chest.
13 Attaches to the ventral aspect of the ribs.
16 A neck bone that is one half of the atlantooccipital joint.

EXERCISE 17.2 DEFINITIONS: KEY TERMS

Instructions: Define each term in your own words.

1. Necropsy _____

2. Prosector _____

3. Pathology _____

4. Gross pathology _____

5. Histopathology _____

6. Pathogenesis _____

7. Lesions _____

8. Autolysis _____

9. In situ _____

10. Hydronephrosis _____

EXERCISE 17.3 MATCHING: INSTRUMENTS AND SUPPLIES USED FOR A NECROPSY

Instructions: Match each instrument or supply in column A with its corresponding use in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Stryker saw
2. _____ Pruning shears
3. _____ String
4. _____ Tissue cassettes
5. _____ Clip-on laundry tags
6. _____ Screw-top plastic containers containing formalin
7. _____ Sealable, plastic bags and plastic vials
8. _____ Meat cutter's band saw

Column B

A. To hold small tissues
B. To hold refrigerated and frozen samples
C. To cut ribs
D. To hold tissues for histopathology
E. To close off bowel ends
F. To remove the brain
G. To remove the spinal cord in a horse
H. To identify tissues

EXERCISE 17.4 ORDERING: PERFORMING A NECROPSY

Instructions: To perform a complete necropsy, 36 steps must be followed that can be grouped in the following categories:

1. *Examination of external and superficial structures*
2. *Examination of the body cavities*
3. *Examination of the head and CNS*
4. *Examination of the thoracic viscera*
5. *Examination of the abdominal viscera*
6. *Final steps*

Within each category, place the steps of performing a complete necropsy in the proper order from first to last by placing the appropriate number (1, 2, 3, etc.) in the space provided.

1. Examination of external and superficial structures *(steps 1 through 7)*

A. _____ Dissect and examine, section, and collect skin, lymph nodes, salivary glands, and testes or mammary glands.

B. _____ Remove the eyes.

C. _____ Dissect and examine, section, and collect the synovium, skeletal muscle, sciatic nerve, and bone marrow.

D. _____ Make a midline skin incision, reflect the limbs and extend the incision rostrally to the mandibular symphysis and caudally to the perineum.

E. _____ Weigh the animal.

F. _____ Open the coxofemoral, stifle, and scapulohumeral joints.

G. _____ Perform an external examination.

2. Examination of the body cavities *(steps 8 through 13)*

A. _____ Dissect and examine, section, and collect thyroid, parathyroids, and adrenal glands.

B. _____ Examine organs and vascular structures.

C. _____ Remove the tongue from the oral cavity, and reflect the tongue, tonsils, larynx, and esophagus caudally.

D. _____ Open the chest by cutting the ribs.

E. _____ Open the abdomen on the midline and puncture the diaphragm.

F. _____ Open the pericardium.

3. Examination of the head and CNS *(steps 14 through 19)*

A. _____ Transect the cranial nerves, and remove the brain and the pituitary gland.

B. _____ Cut the spinal cord and vertebral column at atlantooccipital joint.

C. _____ Section the head longitudinally and examine nasal and oral cavities.

D. _____ Cut the calvaria and remove the caudal-dorsal portion of the calvaria and dorsal meninges.

E. _____ Open the tympanic bullae.

F. _____ Remove skin and muscle from calvaria.

4. Examination of the thoracic viscera *(steps 20 through 24)*

A. _____ Section the lungs saving one section from each lobe.

B. _____ Remove the tongue, tonsils, esophagus, trachea, lungs, heart, and thoracic aorta as a unit.

C. _____ Serially section the tongue.

D. _____ Examine, weigh, and collect sections of the heart.

E. _____ Open the esophagus and trachea.

5. Examination of the abdominal viscera *(steps 25 through 31)*

A. _____ Serial section the spleen.
B. _____ Weigh, section, and collect samples from the liver.
C. _____ Remove the distal duodenum, jejunum, ileum, colon, and mesenteric lymph nodes as a unit.
D. _____ Open the gallbladder and collect samples from the stomach, duodenum, and pancreas.
E. _____ Open the stomach and duodenum.
F. _____ Express the gallbladder.
G. _____ Remove the liver, duodenum, pancreas, stomach, and spleen as a unit.

6. Final steps *(steps 32 through 36)*

A. _____ Remove the spinal cord if necessary.
B. _____ Remove the floor of pelvis.
C. _____ Dissect and examine, section, and collect the small intestine, colon, and mesenteric lymph nodes.
D. _____ Dissect and examine, section, and collect tissues from all parts of the urogenital system.
E. _____ Dissect and examine, section, and collect tissues from the rectum, anal glands, and abdominal aorta.

EXERCISE 17.5 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ A body may either be frozen or refrigerated between death and the necropsy to prevent degeneration of tissues.
2. _____ 10% buffered formalin is a carcinogen and so should not contact skin.
3. _____ Tissues, fluids, and stomach contents that are being tested for toxins may be frozen.
4. _____ When sending in tissues for histopathologic examination, the excess formalin in the bottle should never be removed until the tissues arrive at the lab or tissue artifacts will result.
5. _____ Formalin-fixed material should be refrigerated, then kept on ice until arrival at the lab.
6. _____ When performing a necropsy on a dog, cat, horse, or cow, the patient should be placed in right lateral recumbency.
7. _____ Unlike other soft tissues, the brain should not be sectioned until it is thoroughly fixed.
8. _____ The heart is removed from the thoracic cavity separately from the lungs and other viscera.
9. _____ Fluid content of the lungs can be assessed by gently squeezing them.
10. _____ After removing but before slicing each kidney, the capsule should be peeled off.
11. _____ As with other animals, a fetus should be placed in left lateral recumbency.
12. _____ Birds have only a left ovary.
13. _____ The lungs should be inflated with formalin before the lungs and heart are removed from the thorax in small rodents (mice, hamsters, and gerbils).
14. _____ Sample collection for prion diseases is sometimes necessary in any large animal.
15. _____ Transmissible spongiform encephalopathies (TSE) are caused by abnormal prions.

EXERCISE 17.6 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. When preserving most tissues for histopathology, which of the following fixatives should be used?
   a. 10% buffered formalin, with a fixative to tissue ratio of 10:1 by volume
   b. 50% buffered formalin with a fixative to tissue ratio of 10:1 by volume
   c. 10% buffered formalin with a fixative to tissue ratio of 1:10 by volume
   d. 50% buffered formalin with a fixative to tissue ratio of 1:10 by volume

2. 10% buffered formalin is made by mixing dibasic anhydrous sodium phosphate and monobasic sodium phosphate with
   a. Three parts water and one part 37% to 40% formaldehyde solution
   b. Nine parts 50% formalin and one part 37% to 40% formaldehyde solution
   c. Nine parts water and one part 37% to 40% formaldehyde solution
   d. One part 50% formalin and nine parts 37% to 40% formaldehyde solution

3. 50% formalin is made by mixing
   a. One part water and one part 37% to 40% formaldehyde solution
   b. One part 10% formalin and one part 37% to 40% formaldehyde solution
   c. One part water and one part 10% formalin
   d. One part 10% formalin and five parts 37% to 40% formaldehyde solution

4. Some tissues should be preserved in Bouin fixative, because it produces less tissue shrinkage and better preservation of cellular detail. Which of the following tissues should be preserved in Bouin fixative?
   a. Brain
   b. Liver
   c. Eyes
   d. Lung

5. To avoid decomposition, a complete necropsy should begin with dissection of the
   a. Lungs
   b. Liver
   c. Brain
   d. Eyes

6. Once removed, the interior of the eye can be examined by immersion in
   a. Alcohol
   b. Bouin fixative
   c. Cool water
   d. 10% formalin

7. When performing a complete necropsy on a dog or cat, some joints should be routinely opened and examined. Which of the following joints should be examined in this way?
   a. Stifle joint
   b. Elbow joint
   c. Carpal joints
   d. Metacarpal–phalangeal joints

8. A "Stryker saw" is typically used to
   a. Cut the ribs
   b. Open the joints
   c. Open the calvaria
   d. Cut the hyoid bones

9. When examining the spinal cord, a dorsal laminectomy must be performed by cutting the laminae of each vertebra with bone shears or a Stryker saw. Which cervical vertebrae are more difficult to cut than the others?
   a. The sixth and seventh
   b. The first and last
   c. The fourth and fifth
   d. The first and second

10. When performing a necropsy on very small birds such as hummingbirds and finches
    a. The same technique should be used as with other birds
    b. The entire body should be put in a formalin jar undissected
    c. The body cavities should be opened before placing the body in the formalin jar
    d. The body should be sectioned into two halves before fixing it

11. In very small mammals, such as mice, hamsters, and gerbils, the
    a. Entire vertebral canal with the spinal cord inside should be removed
    b. Spinal cord should be removed as for a dog or cat
    c. Spinal cord should be removed from the vertebral canal after the vertebral column is separated form the rest of the body
    d. Spinal cord should be removed by performing a dorsal laminectomy

12. A cosmetic necropsy is appropriate
    a. As an alternative to a complete necropsy
    b. When the disease is limited to the abdomen and chest
    c. When the cause of death is known before beginning
    d. When tissues do not need to be collected

13. Samples for prion disease surveillance should be
    a. Fixed in Bouin fixative
    b. Frozen
    c. Refrigerated
    d. Fixed in formalin

14. Prions are classified as
    a. Viruses
    b. Bacteria
    c. Proteins
    d. Parasites

15. A transmissible spongiform encephalopathy of sheep is
    a. Chronic wasting disease
    b. Scrapie
    c. BSE
    d. Creutzfeldt–Jakob disease

EXERCISE 17.7 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. It is important to perform a necropsy as soon as possible after death to avoid _____.
2. The fixative 50% formalin is specifically used for the following tissues: (a) _____, (b) _____ _____, and (c) _____.
3. Tissues for virus isolation must be collected aseptically to prevent contamination and either refrigerated in a sterile container or immersed in sterile _____ buffered _____ and preserved by freezing, although fresh, refrigerated tissue immersed in _____ _____ medium is the preferred method of tissue submission.
4. Paired organs can be cut on different planes to distinguish them. When harvesting tissue from the kidneys, to differentiate one from the other, the left kidney should be cut _____ and the right one should be cut _____.
5. Organs removed during a necropsy should be measured and/or weighed if they have an abnormal _____ or _____.
6. To free the tongue, larynx, pharynx, trachea, and esophagus, the _____ bones must be cut.
7. Patency of the bile duct can be determined by squeezing the _____.
8. The ureters should be opened and examined if they or the renal pelvis is _____.
9. Ruminoreticular contents should be examined for _____ objects and undesirable _____ material.
10. When performing a necropsy in a horse and dissecting the head and neck, special attention should be given to the _____ _____ and the _____ veins.
11. Because enteric diseases occur frequently in pigs, attention should be focused on the _____ system.
12. The gestational age of a large-animal fetus can be estimated by _____ or _____ it.

EXERCISE 17.8 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 17.9 CASE STUDY: PERFORMING A NECROPSY ON A RABIES SUSPECT

Signalment: 8-year-old, castrated, male Labrador Retriever mix

History: Acute onset of progressive neurologic disease (seizures, ataxia, cranial nerve abnormalities, and a change in behavior) and an elevated body temperature. The patient had not seen a veterinarian in the 2 years prior to admission, and the routine vaccinations, including the rabies vaccination, were 6 months overdue.

A basic diagnostic work-up (blood work, parasite screen, urinalysis, and x-rays) did not reveal a cause of the neurologic illness. Over the next few days, despite supportive treatment, the neurologic signs continued to progress. Three days after presentation, in view of the severity of the condition and the significant expense that would be necessary to continue with the work-up and treatment, the owners elected euthanasia and requested a necropsy. Although this patient had no known exposure to a potentially rabid animal, and a number of other differentials were being considered, infection with rabies virus could not be ruled out.

When performing a necropsy on a rabies suspect such as this patient, precautions must be taken by the prosector. Answer the following questions about the precautions you would take if involved in the necropsy of this patient.

1. Should restrictions be placed on which hospital personnel are permitted to handle this patient antemortem, handle the body postmortem, and participate in the necropsy? If so, what are they?

2. It is decided that you meet the criteria to assist the doctor with the necropsy. What protective equipment should you use to minimize the risk of transmission?

3. What tissue or other sample is needed to test this patient for rabies, and how is it harvested?

4. How should the tissue sample be prepared and stored between harvesting and transport to the lab?

5. How should the carcass be handled after completion of the necropsy?

6. How should the table, instruments, and other equipment be cleaned?

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EXERCISE 17.8 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. Necropsies are performed to determine why an animal died and for several other reasons. What unique value does a necropsy have for lab animal facilities, farms, and multiple-animal households?

2. Autolysis will occur more quickly following death in obese animals and in ruminants. Why is this the case?

3. When describing lesions, the location, size, and shape of the lesion should be noted along with a number of other characteristics. Findings should be reported in such a way to describe lesions as opposed to drawing conclusions about them.

   a. Other than location, size, and shape, what other characteristics of lesions should be recorded?

   b. What is wrong with the following entry in a necropsy report? "Numerous subcutaneous lipomas noted on the trunk, and siderotic plaques present on the spleen."

4. When performing a necropsy, it is important to prevent contamination of the tissues. When collecting samples for microbiologic culture from a tissue that is contaminated on the surface, what procedure can be used to obtain a noncontaminated sample?

5. When collecting intestine, describe a procedure used to prevent excessive contamination of the outer surface by the internal contents.

6. Tissues fixed for histopathologic examination become rigid. If fixing some tissues such as nerves or a section of skin, that may curl or distort, what procedure can be used to keep the tissue flat?

7. Explain why it is preferable to dissect each organ as it is removed from the body as opposed to removing all the organs and dissecting them later.

8. Before performing an examination of the thoracic cavity, the diaphragm should be punctured. Why is this?

9. Why should ruminants be positioned in left lateral recumbency? How does this make the prosection easier?

10. When performing a necropsy on a ruminant, the mammary gland should be undermined from the body wall, and retracted, but the perineal skin should be left intact. What is the reason for this?

11. In ruminants, because of the size of the chest cavity, the thoracic contents are removed differently than in a small animal. Describe the technique used in these patients.

12. Birds suspected of having infectious or zoonotic diseases such as psittacosis should be submitted to a diagnostic laboratory for necropsy.

    a. Why is this?

    b. Explain how a bird carcass can be handled to decrease the risk of spread of infectious agents.

13. When performing a necropsy, the prosector should wear protective clothing. Briefly discuss the necessary protective equipment.

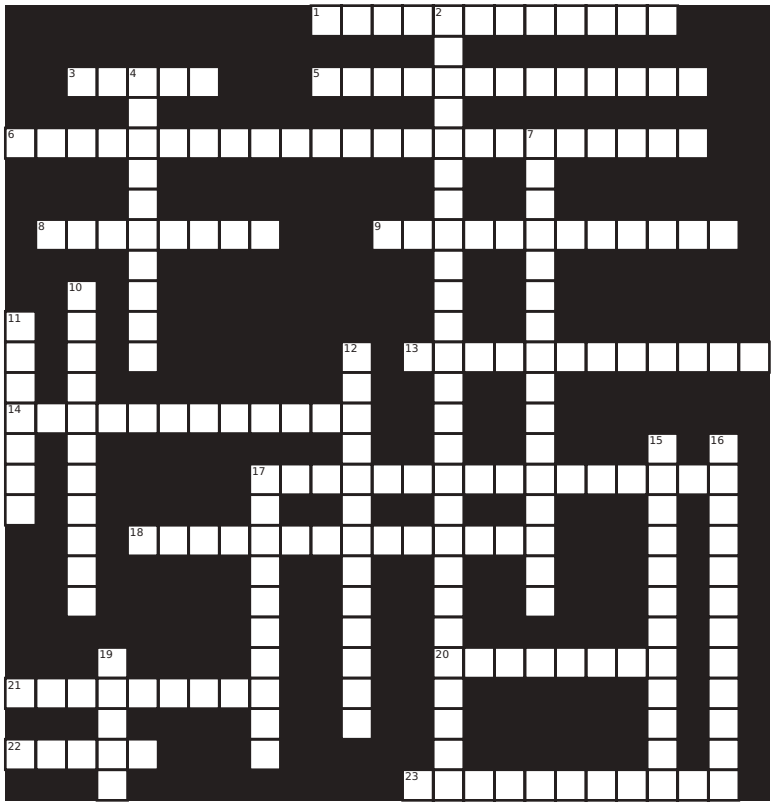
18 Diagnostic Sampling and Therapeutic Techniques

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell each of the Key Terms in this chapter.
2. List and describe general guidelines for the collection of samples for laboratory testing, and do the following regarding the administration of medication in the small animal:
   - Describe indications and methods for administration of medication to cats and dogs using each of the following approaches: oral, orogastric, transdermal, ophthalmic, aural, intrarectal, intranasal, intradermal, subcutaneous, intramuscular, intravenous, intratracheal, intraosseous, and intraperitoneal.
   - Compare and contrast placement of IV catheters in the peripheral and jugular veins in cats and dogs. Describe the specific steps to carry out placement of through-the-needle (TTN), over-the-needle (OTN), and multi-lumen catheters.
3. Compare and contrast the patient's preparation, positioning, and procedures for blood collection using venipuncture and arterial blood sampling techniques.
4. List and describe procedures for collection of urine samples in cats and dogs. Provide advantages and limitations of each method.
5. Describe the indications, materials needed, and procedures for performing fecal sample collection, thoracocentesis, and abdominocentesis.
6. Describe diagnostic peritoneal lavage (DPL) and list its indications and contraindications. Compare and contrast percutaneous and endotracheal lavage techniques.
7. Define arthrocentesis and list indications for performing it in the cat or the dog. List materials needed, and explain the procedure.
8. Explain the procedure of collecting bone marrow aspirate samples. List indications, contraindications, and potential complications. Compare and contrast the procedure if the sample is obtained from the ilium, humerus, or femur, and explain how the procedure of fine-needle aspiration differs.
9. Describe the methods of orally administering medication to large animal species.
10. Compare and contrast the procedures for administering large volumes of medication via nasogastric tubes in the horse and orogastric tubes in ruminants and swine.
11. Do the following regarding intravenous administration of medication in the large animal:
    - Describe the procedure for intravenous administration of medications in the horse using the jugular vein, intravenous catheterization, the cephalic vein, and the lateral thoracic vein.
    - List indications for use of specific veins for intravenous administration of medication in ruminants and swine.
    - Compare and contrast the materials needed and procedures for placing IV catheters in camelids and food animal species.
12. List possible sites of intramuscular administration for each large animal species, and describe limitations and contraindications if food animal species.
13. Compare and contrast the methods used for administration of medication to horses and food animal species using each of the following approaches: subcutaneous, intradermal, intraperitoneal, intranasal, intramammary (cows only), ophthalmic, epidural, transdermal, intrasynovial, and rectal.
14. Compare and contrast venous and arterial blood collection techniques in equine, camelid, and food animal species.
15. List and describe procedures for collection of urine and fecal samples in equine, camelid, and food animal species. List advantages and limitations of each method.
16. Describe procedures for collection and evaluation of milk samples from dairy animals.
17. Describe procedures for collection of rumen fluid in large animals.
18. Describe the indications, materials needed and procedures for performing a thoracocentesis, transtracheal wash, bronchoalveolar lavage, abdominocentesis, and cerebrospinal fluid collection in equine, camelids, and food animal species.

EXERCISE 18.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

1 Application of 70% isopropyl alcohol to a venipuncture site results in improved visualization of the vein because it causes this.
3 Low-profile gastrostomy tubes are made of silicone and cause less irritation of the _____ when compared with traditional latex gastrostomy tubes.
5 When this occurs with certain intravenous chemotherapeutic drugs, as much of the drug should be removed from the site as possible by aspirating 5 mL of blood back through the catheter.
6 An in vitro technique used to rapidly synthesize large quantities of a given DNA segment. (3 words)
8 Improper compression of the vein following venipuncture may cause this complication.
9 This type of catheter can be placed in the femur.
13 An increased number of white blood cells.
14 Passing through the skin.
17 A decrease in circulating platelets.
18 A common site for this procedure to be performed is the carpal joint.
20 Prolonged loss of appetite.
21 Forcibly ejecting collected blood through the syringe needle into the collection tube can cause this sample artifact.
22 Passage of an orogastric tube into this organ allows for sample collection of fluid that is then analyzed for diagnosis of diseases of the forestomachs.
23 In a patient with this white blood count abnormality, a bone marrow aspirate is indicated.

Down

2 Infusion of isotonic fluids into the abdomen for the express purpose of retrieval of the fluid for diagnostic fluid analysis. (3 words)
4 The concentration of osmotically active particles in a solution.
7 A potential complication of this procedure is abdominal pain and distention.
10 The act of surgically making an opening in the abdominal wall and into the stomach, usually for the placement of a feeding tube.
11 Performing this action during a transtracheal wash will help loosen mucus and encourage the animal cough, thereby enhancing sample collection.
12 Although a common procedure in small animals, this urine collection technique is not performed in most large animals.
15 Often a cause of leukocytosis.
16 An overall decrease in red blood cells, white blood cells, and platelets.
17 Potential complication of an indwelling intravenous catheter involving a blood clot obstructing flow, which is characterized by a vein that “stands up” without being held off.
19 This self-retaining catheter is an ideal choice for urinary catheterization of mares.

EXERCISE 18.2 MATCHING #1: INDICATIONS FOR CLINICAL PROCEDURES

Instructions: Match each clinical procedure in column A with its corresponding indication in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Cystocentesis
2. _____ Thoracocentesis
3. _____ Milk sample collection
4. _____ Abdominocentesis
5. _____ Epidural
6. _____ Bone marrow aspirate
7. _____ Arthrocentesis
8. _____ Fine-needle aspiration
9. _____ Bronchoalveolar lavage
10. _____ Cerebrospinal fluid tap

Column B

A. Analgesia
B. Chronic productive cough
C. Skin mass
D. Seizure
E. Mastitis
F. Lameness
G. Pleural effusion
H. Hematuria
I. Ascites
J. Pancytopenia

EXERCISE 18.3 – MATCHING #2: SUPPLIES FOR CLINICAL PROCEDURES

Instructions: Match each clinical procedure in column A with the corresponding list of supplies in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Fine-needle aspiration
2. _____ Transtracheal wash
3. _____ Abdominocentesis
4. _____ Sterile milk collection

Column B

A. 16-gauge catheter, 3.5-French polypropylene urinary catheter, 20-mL syringe filled with sterile saline
B. Teat cannula, scalpel blade
C. Clean hands, culture collection tubes
D. 3-cc syringe with a 22-gauge needle, microscope slides

EXERCISE 18.4 MATCHING #3: URINE COLLECTION IN LARGE ANIMALS

Instructions: Match each large animal species in column A with the corresponding technique used to collect urine by free-catch in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Horse
2. _____ Male Pig
3. _____ Cow
4. _____ Alpaca
5. _____ Female Goat

Column B

A. Wait for the animal to rise after a period of recumbency.
B. Take animal to the dung pile.
C. Stroke prepuce with soft brush.
D. Stroke the skin beneath the vulva.
E. Place fresh bedding in the stall.

EXERCISE 18.5 MATCHING #4: SITES FOR SUBCUTANEOUS INJECTION

Instructions: Match each species in column A with its corresponding site for subcutaneous injection of medication in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ Dog	A. Base of ear
2. _____ Pig	B. Behind the elbow
3. _____ Goat	C. Base of neck
4. _____ Horse	D. Axillary region
5. _____ Cow	E. Lateral hip

EXERCISE 18.6 TABLE #1: ROUTES OF MEDICATION ADMINISTRATION IN SMALL ANIMALS

Instructions: For each route of medication administration in the left column, indicate an associated important potential complication and the action you should take to prevent it.

Route of Medication Administration in the Small-Animal Patient	Important Potential Complication	Actions Taken to *Prevent* the Complication
Oral administration of liquid suspension		
Oral administration of a capsule		
Intramuscular injection		
Administration of topical ophthalmic ointment		
Intravenous administration of a chemotherapeutic agent		

EXERCISE 18.7 TABLE #2: OROGASTRIC TUBE PLACEMENT

Instructions: Regarding orogastric tube placement in either dogs or cattle, give a rationale or reason for each of the procedural steps listed below.

Procedural Step	Rationale
Measure the selected tube against the patient from the tip of the nose to the 13th rib or end of the rib cage. Mark this measurement on the tube.	
Coat the tip of the tube with a water-soluble gel.	
Place a mouth gag or speculum in the patient's mouth.	
Advance the tube into the esophagus. If coughing is heard, stop and withdraw the tube.	
Palpate for "two separate tubes" in the ventral cervical neck area.	
After the fluid has been administered, kink the tube to occlude it and withdraw the tube in a downward direction.	

EXERCISE 18.8 TABLE #3: CATHETERIZATION OF A PERIPHERAL VEIN

Instructions: Read the following instructions for peripheral vein catheterization in the small-animal patient. Circle all incorrect steps and write in the corrected procedural step in the space provided. Then in the space provided, enter the number of each incorrect step you circled and describe the complications that could arise if the procedural step was performed as written.

1. Generously clip the fur from the area.	
2. Spray alcohol once over the area.	
3. Have assistant apply digital pressure proximal to the insertion site.	
4. Extend the leg to visualize the vein.	
5. Use your thumb to stabilize the vein.	
6. With the bevel up, insert the stylet and catheter through the skin at a 45-degree angle.	
7. Advance the catheter into the vessel.	
8. When a flash of blood is seen, advance the stylet and catheter fully into the vessel lumen.	
9. Advance the catheter off the stylet into the vessel lumen.	
10. Cap the catheter with a T-set or injection cap and flush with heparinized saline.	
11. Secure the catheter to the leg with white tape.	
12. Wrap roll gauze around the leg proximally and distally to the insertion site and affix to the leg with white tape.	
13. Make sure the entire bandage is very tight around the leg.	

Step #	Complication

EXERCISE 18.9 TABLE #4: ARTERIAL BLOOD SAMPLE COLLECTION

Instructions: Read the following protocol for arterial blood sample collection in the small- or large-animal patient using a regular needle and syringe. Circle all incorrect steps and write in the corrected procedural step in the space provided. Then in the space provided below the table, enter the number of each incorrect step you circled and describe the patient complication or erroneous blood gas analysis result(s) that could arise if the procedural step was performed as written.

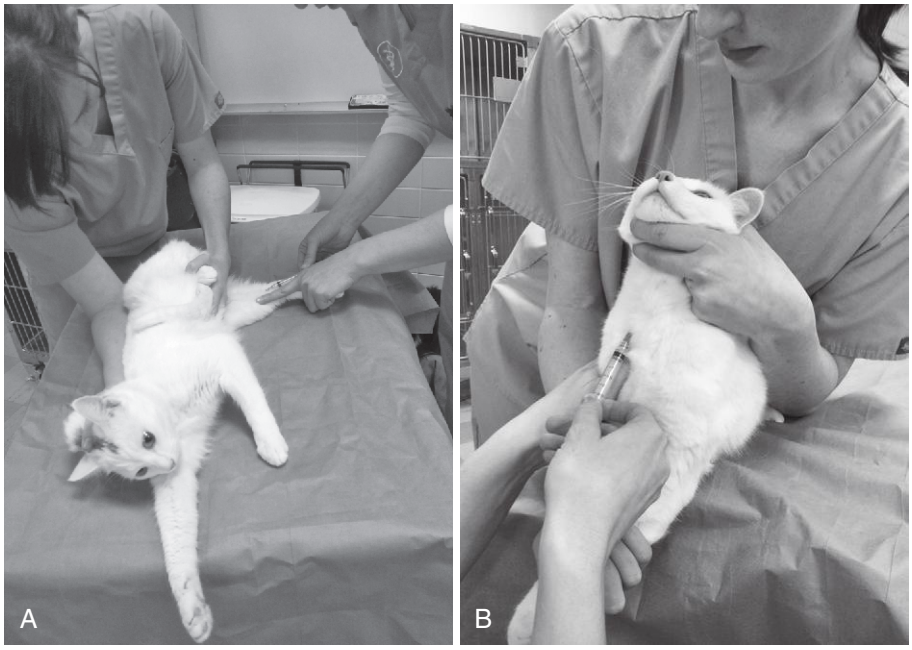
1. Choose a site and locate the artery by palpating the pulse.	
2. Clean the site using the appropriate aseptic technique.	
3. Attach an appropriate-sized needle to a syringe and draw a small amount of heparin into the syringe. Expel this small amount of heparin from the syringe into the needle.	
4. Occlude the artery.	
5. Insert the needle into the artery and firmly pull back on the syringe plunger multiple times to aspirate blood into the syringe.	
6. Withdraw the needle and have the assistant hold off on the puncture site for 20 to 30 seconds.	
7. Expel any air bubbles from the syringe and replace the needle cap onto the needle.	
8. Roll the syringe between your hands to distribute the anticoagulant throughout the sample.	
9. Immediately perform blood gas analysis.	

Step #	Complication

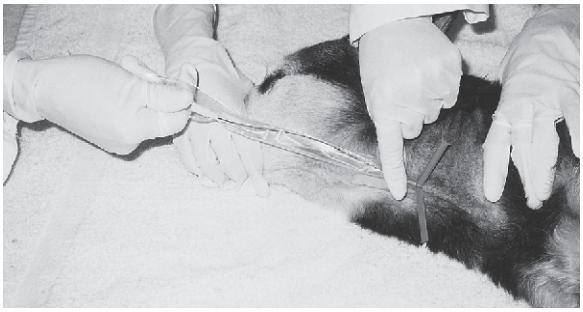
EXERCISE 18.10 PHOTO QUIZ #1: DIAGNOSTIC SAMPLING AND THERAPEUTIC TECHNIQUES

Instructions: Name the procedure being performed in each photo.

1. _____

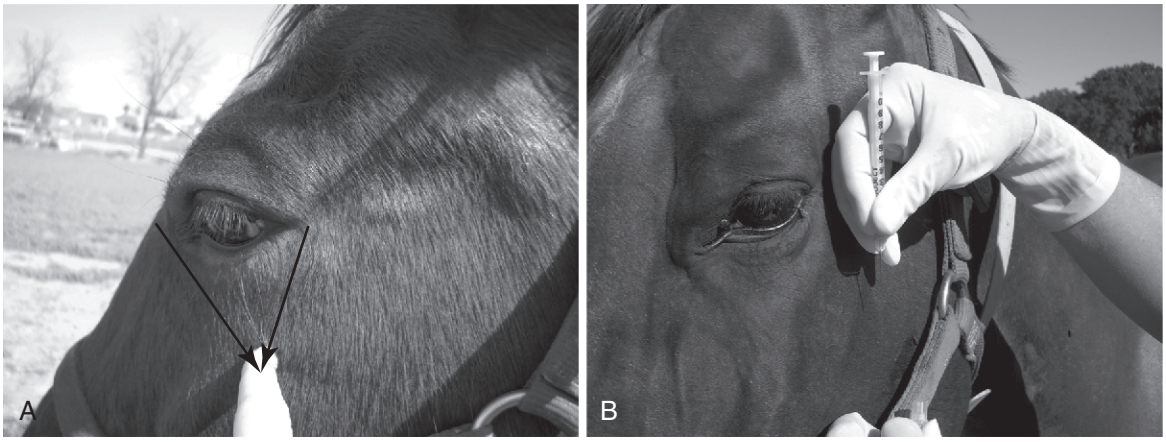


2. _____



3. _____

4. _____

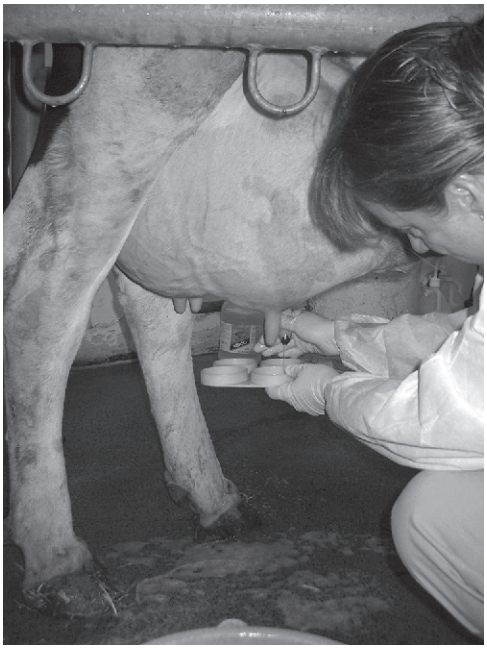


5. _____

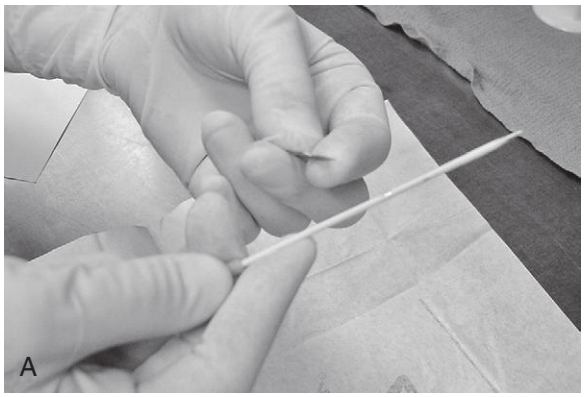
6. _____

7. _____

8. _____



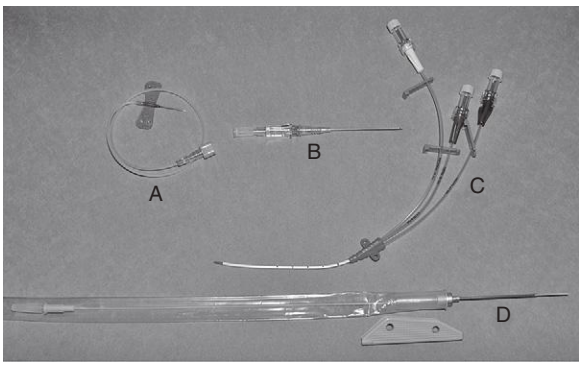
9. _____



10. _____

EXERCISE 18.11 PHOTO QUIZ #2: INTRAVENOUS CATHETERS

Instructions: Answer the following questions by writing the appropriate letter in the space provided. (Note that each letter will be used only once.)



1. _____ Which IV catheter can be used to administer multiple, yet separate, infusions?

2. _____ Which IV catheter is commonly used for a quick, one-time administration of medication?

3. _____ Which IV catheter is commonly placed as an indwelling catheter in the cephalic vein?

4. _____ Which IV catheter is commonly placed as an indwelling catheter in the jugular vein?

EXERCISE 18.12 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ If antiseizure medication cannot be administered to a convulsing dog by the intravenous route, it may be given intranasally or intrarectally.

2. _____ To prevent the needle from going through-and-though the skin while giving a subcutaneous injection, it is important to insert the needle perpendicular to the long axis of the skin fold.

3. _____ In a severely dehydrated patient, intravenous administration of medications or isotonic fluids is preferred over subcutaneous administration.

4. _____ When placing a jugular catheter in a dog, the catheter is always placed with the tip of the catheter directed toward the heart.

5. _____ Marginal ear venipuncture is an appropriate blood collection technique for a coagulation profile.

6. _____ Male dogs may not require sedation for the placement of a urinary catheter whereas male cats are usually sedated for this procedure.

7. _____ When using a Vacutainer blood collection system, it is important to not connect the needle to the blood collection tube prior to venipuncture because doing so will break the vacuum in the collection tube and the blood will not flow into the tube.

8. _____ When performing a cranial vena cava venipuncture in the pig, it is preferred to use the left side because it reduces the risk of damaging the phrenic nerve.

9. _____ When instilling both an ophthalmic ointment and a solution into a patient's eye, the correct order of administration is to apply the ointment first followed by the solution because the ointment will help the solution "stick" to the eye.

10. _____ When performing an equine abdominocentesis, at least 0.5 mL of fluid must be collected and placed into a 2-mL EDTA tube to ensure accurate analysis of the abdominal fluid.

EXERCISE 18.13 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. A common indication for placing an orogastric tube in a small animal patient is
   a. To obtain a sample of stomach contents for analysis
   b. To administer activated charcoal to absorb an ingested toxin
   c. To administer water to correct severe dehydration
   d. To obtain a sample of tracheal secretions for analysis

2. Trauma to the sciatic nerve is a potential complication when administering an intramuscular injection into which of following muscles?
   a. Triceps muscle
   b. Lumbosacral muscle
   c. Cranial thigh muscle
   d. Semimembranosus muscle

3. Jugular vein catheterization is preferred over peripheral vein catheterization in the small-animal patient for which of the following treatment scenarios?
   a. Single administration of an IV medication
   b. Administration of fluids that have an osmolality of less than 600 mosm/L
   c. Administration of total parenteral nutrition
   d. Administration of blood products for a transfusion

4. The Seldinger guidewire technique refers to the placement of
   a. A spinal needle during a cerebrospinal tap
   b. A Foley catheter during a urinary catheter placement
   c. A multilumen catheter during a jugular catheter placement
   d. An over-the-needle catheter during a transtracheal wash

5. Which of the following small-animal procedures requires strict adherence to aseptic technique, including the placement of a surgical drape over the exposed area of the patient?
   a. Cystocentesis
   b. Bone marrow aspiration
   c. Nasoesophageal feeding tube placement
   d. Dorsal metatarsal artery puncture

6. Your patient is a 2-week-old, female, DSH brown tabby who is severely dehydrated as the result of an *Isospora* (coccidia) infection causing profuse diarrhea. Administration of fluids is ordered. You are unable to place an intravenous catheter. Which of the following routes of administration would be the next best choice?
   a. Oral
   b. Intrarectal
   c. Intraosseous
   d. Subcutaneous

7. The doctor has ordered a urine culture and sensitivity to be collected and submitted on your next patient, a neutered, male, Boston Terrier named "Kyle." Which of the following collection methods is preferred for this test?
   a. Free-catch
   b. Bladder expression
   c. Cystocentesis
   d. Urinary catheterization

8. When premeasuring a urinary catheter for placement in a male dog, the measurement is taken from
   a. The base of the prepuce to the caudal portion of the bladder
   b. The base of the prepuce to the cranial portion of the bladder
   c. The tip of the prepuce to the caudal portion of the bladder
   d. The tip of the prepuce to the cranial portion of the bladder

9. It is often necessary to monitor urine production in a small-animal patient with an indwelling urinary catheter. For a normovolemic dog weighing 27 pounds, 8 ounces, how much urine should be produced in 24 hours?
   a. 25 mL
   b. 55 mL
   c. 600 mL
   d. 1300 mL

10. Bone marrow aspirates are very painful. Which part of the procedure is responsible for causing the most amount of pain to the patient?
    a. Infiltrating the skin with 2% lidocaine
    b. Making the stab incision into the skin with a scalpel blade
    c. Inserting the stylet into the bone
    d. Aspirating the bone marrow fluid

11. Which of the following size needles is most appropriate for performing a jugular venipuncture in a cow?
    a. 18 gauge
    b. 20 gauge
    c. 22 gauge
    d. 25 gauge

12. At certain venipuncture sites, it is not possible to directly visualize or palpate the vessel prior to inserting the needle. Instead, anatomic landmarks are used to direct the positioning of the needle. This is called a "blind stick." Which of the following is a "blind stick"?
    a. Cephalic venipuncture in a cat
    b. Lateral saphenous venipuncture in a dog
    c. Jugular venipuncture in a horse
    d. Coccygeal venipuncture in the cow

13. In the llama, which cervical vertebra is used as the landmark for low neck jugular venipuncture?
    a. Fourth
    b. Fifth
    c. Sixth
    d. Seventh

14. Placement of an intravenous catheter in the auricular vein is common practice in which species?
    a. Cat
    b. Horse
    c. Cow
    d. Pig

15. Which of the following muscles is appropriate to use for medication administration in the cow and pig?
    a. Gluteal muscle
    b. Cervical (neck) muscle
    c. Semimembranosus muscle
    d. Shoulder muscle

16. Tuberculosis testing is conducted via a(n)
    a. Intramuscular injection
    b. Intradermal injection
    c. Subcutaneous injection
    d. Intraperitoneal injection

17. Meningitis is a potential complication associated with this procedure.
    a. Cerebrospinal fluid tap
    b. Pleural tap
    c. Diagnostic peritoneal lavage
    d. Arthrocentesis

18. In which of the following patients is it correct to use a balling gun to administer oral tablets?
    a. A foal
    b. A pig
    c. A horse
    d. A steer

19. The most appropriate method for administering mineral oil to a horse is
    a. Through a nasogastric tube
    b. Through an orogastric tube
    c. Via drenching
    d. Mix in with feed

20. What is the purpose of a subpalpebral lavage system?
    a. To facilitate gastric lavage
    b. To administer ophthalmic medications
    c. To facilitate joint lavage
    d. To administer rectal medications

EXERCISE 18.14 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 18.15 CASE STUDY: RESPIRATORY DISTRESS IN A CAT

Patient name: "Louie" Hansen
Signalment: 2-year-old, male, neutered, DSH brown Tabby; indoor-outdoor cat
Presenting complaint: Trouble breathing, seems painful
Relevant triage physical examination findings: Patient is in respiratory distress as evidenced by tachypnea and open-mouthed breathing with abdominal effort. Patient is cyanotic.

1. After completing the triage examination what should you do next? *(Choose the correct response.)*

    a. Complete a full examination to discover what is causing the respiratory distress
    b. Bring patient to the radiology suite for radiographs
    c. Place an IV catheter and administer shock doses of an isotonic fluid
    d. Bring patient into treatment area and administer oxygen

As you are completing this, the doctor comes in to listen to Louie's chest. As she is putting her stethoscope into her ears, she discusses with you her concern that Louie may have pleural effusion or a pneumothorax.

2. Define "pleural effusion."

3. Define "pneumothorax."

Based on the chest auscultation the doctor believes that Louie has pleural effusion and wants to proceed with a thoracocentesis.

4. Define "thoracocentesis."

5. Describe the purpose of each of the following supplies that are needed for this procedure:

   a. Butterfly catheter: _____

   _____

   b. Three-way stopcock: _____

   _____

   c. 20-cc syringe: _____

   _____

The thoracocentesis site has been aseptically prepared.

6. Based on the doctor's assessment, describe where you insert the needle to perform the thoracocentesis.

_____

_____

The thoracocentesis was successful, with 70 mL of fluid drained from the left side and 130 mL drained from the right side. The fluid sample is packaged and awaiting courier pick-up from the lab.

Louie's breathing has returned to normal and his mucous membranes are returning to a healthy pink color. He appears to be comfortable in his oxygen cage. However, even though he appears stable at the moment, you know his status can change quickly if he develops any complications following the procedure or if the fluid builds back up in the pleural space.

7. What should you monitor in your patient to assess his respiratory function?

_____

_____

_____

Now that Louie is stable, the doctor orders a complete blood count, chemistry panel, serum thyroid level, and a urinalysis. You know that minimizing stress during restraint is important for Louie since he has respiratory compromise.

8. With this in mind, describe which venipuncture approach you will choose and why you made this choice.

_____

_____

_____

The pleural fluid analysis reveals that Louie's pleural effusion is pus. He has a pyothorax (pus in the thoracic cavity). Louie is being admitted to the hospital to have bilateral chest tubes placed to drain the pus from his chest. He will be given intravenous analgesics, antibiotics, and fluids.

It is the next morning and you are giving Louie his morning treatments. You notice the bandage around his IV catheter is soaking wet.

9. What problems may have occurred with his IV catheter to cause his bandage to become wet?

As you are changing Louie's bandage to inspect the catheter and catheter site you also assess the area for phlebitis.

10. Define phlebitis.

11. What are the signs of phlebitis?

You discover and fix the cause of Louie's catheter malfunction, confirm he does not have phlebitis, and rebandage his catheter.

After 7 days of intensive nursing care, Louie is finally ready to go home! Louie has been prescribed two oral antibiotic pills he will need to take for the next 2 weeks.

12. Explain to Mrs. Hansen how to administer an oral tablet to Louie using language she can understand.

Mrs. Hansen looks horrified as she listens to you and watches you demonstrate administering a tablet to Louie. When you are finished, she asks, "Wouldn't it be easier to just put the pill in some food and feed it to him? That is the way we gave antibiotic pills to our dog, Chester, last year when he had that skin infection, remember? That was so easy!"

13. What is your reply to Mrs. Hansen's question?

EXERCISE 18.14 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. Percy is a 3-year-old, male, neutered, black and white, DSH cat. Percy was admitted to the hospital 10 days ago for a urethral obstruction caused by a crystal plug. He had a urinary catheter placed to relieve the obstruction and an IV catheter placed to administer IV fluids. He was hospitalized for 3 days and discharged with instructions to come back today for a recheck examination and urinalysis. Today his urinalysis shows that he has a bacterial urinary tract infection. A urine culture and sensitivity is being sent to the lab today and Percy is being started on antibiotics. What breaches in technique during the placement and care of the urinary catheter could have caused Percy's infection?

2. Describe the advantage of diagnostic peritoneal lavage over abdominocentesis for analysis of abdominal fluid.

3. Describe "ballottement" of the vein as it applies to equine and bovine jugular venipuncture.

4. It is often preferred to perform venipuncture in a horse by inserting the needle into the vein and then attaching the syringe to withdraw blood. What is the advantage to this approach?

5. Draw a picture showing the proper position the veterinary technician should assume relative to the horse when performing an abdominocentesis.

6a. What is the main diagnostic indication for placing an orogastric tube in a cow?

6b. What alternative procedure may be used that will serve this same purpose?

7. When administering certain medications to large animals it is important to protect yourself against accidentally absorbing the medication. For each of the following types of medication administration describe how you are at risk and how you can protect yourself.

   a. Administration of an oral paste:

   b. Intramuscular administration of a liquid medication:

   c. Administration of a transdermal medicinal patch:

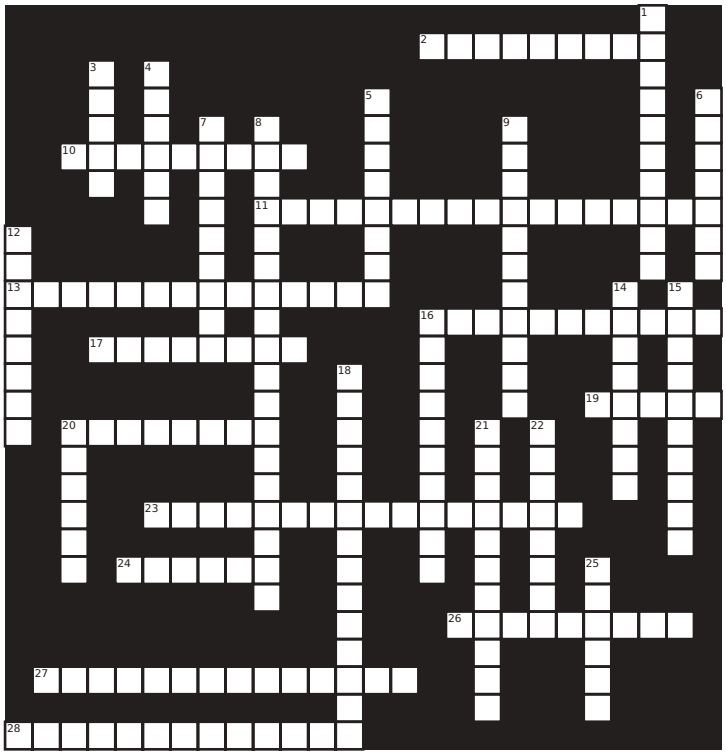
19 Small Animal Medical Nursing

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all Key Terms in this chapter.
2. Explain the relationship between the "Five Freedoms of Animal Welfare" and the responsibilities of the veterinary technician.
3. List in order the four steps that constitute the veterinary technician practice model, and describe what is involved in carrying out each step of the nursing process.
4. Explain the relationship between etiology, pathogenesis, lesions, and clinical signs.
5. Do the following regarding respiratory disease and cardiovascular disease in the small animal:
   - Compare and contrast the clinical relevance of upper versus lower respiratory disease in dogs and cats, and describe how inflammation might be related to nasal discharge, coughing, dyspnea, and hypoxia.
   - Discuss the etiology and pathogenesis of cardiovascular disease in dogs and cats and list and describe the most common cardiovascular diseases.
6. Discuss the etiology and pathogenesis of digestive and hepatobiliary diseases in dogs and cats and list and describe the most common digestive and hepatobiliary diseases.
7. Do the following regarding urinary, endocrine, and reproductive disease in dogs and cats:
   - Discuss the etiology and pathogenesis of urinary disease and list and describe the most common urinary diseases.
   - Discuss the etiology and pathogenesis of endocrine disease and list and describe the most common endocrine diseases.
   - Discuss the etiology and pathogenesis of reproductive disease and list and describe the most common reproductive diseases.
8. Do the following regarding immune-mediated disease, joint disease, and diseases affecting the eyes, ears, and skin of dogs and cats:
   - Discuss the etiology and pathogenesis of immune-mediated disease and list and describe the most common immune-mediated diseases.
   - Discuss the etiology and pathogenesis of joint disease ~~in dogs and cats~~ and list and describe the most common joint diseases.
   - List common diseases affecting the eyes, ears, and skin.
9. Do the following regarding infectious disease in dogs and cats:
   - Discuss the etiology and pathogenesis of infectious disease.
   - List and describe special protocols needed to provide nursing care for dogs and cats with infectious diseases.
   - Explain how to educate clients about stopping the spread of infectious disease.
10. Do the following regarding the development, detection, and treatment of cancer in small animals:
    - Discuss the biology of cancerous tumors in dogs and cats, and explain how tumors are classified.
    - Explain the clinical manifestations of cancer in small animals, how it is diagnosed, and the treatment options available.
    - Describe the safe handling of chemotherapeutics and complications of cancer therapies in dogs and cats.

EXERCISE 19.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

2 The term for the acute disease involving inflammation of the intestinal mucosa.
10 Classification of tumors capable of invasion and destruction of local tissue and of metastasis.
11 The treatment of MG includes administration of anticholinesterase inhibitors and _____ drugs.
13 To diagnose MG, we test for the presence of _____ against AChRs.
16 Tumors of the membranes that surround the brain and spinal cord.
17 Cancer _____ is a syndrome characterized by weight loss and muscle wasting and is caused by the physical presence of a tumor.
19 The type of therapy used to prevent or treat dehydration, ensure hydration in patients with chronic constipation, and treat electrolyte imbalances.
20 The category of tumors that arise from mesenchymal tissues.
23 The type of obstruction involving the stomach, small bowel, or large bowel.
24 GI _____ occur as a result of mucosal layer defects caused by the administration of NSAIDs, neoplasia, and disease of the liver.
26 The acute inflammatory disease of the stomach mucosa often caused by ingestion of toxic plants, spoiled food, foreign objects, or irritating drugs.
27 The syndrome caused by hormones or other substances that are synthesized by the tumor and that circulate systemically, affecting multiple organ systems.
28 The term for a large dilated esophagus.

Down

1 An important risk associated with megaesophagus and regurgitation.
3 The type of hematoma characterized by blood-filled swelling on the inner surface of the pinna.
4 Classification of tumors that do not invade or destroy surrounding normal tissues or metastasize.
5 Generalized _____ that is worse with exercise and resolves with rest is the primary clinical sign of MG.
6 The treatment of choice for localized cancer in dogs and cats.
7 Tumors of _____ glands cause an abnormal hormone secretion and subsequent disruption of body function.
8 The type of inhibitor medication that improves muscle strength by prolonging the action of acetylcholine at the synapses.
9 The term for inflammation of the esophagus.
12 The name of the condition caused by reduced drainage of the aqueous humor through the ciliary body and anterior chamber of the eye.
14 A patient with osteoarthritis often exhibits orthopedic pain and reduced _____ .
15 The category of tumors that arise from epithelial tissues.
16 The process by which cancer cells spread from the primary tumor to distant locations such as lymph nodes and the lungs.
18 The term for the disease of the eye involving inflammation of the conjunctiva.
20 The _____ of the tumor's name generally indicates whether the tumor is benign or malignant.
21 The diagnostic tool most commonly used to determine if megaesophagus is present.
22 The term for pathologic lens opacity.
25 The prefix of a tumor's name indicates the specific tissue of _____.

EXERCISE 19.2 DEFINITIONS: KEY TERMS

Instructions: Define each term in your own words.

1. Idiopathic: _____

2. Pathogenesis: _____

3. Nasal and sinus congestion: _____

4. Sneeze: _____

5. Stertor: _____

6. Stridor: _____

7. Cough: _____

8. Hemoptysis: _____

9. Pleural effusion: _____

10. Dyspnea: _____

11. Orthopnea: _____

12. Hypoxia: _____

13. Hypoxemia: _____

14. Cardiomyopathy: _____

15. Systemic hypertension: _____

16. Regurgitation: _____

17. Vomiting: _____

18. Hematemesis: _____

19. Hematochezia: _____

20. Melena: _____

21. Tenesmus: _____

22. Galactostasis: _____

23. Metritis: _____

24. Hyperthermia: _____

25. Pain: _____

26. Urethral obstruction: _____

27. Diarrhea: _____

28. Constipation: _____

29. Colitis: _____

EXERCISE 19.3 MATCHING #1: TERMS AND DEFINITIONS

Instructions: Match each term in column A with the corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Diarrhea
2. _____ Hepatitis
3. _____ Radiation
4. _____ Nausea
5. _____ Secondary immune-mediated hemolytic anemia (IMHA)
6. _____ Serous
7. _____ Carcinogenesis
8. _____ *Escherichia coli*
9. _____ Hepatic encephalopathy
10. _____ Constipation
11. _____ Mucopurulent
12. _____ Mucoid
13. _____ Hemorrhagic
14. _____ Portosystemic shunts
15. _____ Feline lower urinary tract disease
16. _____ Primary immune-mediated hemolytic anemia

Column B

A. Clear liquid discharge.
B. Opaque and sticky discharge.
C. Green-yellow and mucoid discharge.
D. Bloody discharge.
E. A sign that often precedes vomiting. Characterized by anxiety, hypersalivation, vocalization, and lip smacking.
F. A symptom characterized by frequent passage of loose, unformed, and often watery stool.
G. A condition characterized by infrequent and often difficult passage of hard stool.
H. The result of exposure of the brain to GI toxins.
I. Inflammation of the liver parenchyma.
J. Extrahepatic or intrahepatic vascular abnormalities that connect the systemic and portal circulations.
K. The most common cause of bacterial cystitis in small animals.
L. The term used to describe the constellation of signs indicating bladder and urethra irritation in the cat.
M. A type of IMHA in which the immune system develops auto-antibodies against components of the red blood cell membrane.
N. A type of IMHA in which the immune system attacks RBC pathogens adhered to the membrane, but then also indiscriminately destroys normal RBCs.
O. The multifactorial process by which cells are transformed into tumors.
P. The treatment for cancer that causes cell death by disrupting the cell's DNA or by destroying important molecules required for normal cell function.

EXERCISE 19.4 MATCHING #2: DISEASES AND CONDITIONS

Instructions: Match each disease or condition in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Heartworm disease
2. _____ Canine prostatic disease
3. _____ Hypoadrenocorticism
4. _____ Hyperthyroidism
5. _____ Hepatic lipidosis
6. _____ Myasthenia gravis
7. _____ Hemolytic anemia
8. _____ Infectious disease
9. _____ Hyperadrenocorticism
10. _____ Kidney disease
11. _____ Diabetes mellitus
12. _____ Metritis
13. _____ Immune-mediated disease
14. _____ Acute cholangitis

Column B

A. Mosquito-borne infectious disease affecting dogs and cats.

B. The disease of cats caused by a derangement of lipid metabolism associated with anorexia of approximately 7 days.

C. The acute disease of the bile ducts caused by an ascending bacterial infection from the small intestines and characterized by neutrophilic inflammation.

D. A disease characterized by irreversible, progressive loss of renal function.

E. A disease that affects cats in which the thyroid gland is overactive, producing abnormally large amounts of thyroid hormones.

F. A disease caused by either insufficient production of insulin by the pancreatic beta cells or by insulin resistance characterized by the body's inability to respond properly to endogenous insulin.

G. A disease that primarily affects dogs and is characterized by elevated circulating levels of cortisol produced by the adrenal cortex.

H. A disease caused by adrenal gland atrophy or destruction resulting in inadequate secretion of glucocorticoids and mineralocorticoids.

I. A bacterial infection associated with dystocia and retained placenta and fetuses.

J. A disease occasionally seen in older male dogs that is characterized by stranguria, dysuria, and/or difficulty passing stool.

K. A disease in which the immune system has lost tolerance of self and damages organs.

L. A disease characterized by RBC destruction.

M. A disorder of neuromuscular transmission that causes muscle weakness.

N. A disease in which pathogenic microorganisms invade and colonize the fluids and tissues of a host.

EXERCISE 19.5 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Etiology is defined as the cause of a disease.

2. _____ Anorexia is a complete or partial loss of appetite.

3. _____ Hypovolemia is an increase of intravascular fluid.

4. _____ Regurgitation is the forceful expulsion of contents from the stomach and/or intestines.

5. _____ The use of antiinflammatory drugs in the treatment of lower respiratory disease specifically targets the airways.

6. _____ In dogs, sneezing is most commonly associated with upper respiratory viral infections, whereas sneezing in cats is usually the result of inhalation of foreign material.

7. _____ Cats do not normally pant, so the presence of open-mouth breathing with noticeable chest movements indicates dyspnea.

8. _____ Coughing is a common sign of CHF in the cat.

9. _____ Treatment of feline heartworm disease is unrewarding because a safe and effective adulticide has yet to be found.

10. _____ In dogs, exocrine pancreatic insufficiency is commonly caused by chronic pancreatitis.

11. _____ A urolith is a pathologic stone formed from mineral salts in the urinary tract.

12. _____ In resistant or recurrent UTI cases, a 2-week course of antibiotics is needed.

13. _____ Hypothyroidism primarily affects dogs although a rare congenital form can be seen in kittens.

14. _____ Dogs tend to develop type-2 diabetes mellitus, whereas cats are more prone to type-1 diabetes mellitus.

15. _____ Diabetes mellitus will often progress to a condition called diabetic ketoacidosis despite diagnosis and treatment.

16. _____ Mastitis refers to inflammation of one or more mammary glands.

17. _____ Immune-mediated diseases are those in which the immune system has failed to protect the patient from invasion by microorganisms.

18. _____ Acquired myasthenia gravis is more common in cats than it is in dogs.

19. _____ Confirmation of osteoarthritis is most often made by radiography.

20. _____ Vaccination, maintenance of proper health, and proper nutrition strengthen host defense systems.

21. _____ Oncology is the study of bone and joint disease.

22. _____ Benign tumors do not invade or destroy surrounding normal tissues or spread to a new site.

23. _____ Carcinomas arise from mesenchymal tissue.

24. _____ A disadvantage of cryosurgery is that the completeness of tumor removal cannot be determined because there is no tissue to submit for margin evaluation.

25. _____ Because radiation targets DNA, it is most effective against tumor cells with rapid rates of proliferation.

26. _____ Because of their toxicity, chemotherapeutic drugs are not administered orally and/or given at home by owners.

27. _____ Chemotherapeutic agents cannot differentiate between cancer cells and normal cells that have high proliferation rates, and so may damage both.

28. _____ Gastrointestinal toxicity to chemotherapeutic agents most commonly manifests itself as nausea, vomiting, and hemorrhagic diarrhea.

EXERCISE 19.6 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. The veterinary technician may be responsible for everything except
   a. Gathering a medical history
   b. Reviewing past medical records
   c. Performing a physical exam
   d. Interpreting lab tests

2. A disease of the heart muscle seen in cats that is characterized by an increase in the thickness of the left ventricle wall and a small ventricular lumen is classified as
   a. Dilated
   b. Hypertrophic
   c. Arrhythmogenic
   d. Restrictive

3. Diagnosing heart disease relies partly on diagnostic procedures including all but one of the following
   a. Diagnostic ultrasonography
   b. Radiographs
   c. Endoscopy
   d. Electrocardiography

4. Dilated cardiomyopathy is the most common canine cardiomyopathy. It is characterized primarily by
   a. Enlarged atrial and ventricular lumina with decreased contractility
   b. Thromboembolism with increased contractility
   c. Increased contractility and ventricular arrhythmias
   d. Atrial enlargement with normal ventricular function.

5. Treatment of canine heartworm disease may include any of the following except
   a. Adulticide therapy
   b. Microfilaracide therapy 3 to 4 weeks later
   c. Surgical removal of worms
   d. A gradual increase in activity over 3 to 4 weeks

6. Nursing care for patients suffering from regurgitation includes
   a. Elevating food and water bowls
   b. Keeping patients head and forelimbs elevated for 10 minutes postmeal
   c. Changing the form of food and monitoring for signs of aspiration
   d. All of the above

7. The premature activation of trypsin in the pancreas is associated with what condition?
   a. Tenesmus
   b. Exocrine pancreatic insufficiency
   c. Pancreatitis
   d. Hepatic lipidosis

8. Clinical signs associated with feline pancreatitis typically include
   a. Vomiting, weight gain, hyperthermia, lethargy, and hypotension
   b. Hypothermia, diarrhea, anorexia, vomiting, and hypotension
   c. Vomiting, diarrhea, regurgitation, and hypothermia
   d. Vomiting, lethargy, weight loss, anorexia, and hypothermia

9. Management of acute hepatic encephalopathy includes all of the following except
   a. Fluid therapy
   b. Correcting electrolyte imbalances
   c. Analgesia
   d. Treatment of seizures

10. Chronic hepatitis indicates a history of liver disease for a prolonged period of time, usually greater than
    a. 2 to 3 weeks
    b. 6 to 8 weeks
    c. 2 to 3 months
    d. 4 to 6 months

11. Cholangitis refers to
    a. Inflammation of the bile ducts
    b. Inflammation of the liver
    c. Inflammation of the pancreas
    d. Inflammation of the gallbladder

12. Medical management of chronic kidney disease focuses on
    a. Slowing the progression
    b. Treating concurrent diseases
    c. Correcting electrolyte imbalances
    d. All of the above

13. UTI is a common secondary complication in all but one of the following
    a. Diabetes mellitus
    b. Chronic kidney disease
    c. Hyperadrenocorticism
    d. Hypothyroidism

14. Feline lower urinary tract disease is typically classified as
    a. Nonhemorrhagic or hemorrhagic
    b. Nonobstructive or obstructive
    c. Noninvasive or invasive
    d. Nonpainful or painful

15. Clinical signs of hyperthyroidism include
    a. Increased activity
    b. Weight gain
    c. Decreased appetite
    d. Decreased urine output

16. Treatment of feline hyperthyroidism falls into two categories
    a. Curative and palliative
    b. Symptomatic and supportive
    c. Acute and chronic
    d. Primary and secondary

17. The treatment of diabetes mellitus is different for dogs and cats. Dogs require lifelong treatment that includes the administration of insulin, glucose monitoring, and a high fiber diet. In contrast, a high-protein/lower-fat diet is recommended for cats. In addition, which of the following is true of cats?
    a. Aggressive treatment with insulin is often associated with spontaneous remission within 3 to 4 months.
    b. Cats require a lifelong treatment with insulin and lifelong daily glucose monitoring.
    c. Blood glucose is monitored and insulin therapy is incorporated as needed.
    d. Most cats respond well long term to the administration of oral hypoglycemics.

18. Hyperadrenocorticism or Cushing syndrome can be caused by
    a. A functional adrenal gland tumor
    b. A functional anterior pituitary tumor
    c. Immune damage of the adrenal gland
    d. Either a or b
    e. Either b or c

19. Feline Cushing syndrome is rare and when diagnosed is often seen concurrently with
    a. Mastitis
    b. Osteosarcoma
    c. Pancreatitis
    d. Diabetes mellitus

20. Which of the following is not typically a sign of hypoadrenocorticism (Addison disease)?
    a. Diarrhea
    b. Vomiting
    c. Polydipsia
    d. Hyperactivity

21. Which of the following is usually not associated with metritis in dogs and cats?
    a. Prolapsed uterus
    b. Retained placentae
    c. Dystocia
    d. Retained fetus

22. Eclampsia usually occurs
    a. 2 to 3 days postpartum and occasionally before parturition
    b. 2 to 3 weeks postpartum and occasionally before parturition
    c. 2 to 3 days before parturition, and occasionally after
    d. 2 to 3 weeks before parturition and occasionally after

23. Secondary immune-mediated disease can result from
    a. Infection
    b. Cancer
    c. Vaccine administration
    d. All of the above

24. If a patient with myasthenia gravis has megaesophagus, common presenting signs are
    a. Dry mouth and vomiting
    b. Vomiting and diarrhea
    c. Diarrhea and hypersalivation
    d. Hypersalivation and regurgitation

25. Which of the following is contagious directly between animals or indirectly through fomites?
    a. Canine heartworm disease
    b. *Borrelia burgdorferi*
    c. Feline calicivirus
    d. Rocky Mountain spotted fever

26. Neoplasia is
    a. The process of healing through the controlled growth of new cells
    b. The natural process by which dead and dying cells are replaced
    c. The formation of a tissue mass because of uncontrolled cell growth
    d. Changing the appearance of a body part surgically

27. Metastasis is the process by which cancer cells
    a. Form from normal cells
    b. Spread from a primary tumor to a secondary location
    c. Grow in a primary tumor
    d. Invade surrounding tissues

28. In addition to being classified as benign or malignant, tumors are categorized according to
    a. Size and shape
    b. Tissue of origin and size
    c. Shape and histologic features
    d. Tissue of origin and histologic features

29. Unlike most other tumors, highly vascular tumors or ulcerated gastric tumors may contribute to
    a. Weight loss
    b. Significant blood loss
    c. Impaired digestion of food
    d. Anorexia

30. Nursing care of the cancer patient includes
    a. Recognition and control of pain
    b. Nutritional support
    c. Control of nausea and vomiting
    d. All of the above

31. Which of the following is NOT one of the three primary treatment options for dogs and cats with cancer?
    a. Surgery
    b. Dietary therapy
    c. Chemotherapy
    d. Radiotherapy

32. A tumor that arises from skin, mucous membranes, or glandular structures is known as a
    a. Sarcoma
    b. Carcinoma
    c. Lymphoma
    d. Fibroma

33. If the chemotherapeutic drug is given perivascularly. You should do all but one of the following
    a. Remove the catheter
    b. Irrigate the area with sterile saline
    c. Cold compress for 72 hours
    d. Monitor for redness, swelling, pain, and skin sloughing

34. Hyperbilirubinemia will cause the mucous membranes to be
    a. Pale
    b. Cyanotic
    c. Icteric
    d. Brick red

35. In lung auscultation, "crackles" are associated with
    a. Bronchial and pleural disease
    b. Pleural and pulmonary disease
    c. Pulmonary disease and effusion
    d. Effusion and bronchial disease

36. An increased PCV and TP indicates
    a. Dehydration
    b. Hypovolemia caused by blood loss
    c. Hypothermia
    d. Cardiac insufficiency

37. Which of the following is NOT associated with restoration of normovolemia?
    a. Pink/dry mucous membranes
    b. CRT less than 2 seconds
    c. Normal cardiac function
    d. Normal blood pressure

38. A temp less than 99°F, shivering, prolonged CRT, bradycardia, cyanosis, and decreased respirations are symptoms of
    a. Pain
    b. Hypothermia
    c. Electrolyte imbalance
    d. Cardiac insufficiency

39. Symptoms of cardiac insufficiency include
    a. Tachypnea
    b. Tachycardia
    c. Prolonged CRT
    d. All of the above

40. A body condition score of 4+ out of 5 indicates
    a. Obesity
    b. Overhydration
    c. Neurologic depression
    d. Decreased muscle mass

41. Malnutrition leads to all but one of the following
    a. Multisystemic organ dysfunction
    b. Electrolyte imbalance
    c. Dehydration
    d. Pancreatitis

42. Loss of gag and swallow reflexes commonly occur in all but one of the following
    a. Sedation or anesthesia
    b. Megaesophagus
    c. Damage to cranial nerves
    d. Hyperadrenocorticism

43. Clinical signs of feline bronchitis include all but one of the following
    a. Cough
    b. Stridor
    c. Wheezing
    d. Dyspnea

EXERCISE 19.7 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. Nasal discharge results from irritation or inflammation of the nasal mucosa and can be described as _____ (green-yellow and mucoid), _____ (bloody), _____ (clear liquid), or _____ (opaque and sticky).
2. A patient with nasal discharge, sneezing, and/or congestion should be closely examined for facial _____ that can accompany some causative diseases such as fungal infections, tooth root abscess, and neoplasms.
3. A cough may be _____, meaning fluid, mucus, or blood is brought up from the airway.
4. A _____ cough is sometimes referred to as a "dry cough."
5. The presence of pleural effusion can be confirmed via _____, ultrasonography, or radiography.
6. In an extreme situation, stressing a dyspneic patient can result in _____.
7. Heart disease can be caused by a pathologic abnormality affecting the _____, _____, rhythm conduction, or the overall structure of the heart.
8. The first respiratory sign that heart disease has progressed to heart failure is often _____.
9. Degenerative atrioventricular valve disease affects the cardiac valve _____ or _____ and is characterized by thickening of the tissue.
10. Patients with high heartworm burdens and severe cardiopulmonary disease are at high risk for pulmonary _____ and must be stabilized prior to administration of the adulticide for heartworm treatment.
11. For both dogs and cats the key to avoiding heartworm disease is to _____ infection. This is achieved through the use of approved _____ class preventatives.
12. Once high blood pressure is diagnosed, treatment with _____ medication is begun immediately.
13. Systemic hypertension is often secondary to another disease such as chronic _____ disease, _____, _____, or diabetes mellitus.
14. Difficulty eating is also referred to as _____.
15. _____ material typically consists of undigested or partially digested food.
16. Vomiting patients are prone to _____ and _____ imbalances, so monitoring for and treating these secondary problems is of importance when providing complete patient care.
17. Hematochezia usually indicates a problem with the _____ or _____.
18. Tenesmus of GI origin is usually the result of _____ disease, and often accompanies diarrhea or constipation.
19. Pancreatitis occurs when the digestive enzyme _____ is prematurely activated within the _____ tissue instead of within the duodenum.

20. Pancreatitis may be chronic or acute in nature. The frequency of each type varies among species. Chronic cases are seen more commonly in _____, whereas acute cases are seen more commonly in _____.

21. Chronic pancreatitis can lead to the endocrine disease _____ _____.

22. _____ _____ _____ is caused by insufficient production and secretion of digestive enzymes by the pancreas.

23. In dogs, EPI is most commonly the result of pancreatic acinar _____.

24. The loss of digestive enzymes leads to maldigestion and malabsorption of ingested nutrients causing clinical signs of polyphagia, _____ _____, and chronic pale, fatty, and voluminous diarrhea.

25. Patients with severe hepatobiliary disease may develop _____ _____ as a result of exposure of the brain to GI toxins.

26. Symptomatic treatment of HE focuses on decreasing the amount of _____ in the systemic circulation, which can be achieved by decreasing production within the _____.

27. Feline hepatic lipidosis is caused by a derangement of lipid _____ associated with _____ of approximately 7 days.

28. _____ portosystemic shunts are congenital and typically involve one or two vessels that connect the portal vein to the vena cava.

29. _____ portosystemic shunts can be congenital or acquired secondary to portal hypertension and are multiple shunts within the hepatic parenchyma.

30. Chronic feline cholangitis is characterized by _____ - _____ inflammation. The cause of this condition is _____.

EXERCISE 19.8 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 19.9 CASE STUDY #1: DISEASES AFFECTING THE THYROID GLAND

Signalment: Petunia, a 10-year-old, female, spayed, domestic long hair.
Chief Complaint: The owner reports that Petunia has been losing weight gradually over the past several months.
Minimum Database: Petunia's appetite is good, but she is acting more lethargic lately. The physical examination confirmed weight loss (body weight of 5.7 pounds, and a body condition score of 2/5), an elevated heart rate, an unkempt hair coat, and a palpable thyroid nodule. Blood testing revealed an elevated serum T_4 level, along with a number of other changes in chemistry values. The attending veterinarian diagnosed hyperthyroidism.

1. Briefly describe hyperthyroidism. Specifically explain the causes of this condition, how it is diagnosed, common clinical signs, and treatment options.

   a. Brief description of hyperthyroidism: _____

b. Causes: _____

_____

c. Diagnosis: _____

_____

_____

d. Clinical signs: _____

_____

e. Treatment options: _____

_____

_____

_____

2. Unlike cats, which much more frequently develop hyperthyroidism, dogs much more frequently develop hypothyroidism. These diseases differ greatly, and are in many ways opposites. Explain the causes of hypothyroidism, how it is diagnosed, common clinical signs, and treatment options.

a. Brief description of hypothyroidism: _____

_____

_____

b. Causes: _____

_____

c. Diagnosis: _____

_____

_____

d. Clinical signs: _____

_____

e. Treatment options: _____

_____

_____

_____

3. Finally, explain the key differences between these diseases of the thyroid gland.

EXERCISE 19.10 CASE STUDY #2: THE VETERINARY TECHNICIAN PRACTICE MODEL

Signalment: Molly, a 10-year-old, female, spayed, Terrier mix-breed dog.
Chief Complaint: The owner reports that Molly has been coughing lately, doesn't have much energy, and tires quickly after going on walks.
Database: After gathering a complete history, and performing a physical examination, the doctor orders a complete work-up to evaluate Molly's heart, including blood work and thoracic radiographs. He is concerned about valvular heart disease, but wants more data before a treatment plan is developed. Consider the following facts gleaned from Molly's patient database.

Physical findings:

- Tachycardia and tachypnea
- Open-mouth breathing, increased respiratory effort, and slight cyanosis
- Grade V/VI systolic heart murmur
- Increased lung sounds (crackles)

Diagnostic workup:

- Radiographs reveal left-sided heart enlargement, and evidence of fluid in the lungs (pulmonary edema)
- Blood work results are unremarkable

The doctor believes Molly may have degenerative A-V valve disease, and secondary congestive heart failure. In animals with this condition, the heart valves degenerate and thicken, and allow blood to flow backwards from the ventricles into the atria. This causes a back-up of blood in the heart and subsequent development of fluid in the lungs, as well as a decrease in forward flow. The cause of this disease is unknown, although there may be a genetic predisposition as dogs of certain breeds are especially prone to this condition.

1. Any disease, including this one, can be defined by its etiology, pathogenesis, associated lesions, and clinical signs.

   a. Define each of these terms.

      i. Etiology: _____

      ii. Pathogenesis: _____

iii. Lesion: _____

_____

iv. Clinical signs: _____

_____

b. What is the relationship between each of these elements?

_____

_____

_____

c. What are Molly's main clinical signs?

_____

_____

_____

2. Use of the technician practice model in this case will ensure that Molly is provided with consistently excellent care. This first step is to help gather patient data, which you have already done.

a. What would be the next steps?

_____

_____

b. List two technician evaluations shown in Table 19-4 that would apply to Molly. What evidence do you have that each of these evaluations applies?

i. _____

_____

_____

ii. _____

_____

_____

c. What technician interventions would be indicated to help Molly?

_____

_____

_____

_____

_____

d. How will you know that Molly is responding to your interventions?

EXERCISE 19.11 WORD SEARCH: TERMS

Find the words that are defined by the clues given below. The words may be located horizontally, vertically, or diagonally, and may be reversed.

M	N	I	T	N	E	P	Y	O	T	H	O	R	A	X	N	M	H	C
Y	I	B	I	T	C	G	N	I	Z	I	N	O	I	R	U	U	A	H
E	H	R	T	B	C	Y	R	E	G	R	U	S	O	Y	R	C	N	I
L	Y	O	I	A	I	N	O	M	U	E	N	P	R	R	E	O	N	U
O	P	N	C	R	T	C	I	S	R	M	R	P	E	M	C	S	I	R
S	A	C	H	Y	U	R	H	A	I	H	O	D	H	U	Y	I	A	N
U	R	H	Y	P	E	R	S	E	N	S	I	T	I	V	I	T	Y	M
P	E	I	L	A	P	T	C	R	M	T	O	N	H	C	I	I	T	E
P	H	T	O	R	A	Y	I	L	P	O	I	R	I	O	A	S	S	H
R	T	I	T	E	R	I	T	I	A	R	T	B	C	T	R	T	E	C
E	O	S	H	H	E	T	N	I	G	R	O	O	I	E	I	A	N	R
S	M	I	O	T	H	E	I	P	Y	C	Y	B	X	O	N	S	X	A
S	E	I	R	O	T	A	M	M	A	L	F	N	I	I	T	N	A	G
I	H	N	A	I	O	T	L	E	I	R	H	R	G	O	C	I	I	E
O	C	N	X	D	M	R	E	A	N	T	I	E	M	E	T	I	C	X
N	T	L	T	A	E	H	H	R	O	O	I	E	N	I	A	I	T	S
P	H	P	I	R	H	P	T	H	T	N	N	E	T	E	S	L	C	Y
T	N	C	I	Y	C	I	N	N	E	H	P	C	I	I	O	N	M	I
I	D	I	A	P	H	R	A	G	M	A	T	I	C	I	I	I	U	E

Cryosurgery
Antiemetic
Ionizing
Antacid
Radiotherapy
Probiotic
Mucositis
Antibiotics
Chemotherapy
Antiinflammatories
Chemotherapeutic
Anthelmintics
Necrosis
Hypersensitivity
Myelosuppression
Chemotoxicity
Rhinitis
Laryngeal
Bronchitis
Pneumonia
Diaphragmatic
Pyothorax
Chylothorax
Pneumothorax

EXERCISE 19.8 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1a. List in order and describe the "Five Freedoms of Animal Welfare" developed by the Farm Animal Welfare Council of the United Kingdom.

i. _____

ii. _____

iii. _____

iv. _____

v. _____

1b. What is the significance of the Five Freedoms to the practicing veterinary technician?

_____

_____

2. The veterinary technician's duties in the clinical setting can be divided into three different categories. Name the three categories, and provide one example of a specific task that falls under each category.

i. _____

_____

ii. _____

_____

iii. _____

_____

3. The formation of uroliths is dependent upon what three characteristics of the urine?

a. _____ b. _____ c. _____

4. Urolith classification is generally based on what specific characteristic of the urolith?

_____

5. Uroliths are named based on the different anatomic locations within the urinary system in which they are found. For instance, nephroliths are found in the kidney. Name the other three types of uroliths based on anatomic location.

a. _____ b. _____ c. _____

6. What is another name for a urolith (in addition to the term *urinary stone*)?

_____

7. Which sex of dogs is more prone to urinary tract infections?

_____

8. At what approximate age in years is FLUTD most commonly seen in cats?

   _____ years of age

9. Obstructive FLUTD refers to obstruction of what anatomic structure?

   _____

10. Provide the names of the two thyroid hormones that a cat will overproduce when hyperthyroid.

    i. _____

    ii. _____

11. What is the name of the surgical procedure during which one or both thyroid lobes are removed?

    _____

12. What is the most common cause of hypothyroidism in dogs?

    _____

13. List the four most common signs associated with hypothyroidism as a result of the decreased metabolic rate.

    i. _____

    ii. _____

    iii. _____

    iv. _____

14. How is diabetes mellitus treated?

    _____

    _____

    _____

15. List the clinical signs of diabetes mellitus.

    _____

    _____

    _____

16. List the clinical signs of hyperadrenocorticism.

    _____

    _____

    _____

17. Define mastitis, galactostasis, and metritis. Explain the diagnosis, clinical signs, and treatment of each of these postpartum disorders of the dam.

    a. Mastitis: _____

    _____

        i. Diagnosis: _____

        _____

        ii. Clinical signs: _____

        _____

        iii. Treatment: _____

        _____

    b. Galactostasis: _____

    _____

        i. Diagnosis: _____

        _____

        ii. Clinical signs: _____

        _____

        iii. Treatment: _____

        _____

    c. Metritis: _____

    _____

        i. Diagnosis: _____

        _____

        ii. Clinical signs: _____

        _____

        iii. Treatment: _____

        _____

18. What are the two main mechanical abnormalities of the musculoskeletal system that cause osteoarthritis?

    i. _____

    ii. _____

19a. What are infectious diseases, and what general types of pathogens cause them in dogs and cats?

19b. Define the following terms used to classify transmissible infectious diseases: (i) contagious, (ii) vector-borne, (iii) zoonoses, and (iv) reverse zoonoses.

i. Contagious:

ii. Vector-borne:

iii. Zoonoses:

iv. Reverse zoonoses:

20. A number of factors determine whether or not an animal will acquire a transmissible infectious disease, including the host's susceptibility to the organism, where the organism resides, and how it spreads from animal to animal. Review the required steps and components needed for infection to take place.

21a. What are three items worn by the veterinary technician that are considered to be components of barrier nursing?

i. _____

ii. _____

iii. _____

21b. What are the main reasons for wearing these items?

_____

_____

22. What are the three events that must take place within a cell before malignant transformation can occur?

i. _____

ii. _____

iii. _____

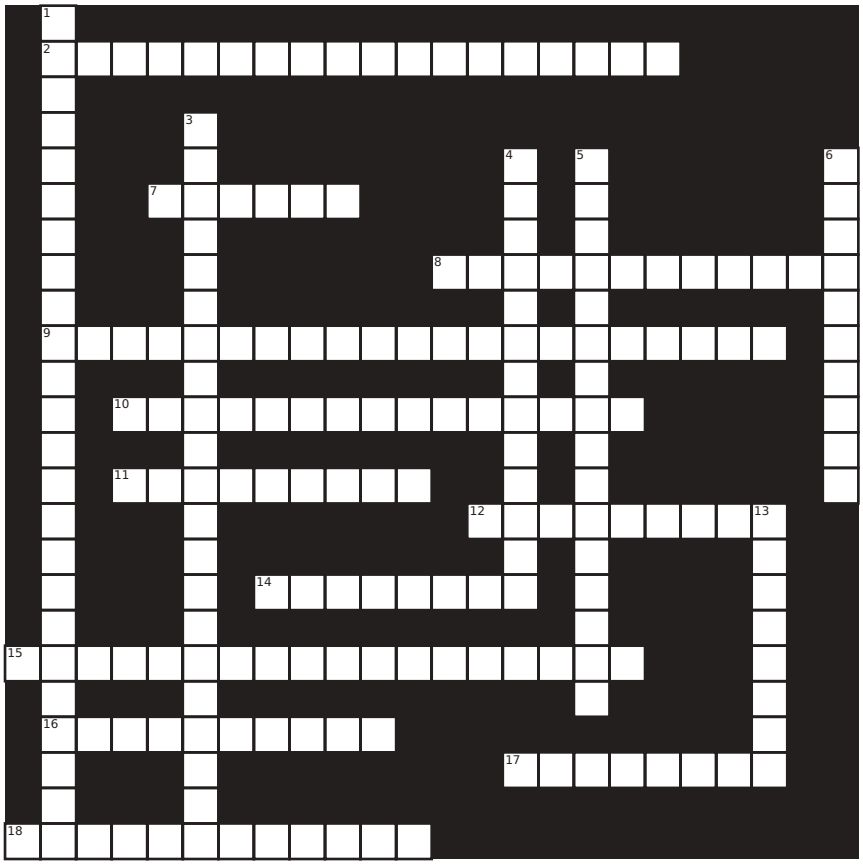
20 Large Animal Medical Nursing

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all Key Terms in the chapter.
2. Explain the importance of a thorough physical examination and medical record for large animal patients.
3. List and describe the most common diseases and conditions of the horse for each body system, including the causes and pathogenesis of each: respiratory, cardiovascular, hemolymphatic, gastrointestinal, neurologic, urinary tract, dermatologic, and ophthalmologic.
4. Explain how to care for a hospitalized equine patient.
5. List and describe the most common diseases and conditions of ruminants for each body system, including special care and conditions of the neonate: digestive, respiratory, reproductive/mammary gland, metabolic, hemolymphatic, cardiovascular, nervous, ophthalmologic, musculoskeletal, dermatologic, and urinary.
6. Do the following regarding common diseases and conditions of swine:
   - Discuss common diseases and conditions of swine, including neonatal care, multisystemic diseases, gastrointestinal disease, and diseases of the respiratory, nervous, and musculoskeletal systems.
   - Discuss normal and abnormal behaviors of swine.
   - Discuss the special care and concerns of potbellied pigs.
7. Do the following regarding common diseases and conditions of camelids:
   - Discuss common diseases and conditions of camelids, including special care and conditions of the neonate.
   - List and describe the most common diseases of camelids for each of the following body systems: digestive, metabolic, and nervous.
   - List preventive health measures in the management of camelids.

EXERCISE 20.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

2 Adjective describing a pathologic condition in which the body forms few or no antibodies.
7 A bacterial toxin that has been weakened by heat or chemical treatment.
8 Lower-than-normal levels of blood glucose.
9 Condition characterized by altered function of the central nervous system in which brain swelling and inflammation leads to necrosis of brain tissue.
10 A common reproductive condition in goats that may develop in does with or without exposure to a buck.
11 An antibody that neutralizes a specific biologic toxin. The antibody is produced in response to a particular toxin such as tetanus.
12 First milk containing antibodies.
14 Slow or difficult labor or delivery of a newborn.
15 Necrosis of a large area of a mammary gland or glands secondary to infection. (2 words)
16 Invasion of the bloodstream by microorganism (usually bacteria) from a focus of infection.
17 Inflammation of muscle.
18 A condition that is characterized by the formation or presence of calculi in the urinary tract.

Down

1 Deficient levels of antibodies absorbed by the gut in animals dependent upon colostrum for immunologic protection. (4 words)
3 A neurologic deficit in which the animal loses awareness of body position and movement in space. (2 words)
4 A cancer of lymphocytes and lymphoid tissues that is the third most common cancer diagnosed in dogs.
5 Condition that occurs in ewes during the last few weeks of pregnancy when there is a sudden demand for energy by fast-growing fetuses. (2 words)
6 Abnormal position of the eyes.
13 Inflammation of the mammary gland.

EXERCISE 20.2 MATCHING #1: TERMS AND DEFINITIONS

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Azotemia
2. _____ Endotoxemia
3. _____ Epistaxis
4. _____ Keratoconjunctivitis
5. _____ Ketosis
6. _____ Pericarditis
7. _____ Persistent infection
8. _____ Serosanguineous
9. _____ Serous
10. _____ Stranguria

Column B

A. Inflammation of the pericardial membrane surrounding the heart.
B. Bleeding from the nose.
C. Straining to urinate.
D. Condition in high-producing dairy cows caused by the buildup in the blood of products of fat breakdown.
E. Chronic infection that does not resolve despite use of antimicrobials.
F. Of, relating to, producing, or resembling serum.
G. A group of clinical signs caused by bacterial-associated toxins circulating through the bloodstream.
H. Containing or consisting of both blood and serous fluid.
I. Combined inflammation of the cornea and conjunctiva.
J. Increased serum blood urea nitrogen and creatinine.

EXERCISE 20.3 MATCHING #2: DISEASES OF RUMINANTS

Instructions: Match each disease or causative organism of disease in column A with the primary body system that it affects in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A

1. _____ Grain overload
2. _____ Nervous ketosis
3. _____ BVD
4. _____ Listeriosis
5. _____ Infectious bovine rhinotracheitis
6. _____ Traumatic reticuloperitonitis
7. _____ *Pasteurella multocida*
8. _____ Caprine arthritis encephalitis
9. _____ *Mycoplasma bovis*
10. _____ Salmonellosis
11. _____ Rabies
12. _____ Coronavirus

Column B

A. Central nervous system
B. Respiratory system
C. Gastrointestinal system

EXERCISE 20.4 MATCHING #3: DISEASES OF PIGS

Instructions: Match each description in column A with its corresponding disease of pigs in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once, and some responses may not be used.)

Column A

1. _____ Infection causes a high fever and may produce characteristic diamond skin lesions.
2. _____ Infection in baby pigs results in development of neurologic signs and, in some cases, vomiting and diarrhea.
3. _____ Infection results in pneumonia.
4. _____ Weaning and growing pigs exhibit fever, pneumonia, a dry, nonproductive cough, and flu-like signs.
5. _____ Respiratory signs include labored breathing, increased secondary respiratory infections, increased postweaning mortality, and decreased rate of gain and feed efficiency.
6. _____ Infection in adults may cause reproductive problems, including early embryonic death, abortion, or stillbirths, in pregnant sows or gilts.
7. _____ Reproductive signs include abortion, stillbirths, fetal mummies, and the birth of weak piglets.

Column B

A. Rhinotracheitis
B. Pseudorabies
C. Erysipelas
D. Rabies
E. Porcine reproductive and respiratory syndrome

EXERCISE 20.5 MATCHING #4: BODY CONDITION SCORE (BCS) FOR SHEEP

Instructions: Match each description in column A with its corresponding body condition score for sheep in column B by writing the appropriate number in the space provided.

Column A

Match the body score number to the correct definition.

A. _____ Slight bulging (convexity) between dorsal and transverse spinous processes.
B. _____ Mild concavity between the dorsal and transverse spinous processes.
C. _____ Absence of lumbar musculature and subcutaneous fat, leaving a profound depression between the tips of the dorsal and transverse spinous processes.
D. _____ No depression (straight line) between the dorsal and transverse spinous processes.
E. _____ Moderate concavity between the dorsal and transverse spinous processes.
F. _____ Profound convexity between the dorsal and transverse spinous processes (cannot palpate spinous processes).

Column B

0
1
2
3
4
5

EXERCISE 20.6 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Horses with upper respiratory tract problems have obvious abnormalities when the lungs are auscultated.
2. _____ Bastard strangles is characterized by development of an abscess in an abnormal location in the equine patient.
3. _____ A life-threatening side effect of guttural pouch infections can be the growth of plaque over the internal carotid artery.
4. _____ Heaves can be cured in the equine patient.
5. _____ Second-degree atrioventricular (AV) block is an arrhythmia in horses that is a medical emergency.
6. _____ Horses are predisposed to atrial fibrillation because of the small atria and high vagal tone.
7. _____ Equine contagious arteritis is a bacterial disease that produces limb swelling, conjunctivitis, abortion, and respiratory disease in horses.
8. _____ Choke is an indication of a tracheal obstruction.
9. _____ Eastern, Western, and West Nile equine encephalitis vaccines are highly effective, and vaccinated horses rarely get sick.
10. _____ Equine patients with Wobbler syndrome are more likely to be female than male.
11. _____ You must isolate horses with equine herpes virus to stop the spread of the disease.
12. _____ Addison disease in the horse is a common cause of polyuria and polydipsia.
13. _____ Changing the diet of a hospitalized equine patient is okay as long as you ask the owner.
14. _____ Bovine respiratory disease syndrome (BRDS) is caused by a single organism, *Pasteurella multocida*.
15. _____ BRDS in feedlot cattle is often referred to as shipping fever.
16. _____ Milk fever predominantly occurs in first-calf heifers.
17. _____ Pregnancy toxemia in ewes occurs in late gestation.
18. _____ Goats are more prone to copper toxicity than sheep.
19. _____ Small ruminants are susceptible to tetanus and should receive toxoid/antitoxin prior to surgery.
20. _____ Most cases of lameness in ruminants occur in the foot as opposed to the upper limb.
21. _____ Orf is treated with antibiotics as it is caused by a bacterium.
22. _____ Neonatal pigs easily become hyperthermic and care must taken to keep them cool and comfortable.

EXERCISE 20.7 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. Normal temperature for the adult horse is
   a. 89°F to 91.5°F
   b. 96°F to 101.5°F
   c. 99°F to 101.5°F
   d. 100°F to 103.5°F

2. A normal pulse in the adult horse is
   a. 18 to 34 bpm
   b. 28 to 44 bpm
   c. 38 to 54 bpm
   d. 48 to 64 bpm

3. Normal respiration for the adult horse is
   a. 4 to 8 breaths/min
   b. 6 to 16 breaths/min
   c. 16 to 26 breaths/min
   d. 34 to 48 breaths/min

4. Strangles is caused by the bacterial pathogen
   a. *Neorickettsia risticii*
   b. *Clostridium perfringens*
   c. *Salmonellosis equi*
   d. *Streptococcus equi*

5. The most common cause of a fungal infection of the guttural pouches is
   a. *Aspergillus* spp.
   b. *Salmonellosis* spp.
   c. *Streptococcus* spp.
   d. *Neorickettsia* spp.

6. Abortion secondary to equine herpesvirus occurs in what month of gestation?
   a. 1 to 3
   b. 3 to 5
   c. 6 to 8
   d. 7 to 11

7. Heaves most commonly occurs in horses that are
   a. Older than 2 years of age
   b. Older than 5 years of age
   c. Older than 10 years of age
   d. Older than 15 years of age

8. Potomac horse fever is caused by
   a. *Salmonella* spp.
   b. *Neorickettsia risticii*
   c. *Clostridium perfringens*
   d. Larval cyathostomiasis

9. The secondary hosts of the causative agent of equine protozoal myelitis (EPM) are
   a. Raccoons
   b. Opossums
   c. Birds
   d. Mice

10. Which ophthalmic disease is most common in horses?
    a. Corneal ulceration
    b. Recurrent uveitis
    c. Entropion
    d. Glaucoma

11. Monitoring of the equine patient with an infectious disease should occur
    a. Every 1 to 2 hours
    b. Every 3 to 4 hours
    c. Every 4 to 6 hours
    d. Every 8 to 12 hours

12. Equine patients unable to defecate because of recumbency should have the feces manually removed
    a. Once per day
    b. Twice per day
    c. Three times per day
    d. Only when the patient is uncomfortable

13. The recumbent equine patient should be repositioned every
    a. 2 hours
    b. 4 hours
    c. 6 hours
    d. 8 hours

14. The following agents are used in the equine patient. Which one has no analgesic properties?
    a. Xylazine
    b. Acepromazine
    c. Detomidine
    d. Butorphanol

15. The normal range for the PCV in the equine patient is
    a. 12% to 17%
    b. 19% to 32%
    c. 32% to 45%
    d. 45% to 57%

16. Endotoxins can cause margination and sequestration of the
    a. White blood cells
    b. Red blood cells
    c. Platelets
    d. Plasma

17. The equine patient has a yellow tint to the blood serum because
    a. It doesn't have a gall bladder
    b. Of the large cecum
    c. Of the large muscle mass
    d. The liver is small in comparison to the patient's size

18. What chemistry test is an indicator of muscle damage?
    a. Phosphate
    b. Blood urea nitrogen
    c. Albumin
    d. Creatine phosphokinase

19. Normal equine urine pH is
    a. 2 to 4
    b. 5 to 7
    c. 7 to 9
    d. 9 to 10

20. Small ruminants should be vaccinated for enterotoxemia
    a. Every 2 months
    b. Every 4 months
    c. Every 6 months
    d. Once a year

21. The normal pH of the rumen is
    a. 6.0 to 6.4
    b. 6.5 to 6.8
    c. 7.2 to 7.8
    d. 7.5 to 8.8

22. Which disease affects both cattle and small ruminants?
    a. Johne
    b. BVD
    c. Nervous ketosis
    d. BRDS

23. In the ruminant foot, which claws bear the most weight?
    a. Front lateral and hind lateral claws
    b. Front medial and hind lateral claws
    c. Front medial and hind medial claws
    d. Front lateral and hind medial claws

24. PPV causes death and mummification of the fetus
    a. At less than 30 days of gestation
    b. Between 30 and 70 days of gestation
    c. After 70 days of gestation
    d. At any stage of gestation

25. PPV causes death and resorption of fetus
    a. At less than 30 days of gestation
    b. Between 30 and 70 days of gestation
    c. After 70 days of gestation
    d. At any stage of gestation

26. Which animals listed below are classified as old world camelids? *(Choose all that apply.)*
    a. Guanaco
    b. Bactrian camels
    c. Vicuña
    d. Dromedary camels
    e. Llama
    f. Alpaca

27. Which animals listed below are classified as new world camelids? *(Choose all that apply.)*
    a. Guanaco
    b. Bactrian camels
    c. Vicuña
    d. Dromedary camels
    e. Llama
    f. Alpaca

28. Which animal is the normal host of *Parelaphostrongylus tenuis?*
    a. Llama
    b. White-tailed deer
    c. Mule deer
    d. Alpaca

EXERCISE 20.8 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 20.9 CASE STUDY #1: EQUINE INFECTIOUS ANEMIA

Your client, Mrs. Ratcliff, has called the clinic and asked why it is important to test her horses for equine infectious anemia (EIA) and why everyone thinks it is such a serious issue.

1. What do you tell her?

EXERCISE 20.10 CASE STUDY #2: EQUINE GASTRIC ULCERS

Mr. Fredrickson has had a call from his farm manager. Many of the young horses on his farm are developing gastric problems and they think it is ulcers. Your boss asked Mr. Fredrickson to call you to discuss the predisposing factors in horses that may contribute to the formation of gastric ulcers and what signs to be aware of so that he can address this issue with the farm manager.

1. What do you tell him?

EXERCISE 20.11 CASE STUDY #3: DERMATOPHILOSIS AND *CULICOIDES* HYPERSENSITIVITY

Mr. Robinson calls to talk to you. Dr. Rainy has been to see the horses at his barn. Several of them have dermatophilosis and a couple of his older mares have *Culicoides* hypersensitivity.

Dr. Rainy prescribed medication for the affected horses and directed Mr. Robinson to call you so you could talk to him about what he could do with regards to the environment to help these horses recover and not become affected each year.

1. What do you tell him?

EXERCISE 20.12 CASE STUDY #4: REARING LAMBS

Mrs. Rogers has just started a small sheep operation and she is interested in raising lambs. She has contacted your clinic to ask questions about how best to make sure her lambs are born healthy, how to prevent lamb rejection, and how to prevent lamb stealing by ewes. Your DVM has indicated that you can share the standard protocol the clinic recommends with Mrs. Rogers, and that she should also schedule a herd wellness check prior to breeding season.

1. What do you tell her?

EXERCISE 20.13 CASE STUDY #5: CARE OF NEONATAL CRIAS

Mrs. Jones has just purchased a pair of llamas and the female is pregnant. Mrs. Jones is concerned about the birth of the cria and what she needs to do to make sure that everything goes well after the birth. She also asked what to look for that would warn her that the cria is getting into trouble.

1. What information will you share with Mrs. Jones?

EXERCISE 20.8 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. Explain how the veterinary technician practice model works in a large-animal practice setting.

2. Explain the importance of being quiet and alert around the large-animal patient.

3. What anatomic parts are considered part of the upper respiratory tract?

4. Describe what guttural pouches are and where they are located.

5. What is the common name for recurrent airway obstruction (RAO) and what are the potential causes?

6. List two technician evaluations that would apply to an equine patient with respiratory disease and one intervention that could be applied to each evaluation.

   Technician evaluation #1: _____

   Intervention: _____

Technician evaluation #2: _____

Intervention: _____

_____

7. Describe the physiology of an AV block in the equine patient and what category of drugs can also cause it to occur.

_____

_____

_____

8. Describe the two ways atrial fibrillation can be converted in the equine patient without any other underlying cardiac disease.

i. _____

ii. _____

9. Describe the clinical signs associated with choke and the measures taken to minimize its occurrence in horses.

_____

_____

_____

10. What are the four most common causes of neurologic disease in horses?

i. _____

ii. _____

iii. _____

iv. _____

11. List one diagnostic test that can be used to evaluate brainstem or cerebral problems in the horse.

_____

12. Summarize the supportive care used for the equine patient infected with viral equine encephalitis.

_____

_____

13. List two diagnostic tools that can be utilized for diagnosis of spinal disorders of the equine patient.

i. _____

ii. _____

14. Explain the most common ways that an equine patient can contract tetanus.

15. List two technician evaluations that would apply to an equine patient with a neurologic disease and one intervention that could be applied to each evaluation.

    Technician evaluation #1: _____

    Intervention: _____

    Technician evaluation #2: _____

    Intervention: _____

16. List three pharmaceuticals that may cause acute renal failure in the equine patient.

    i. _____

    ii. _____

    iii. _____

17. Describe the most common treatment for acute renal failure in the equine patient.

18. What is the definition of polyuria in the equine patient?

19. What is the definition of polydipsia in the equine patient?

20. Which skin tumors are most common in gray horses?

21. What is the most common cause of endotoxemia in the equine patient?

22. Describe proper catheter care in the hospitalized equine patient.

23. List the information provided by a complete blood count (CBC).

24. Explain three steps that a technician should take to assist a newborn calf.

    i. _____

    ii. _____

    iii. _____

25. Describe how failure of passive transfer may occur.

26. List one viral and one bacterial cause of calf scours.

    Viral cause: _____

    Bacterial cause: _____

27. What causes white muscle disease in young calves, lambs, and kids?

28. Describe the clinical signs that may indicate enterotoxemia in goats.

29. Describe the parameters used to evaluate a rumen fluid sample.

30. Describe what would be seen with microscopic examination of normal rumen fluid.

31. Describe the procedure for performing the redox potential test.

32. Describe how grain overload can lead to dehydration and metabolic acidosis in the ruminant.

33. What are the two types of bloat and what is each caused by?

    i.

    ii.

34. Explain two possible outcomes when a metallic foreign body is ingested by a ruminant.

    i.

    ii.

35. List two possible causes of diarrhea in cattle and describe the specific clinical signs associated with each.

    i.

    ii.

36. Describe each step of the "five-point plan" for mastitis prevention.

    i.

    ii.

    iii.

    iv.

    v.

37. Describe the two ways that mastitis is categorized.

i. _____

_____

_____

ii. _____

_____

_____

38. Explain how an acute metritis may be linked to a retained placenta.

_____

_____

_____

39. Explain why cattle suspected of carrying anthrax should *not* be necropsied.

_____

_____

_____

40. *Moraxella bovis* is the cause of what disease in cattle?

_____

41. What type of diet might increase the incidence of urolithiasis in small ruminants?

_____

42. What four procedures are performed routinely in piglets that are raised in confinement?

i. _____

ii. _____

iii. _____

iv. _____

43. Explain the difference between direct and indirect salt poisoning in the swine.

_____

_____

_____

44. Describe normal behavior of pig herds and ways in which stressors alter this behavior.

45. Describe common misconceptions of the potbellied pig owner and what management practices can be implemented to support the health of these pets.

46. Briefly review the components of a preventive health care program for camelids.

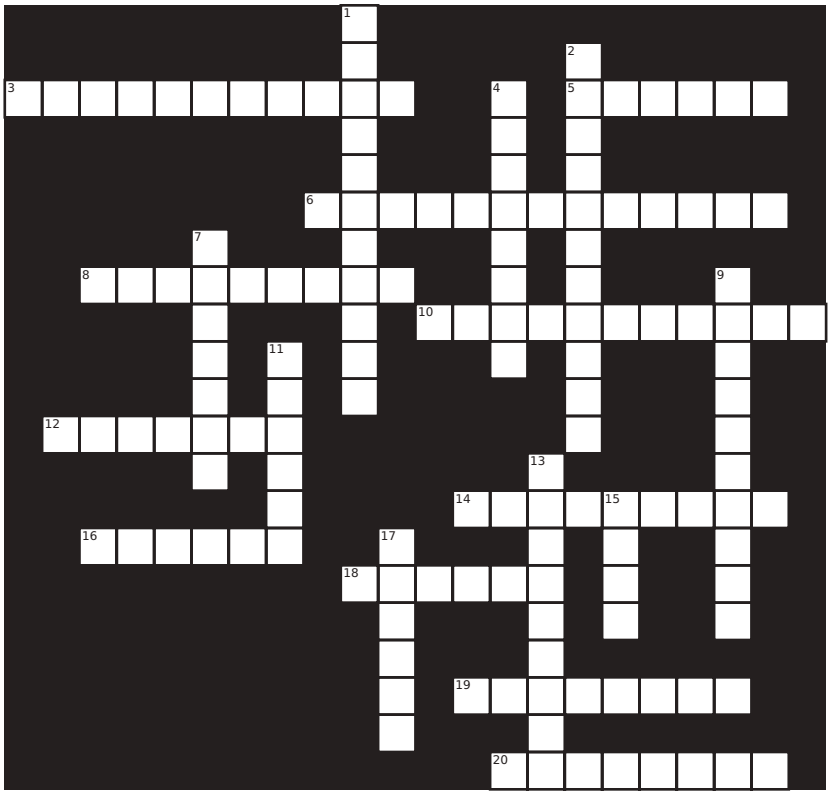
21 Neonatal Care of the Puppy, Kitten, and Foal

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all Key Terms in this chapter.
2. Define the neonatal period for puppies and kittens, obtain an accurate and thorough clinical history for all littermates and parents, and describe the procedure for physical examination of a neonate, including equipment needed and potential abnormalities.
3. Explain the timeline of normal development in neonatal puppies and kittens.
4. Do the following regarding performance of diagnostic procedures and routine maintenance in neonatal puppies and kittens:
   - Discuss how to perform diagnostic procedures on a neonatal puppy or kitten, including obtaining blood and urine samples, performing an ultrasound, and taking radiographs.
   - Discuss appropriate times to give medical treatments to neonatal puppies and kittens, including deworming and health examinations; be able to explain to the owner proper nutrition, preventive medicine, and behavior issues.
5. Do the following regarding common concerns and disorders in the puppy and kitten:
   - Explain common concerns and disorders of neonatal puppies and kittens, such as hypothermia, hydration status, hypoglycemia, malnutrition, fading puppy or kitten syndrome, and neonatal isoerythrolysis in kittens.
   - Discuss proper care of an orphaned neonatal puppy or kitten, including appropriate ambient temperatures and diet and common complications involved with orphaned neonates.
6. Do the following regarding the perinatal period and the high-risk mare:
   - Differentiate between normal and abnormal perinatal periods in the mare, and explain how to care for a high-risk mare.
   - Identify the stages of labor in a mare, and describe how to treat any complications that may arise at each stage.
7. Describe the normal development of a neonatal foal that occurs during the first 24 hours, and identify normal vital signs and behavior.
8. Do the following regarding care of the sick foal:
   - List the signs of a critically ill foal, including symptoms of prematurity and dysmaturity and classic early clinical signs of disease.
   - Identify common sites and procedures for venous and arterial blood collection, as well as appropriate needles, syringes, and restraint techniques to be used in the neonatal foal.
   - Identify parameters that should be monitored in the hospitalized foal, and describe complications that may arise during hospitalization.
   - Describe proper nursing care for the foal to prevent contamination, including washing of hands and injection sites, changing of IV fluid lines, and maintenance of IV and jugular catheters.
   - Explain appropriate physical therapy for the recumbent foal, the necessity for being kept in sternal position and rotated, and proper restraint techniques that can be used for the ambulatory foal.
9. Explain alternative methods that can be used to ensure that nutritional needs are met if a foal is unable to nurse from the mare.

EXERCISE 21.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

3 This type of ultrasound examination will allow the veterinarian to evaluate placental thickness near the cervical star, fetal fluid, and amount present.
5 A neonatal foal's fecal material will be of soft consistency and _____ in color.
6 In addition to an NSAID, a broad-spectrum _____ is typically used when treating placentitis in the mare.
8 A major complication a foal may experience if the mare fails to deliver within 30 minutes of the onset of Stage 2 labor.
10 The heartbeat of a neonatal foal should be strong and regular with a _____ pulse.
12 This type of discharge may indicate placentitis or urine pooling in a pregnant mare, and should be evaluated by a veterinarian.
14 Mares with placentitis will often deliver _____ foals, if left untreated.
16 The agent applied to the remnant of a foal's umbilical cord to prevent infection.
18 A reflex of the newborn foal characterized by curling the tongue and seeking to nurse.
19 The term used to describe a portion of the mare's placenta that has not been expelled.
20 A specific type of quiet heart murmur that may be present in a neonatal foal, but which is expected to disappear over time.

Down

1 The presence of a thickened or detached placenta, and/or hyperechoic fetal fluid on ultrasonographic examination is evidence of this condition.
2 The adjective used to describe an increase in white areas noted on the ultrasound image of fetal fluid caused by the presence of cellular debris.
4 Milk dripping or milk streaming from a mare's udders should not occur unless delivery is
7 The term used to describe parturition in a horse.
9 The time period immediately following parturition, during which intervention is necessary if a mare is not interested in her foal or appears to be in pain.
11 A specific gravity of 1.001 to 1.006 indicates a foal's urine is _____.
13 The technology used to monitor the heart rates of a mare and foal during "high-risk" delivery.
15 In response to a neonatal foal experiencing hypoxemia, an endotracheal tube is placed, and this type of bag is used to deliver breaths of oxygen.
17 As a result of poor _____ conformation, older mares are prone to the problem of dripping milk as they age.

EXERCISE 21.2 DEFINITIONS: COMMON DISEASES AND CONDITIONS OF NEONATAL FOALS

Instructions: Define each disease or condition of neonatal foals in your own words.

1. Sepsis or septic shock:
2. Neonatal encephalopathy:
3. Failure of passive transfer (FPT):
4. Neonatal nephropathy:
5. Neonatal isoerythrolysis:
6. Dysmaturity:
7. Neonatal gastroenteropathy:
8. Colitis:
9. Musculoskeletal abnormalities:
10. Patent urachus:
11. Ruptured bladder:
12. Entropion:
13. Septic arthritis or septic physitis:

14. Meconium retention: _____

15. Prematurity: _____

EXERCISE 21.3 MATCHING: THE NEONATAL FOAL

Instructions: Match each word in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Urachus
2. _____ Nosocomial
3. _____ Omphalitis
4. _____ Bacteremia
5. _____ Petechiae
6. _____ Pinna
7. _____ Insufflation
8. _____ Colostrum
9. _____ Hypovolemia
10. _____ Foaling
11. _____ Icterus
12. _____ Water breaking
13. _____ Fibrinogen
14. _____ Dysmaturity
15. _____ Hypoxemia
16. _____ Wax
17. _____ Entropion
18. _____ Glucosuria
19. _____ Bucket baby
20. _____ Primiparous
21. _____ Injected
22. _____ Miotic

Column B

A. Parturition in a mare.
B. Drops of dried milk on the tip of a mare's teats.
C. Another name for a maiden mare.
D. Mare's first milk.
E. Rupture of a mare's placenta releasing allantoic fluid.
F. Low oxygen blood levels.
G. A foal raised as an orphan.
H. Acute phase protein produced by the liver in response to active inflammation.
I. Infection in the bloodstream.
J. The state resulting in a foal with a longer-than-expected gestation.
K. The word used to describe dark purple mucous membranes with prominent vessels.
L. Yellow sclerae and mucous membranes.
M. Small areas of hemorrhage.
N. Foal's outer ear.
O. A condition in which the lower eyelids roll inward.
P. Decreased blood volume.
Q. A term used to describe constricted pupils.
R. Administration of intranasal oxygen.
S. Sugar present in the urine.
T. A canal in the umbilicus that drains the urinary bladder.
U. Inflammation of the umbilicus.
V. Resistant infections acquired in the hospital.

EXERCISE 21.4 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ When obtaining a comprehensive history on puppies and kittens, the history of the littermates, parents, and relatives should also be obtained.

2. _____ Painting the toenails of neonates is an acceptable method of identification.

3. _____ A mercury thermometer is more practical to use than a digital thermometer when obtaining the body temperature of a neonate.

4. _____ When assessing the hydration status of a neonate, checking the skin turgor is the preferred method.

5. _____ Normal neonatal puppies and kittens often have sparse hair coats.

6. _____ Bluish or dark red skin may be normal in a neonatal puppy or kitten.

7. _____ A bloated abdomen in a neonatal puppy or kitten should not be ignored.

8. _____ Neonates lack neuromuscular reflexes.

9. _____ Normal neonates may have irregular heart and respiratory rates.

10. _____ When neonates are born, they are capable of maintaining their own body temperature.

11. _____ The abdominal component to breathing is absent in neonatal puppies and kittens.

12. _____ When compared to males, female kittens will have a longer anogenital distance.

13. _____ Cystocentesis is a safe method of urine collection in neonates.

14. _____ Undesirable behavior is one of the most common reasons for abandonment of dogs and cats younger than 1 year of age.

15. _____ Body heat is produced by brown fat metabolism, which is controlled by the parasympathetic nervous system (PNS).

16. _____ The fluid requirement of neonates is much higher than that of adult animals.

17. _____ There is less risk of aspiration associated with tube feeding than with syringe and bottle feeding in neonates.

18. _____ Mares with multiple pregnancies often deliver around the same time each pregnancy.

19. _____ Foals are born without a menace response.

20. _____ The packed-cell volume (PCV) of the normal foal during the first 24 hours of life is less than that of an adult horse.

EXERCISE 21.5 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. The time period of a puppy or kitten's life that is considered to be the neonatal phase.
   a. 1 to 2 weeks
   b. 2 to 4 weeks
   c. 4 to 6 weeks
   d. 6 to 8 weeks

2. Neonatal puppies and kittens are unable to regulate their own body temperature during the first _____ weeks of life.
   a. 2
   b. 3
   c. 4
   d. 6

3. Normal developing puppies and kittens will nurse as frequently as every _____ during their first week of life.
   a. 1 to 2 hours
   b. 2 to 4 hours
   c. 3 to 6 hours
   d. 3 to 5 hours

4. The age in which puppies and kittens should be able to lift their head.
   a. Day 1
   b. Day 2
   c. Day 3
   d. Day 4

5. The age at which puppies and kittens begin to crawl in a coordinated manner.
   a. 1 week
   b. 2 weeks
   c. 3 weeks
   d. 4 weeks

6. The shiver reflex of newborn puppies and kittens does not develop until after
   a. 1 week of age
   b. 2 weeks of age
   c. 3 weeks of age
   d. 4 weeks of age

7. Kittens and puppies will begin to open their eyes at the age of
   a. 3 to 7 days
   b. 5 to 10 days
   c. 7 to 12 days
   d. 10 to 14 days

8. The external ear canals of puppies and kittens will open at the age of
   a. 10 to 12 days
   b. 12 to 14 days
   c. 14 to 16 days
   d. 16 to 18 days

9. When obtaining blood from a neonate, the percentage of the circulating blood volume obtained over the course of 1 week should not exceed
   a. 5%
   b. 10%
   c. 15%
   d. 20%

10. At what age do puppies and kittens have a temperature that is similar to an adult's temperature?
    a. 2 weeks
    b. 4 weeks
    c. 6 weeks
    d. 8 weeks

11. Blood can easily be obtained from neonates by using the
    a. Cephalic vein
    b. Jugular vein
    c. Saphenous vein
    d. Femoral artery

12. Puppies and kittens are able to stand with good postural reflexes at the end of week
    a. 2
    b. 3
    c. 4
    d. 5

13. If a neonatal puppy or kitten weighs 300 g, the maximum volume of blood that can be drawn in the course of 1 week would be
    a. 1.5 cc
    b. 2.0 cc
    c. 3.0 cc
    d. 3.5 cc

14. Radiology of the neonate requires
    a. Low-detail intensifying screens and single-emulsion film
    b. High-detail intensifying screens and double-emulsion film
    c. High-detail intensifying screens and single-emulsion film
    d. Low-detail intensifying screens and double-emulsion film

15. Because neonatal animals have immature kidneys, it is considered normal to find urine with a specific gravity between
    a. 1.010 and 1.015
    b. 1.012 and 1.020
    c. 1.015 and 1.025
    d. 1.020 and 1.030

16. The age puppies and kittens should be taken to the veterinarian for their first official health examination is
    a. 4 to 6 weeks
    b. 6 to 8 weeks
    c. 8 to 10 weeks
    d. 10 to 14 weeks

17. A neonate is considered hypothermic if, at birth, the body temperature drops below
    a. 90°F
    b. 92°F
    c. 94°F
    d. 97°F

18. When treating hypothermic neonatal puppies, it is important to withhold the administration of oral food until the animal has
    a. Audible gut sounds and is moderately warmed
    b. Audible gut sounds and is fully rewarmed
    c. No gut sounds but is moderately rewarmed
    d. No gut sounds but is fully rewarmed

19. Any disease process or fluid or electrolyte imbalance in neonatal animals will quickly lead to
    a. Hypothermia
    b. Colic
    c. Lethargy
    d. Dehydration

20. Acceptable route(s) of fluid administration in the neonate are
    a. IV only
    b. IV or IO only
    c. IV, IO, and IP
    d. IV, IO, IP, and SC

21. When administering fluids intraosseously to a neonate, an 18- or 19-gauge needle can be placed in the
    a. Proximal tibia or proximal femur
    b. Proximal tibia or distal femur
    c. Distal tibia or distal femur
    d. Distal tibia or proximal femur

22. Failure of a neonate to suckle will result in _____ after 24 to 36 hours as a consequence of depletion of hepatic storage.
    a. Hypothermia
    b. Hyperthermia
    c. Hypoglycemia
    d. Hyperglycemia

23. Dextrose solutions should never be administered _____ as they may cause tissue damage.
    a. Intravenously
    b. Subcutaneously
    c. Intraosseously
    d. Intraperitoneally

24. Occasionally a mare will develop a problem in late-term pregnancy. These mares are referred to as
    a. Primiparous mares
    b. High-risk mares
    c. Late-term mares
    d. Problem mares

25. The average gestational length for the mare is
    a. 200 days
    b. 240 days
    c. 300 days
    d. 340 days

26. The veterinarian will perform a rectal examination and transrectal ultrasound on a pregnant mare at approximately
    a. 15 days and 30 days
    b. 15 days, 30 days, and 90 days
    c. 30 days and 90 days
    d. 30 days, 90 days, and 120 days

27. In late-term pregnancy, the foal's heart rate will fall within the range of
    a. 20 to 80 bpm
    b. 30 to 100 bpm
    c. 40 to 150 bpm
    d. 80 to 180 bpm

28. Mares often foal
    a. First thing in the morning
    b. In the afternoon
    c. In the evening
    d. At night

29. Agitation, pacing, nickering, lifting the tail head, turning and biting at sides, and kicking the abdomen occur during which stage of labor in the mare?
    a. Stage 1
    b. Stage 2
    c. Stage 3
    d. Stage 4

30. Sweating around the shoulders of a mare in labor is indicative of
    a. Dystocia
    b. Foaling within 30 minutes
    c. Colic
    d. Nothing significant

31. The mare will pass her placenta during _____ of labor.
    a. Stage 1
    b. Stage 2
    c. Stage 3
    d. Stage 4

EXERCISE 21.6 FILL-IN-THE-BLANK: NEONATOLOGY OF PUPPIES AND KITTENS

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. When performing a physical examination on a neonate, the use of a _____ stethoscope with a 2-cm bell is helpful.

2. When a neonate is born, hair will be present on most of the body excluding the _____ abdomen.

3. The only motor skills present in a neonatal puppy or kitten are _____, _____, and distress _____.

4. Urination and defecation of neonates is initiated by the bitch or queen licking the _____ area.

5. The body temperature of puppies and kittens at birth will be lower than in adult animals and will rise to 94.7°F to 100.1°F during their first _____ of life.

6. A neonate's umbilical cord will dry out during its first day of life and is expected to fall off by day _____ to _____.

7. The flexor tone present at birth in puppies and kittens will switch over to the extensor tone after the _____ day of life.

8. Neonates generally tolerate a(n) _____ examination better than a radiography examination when imaging techniques are used.

9. At the beginning of week _____ of life, puppies and kittens should receive their first deworming treatment of pyrantel pamoate.

10. Deworming treatment in puppies and kittens is aimed mainly toward eliminating a common intestinal parasite called _____.

11. As long as neonates remain close to their mother and, specifically, the mammary glands, they will be able to maintain their _____ balance.

12. Hypothermia in the neonate is a serious problem that may lead to slowing of gut motility and, ultimately, _____.

13. When hypothermic neonates are tube fed, milk replacer is either regurgitated and aspirated resulting in _____ or the ingesta may ferment leading to _____.

14. Clinical signs in a chilled neonate with a body temperature above 88°F include restlessness, continuous crying, _____ mucous membranes, and skin that feels _____ to the touch.

15. When the body temperature of a small animal neonate falls into the range of _____°F to _____°F, the neonate appears lethargic and uncoordinated.

16. When the body temperature of a small animal neonate is below _____°F, the animal will appear to be dead.

17. _____ also contributes significantly to hypothermia in the neonate, thus proper ventilation or oxygen should be administered when possible.

18. Warm air and _____ in a human neonatal incubator is optimal for rewarming hypothermic neonates.

19. _____ rewarming of a neonate will result in heat prostration with increased respiratory rate and effort.

20. Raising the body temperature of a neonate more than _____°F is usually fatal because of delayed organ failure.

21. Hydration status of a neonate, is best checked by looking at the oral _____ _____.

22. When the oral mucous membranes of a neonate are _____, the neonate is adequately hydrated.

23. Tacky or dry mucous membranes in a neonate indicates _____% to _____% dehydration.

24. When a neonate has reached _____% dehydration, the oral mucous membranes will be dry with a noticeable decrease in skin elasticity.

25. Fluid requirements are _____ in neonates; however, total fluid volumes that can be administered are _____.

26. When administering intravenous fluids to a neonate, it is often easiest to place a short 23- or 25-gauge catheter in the _____ vein.

27. The key element to nursing a dehydrated neonate back to health is _____ _____.

28. The risk of hypoglycemia is great in neonatal animals because they are born with little _____ stores and have poor _____ in their liver.

29. Hypoglycemic neonates will have serum glucose less than _____ mg/dL.

30. A _____ solution is used to treat a neonate with hypoglycemia.

31. One of the most common causes of seizures in neonatal puppies and kittens is _____.

EXERCISE 21.7 SHORT ANSWER #1: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 21.8 SHORT ANSWER #2: NEONATOLOGY

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 21.9 CASE STUDY: POSTPARTUM EXAMINATION OF A LITTER OF PUPPIES

Signalment: Roxanne, a 3-year-old, female, Rottweiler with her litter of six 4-day-old puppies.
Chief Complaint: Roxanne and her puppies are presented for a routine postpartum examination, including puppy tail docking and dewclaw removal. The owner reports that Roxanne delivered the six puppies uneventfully 4 days prior to presentation. This is Roxanne's second pregnancy, and she is accepting and caring for the puppies. All of the puppies seem to be nursing vigorously and gaining weight. Answer the following questions regarding this case.

a. What are the ways in which examination of neonates differs from examination of adult animals?

b. What special equipment is needed when examining neonates?

c. What are the components of a complete neonatal examination, including specific abnormalities you would look for?

EXERCISE 21.10 WORD SEARCH: TERMS

Find the words that are defined by the clues given below. The words may be located horizontally, vertically, or diagonally, and may be reversed.

L	W	P	E	R	I	N	A	T	A	L	S	A	L	L
S	L	A	O	E	N	I	A	C	O	D	I	L	B	R
B	A	A	T	T	L	A	N	A	E	O	H	L	L	A
E	L	E	I	E	T	A	E	N	E	Y	O	N	N	C
N	A	C	N	M	R	H	T	C	D	A	A	E	I	C
E	T	L	I	O	R	M	U	R	T	S	O	L	O	C
C	I	E	A	R	I	M	A	W	I	N	O	I	O	G
R	G	D	A	T	T	T	R	B	A	B	S	S	M	R
O	I	I	S	S	I	S	A	T	A	T	S	A	U	N
P	D	S	U	O	E	N	A	T	U	C	B	U	S	Y
S	O	R	N	L	D	L	E	G	S	T	N	N	R	E
Y	O	I	C	O	S	M	M	G	O	E	P	C	O	N
A	I	A	O	C	A	E	I	O	O	S	G	E	D	D
S	A	S	E	I	D	O	B	I	T	N	A	T	O	B
O	Y	Y	D	T	T	I	A	I	C	N	A	N	N	S

Digital
ELISA
Dorsum
Nasogastric
Water
Band
Anogenital
Lidocaine
Subcutaneous
Metabolic
Bloat
Antibodies
Hydration
Diarrhea
Necropsy
Perinatal
Neonatal
Gestation
Colostrum
Colostrometer

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EXERCISE 21.7 SHORT ANSWER #1: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. When is the thymus gland the largest in a dog?

2. Explain why drugs that require hepatic metabolism should only be carefully administered to a neonatal patient.

3a. How is optimal contrast achieved when obtaining neonatal radiographs?

3b. Why is the kilovoltage reduced to half that of an adult when obtaining neonatal radiographs?

4. During a new puppy or kitten's first visit to the hospital, it is important to talk with the owner about several health-related topics. What are the three most important topics to discuss during this visit?

   i.

   ii.

   iii.

5. Explain why heat loss is much greater in neonates when compared with older animals.

6a. What temperature should all fluids be warmed to prior to administration to a neonate?

6b. Should this temperature be changed for substantially colder neonates?

7. Explain the importance of only puncturing each bone once when preparing to administer fluids intraosseously to a neonatal animal.

8a. List clinical signs that may occur in a hypoglycemic neonate.

8b. How long can a healthy neonate maintain normal blood glucose concentrations without nursing?

8c. Why should high concentrations of intravenous dextrose be avoided?

9a. List clinical signs related to neonatal isoerythrolysis in kittens.

9b. Explain why blood type A kittens who receive colostral antibodies from a blood type B queen may lead to incompatibility.

10a. Describe how to stimulate a neonate to urinate or defecate after consuming a meal.

10b. For how long should neonates be weighed on a daily basis in order to ensure proper weight gain?

11. What is the name of the enzyme contained in a mother's milk that is beneficial for helping with proper digestion in the neonate?

12a. Under what circumstances is tube feeding necessary in a neonate?

12b. Under what circumstances is tube feeding a puppy or kitten contraindicated? Explain why.

13a. Explain why proper identification and accurate daily weight recordings for each orphan puppy or kitten is important information to obtain.

13b. What are the most common mistakes made by those raising an orphan?

14. What is the reason for exercising a pregnant mare?

15a. Describe the changes that occur in a mare's udders toward the end of gestation and before delivery.

15b. List three reasons for dripping or streaming milk from a mare's udders prior to delivery.

i. _____

ii. _____

iii. _____

16. What information can be obtained through rectal and transrectal ultrasound examinations on a pregnant mare?

_____

_____

17. Describe the typical treatment of placentitis in a pregnant mare, including what the treatment is designed to do.

_____

_____

18a. List the three primary reasons for classifying a mare as "high risk."

i. _____

ii. _____

iii. _____

18b. List the methods used to monitor "high-risk" mares during labor.

_____

19. Why is it important for a mare to remain comfortable during Stage 1 labor?

_____

20. During late-term pregnancy, why is it important for a foal to have a range of heart rates over time as opposed to a sustained low or high heart rate?

_____

_____

21. Explain why colostral calcium levels can be used to predict parturition in the mare.

_____

22. List three physical signs that occur in the mare as parturition approaches.

i. _____

ii. _____

iii. _____

23. What is the most reliable way to determine when a mare will foal?

_____

24. List five postpartum complications that require immediate attention to prevent rejection of the foal by the mare.

i. _____

ii. _____

iii. _____

iv. _____

v. _____

25. Why is a nursing foal's urine dilute?

_____

26. It is very important that newborn foals receive colostrum within the first 12 to 24 hours of life.

a. Why is this the case?

_____

b. What is the specific gravity of high-quality colostrum?

_____

c. Explain the function of opsonins in colostrum.

_____

d. What is the significance of a foal's IgG level that is less than 800 mg/dL after 24 hours of age?

_____

e. List four reasons why failure of passive transfer may occur in the foal.

i. _____

ii. _____

iii. _____

iv. _____

27. What is the significance of finding more than 100 to 150 band neutrophil cells/dL on a CBC in a foal?

_____

28. Explain why foals will eat their mother's manure during the first week of life.

_____

29. List the three main sites through which bacteria and viruses enter a foal.

    i. _____

    ii. _____

    iii. _____

30. List the names of the two arteries frequently used to assess pulses and to obtain arterial blood gas samples from in the foal.

    i. _____

    ii. _____

31. Why is it important to monitor a critically ill foal's blood pressure once admitted into a veterinary hospital?

    _____

32. Describe the method usually used to restrain ambulatory foals.

    _____

33. Why should a recumbent foal be turned from side to side every 2 hours?

    _____

34a. What fungal infection can occur in foals that are unable or reluctant to swallow and that are concurrently being treated with antimicrobials?

    _____

34b. How is candidiasis recognized in neonatal foals?

    _____

35. What is the ideal source of oral nutrition for neonatal foals?

    _____

EXERCISE 21.8 SHORT ANSWER #2: NEONATOLOGY

Instructions: Respond to each of the following questions in the space provided.

1. List the symptoms, causes, and treatments of fading puppy or kitten syndrome.

    a. Symptoms: _____

b. Causes: _____

c. Treatments: _____

2. List normal physiologic and behavioral parameters of neonatal puppies during their first week of life. Make sure to include nursing and sleeping habits; central nervous system, including neuromuscular reflexes; motor skills; response to stimuli; urination and defecation, body temperature; heart rate and respiratory rate; and character.

   Nursing and sleeping habits: _____

   a. Central nervous system including neuromuscular reflexes: _____

   b. Motor skills: _____

   c. Response to stimuli: _____

   d. Urination and defecation: _____

   e. Body temperature: _____

   f. Heart rate and respiratory rate and character: _____

22 Care of Birds, Reptiles, and Small Mammals

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all Key Terms in this chapter.
2. Do the following regarding the intake process and examination of birds:
   - Explain how to properly transport an avian patient to the veterinary hospital.
   - List the information included in an accurate and thorough clinical history for an avian patient, and explain proper capture and restraint techniques for an effective and timely examination with minimal stress for the patient.
3. Explain the sample collections and diagnostic procedures commonly used in birds, as well as proper anesthetic induction techniques and intubation procedures.
4. Do the following regarding management and care of a hospitalized avian patient:
   - Discuss the proper husbandry of avian patients, including the purpose and procedure of wing trimming and toenail clipping.
   - Explain the dietary and water requirements for pet birds.
   - Describe the care of a hospitalized avian patient, including common routes for administering medication, housing requirements, cage cleaning, monitoring appetite, crop emptying, and basal metabolic rate.
   - List zoonoses and other common clinical problems associated with avian patients, and explain how to prevent transmission to humans.
5. List the materials needed to properly treat and handle reptile species in the veterinary hospital, and discuss the information needed for an accurate and thorough clinical history of a reptile patient.
6. Do the following regarding the collection of samples, diagnostic procedures, radiography and anesthesia in reptiles:
   - Explain sample collections and diagnostic procedures commonly used in reptiles.
   - Describe proper restraint and handling techniques when obtaining radiographs of reptilian patients, and anesthesia and intubation recommendations for the chelonian, snake, and lizard.
7. Do the following regarding management and care of a hospitalized reptile patient:
   - Describe husbandry requirements for the reptilian patient, including temperature, humidity, and substrate preferences.
   - Explain the dietary and light requirements, as well as nutritional deficiencies, of chelonians, snakes, and lizards.
   - Discuss diagnostic sampling of skin, feces, and sputum in reptile patients.
   - List common zoonoses associated with reptiles and explain how to prevent their transmission to humans.
8. Explain the proper care of a ferret, including nail trimming, blood collection techniques, anesthesia procedures, and nutritional requirements. Also, list common presenting complaints in this species.
9. Explain the proper care of a rabbit, including nutritional requirements, anesthesia techniques, and general care procedures. Also, list common presenting complaints in this species.
10. Discuss the use of antibiotics, anesthesia, and antiparasitic agents in pet rodents.
11. Describe the special dietary and housing requirements of guinea pigs, including substrate preferences and problems with delivery of young.
12. Describe the proper care of hamsters, gerbils, mice, rats, prairie dogs, hedgehogs, and sugar gliders, including husbandry requirements, dietary requirements, and common disease conditions.

EXERCISE 22.1 DEFINITIONS: KEY TERMS

Instructions: Define each term in your own words including the species or general type of animal to which it applies.

1. Cloaca: _____

2. Ecdysis: _____

3. Conjunctivitis: _____

4. Colonic wash: _____

5. Medial metatarsal vein: _____

EXERCISE 22.2 FILL-IN-THE-BLANK: TERMS AND DEFINITIONS

Instructions: Fill in each of the spaces provided with the missing term that completes the sentence.

1. The use of penicillin antibiotics in rodents often causes _____ to occur.
2. The _____ is a dilation of the esophagus that is found in most birds.
3. In birds, the neutrophils are known as _____.
4. A turtle is an example of a _____.

EXERCISE 22.3 MATCHING: TERMS AND DEFINITIONS

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ *Giardia*	A. Located on the wing of birds.
2. _____ Glottis	B. Swelling around the eye.
3. _____ Palpebral edema	C. A common nematode found in birds.
4. _____ Perineum	D. The opening into the trachea.
5. _____ Capillaria	E. The area around the anus and vulva.
6. _____ Basilic vein	F. A protozoan GI parasite that affects birds.

EXERCISE 22.4 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Most medical problems in exotic pets are caused by the owner's lack of knowledge about proper husbandry.
2. _____ A choanal culture is recommended when birds are exhibiting upper respiratory signs.
3. _____ The left jugular vein is much larger than the right jugular vein in birds.
4. _____ Injectable anesthetics are most commonly used to restrain birds for radiography.
5. _____ The primary feathers are often clipped in pet bids to prevent flight.
6. _____ The best method to medicate birds is by putting the drugs in the water.
7. _____ Most pet birds should be weighed on a gram scale.
8. _____ Nutritional deficiencies are common in pet birds.
9. _____ Seed diets are acceptable for smaller psittacine birds.
10. _____ Birds do not have sweat glands.
11. _____ Stomach lavage may be used to identify cryptosporidiosis in reptiles.
12. _____ Positive pressure ventilation is recommended with isoflurane anesthesia in chelonians.
13. _____ All reptiles are easily induced with isoflurane through a mask.
14. _____ Unlike in mammals, ketamine is metabolized quickly in snakes resulting in a rapid recovery.
15. _____ Tortoises are primarily herbivores.
16. _____ Box turtles cannot swim and may drown in a large water bowl.
17. _____ The green iguana is a strict carnivore.
18. _____ Ferrets are induced ovulators.
19. _____ There is a distemper vaccine approved for use in ferrets.
20. _____ Ferrets are very susceptible to feline panleukopenia.
21. _____ Rabbits are susceptible to fleas, mites, and lice.
22. _____ Guinea pigs may be fed rabbit pellets.
23. _____ Wire cage bottoms may cause footpad ulcers in guinea pigs.
24. _____ Guinea pigs rarely bite and are relatively easy to handle.
25. _____ Hamsters should be housed separately.
26. _____ Gerbils have cheek pouches.
27. _____ Nasal discharges in rats may turn red, but it is not usually caused by blood.
28. _____ Prairie dogs in captivity are prone to obesity.
29. _____ Malnutrition is one of the most common disease conditions diagnosed in sugar gliders.

EXERCISE 22.5 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. Which is a protozoan parasite that may be found on a crop wash?
   a. *Candida*
   b. *Capillaria*
   c. *Giardia*
   d. *Trichomonas*

2. Where is the basilic vein found on the bird?
   a. Medial surface of the wing
   b. At the back of the head
   c. On the lower leg
   d. In the roof of the mouth

3. Which muscles are most commonly used for injections in birds?
   a. Pectoral
   b. Epaxial
   c. Gluteal
   d. Biceps

4. Which is the recommended site for placement of intraosseous catheters in birds?
   a. Distal humerus
   b. Proximal tibia
   c. Distal femur
   d. Distal ulna

5. Which of the following does not open into the cloaca of reptiles?
   a. Urethra
   b. Oviduct
   c. Choana
   d. Colon

6. Which site is used for blood collection in turtles?
   a. Heart
   b. Occipital sinus
   c. Cranial vena cava
   d. Saphenous vein

7. Which radiographic view is used routinely in turtles, but not in snakes, lizards, or birds?
   a. Lateral
   b. Hanging VD
   c. AP (or frontal)
   d. Lateral oblique

8. Which is the most common site used for IM injections in snakes?
   a. Cranial epaxial muscles
   b. Gluteal muscles
   c. Caudal epaxial muscles
   d. IM injections cannot be administered to snakes

9. Metabolic bone disease is least likely to occur in which of the following?
   a. Iguana
   b. Bearded dragon
   c. Burmese python
   d. Box turtle

10. If a ferret-specific commercial diet is not available, then _____ can be substituted.
    a. Canned dog food
    b. Insectivore diet
    c. Cat food
    d. Rodent chow

11. Which animal is most difficult to intubate and therefore is usually maintained with isoflurane using a mask?
    a. Rabbit
    b. Ferret
    c. Parrot
    d. Iguana

12. Human influenza is seen in which of the following animals?
    a. Hedgehog
    b. Prairie dog
    c. Ferret
    d. Guinea pig

13. Which mite most commonly affects the fur of rabbits?
    a. *Sarcoptes*
    b. *Microsporum*
    c. *Demodex*
    d. *Cheyletiella*

14. Which animal produces precocious young?
    a. Ferret
    b. Rabbit
    c. Guinea pig
    d. Sugar glider

15. Which antibiotic is least likely to cause dysbiosis in rabbits and rodents?
    a. Amoxicillin
    b. Streptomycin
    c. Tetracycline
    d. Penicillin

16. An adult female ferret with a swollen vulva and hair loss most likely has which disorder?
    a. Hyperadrenocorticism
    b. Hypothyroidism
    c. Ovarian neoplasia
    d. Hyperthyroidism

17. Which animal requires vitamin C in its diet?
    a. Rabbit
    b. Sugar glider
    c. Hedgehog
    d. Guinea pig

18. Which of the following is a social animal and needs special attention if housed singly?
    a. Guinea pig
    b. Sugar glider
    c. Hamster
    d. Rabbit

19. The cranial vena cava is often the preferred site for blood collection in which animal?
    a. Rabbit
    b. Ferret
    c. Parrot
    d. Snake

20. Which animal has the enzyme atropinase, which can interfere with atropine administration?
    a. Ferret
    b. Snake
    c. Sugar glider
    d. Rabbit

21. Ferrets should be vaccinated against which disease?
    a. Feline panleukopenia
    b. Canine distemper
    c. Measles
    d. Leptospirosis

22. Which of the following animals has cheek pouches that it can stuff with food?
    a. Sugar glider
    b. Guinea pig
    c. Ferret
    d. Hamster

23. Seizures are an inherited disorder seen in which of the following?
    a. Gerbils
    b. Hamsters
    c. Rabbits
    d. Ferrets

24. Which animal originally comes from Australia?
    a. Gerbil
    b. Sugar glider
    c. Hedgehog
    d. Hamster

25. Which rodent is used most commonly in research?
    a. Rabbit
    b. Guinea pig
    c. Mouse
    d. Hamster

26. Which of the following should be fed an insectivore diet?
    a. Hedgehog
    b. Prairie dog
    c. Sugar glider
    d. Iguana

27. Which of the following rodents has open rooted molar teeth?
    a. Hamster
    b. Rabbit
    c. Guinea pig
    d. Gerbil

28. Which of the following reduces the incidence of hairballs in rabbits?
    a. High-fiber diet
    b. High-carbohydrate diet
    c. High-protein diet
    d. High-fat diet

29. Which of the following animals should be on heartworm preventative if kept outdoors in an area with a high prevalence of heartworm?
    a. Rabbit
    b. Prairie dog
    c. Sugar glider
    d. Ferret

30. Which animal should be housed in a tall wire enclosure with branches and places to hide?
    a. Hedgehog
    b. Sugar glider
    c. Guinea pig
    d. Prairie dog

EXERCISE 22.6 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 22.7 CASE STUDY: GUINEA PIG NUTRITION, HUSBANDRY, AND PREVENTIVE CARE

1. A client calls and states that her daughter got an adult guinea pig for Christmas. It is now a month later and she wants to know when it should be spayed and what vaccinations it requires. She also notes that it has not been eating well and has been salivating more than usual. On further questioning she mentions that she is feeding it the same diet she feeds her rabbit. What advice should you give her?

EXERCISE 22.6 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. A client calls your practice at 10 AM on a Tuesday, concerned that her cockatoo appears depressed and is sitting on the cage floor.

   a. What advice should the client be given?

   b. If the bird needs to be brought to the hospital, it is important to secure the animal during transport. Explain to the client how this should be done.

   c. Why should the bird's cage not be cleaned before bringing it to the hospital (assuming it is small enough to fit in the car)?

2. When taking a medical history on an avian patient, it is important to obtain information in each of the following general areas. For each area, state one specific question that should be asked to obtain useful information, including why the stated question is important.

   a. Origin:

   b. Environment:

   c. Diet:

   d. Appetite:

   e. Feces:

f. Cage mates: _____

g. Molting cycle: _____

h. Behavior: _____

i. Previous medical history: _____

3. Careful patient capture, restraint, and examination techniques are important to prevent undue stress or injury to an avian patient.

   a. Describe proper capture and restraint of an avian patient.

   b. What can you do to minimize stress associated with the examination?

4. Why are uncuffed endotracheal tubes recommended for birds and reptiles?

5. What are the caloric requirements for a clinically ill Amazon parrot? Use the basal metabolic rate (BMR) formula $K(W^{0.75})$ where K for an Amazon parrot is 78 and the bird's body weight (W) is 375 grams.

6. Describe the common signs of heat stress in an avian patient.

7a. What is the purpose of providing grit to a bird?

7b. There are different types of grit available. What are they?

7c. Which one is recommended for all caged birds and why?

8. Describe the proper diet for a parrot.

9. Identify a blood vessel commonly used for blood collection in each of the following species.

   a. Iguana

   b. Cockatiel

   c. Rabbit

   d. Turtle

   e. Hedgehog

   f. Ferret

10. Close attention must be paid to some specific issues when hospitalizing avian patients. Summarize the reasons for each of the following precautions.

    a. The cage should be in a separate room, away from other species.

b. A visual barrier should be provided.

c. Sudden changes in temperature and drafts should always be prevented.

11. Describe the requirements for housing a reptile in the veterinary hospital.

12. Why should birds and reptiles not be housed in the same room?

13a. Describe the correct diet for a green iguana.

13b. What is the most common nutritional deficiency seen in these lizards?

14. Skin, feces, and sputum samples must often be taken from sick reptiles to aid in diagnosis. Briefly explain how to take each of these diagnostic samples.

    a. Skin:

    b. Feces:

    c. Sputum:

15. Why do lizards and chelonians require sunlight and/or ultraviolet light?

16. Which reptiles are most susceptible to metabolic bone disease and what signs are seen?

    a. Susceptible species:

    b. Signs:

17a. Estrogen toxicity causes what clinical problem in ferrets?

17b. Why is this condition not commonly seen in the United States today?

18. What is the significance of blue dots on the pinna of a ferret?

19a. Ferrets should be vaccinated against what two diseases?

i. _____

ii. _____

19b. What are the common signs of a vaccine reaction in a ferret and what procedures should be followed when vaccinating a ferret to manage a reaction?

20a. What is the disadvantage of feeding alfalfa hay to rabbits?

20b. What is the advantage of feeding a high-fiber diet to rabbits?

21. List four different clinical signs seen in rabbits with pasteurellosis.

i. _____

ii. _____

iii. _____

iv. _____

22. What are the clinical signs of vitamin C deficiency in the guinea pig?

23. How do you tell the difference between a male and female guinea pig?

24. Describe the difference in appearance between a male rat or gerbil and a female rat or gerbil?

25. What is a recommended diet for a hedgehog?

26. What is the recommended diet for a sugar glider?

27. Name a pet discussed in this chapter that has been shown to transmit each of the following zoonotic diseases.

    a. Monkey pox _____

    b. Chlamydiosis _____

    c. Salmonellosis _____

    d. Plague _____

28. Write the name of an animal discussed in this chapter most commonly affected by each condition.

    a. Vitamin C deficiency _____

    b. Mycoplasmosis _____

    c. Insulinoma _____

    d. Pasteurellosis _____

    e. Metabolic bone disease _____

    f. Candidiasis _____

    g. Vitamin A deficiency _____

29. Anesthesia is necessary for performing many procedures on exotic animals safely. Summarize commonly used agents and procedures used to induce anesthesia in each of the following species.

a. Bird: _____

b. Chelonians: _____

c. Lizards: _____

d. Snakes: _____

e. Ferrets: _____

f. Rabbits: _____

g. Rodents: _____

23 Physical Therapy, Rehabilitation, and Alternative Medical Nursing

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all Key Terms in this chapter.
2. Do the following regarding alternative concepts in nutrition:
   - Describe considerations in the development of home-prepared diets for dogs and cats.
   - List commonly used nutraceuticals and glandulars and describe their therapeutic uses.
3. Do the following regarding the use of herbal medicine:
   - List commonly used Western herbs, Chinese herbs, and Ayurvedic herbs and describe their therapeutic uses.
   - Describe the principles of aromatherapy and list common aromatherapy oils and their uses.
   - Explain the basic principles of homeopathy and list forms of homeopathic preparations and considerations for storage and administration.
   - Describe the principles of flower essence therapy and list common flower essences and their uses.
4. Explain the principles and techniques of acupuncture and describe the role of the veterinary technician in acupuncture therapy.
5. Describe how chiropractic and applied kinesiology can benefit animal patients and explain the role of the veterinary technician in each discipline.
6. List common indications for veterinary rehabilitation.
7. Compare and contrast the physical therapeutic modalities used in veterinary rehabilitation, including exercise-based therapies, electrical and magnet-based therapies, light and sound–based therapies, and superficial thermal therapies.
8. List supportive and assistive devices commonly used for animal patients and explain the importance of podiatric care in the overall health of dogs.

EXERCISE 23.1 DEFINITIONS: KEY TERMS

Instructions: Define each term in your own words.

1. Applied kinesiology: _____

2. Aromatherapy: _____

3. Ayurvedic medicine: _____

4. Goniometry: _____

5. Holistic medicine: _____

6. Homeopathy: _____

7. Nutraceutical: _____

8. Rehabilitation: _____

9. Traditional Chinese medicine (TCM): _____

10. Modality: _____

11. Thermal agents: _____

12. Botanical medicine: _____

EXERCISE 23.2 MATCHING #1: KEY TERMS AND DEFINITIONS

Instructions: Match each term in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Chiropractic therapy
2. _____ Glandular therapy
3. _____ Passive range of motion (PROM)
4. _____ Hydrotherapy
5. _____ Massage
6. _____ Pulsed electromagnetic field therapy (PEMF)
7. _____ Cryotherapy
8. _____ Low-level laser therapy (LLLT)
9. _____ Myotherapy
10. _____ Neuromuscular electrical stimulation (NMES)
11. _____ Ultrasound (therapeutic)
12. _____ TENS
13. _____ Acupuncture
14. _____ Orthotic

Column B

A. Relief of soft-tissue pain resulting from muscle tension or "knots."

B. Preparation of animal products into a food additive to treat disease or sustain organ health.

C. Device applied to the body to limit motion or provide support.

D. Application of light waves that are monochromic and polarized to stimulate healing.

E. Corrects subluxations of the vertebral column.

F. Removes heat from the body and causes rebound vasodilation when removed.

G. Involves stimulation of specific points along meridians to alter the flow of qi.

H. Flexion and extension of a joint within its normal ability to move by a practitioner.

I. Manual movement or vibration of soft tissue to relieve pain and increase circulation.

J. Contraction of type II muscle fibers through the application of electric current.

K. Used to treat chronic and acute pain through electroanalgesia.

L. Waves of energy introduced to the body that stimulate the production of proteoglycans.

M. Sound waves that can have a thermal effect on the body.

N. Movements occur in water to enhance range of motion and reduce concussion of joints.

EXERCISE 23.3 MATCHING #2: HERB DOSAGE FORMS

Instructions: Match each herb dosage form in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ Poultice	A. Form concentrated in alcohol.
2. _____ Tea	B. Often in a dried and powdered form.
3. _____ Bulk	C. Form applied topically and left in place.
4. _____ Extract	D. Form made by straining the herb in water.
5. _____ Ointment	E. Form applied topically for short periods.
6. _____ Capsule	F. Form taken internally in an extremely dilute form.
7. _____ Essential oil	G. One of two oral forms preferred for dogs and cats.

EXERCISE 23.4 MATCHING #3: ALTERNATIVE THERAPIES

Instructions: For the following alternative therapies, identify whether each condition is an indication or contraindication for that therapy by writing an "I"(for indication) or "C" (for contraindication) in the space provided.

1. Alternative Therapy: **Neuromuscular electrical stimulation**
   a. _____ Moist dermatitis
   b. _____ Thrombophlebitis
   c. _____ Mast cell tumor
   d. _____ Muscle atrophy following surgery

2. Alternative Therapy: **Low-level laser therapy**
   a. _____ Treatment of trigger points
   b. _____ Intervertebral disc disease
   c. _____ Postoperative pain
   d. _____ Tendinitis

3. Alternative Therapy: **Massage therapy**
   a. _____ Bite wound abscess
   b. _____ Toning atrophied muscle
   c. _____ Tendonitis
   d. _____ Surgical site

EXERCISE 23.5 MATCHING #4: REHABILITATION–PHYSICAL DYSFUNCTIONS

Instructions: Match each physical dysfunction in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Pain
2. _____ Inflammation
3. _____ Reduced range of motion
4. _____ Hypermobility
5. _____ Muscle atrophy
6. _____ Muscle tightness or spasm
7. _____ Trigger points
8. _____ Scarring
9. _____ Abnormal gait
10. _____ Neurologic dysfunction
11. _____ Ataxia
12. _____ Weakness
13. _____ Exercise intolerance

Column B

A. A response to tissue injury characterized by pain, swelling, redness, and heat.
B. According to TCM, deficient energy can manifest as this.
C. Temporary tender areas.
D. Decreased muscle mass.
E. A decrease in the parameter measured by goniometry.
F. Often treated with massage.
G. An unpleasant feeling caused by real or potential tissue damage.
H. Lameness and pacing are two examples of this.
I. Friction is a massage technique that is used to break up this type of tissue.
J. Inability to engage in a normal level of activity.
K. Conscious proprioceptive deficits are an example of this.
L. Uncoordinated gait.
M. Increased in the range of motion of a joint.

EXERCISE 23.6 MATCHING #5: REHABILITATION–THERAPEUTIC EXERCISES

Instructions: Match each of the therapeutic exercises in column A with its corresponding benefit in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Proprioceptive exercises
2. _____ Endurance exercises
3. _____ Neuromuscular reeducation exercises
4. _____ Balance exercises
5. _____ Strengthening exercises

Column B

A. To decrease muscle atrophy.
B. For the cardiovascular system.
C. To improve stability.
D. To correct posture and gait.
E. To improve body awareness.

EXERCISE 23.7 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Raw meat diets are the best type of food to feed dogs and cats because they are closer to what nature intended these animals eat.

2. _____ The best approach to dietary counseling is to find two or three high-quality diets that you can recommend to all dog-owning clients.

3. _____ The main advantage of using herbal supplements is that, unlike drugs, they are safe and do not cause side effects.

4. _____ Chinese herbs are typically prescribed based on a pathologic diagnosis.

5. _____ It is important that herbs are purchased from a reputable source that emphasizes quality control.

6. _____ Unlike conventional medications, the potency of a homeopathic remedy is inversely proportional to dilution.

7. _____ Homeopathic medicines should be taken orally with food.

8. _____ Flower essences are usually in a tablet form.

9. _____ A veterinarian can use acupuncture to treat birds, dolphins, and elephants.

10. _____ Meridians are pathways through which acupuncture points are connected.

11. _____ A chiropractic vertebral subluxation is most often detected on x-rays.

12. _____ Swimming is the best treatment for strengthening both fore- and hind limbs.

13. _____ In the underwater treadmill, the most resistance with the least boyancy is achieved when the water is at the level of the shoulder.

14. _____ Benefits of a land treadmill are greatest when going up or down hill.

15. _____ TTEAM is a method of electrical stimulation used for muscle strengthening.

16. _____ The frequency of sound waves affect tissue penetration. For instance, low-frequency sound waves will penetrate further into the body than high-frequency sound waves.

17. _____ With LLLT, a laser with an output of 400 mW has a lower probability of producing adverse reactions than a laser with an output of 200 mW.

18. _____ Cyotherapy and heat therapy can be used over areas without sensation as long as the application time is limited to 5 minutes or less.

19. _____ Heat therapy is best provided with an electric heating pad.

20. _____ Regardless of the size of the dog, carts and wheelchairs are recommended for both indoor and outdoor use under close supervision.

21. _____ Harnesses and slings can be used to assist both large and small animals with weight-bearing and balance issues.

EXERCISE 23.8 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. A food additive that can help to balance gastrointestinal flora of dogs is
   a. Steamed vegetables
   b. Raw meat
   c. Plain yogurt
   d. Good-quality grain

2. A holistic approach to feeding your dogs can be summarized as
   a. Once you develop or find a balanced diet, it should be fed to all of your dogs.
   b. Most diets that have natural ingredients are acceptable.
   c. You should try to find the diet that will best meet each dog's needs.
   d. Varing the diet regularly is most important.

3. Which of the following statements is true of individual medical herbs?
   a. They are not regulated by the FDA.
   b. They are sometimes patented and "owned" by one company.
   c. Much of the research on the effects of herbs is done in the United States.
   d. Combinations of herbs cannot be patented in the United States.

4. An herb concentrated in alcohol or gylcerine is known as a
   a. Tea
   b. Poultice
   c. Liniment
   d. Extract

5. Balancing "Doshas" is the primary goal of
   a. Ayurvedic medicine
   b. Traditional Chinese medicine
   c. Homeopathy
   d. Aromatherapy

6. Aromatherapy involves the use of
   a. Nutraceuticals
   b. Sweet herbs
   c. Extracts
   d. Essential oils

7. Using a dilution of a disease-causing agent to stimulate the body's own defenses is the theory behind which of the following alternative techniques?
   a. Ayurvedic medicine
   b. Homeopathic medicine
   c. TCM
   d. Aromatherapy

8. Which complementary modality is based on the notion that all agents used to treat patients should be nontoxic, whether diluted or undiluted?
   a. Ayurvedic medicine
   b. Homeopathic medicine
   c. Flower essence therapy
   d. Aromatherapy

9. The commonly used flower essence combination called "Rescue Remedy" would be appropriate to treat
   a. Vomiting and diarrhea
   b. Upper respiratory infections
   c. Cardiopulmonary arrest
   d. Trauma

10. Acupuncture causes release of internal substances that decrease pain in a similar manner to morphine. This method of controlling pain is explained by the
    a. Endogenous opioid theory
    b. Bioelectric theory
    c. Gate theory
    d. Humoral theory

11. Testing the resistance of a patient's muscle (referred to as manual muscle testing) is one of the evaluation techniques used in
    a. Massage
    b. Chiropractic therapy
    c. Applied kinesiology
    d. Ayurvedic medicine

12. Rehabilitation is primarily used to treat
    a. Cardiac and musculoskeletal disorders
    b. Musculoskeletal and neurologic disorders
    c. Neurologic and pulmonary disorders
    d. Pulmonary and cardiac disorders

13. Which of the following modalities would typically not be part of a comprehensive rehabilitation plan?
    a. Hydrotherapy
    b. Laser and ultrasound therapy
    c. Chiropractic
    d. Aromatherapy

14. The massage stroke most commonly used to remove metabolic waste and increase circulation is
    a. Pétrissage
    b. Effleurage
    c. Tapotement
    d. Coupage

15. The massage stroke most commonly used to stimulate nerve endings is
    a. Pétrissage
    b. Effleurage
    c. Tapotement
    d. Coupage

16. Transcutaneous electrical nerve stimulation is most often used to treat
    a. Muscle spasms
    b. Inflammation
    c. Atrophy
    d. Pain

17. It is felt that therapeutic ultrasound works by producing
    a. Vibrations
    b. A magnetic field
    c. Electrical impulses
    d. Heat

18. Patients that cannot bear full weight on an injured limb may require a brace to provide support. Commercial braces are available for each of the following anatomic sites except one. Which one is it?
    a. Canine carpus
    b. Equine hock
    c. Canine hip
    d. Equine fetlock

EXERCISE 23.9 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. Information about herbs can be found in the publication called the _____ _____.
2. The practice of _____ is one in which herbs are given over a long period to support the general health of the patient.
3. When interpreted literally, the term *Ayurveda* means the science of _____.
4. The practice of Ayurveda includes use of herbs, diet, exercise, _____, and _____ to maximize health and wellness.
5. The use of essential oils to obtain a psychological or physiologic response is called _____.
6. _____ is a system of medicine based on the premise that "like cures like."
7. In homeopathy, the process of listing the appropriate remedies for each sign or symptom is called _____.
8. The most common use of acupuncture is treatment of _____.
9. In most species, there are 14 acupuncture meridians. _____ of these meridians are associated with particular organ systems, and _____ run along the midlines.
10. In TCM, energy circulates through each meridian. A blockage of energy manifests as disease. Stagnant energy manifests painful spasms or _____, whereas deficient energy manifests as weakness or _____.
11. Stimulation of acupuncture points by surgically placing gold beads is known as _____. Injection of vitamin B_{12} into a point is known as _____. Passing electrical energy through a point is known as _____. Stimulation of a point with pressure is known as _____.

12. Veterinary spinal manipulative therapy is a complementary technique also known as _____.

13. The technician's role in chiropractic is primarily centered around _____ _____.

14. Applied _____ utilizes neurologic evaluation, muscle testing, posture, and gait analysis to diagnose patients.

15. Measurement of joint range of motion, or _____, is an important part of a comprehensive rehabilitation evaluation.

16. _____ exercises help develop an awareness of where the body is in relationship to other objects.

17. Hippocrates used _____ as early as 400 BC to treat paralysis.

18. Whereas swimming strengthens muscle but not bone, exercises on a(n) _____ _____ strengthens both.

19. _____ is a massage technique in which finger pressure is applied to acupuncture points.

20. _____ is the most commonly used massage stroke in animals.

21. To loosen phlegm and relieve congestion in a patient's lungs, _____ can be used.

22. The length of one massage stroke is referred to as _____.

23. A voluntary muscle contraction involves slow-twitch, type _____ fibers, whereas an electrically induced muscle contraction involves fast-twitch, type _____ fibers.

24. Therapeutic magnets come in two basic types: (a) stationary magnets and (b) _____.

25. The effects of the two poles of a therapeutic magnet differ. For instance the _____ pole is known to enhance vasodilation, whereas the _____ pole enhances vasoconstriction.

26. The technique used to restore the disturbed electrical field around a diseased joint is known as PEMF or _____ _____ field therapy.

27. The strength of therapeutic _____ is measured in gauss or tesla.

EXERCISE 23.10 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 23.11 CASE STUDY #1: REHABILITATION AND COMPLEMENTARY MODALITIES

A Greyhound is being treated at your clinic for pain caused by trigger points. The veterinarian decided massage would be beneficial, and the owner has brought in her pet for its first massage session.

1. Explain to the owner the basic massage techniques you will perform on her pet.

EXERCISE 23.12 CASE STUDY #2: REHABILITATION AND COMPLEMENTARY MODALITIES

A 7-year-old, spayed, female Dachshund presents with an inability to move her hind limbs. She has normal reflexes in the front limbs, but abnormal hind limb reflexes and minimal response to a painful stimulus in the hind limbs. The owner reports that the dog cries out when picked up or moved.

1. List the two most relevant physical dysfunctions you would associate with this case and explain why you feel they are most relevant.

   i.

   ii.

2. This patient was diagnosed with intervertebral disc disease (IVDD) and underwent surgery to correct a compression at the lumbosacral junction. What general types of complementary modalities might be used as a part of holistic care of this patient, and what is the purpose of each modality?

EXERCISE 23.13 CASE STUDY #3: REHABILITATION AND COMPLEMENTARY MODALITIES

A 3-year-old, neutered, male Labrador returns to your practice for physical therapy 3 weeks after surgical repair of a ruptured cranial cruciate ligament. He is non–weight-bearing on the limb, and there is swelling of the stifle. The owner reports that the dog had been walking on the limb since the last therapy session 2 days ago, only exhibiting lameness this morning.

1. List the two most relevant physical dysfunctions you would associate with this case and explain why you feel they are most relevant.

   i. _____

   _____

   _____

   ii. _____

   _____

   _____

EXERCISE 23.14 CASE STUDY #4: REHABILITATION AND COMPLEMENTARY MODALITIES

A 4-year-old, 65-pound German Shepherd is recovering from intervertebral disc disease (IVDD) and has minimal use of his hind limbs. His owners are struggling with carrying him outside to urinate and defecate.

1. List two mobility aids that would benefit this patient and discuss why each would be of benefit.

   i. _____

   _____

   _____

   ii. _____

   _____

   _____

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EXERCISE 23.10 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. What is the basic difference between the traditional approach to treating disease and a "holistic" approach?

2. Give two specific reasons that a good understanding of basic nutrition is essential for the veterinary technician working in a practice?

   i.

   ii.

3. Feeding raw diets is a controversial practice. What are the advantages and disadvantages of feeding raw meat diets?

   Advantages:

   Disadvantages:

4. Why can raw bones be dangerous to dogs?

5. Why might a holistic practitioner have an ethical problem with using "grandulars" as a dietary supplement?

6. Aromatherapy uses volatile essential oils to produce a physiologic or psychological effect. They are often applied topically.

   a. What other more unusual ways are these oils sometimes administered?

   b. What are some of the general uses for aromatherapy?

7. Homeopathy uses remedies that are diluted to an extreme degree. What is the nature of these remedies, and what medicinal properties are these remedies said to have that is produced by dilution?

8. Occasionally a patient that has received a homeopathic treatment will experience an "aggravation." Briefly explain what an aggravation is, and how these patients are handled.

9. What three forms do homeopathic remedies come in?

   i.

   ii.

   iii.

10. Briefly discuss proper storage of homeopathic remedies.

11. What is the primary difference between classical homeopathy and modern homeopathy?

12. Flower essences are most commonly given with a dropper directly into the mouth. What are other ways these remedies can be administered?

13. Acupuncture points are usually stimulated by piercing the skin with a needle at specific acupuncture points. In what other ways can they be stimulated?

14. Briefly explain how alteration of energy circulation through the meridians is thought to cause disease in the practice of traditional Chinese medicine.

15. What techniques can be used to remove an acupuncture needle when there is resistance?

16. What three signs are seen in patients with the chiropractic lesion known as vertebral subluxation complex (VSC)?

    i. _____

    ii. _____

    iii. _____

17. Briefly summarize the method of treatment for chiropractic lesions.

18. In applied kinesiology, it is thought that some cases of muscle imbalance may be caused by "deafferentation." Briefly explain the concept of deafferentation.

19. What is the role of the veterinary technician in providing rehabilitation and physical therapy to veterinary patients?

20. TTEAM is a specialized massage system used to teach physical awareness of the body. How is TTEAM different from other types of massage?

21. Sports massage can be used before, during, or after a competition, as well as for maintenance. The goal at each of these points is different, however. List the goal for each of these types of massage.

    Preevent massage: _____

    Interevent massage: _____

    Postevent massage: _____

    Maintenance massage: _____

22. The elements of Swedish massage include intention, touch, pressure and depth, excursion, speed, rhythm and continuity, duration, and sequence. The meaning of most of these elements is relatively intuitive (e.g., pressure refers to the force applied to the surface).

    a. What is the meaning of "intention" when used in this context?

    b. What are some of the signs that a patient is relaxing under the influence of massage?

23. Passive range of motion (PROM) exercises are used to prevent loss of range of motion, and to restore normal range of motion.

    a. Briefly describe the basic technique used for PROM exercises.

    b. What steps should be taken to prevent damage to the limb?

24. When performing neuromuscular electrical stimulation (NMES), electrodes are placed over the "motor point" of the muscle, and the "distal point" of the muscle. What anatomic structures help identify these locations?

    Motor point: _____

    Distal point: _____

25. Other than frequency, what two properties of ultrasound waves determine its effect on the tissue?

    i. _____

    ii. _____

26. In what ways does laser light differ from the light emitted by a light bulb?

27. Postsurgical cryotherapy is sometimes used to reduce bleeding, swelling, bruising, and pain. List three devices that can be made from household materials that are easily available and can be used to apply cold to a surgery site post-operatively.

    i.

    ii.

    iii.

28. Compare and contrast "orthotic" and "prosthetic."

29. The most important part of a toenail trim in a dog is to shorten the toenail so that it does not bear weight.

    a. What is a "corrective toenail trim" and how is it different from a conventional one?

    b. How is a corrective toenail trim done?

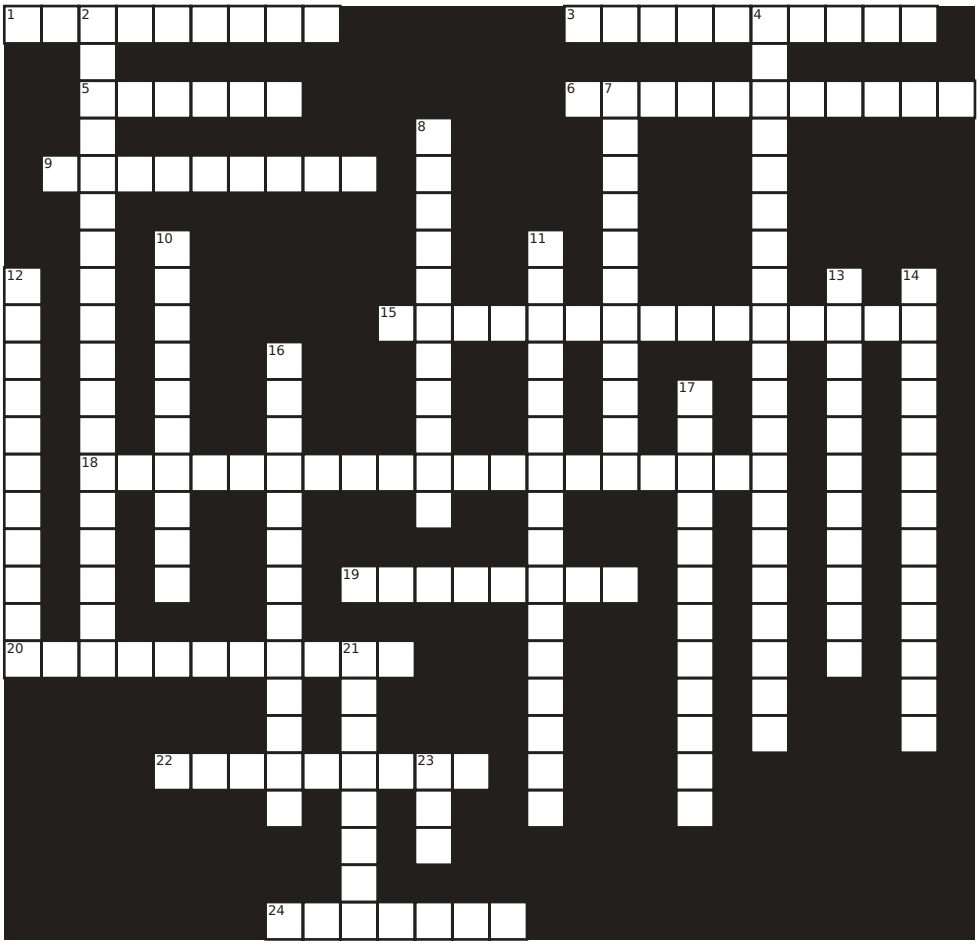
24 Fluid Therapy and Transfusion Medicine

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all key terms in the chapter.
2. Explain the indications for fluid therapy and describe the body fluid compartments, including movement of fluids between these compartments.
3. Compare and contrast crystalloid and colloid fluids, and describe the uses for and characteristics of each.
4. Do the following regarding the administration of fluids and fluid therapy additives:
   - Discuss the objectives of each phase of fluid therapy and the specific products and administration rates used during each phase.
   - Compare and contrast the indications for and techniques used to administer fluids by the intravenous, subcutaneous, intraosseous, and enteral routes.
   - Explain the indications for and techniques used to administer potassium chloride, dextrose, and sodium bicarbonate.
5. Do the following regarding monitoring and complications of fluid therapy:
   - Describe the methods used to monitor the effectiveness of fluid therapy.
   - Discuss common complications of fluid therapy, including appropriate interventions.
6. Do the following regarding transfusion medicine:
   - Describe the indications for blood, plasma, and blood component transfusion.
   - Discuss the selection and care of blood donors.
   - Explain pretransfusion testing, including blood typing, antibody screening, and cross-matching.
7. Do the following regarding collection techniques, blood products, and product administration:
   - Describe the techniques used to collect blood from a dog, cat, or horse.
   - List blood products, including the indications for and benefits provided by each.
   - Describe the technique used to administer blood products to a patient, including calculating administration rates.
   - Discuss patient monitoring during blood transfusions and recognition and management of transfusion reactions.

EXERCISE 24.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

1 The term used to describe a fluid with an osmolality of 154 mOsm/kg.
3 The term used to describe a fluid with an osmolality of 1026 mOsm/kg.
5 A condition that results from blood loss.
6 The most common general fluid type given during the replacement and the maintenance phases.
9 Destruction of red blood cells within the body.
15 A frozen plasma product.
18 A blood product prepared by plateletpheresis. (2 words)
19 Canine albumin solution and hetastarch are two of these.
20 A serious hypersensitivity reaction to foreign proteins or drugs that may occur following transfusion of incompatible blood.
22 Tells you the specific erythrocyte antigens present in a donor or recipient. (2 words)
24 _____ pressure is the portion of total osmotic pressure contributed by albumin and like substances.

Down

2 A concentrated source of platelets prepared by centrifugation of fresh whole blood. (3 words)
4 TRALI and TACO are two types of these. (2 words)
7 The phase of fluid therapy intended to correct dehydration.
8 An abnormal depletion of body water.
10 A test for compatibility.
11 An exaggerated immune response to some source of stimulation.
12 A decreased circulating blood volume.
13 The _____ rate of fluid administration is needed to meet daily needs.
14 The phase of fluid therapy intended to reverse shock.
16 Sign of a donor–recipient incompatibility on a crossmatch.
17 A condition in which there is abnormal blood clotting.
21 The term used to describe a fluid with an osmolality of 308 mOsm/kg.
23 The percent of blood volume composed of red blood cells. (acronym)

EXERCISE 24.2 MATCHING #1: BODY FLUID COMPARTMENTS

Instructions: Match each body fluid compartment term in column A with its corresponding statement in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ TBW	A. Separates the ISF and IVF
2. _____ Cell membrane	B. Approximately two-thirds of TBW
3. _____ ICF	C. ~60% of body weight
4. _____ ECF	D. Approximately one-fourth of the ECF
5. _____ Vascular endothelium	E. Separates the ICF and ECF
6. _____ ISF	F. Approximately three-fourths of ECF
7. _____ IVF	G. Approximately one-third of TBW

EXERCISE 24.3 MATCHING #2: BODY TONICITY OF INTRAVENOUS FLUIDS

Instructions: Match each intravenous fluid in column A with its corresponding tonicity in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A	Column B
1. _____ Dextrose 5% in water	A. Hypotonic
2. _____ 0.45% NaCl	B. Isotonic
3. _____ 7% NaCl	C. Hypertonic
4. _____ Normosol M	
5. _____ 0.9% Saline	
6. _____ 0.45% Sodium chloride	
7. _____ Lactated Ringer solution	
8. _____ 3% Saline	
9. _____ Plasmalyte 148	
10. _____ 0.45% NaCl + 2.5% Dextrose	
11. _____ Plasmalyte 56	
12. _____ Normosol R	

EXERCISE 24.4 MATCHING #3: BLOOD GROUP FACTORS

Instructions: Match each species in column A with its corresponding blood group factors in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ Canine	A. Many, including Aa, Ca, Pa, Qa, and Ua
2. _____ Equine	B. Many, including F, J, L, M, R, T, and Z
3. _____ Feline	C. Many, including 1.1, 1.2, and 3 through 7
4. _____ Bovine	D. A, B, and AB

EXERCISE 24.5 MATCHING #4: IDEAL AND UNIVERSAL BLOOD DONORS

Instructions: Match each species donor in column A with its corresponding description in column B by writing the appropriate letter in the space provided. (Note that not all responses will be used.)

Column A	Column B
1. _____ Universal canine donor	A. 3, 5, and 7 negative
2. _____ Ideal equine donor	B. No universal donor for this species
3. _____ Universal feline donor	C. J negative
4. _____ Ideal bovine donor	D. A negative
	E. Ca and Pa negative
	F. 1.1, 1.2, 3, 5, and 7 negative
	G. J, M, and R negative
	H. Aa and Qa negative

EXERCISE 24.6 MATCHING #5: BLOOD PRODUCTS

Instructions: Match each blood product in column A with the corresponding primary indication for its use in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ Washed RBCs	A. Thrombocytopenia
2. _____ Packed RBCs	B. Neonatal foals with failure of passive transfer
3. _____ Fresh plasma or fresh-frozen plasma	C. Anemia
4. _____ Platelet-rich plasma or platelet concentrate	D. Replace some coagulation factors
5. _____ Cryoprecipitate	E. Neonatal isoerythrolysis in foals
6. _____ Hyperimmune plasma	F. von Willebrand disease

EXERCISE 24.7 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ The circulating blood volume of a horse is approximately 40 to 60 mL/kg body weight.

2. _____ Both water and electrolytes are able to move freely across all fluid space barriers (the cell membrane and vascular endothelium) and so distribute throughout the total-body water.

3. _____ Colloids do not readily move out of the vascular space.

4. _____ Dextrose 5% in water is an example of an isotonic fluid.

5. _____ Normosol R would be an appropriate fluid choice for a patient with severe acidemia.

6. _____ Administration of hypertonic saline IV will promote rapid and long-lasting expansion of the vascular volume.

7. _____ Hetastarch and 23.4% NaCl can be mixed in a 2:1 ratio to produce a combination fluid that reduces both the total dose of each and the side effects.

8. _____ Arterial blood pressure is an accurate indicator of response to fluid resuscitation.

9. _____ When calculating the ongoing losses so that the fluid administration rate can be increased appropriately, normal urinary losses should be included in this calculation.

10. _____ Pain or irritation when an IV catheter is flushed is a sign that the vein is inflamed.

11. _____ An advantage of subcutaneous fluid administration is that this route works well for resuscitation, replacement, or maintenance.

12. _____ Subcutaneous fluids can be given by a client at home.

13. _____ Only certain medications that are safe for IV administration can be given IO.

14. _____ Sodium bicarbonate is commonly used to treat a variety of conditions that lead to acidosis.

15. _____ Sodium bicarbonate can be used for severe cases of hyperkalemia to promote a shift of potassium into the cells.

16. _____ Patients that are in shock always have weak pulses.

17. _____ The term *cavitary bleeding* refers to hemorrhage into the pleural or peritoneal space.

18. _____ If a patient has severe, acute hemorrhaging, the packed cell volume (PCV) will be decreased.

19. _____ The primary goal of blood transfusion is to improve oxygen delivery to the tissues.

20. _____ Dogs do not have naturally occurring antibodies to erythrocyte antigens and so a reaction is less likely following a first transfusion.

21. _____ Like dogs, cats do not have naturally occurring antibodies to erythrocyte antigens, and so a reaction following a first transfusion is unlikely.

22. _____ Glass blood-collection bottles are preferred over bags because they preserve blood cells more effectively.

23. _____ When drawing blood from a transfusion donor, you should assure that the blood-to-anticoagulant ratio is correct by weighing the bag.

24. _____ Transfusion reactions will not occur as long as major and minor crossmatches indicate compatibility.

EXERCISE 24.8 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. The circulating blood volume as a proportion of total body weight (mL/kg) is the lowest in a
   a. Dog
   b. Horse
   c. Cow
   d. Cat

2. When 0.9% saline solution is administered intravenously, within a short time, only about _____ will remain in the vascular space.
   a. One-quarter
   b. One-third
   c. One-half
   d. Most of it

3. Which of the following fluids is NOT a hypotonic fluid?
   a. 0.45% Saline
   b. Normosol M
   c. Plasmalyte 148
   d. D5W

4. Hypotonic fluids are used to treat
   a. Shock
   b. Hypernatremia
   c. Hypokalemia
   d. Metabolic acidosis

5. Which of the following fluids has an acidifying effect?
   a. LRS
   b. 0.9% Saline
   c. Normosol R
   d. Plasmalyte 148

6. 3% or 7% hypertonic saline is used to treat
   a. Heart failure
   b. Kidney failure
   c. Head trauma
   d. Hypernatremia

7. Which of the following fluids would increase intravascular oncotic pressure in a patient with hypoproteinemia?
   a. Hetastarch
   b. Normosol M
   c. Plasmalyte 148
   d. D5W

8. The shock dose of isotonic crystalloid fluids in a cat is (in mL/kg body weight)
   a. 2 to 4
   b. 10 to 15
   c. 40 to 60
   d. 80 to 90

9. Patients that need multiple blood samples taken over a period of time, or that need multiple medications given by constant rate infusion, should have a _____ catheter placed.
   a. Cephalic
   b. Central line
   c. Butterfly
   d. Peripheral

10. Which of the following devices is often used to decrease the risk of fluid overload?
    a. Buretrol®
    b. Administration line filter
    c. Carboy
    d. 10 drops/mL drip set

11. Fluids administered subcutaneously are usually absorbed in approximately
    a. 1 to 2 hours
    b. 2 to 4 hours
    c. 6 to 8 hours
    d. 12 to 24 hours

12. Even though it is isotonic, which of the following fluids can cause discomfort when given subcutaneously owing to its acidic pH?
    a. Lactated Ringer solution
    b. Plasmalyte 148
    c. Normosol R
    d. Dextrose 5% in water

13. Which of the following routes of fluid administration is used in neonates, because it has essentially the same effect as IV administration, but does not require catheterization of a vein?
    a. Intramuscular
    b. Subcutaneous
    c. Enteral (via stomach tube)
    d. Intraosseous

14. Enteral fluids are often used to treat large-bowel impaction in
    a. Cattle
    b. Cats
    c. Dogs
    d. Horses

15. The combination of PU/PD, cardiac arrhythmias, and severe muscle weakness is very suggestive of
    a. Hypokalemia
    b. Hypoglycemia
    c. Lactic acidosis
    d. Dehydration

16. During the resuscitation phase of IV fluid therapy, arterial systolic blood pressure should be maintained at approximately
    a. 50 to 80 mm Hg
    b. 80 to 110 mm Hg
    c. 110 to 140 mm Hg
    d. 140 to 170 mm Hg

17. Normal central venous pressure is
    a. 0 to 10 cm H_2O
    b. 0 to 10 mm Hg
    c. 80 to 100 cm H_2O
    d. 80 to 100 mm Hg

18. A significant complication of fluid therapy is fluid overload. Of greatest concern in these patients is the possibility of
    a. Coagulation abnormalities
    b. Cavitary effusion
    c. Pulmonary edema
    d. Peripheral edema

19. During an acute bleeding episode, a blood transfusion is necessary if the PCV drops below
    a. 12% to 15%
    b. 15% to 20%
    c. 20% to 25%
    d. 25% to 30%

20. A blood plasma transfusion is not indicated for treatment of
    a. Low albumin
    b. A blood-clotting disorder
    c. Failure of passive transfer of immunity in foals
    d. Anemia

21. Canine blood-typing cards are used to detect
    a. DEA 1.1
    b. DEA 1.2
    c. DEA 4
    d. DEA 7

22. Which of the following statements regarding blood transfusions is most accurate?
    a. Transfusion of type A blood into a type B cat will result in decreased life span of transfused cells.
    b. Transfusion of type B blood into a type A cat is expected to cause a severe, potentially fatal hemolytic reaction.
    c. Transfusion of type B blood into a type AB cat is not expected to cause a reaction.
    d. Transfusion of type AB blood into any cat should not cause a reaction, because this is the universal donor blood type in cats.

23. A "major crossmatch" detects
    a. Reactions of a recipient's plasma with its own RBCs
    b. Reactions between donor RBCs and recipient plasma
    c. Reactions between donor plasma and recipient RBCs
    d. Reactions of a donor's plasma with its own RBCs

24. The maximum recommended blood donation for dogs expressed as a percent of the blood volume is
    a. 5% to 10%
    b. 10% to 15%
    c. 15% to 20%
    d. 20% to 25%

25. Donor blood plasma is considered to be fresh plasma if used within _____ hours of collection.
    a. 4
    b. 8
    c. 12
    d. 24

26. When transfusing blood, it is usually given concurrently with isotonic crystalloid fluids. Which of the following fluids should not be used for this purpose because it can result in activation of the coagulation cascade?
    a. Normosol R
    b. Plasmalyte 148
    c. 0.9% Saline
    d. Lactated Ringer solution

27. Using the rule of thumb provided, if you want to raise the PCV of a 25-kg patient by 10%, you should give approximately
    a. 250 mL of whole blood or packed RBCs
    b. 500 mL of whole blood or 250 mL of packed RBCs
    c. 250 mL of whole blood or 500 mL of packed RBCs
    d. 500 mL of whole blood or packed RBCs

EXERCISE 24.9 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. The approximate circulating blood volume of a dog is estimated to be approximately _____ to _____ mL/kg body weight.

2. The two main categories of fluids based on the size of their solute molecules are _____ and _____.

3. A 23% saline solution must be _____ before giving it IV to avoid osmotic injury to the tissues.

4. The product "Voluven" is a synthetic _____ that has a lesser negative effect on blood coagulation than hetastarch.

5. The maintenance fluid administration rate includes appropriate losses from the following three sources: (a) the _____ system, (b) the _____, and (c) the _____ tract.

6. A route of fluid administration used in small animals, but not usually in large animals, is _____.
   A route of fluid administration used in large animals, but not in small animals, is via _____ tube.

7. Subcutaneously administered fluids should have an osmotic pressure that is approximately _____ to extracellular fluid.

8. When tissues don't receive enough oxygen because of decreased tissue perfusion, the levels of _____ increase.

9. Central venous pressure (CVP) is the pressure inside the vena cava. This pressure is used to monitor fluid therapy because it approximates cardiac preload and thereby _____ volume.

10. Impaired blood coagulation is a possible side effect of administration of the synthetic colloid _____.

11. During severe, acute hemorrhage, the total protein (TP) will decrease before the packed cell volume (PCV) because of contraction of the _____.

12. The primary goal of blood transfusion is to increase the _____-carrying capacity of the blood.

13. The ideal equine blood donor is negative for factors _____ and _____.

14. The ideal bovine donor should be negative for factor _____.

15. If incompatible blood is given to a horse for a first transfusion, it takes approximately _____ to _____ days for RBC antibodies to form.

16. If a blood donation is taken from a dog in an amount equivalent to 20% of the blood volume, _____ to _____ mL/kg intravenous crystalloid fluids should be given to compensate for the fluid loss.

17. Concerning anticoagulants used for blood collection: If blood is going to be stored, either _____ or _____ anticoagulant should be used. If blood will be transfused immediately, _____ _____ is acceptable. *(Note: Use of abbreviations is acceptable.)*

18. Donor blood plasma that is frozen within _____ hour(s) of collection and is less than _____ month(s) old is considered to be fresh-frozen plasma. Otherwise, it is considered to be frozen plasma.

19. When giving blood to hypothermic patients or those receiving large volumes of blood, refrigerated blood should be warmed to between _____°C and _____°C.

20. For patients with hemorrhage, the volume of blood to be transfused can be calculated based on the estimated blood _____, whereas for patients with chronic anemia, it can be calculated based on the _____ _____ _____.

EXERCISE 24.10 SHORT ANSWER #1: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 24.11 SHORT ANSWER #2: TRANSFUSION REACTIONS

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 24.12 CASE STUDY #1: IV FLUID THERAPY

A 4-year-old, 50-pound, neutered, male Basset Hound presents for anorexia and vomiting. He is estimated to be 6% dehydrated. The attending veterinarian orders a diagnostic work-up including blood work, urinalysis, and abdominal radiographs. She also orders intravenous lactated Ringer solution. She asks you to calculate the infusion and drip rates based on the sum of (a) the volume necessary to correct dehydration over the first 18 hours, (b) the standard maintenance rate, and (c) the amount necessary to replace ongoing losses.

1. Calculate the fluid deficit of this patient based on the estimated level of dehydration.

   _____ mL

2. Calculate the fluid infusion rate in mL/hour for replacement of this deficit over 18 hours.

   _____ mL/hour

3. Using the following formula, calculate the daily maintenance needs for this patient. **132*body weight (kg)$^{(3/4)}$**

*(Note: This is accomplished on a multifunction calculator by taking the body weight in kg, multiplying it by itself twice (wt*wt*wt), then pressing the square root button twice, and, finally, multiplying the result by 132.)*

   _____ mL/day

4. Now calculate the hourly administration rate for maintenance.

   _____ mL/hour

5. Calculate this patient's infusion rate (in mL/hour) necessary for replacement of the deficit and for maintenance.

   _____ mL/hour

6. Calculate the drip rate in drops/second when using a drip set with a delivery rating of 10 drops/mL.

   _____ gtt/second

7. During the first 6 hours, the patient vomited several times into two absorbent pads. The pads by themselves weighed 160 grams each; including the vomitus, the two pads weighed 580 grams. Approximately how much volume (mL) did this patient lose through vomiting?

   _____ mL/hour

8. Adjust the infusion rate in mL/hour to replace this loss over the next 6 hours (as well as to replace the deficit and provide maintenance).

   _____ mL/hour

9. Finally calculate the drip rate in drops/second.

   _____ gtt/second

EXERCISE 24.13 CASE STUDY #2: IV FLUID THERAPY AND TRANSFUSION THERAPY

A 2-year-old, neutered, male, mix-breed dog, weighing 20 kg is presented after being hit by a car. It is estimated to have lost approximately 30% of its blood volume, and is shocky. The doctor has ordered a variety of interventions, including IV fluid therapy and a transfusion of whole blood.

1. Calculate the estimated volume of blood lost (in mL) by this patient.

   _____ mL

2. By this estimation, you determine that this patient needs about 1 unit of whole blood. During the first 10 to 20 minutes, there was no sign of a transfusion reaction. So the doctor would like you to administer the whole blood at a rate of 20 mL/kg/hour. Calculate the infusion rate (in mL/hour) for this patient.

   _____ mL/hour

3. Now calculate the drip rate in gtt/second. You are using a standard blood administration set rated at 10 gtt/mL.

   _____ gtt/second

4. The donor dog at your clinic weighs 70 pounds. Calculate the maximum amount of blood you can collect from this donor using the rule of thumb in the text, and determine if this will be enough blood to meet this patient's needs.

   _____ mL

   Yes, it will be enough to meet this patient's needs. ❑

   No, it will not be enough to meet this patient's needs. ❑

EXERCISE 24.10 SHORT ANSWER #1: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. What characteristic do intravenously administered colloids have that crystalloids don't have, which moves fluid from the ISF space into the IVF space?

2. Explain why hypertonic saline pulls fluid from the interstitium into the intravascular space, whereas 0.9% saline will not.

3a. What specific physical property of the solutes in colloid solutions causes fluid to be drawn into the vascular space?

3b. Why does this make these fluids well suited for resuscitation?

4. Even though both are isotonic, synthetic colloid solutions like hetastarch increase the vascular volume 1 to 1.5 mL for every 1 mL of solution administered IV, but isotonic crystalloids like lactated Ringer solution increase the vascular volume only 1 mL for every 3 to 4 mL administered IV. Why is this the case?

5. When large animals receive shock doses of crystalloid or colloid fluids, large volumes must be given over 10 to 15 minutes. It is difficult to give the fluids this quickly. What can be done to increase the speed at which the fluids can be given?

6. Fluid deficits that develop slowly (such as those in patients with dehydration) should be replaced over a longer period than fluid deficits that occur more quickly. Why is this?

7. When providing maintenance fluid therapy, hypotonic or "maintenance" crystalloids best meet maintenance requirements. Why, then, are isotonic fluids most often given during the maintenance phase? How is this common practice justified?

8. There are two main types of fluid administration pumps used in veterinary patients. What are the two types, and what is the difference in how they control the fluid administration rate?

   i. _____

   ii. _____

9. When teaching clients to give subcutaneous fluids at home, describe the client education points that the clients need to know.

10. An important goal of the resuscitation phase of fluid therapy is to restore tissue perfusion. List the signs of improved perfusion.

11. Some clinicians believe that when giving fluids to patients with intraabdominal bleeding (such as those with ruptured splenic tumors), the arterial blood pressure should be kept lower than other patients. What is the reason for this belief?

12. What are the physical signs evident in each of the tissues, organs, or organ systems listed that indicate dehydration? Explain what each sign means.

    a. Skin: _____

    _____

    b. Mucous membranes: _____

    _____

    c. Eyes: _____

    _____

    d. Cardiovascular system: _____

    _____

13. One possible complication of fluid therapy is "dilution coagulopathy." Explain what this term means.

    _____

    _____

    _____

14. What is meant by the term *transfusion trigger*?

    _____

    _____

15. Patients with hypoalbuminemia may be treated with albumin transfusions using either human or canine albumin solution. Even though the human product is more cost effective, why must it be used with caution and only after careful consideration?

    _____

    _____

16. Briefly list some of the characteristics of and requirements for a dog or cat to be chosen as a blood donor.

    _____

    _____

    _____

    _____

    _____

    _____

17. Results of equine blood crossmatches may be difficult to interpret. Why is this, and what can be done to remedy this situation?

18. Routine crossmatches evaluate agglutination reactions. What other important transfusion reaction will this test not detect?

19. The usual shelf life of canine packed red blood cells (PRBCs) is 20 days when stored in CPDA-1. What can be done to extend this shelf life?

EXERCISE 24.11 SHORT ANSWER #2: TRANSFUSION REACTIONS

Instructions: Respond to each of the following questions in the space provided.

1. A blood recipient's heart rate, temperature, respiratory rate, and attitude should be monitored closely during a transfusion, especially during the first 15 minutes.

   a. Summarize physical changes that would alert you that a patient is having an acute allergic (type I) hypersensitivity reaction using both nonmedical and corresponding medical terms (e.g., erythema or skin redness is one).

   b. Another type of transfusion reaction is an acute hemolytic reaction (type II hypersensitivity). This can occur during the transfusion or within hours. Summarize lab and physical changes that would alert you to this reaction.

c. Now summarize other nonhemolytic immune reactions and nonimmune acute reactions to transfusions, including a summary of lab and physical changes that would alert you to each.

Nonhemolytic immune reactions: _____

Nonimmune acute reactions: _____

d. Finally, what should you do if a transfusion reaction occurs? Include the treatment common to all types of reactions as well as specific treatments for each type.

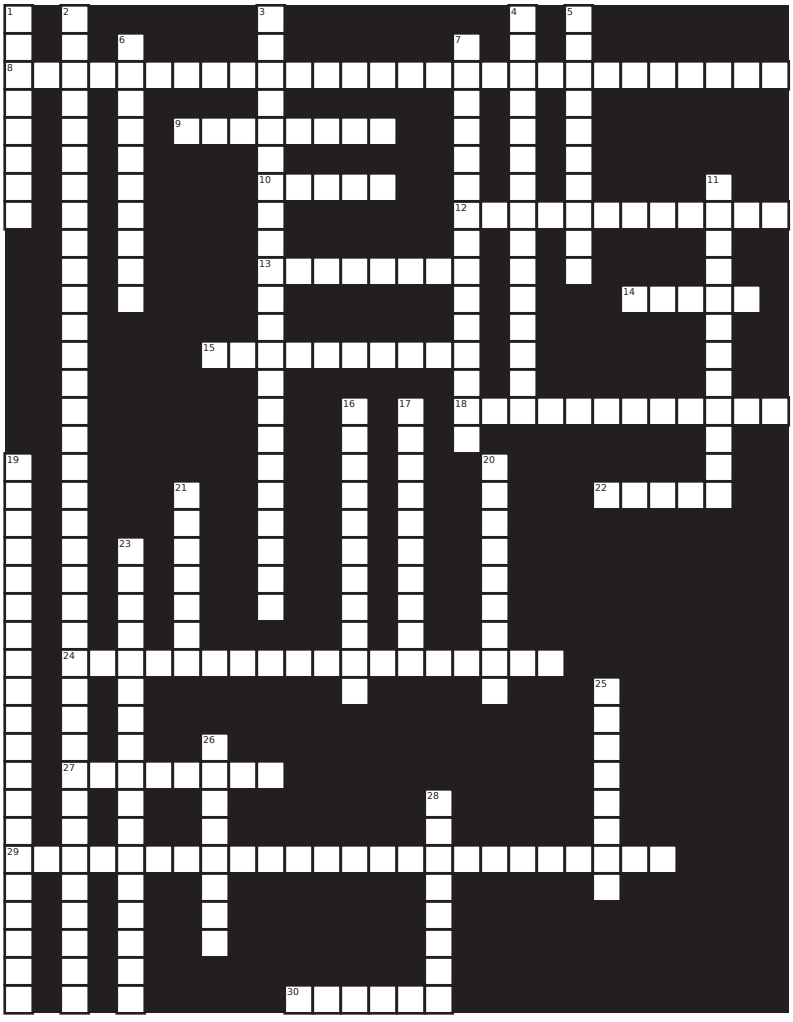
25 Emergency and Critical Care Nursing

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all Key Terms in this chapter.
2. Triage a patient over the phone and upon arrival at the veterinary hospital.
3. Do the following regarding emergency and critical care assessment, initial diagnostics, and first aid:
   - Assess hydration and recognize hypovolemia in critical care patients.
   - Identify the diagnostic tests most commonly used in emergency and critical care settings.
   - Explain the principles of basic first aid.
   - Identify the ideal location for an emergency care station and/or resuscitation area, and explain how to set up and stock a crash cart.
4. Compare and contrast the different types of shock, explain how each is treated, and identify and explain advanced emergency techniques most commonly performed on small animals.
5. Discuss disorders of the respiratory system seen in critically ill small animal patients.
6. Do the following regarding cardiopulmonary cerebral resuscitation:
   - List the common causes of cardiopulmonary arrest, and explain the principles of cardiopulmonary cerebral resuscitation (CPCR).
   - Describe the principles of basic and advanced life support in small animals and care of the post-arrest patient.
7. Describe methods used to monitor critically ill patients and the principles of effective patient monitoring.
8. Identify key aspects of recumbent patient care.
9. List common small animal toxicities and emergencies, and discuss appropriate patient stabilization and treatment.
10. Do the following regarding canine and feline electrocardiography:
    - List the indications for and discuss the principles of electrocardiography.
    - Explain the processes used to acquire, analyze, and interpret an electrocardiogram.
    - Identify and explain the significance of common cardiac arrhythmias.
11. Describe initial management, assessment, diagnostic, and treatment procedures for common equine emergencies.
12. Describe initial management, assessment, diagnostic, and treatment procedures for common food animal emergencies.

EXERCISE 25.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

8 A syndrome also known as SIRS. (3 words)
9 Inflammation of the uterus.
10 An esophageal obstruction from a foreign body (seen most commonly in cows).
12 Air within the pleural space.
13 A cardiac arrhythmia associated with a "flatline" appearance to the ECG tracing.
14 Any condition causing severe abdominal pain; common in horses.
15 A fracture of two or more ribs resulting in a freely moveable segment of chest wall. (2 words)
18 A condition in cows commonly referred to as bloat. (2 words)
22 A loss of intestinal motility.
24 A fast irregularly irregular cardiac arrhythmia identified by fibrillatory (f) waves instead of P waves. (2 words)
27 An abnormally low pH of the blood or tissue.
29 The syndrome that is a serious complication of shock
involving failure of multiple organs. (3 words)
30 A state of systemic inflammation caused by infection.

Down

1 Difficult birth.
2 A serious complication of shock that involves a pattern of generalized concurrent intravascular thrombosis and bleeding. (3 words)
3 A run of four or more VPCs in succession. (2 words)
4 Blood clot formation with obstruction of blood flow.
5 An abnormal heart rhythm.
6 Blood in the pleural space.
7 QRS complexes originating from the atrial myocardium, that occur early, but are otherwise normal. (2 words)
11 The presence of urinary stones.
16 Decreased circulating blood volume.
17 The term for a cow that cannot stand. (2 words)
19 An early, wide, and bizarre QRS complex. (2 words)
20 Low blood oxygen.
21 Low tissue oxygen.
23 Tissue damage resulting from the reestablishment of blood flow following a period of oxygen deprivation. (2 words)
25 Excess of nitrogenous wastes in the blood because of kidney insufficiency.
26 Deficient blood supply to a body part.
28 Inflammation of the mammary gland.

EXERCISE 25.2 DEFINITIONS: KEY TERMS

Instructions: Define each term in your own words.

1. Borborygmi: _____

2. Capillary refill time: _____

3. Emesis: _____

4. Eructation: _____

5. Stridor: _____

6. Syncope: _____

7. Tachycardia: _____

8. Tachypnea: _____

9. Tympany: _____

10. Toxin: _____

11. Urethral process: _____

12. Uterine prolapse: _____

13. Uterine torsion: _____

14. Endometrial: _____

15. Jugular vein: _____

16. Perineal area: _____

EXERCISE 25.3 MATCHING #1: TERMS AND DEFINITIONS RELATED TO PROCEDURES

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Abdominocentesis
2. _____ Cardiopulmonary cerebrovascular resuscitation
3. _____ Chest tube
4. _____ Defibrillation
5. _____ Electrocardiogram
6. _____ Fetatome
7. _____ Fetotomy
8. _____ Pericardiocentesis
9. _____ Pulse oximeter
10. _____ Regional nerve block
11. _____ Rumenostomy
12. _____ Thoracocentesis
13. _____ Tracheostomy
14. _____ Tracheotomy
15. _____ Transfaunation
16. _____ Triage
17. _____ Tube cystostomy
18. _____ Urethrostomy

Column B

A. The transfer of beneficial microorganisms from the rumen of one individual to another.

B. A procedure in which a relatively small amount of local anesthetic is injected near a nerve causing desensitization of a larger area of the body.

C. A tube inserted into the pleural space.

D. A device that is used to cut a fetus into smaller parts that can be extracted vaginally more easily.

E. Aspiration of fluid by inserting a needle in the pleural space.

F. Creation of a permanent opening from the skin into the urethra.

G. A response to cardiac arrest.

H. Aspiration of fluid by inserting a needle into the sac around the heart.

I. Creation of a permanent opening from the skin to the trachea.

J. Aspiration of fluid by inserting a needle in the peritoneal cavity.

K. Placement of a catheter through the abdominal wall and into the bladder.

L. A procedure in which a dead fetus is cut into smaller pieces so that they can be extracted vaginally.

M. The treatment for ventricular fibrillation.

N. Sorting patients according to the severity of an injury.

O. A visual representation of the electrical activity of the heart.

P. Creation of a temporary opening from the skin to the trachea.

Q. Creation of the permanent opening from the skin to the rumen.

R. A monitor used to measure oxygen saturation of hemoglobin.

EXERCISE 25.4 MATCHING #2: BREATHING PATTERNS

Instructions: Match each breathing pattern in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Restrictive breathing
2. _____ Apneustic breathing
3. _____ Labored breathing
4. _____ Cheyne-Stokes breathing
5. _____ Kussmaul breathing

Column B

A. Alternating tachypnea and bradypnea.
B. Deep inhalation with an abnormally long pause before exhalation.
C. A slow, deep, regular respiratory pattern.
D. Fast, short, and shallow breaths.
E. Prolonged and deep respirations.

EXERCISE 25.5 MATCHING #3: MENTATION

Instructions: Match each term used to describe mentation in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Normal
2. _____ Dull
3. _____ Obtunded
4. _____ Stuporous
5. _____ Comatose

Column B

A. Only reacts to noxious stimuli.
B. Not eager to interact with the environment.
C. Interacts with the environment and is alert.
D. Unresponsive to any stimuli.
E. Reacts to stimuli more slowly than normal.

EXERCISE 25.6 MATCHING #4: EVALUATION OF PUPILS AND POSTURE

Instructions: Match each pupillary assessment or postural finding in column A with its corresponding significance in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Fixed and dilated pupils
2. _____ Rigid forelimbs and flexed hind limbs with normal mentation
3. _____ Anisocoria
4. _____ Rigid forelimbs and flaccid hind limbs when in lateral recumbency is typical
5. _____ Unresponsive midrange pupils
6. _____ Extreme rigidity of all four limbs with arching of the neck and back

Column B

A. A lack of connection between the forebrain and brainstem.
B. Irreversible midbrain lesion.
C. Schiff-Sherrington, associated with a T3 to L3 spinal lesion.
D. Lesion in the medulla supporting brain injury.
E. Injury to the cerebellum.
F. Injury of the cerebrum.

EXERCISE 25.7 MATCHING #5: TYPES OF SHOCK

Instructions: Match each type of shock in column A with its corresponding cause in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ Septic shock	A. Impaired venous return to the heart.
2. _____ Distributive shock	B. Decreased circulating blood volume.
3. _____ Hypovolemic shock	C. Severe infection.
4. _____ Cardiogenic shock	D. Vasodilation and pooling of blood in the capillaries.
5. _____ Obstructive shock	E. Decreased cardiac output.

EXERCISE 25.8 MATCHING #6: ABNORMAL RHYTHMS ASSOCIATED WITH CARDIAC ARREST

Instructions: Match each abnormal rhythm associated with cardiac arrest in column A with the drug(s) used to treat the abnormality in column B by writing the appropriate letter(s) in the space provided. (Note that there may be more than one correct response and that responses may be used more than once.)

Column A	Column B
1. _____ Ventricular tachycardia	A. Epinephrine
2. _____ Asystole	B. Atropine
3. _____ PEA	C. Vasopressin
4. _____ Bradycardia	D. Lidocaine
5. _____ Vagally mediated arrest or AV block	E. Magnesium sulfate
6. _____ Refractory, unstable ventricular tachycardia	F. Amiodarone

EXERCISE 25.9 MATCHING #7: DRUGS USED DURING CPCR

Instructions: Match each abnormality seen in patients that arrest in column A with the drug(s) used to treat the abnormality in column B by writing the appropriate letter(s) in the space provided. (Note that there may be more than one correct response.)

Column A	Column B
1. _____ Hypotension	A. Furosemide
2. _____ Pulmonary edema	B. Dobutamine
3. _____ Cerebral edema	C. Mannitol
4. _____ Low cardiac output	D. Vasopressin
5. _____ Hyperkalemia	E. Dopamine
	F. Calcium gluconate

EXERCISE 25.10 – MATCHING #8: ELECTROCARDIOGRAPHIC WAVEFORMS

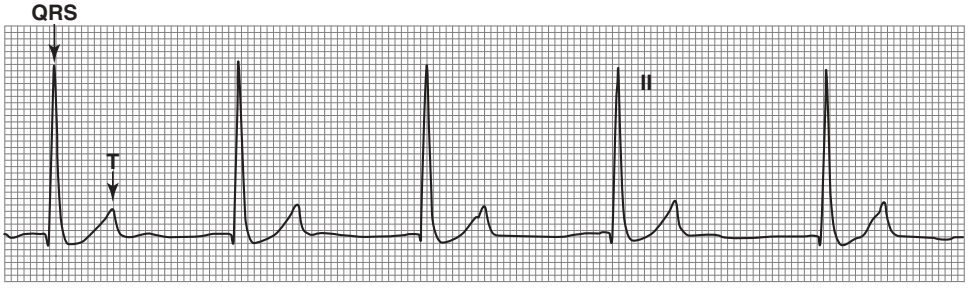
Instructions: Match each waveform in column A with its corresponding significance in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ P wave	A. Time interval from ventricular depolarization to repolarization.
2. _____ PR interval	B. Ventricular depolarization.
3. _____ QRS complex	C. Time it takes for the impulse to conduct through the AV node.
4. _____ ST segment	D. Ventricular repolarization.
5. _____ T wave	E. Atrial depolarization.

EXERCISE 25.11 PHOTO QUIZ: ECG TRACINGS

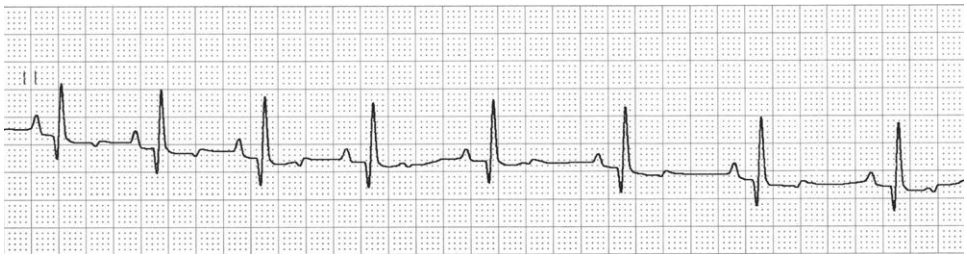
Instructions: Match each ECG tracing with the name corresponding to the cardiac rhythm by writing the name in the space provided. Then summarize the significance of each rhythm.

A. Normal sinus rhythm
B. Sinus arrhythmia
C. Atrial premature complexes (APCs)
D. Atrial tachycardia
E. Atrial fibrillation
F. Ventricular premature complexes (VPCs)
G. Ventricular tachycardia
H. Ventricular fibrillation
I. Atrial standstill
J. Second-degree AV block
K. Third-degree (complete) AV block



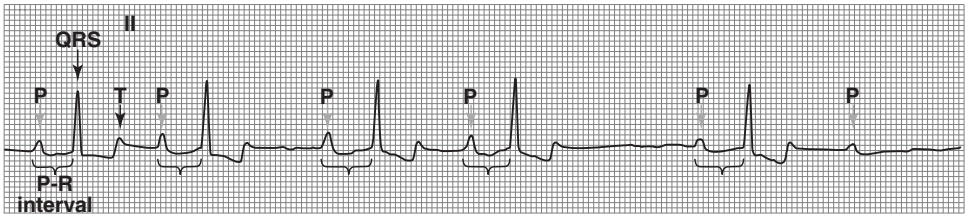
1. Name and significance of this rhythm: _____

_____



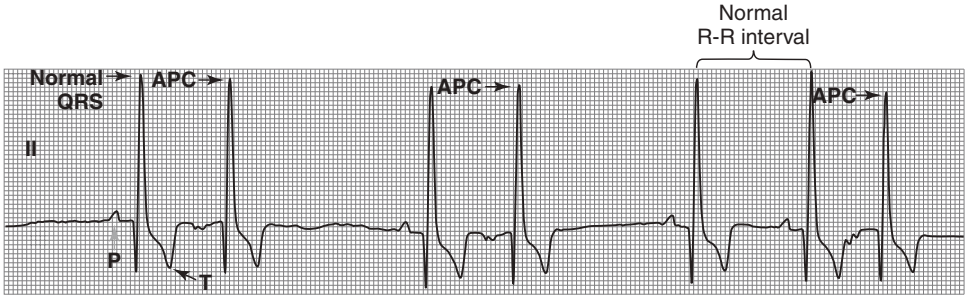
2. Name and significance of this rhythm: _____

_____



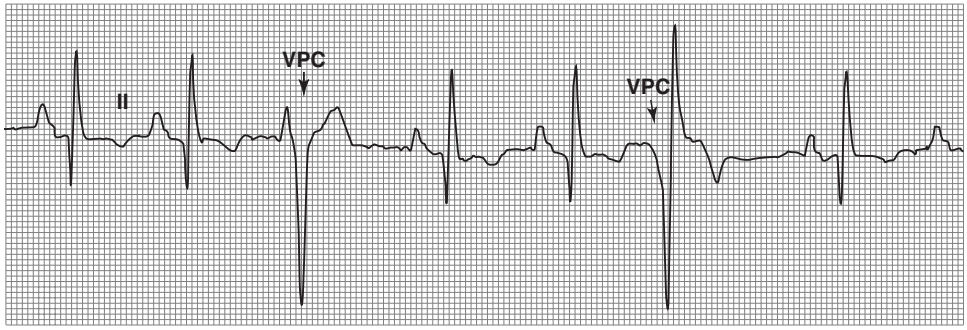
3. Name and significance of this rhythm: _____

_____



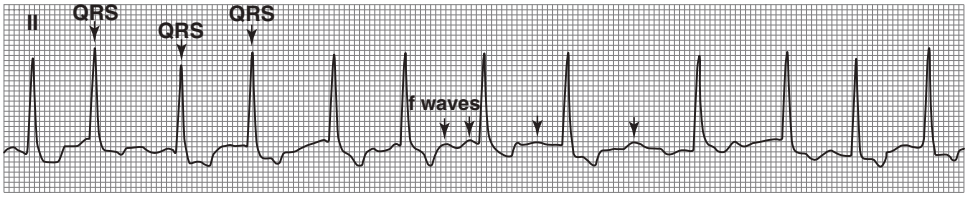
4. Name and significance of this rhythm: _____

_____



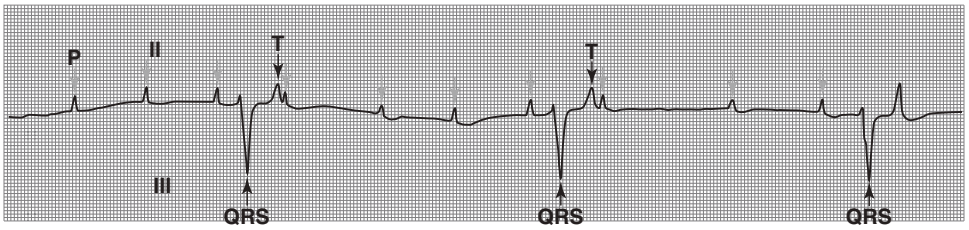
5. Name and significance of this rhythm: _____

_____



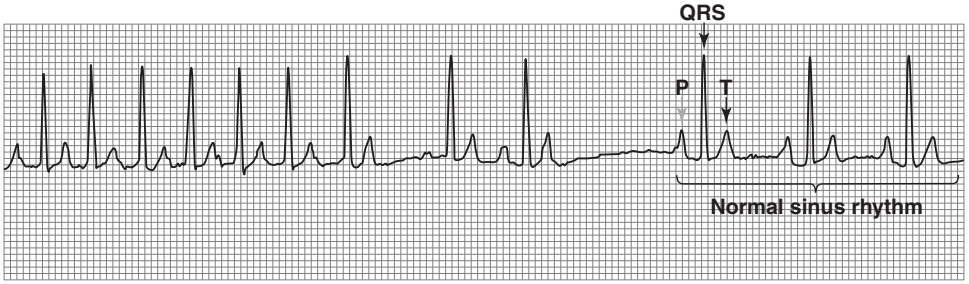
6. Name and significance of this rhythm: _____

_____



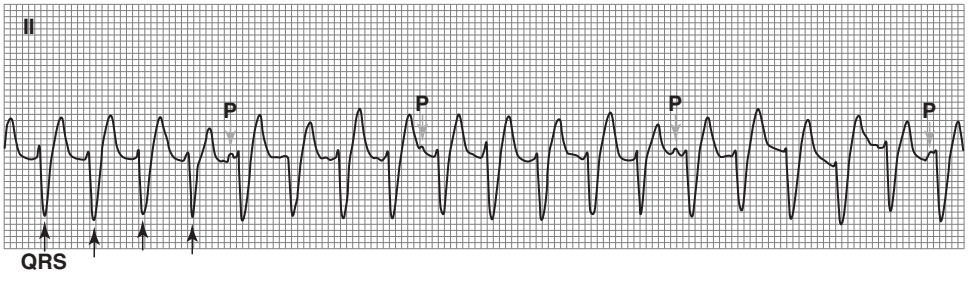
7. Name and significance of this rhythm: _____

_____



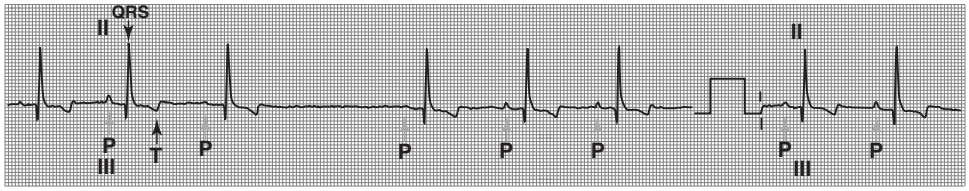
8. Name and significance of this rhythm: _____

_____



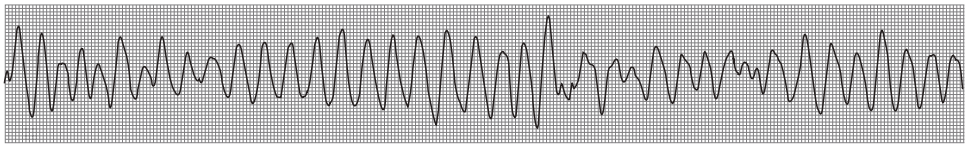
9. Name and significance of this rhythm: _____

_____



10. Name and significance of this rhythm: _____

_____



11. Name and significance of this rhythm: _____

_____

EXERCISE 25.12 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ If an owner calls because his or her pet swallowed drain cleaner, it would be appropriate to advise him or her to administer hydrogen peroxide to induce vomiting.
2. _____ Orthopnea refers to a posture assumed by animals that are dyspneic.
3. _____ When evaluating mucous membrane color, blue means something is wrong, whereas pink means things are OK.
4. _____ Animals that are 3% to 4% dehydrated have decreased skin turgor.
5. _____ A blood pH of 7.2 indicates buildup of acid from a variety of conditions, including diabetic ketoacidosis.
6. _____ When blood is aspirated during abdominocentesis, abdominal bleeding can be differentiated from fresh blood by looking at the color.
7. _____ The ventral neck should be aseptically prepared when performing a tracheostomy tube placement.
8. _____ Animals with respiratory distress should have chest radiographs taken immediately upon presentation to diagnose the cause quickly.
9. _____ Animals with hypoxia caused by severe anemia can have normal pulse oximeter readings.
10. _____ The A-a gradient is a measure of oxygen saturation of hemoglobin.
11. _____ An ECG tracing is a reliable method of determining cardiac activity following cardiopulmonary arrest.
12. _____ An Ambu bag is used to provide ventilatory support during CPCR.
13. _____ When performing defibrillation, the electrical conduction should be enhanced by wetting the hair with 70% isopropyl alcohol.

14. _____ The overall survival rate for all causes of witnessed in-hospital cardiopulmonary arrest patients is good, as long as treatment is initiated quickly.

15. _____ A single increased central venous pressure (CVP) measurement is an accurate indicator of fluid overload.

16. _____ Doppler blood pressure monitoring is only reliable for detecting systolic arterial blood pressure.

17. _____ The life-threatening condition gastric dilation volvulus (GDV) can be readily ruled out as long as the patient doesn't have visible abdominal distention.

18. _____ The "P" wave on an ECG tracing corresponds to propagation of the electrical impulse through the atrial heart muscle.

19. _____ The horizontal axis on an ECG tracing represents the strength of the electrical impulse measured in mV.

20. _____ A normal sinus rhythm is normal in both the dog and the cat.

21. _____ Atrial standstill is a cardiac arrhythmia that has hyperkalemia as its most common cause.

22. _____ The term *high-grade second-degree AV block* is another term for third-degree AV block.

23. _____ Horses that have colic can be divided into two main categories: a small number that resolve with minimal or no treatment, and many more that require aggressive treatment.

24. _____ Abrasions around the head and the presence of dirt, mud, and hay in the hair coat of a horse experiencing colic are signs that it was in severe pain prior to arrival at the hospital.

25. _____ Nasogastric intubation in colic patients is important, because horses with excessive accumulation of stomach gas and fluid will often vomit and aspirate.

26. _____ After passing a nasogastric tube in a colic patient, the tube should be removed immediately if no fluid is obtained to avoid further damage to the stomach.

27. _____ When managing a colic patient, the body temperature should always be taken prior to performing a rectal examination.

28. _____ Endoscopic examination of the airways can be used to evaluate the pharynx, guttural pouches, and trachea in horses, but cannot be used to evaluate deeper structures like the bifurcation of the bronchi.

29. _____ When performing a thoracocentesis, the caudal aspect of the rib should be avoided with the needle.

30. _____ The location most often used to perform a tracheotomy in an equine patient is the ventral midline between the middle and caudal third of the neck.

31. _____ Splint stabilization of an equine elbow fracture is not necessary if the patient can extend, plant, and move the leg.

32. _____ A sicca splint extending over the back of an equine patient should be used to stabilize a fracture of the scapula.

33. _____ The size of the area around a wound that should be clipped is most closely associated with the presence or absence of infection.

34. _____ When checking a wound for joint involvement by tapping the joint, the needle should always be introduced at a site distant from the wound.

35. _____ Food animals seldom need emergency care because with few exceptions, their value is seen as economic.

36. _____ Farm animals are frequently presented to emergency service because of complications of gastrointestinal parasitism.

37. _____ Choke is a gastrointestinal condition commonly seen in camelids.

38. _____ The ruminal contents of a cow can be used to perform ruminal transfaunation of a goat.

39. _____ Choanal atresia is a condition affecting the large intestine of alpaca crias.

40. _____ The rapidity with which joint luxations are treated is an important determinant of the likelihood of success.

41. _____ Sheep and goats that are targets of dog attacks often suffer puncture wounds, which, although potentially serious, usually involve only superficial structures.

42. _____ By using proper equipment, dystocias of food animals can usually be managed by the vet without additional help.

43. _____ When replacing a prolapsed uterus, a large plastic bag can be used to prevent further contamination and trauma of the prolapsed organ.

44. _____ When faced with a small ruminant with an inability to urinate, urethral stones can easily be ruled out by taking radiographs.

45. _____ General anesthesia is required to perform a urethrostomy in a goat.

EXERCISE 25.13 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. Laryngeal paralysis and other extrathoracic airway obstructions are characterized by
   a. Fast, short, and shallow breaths
   b. Prolonged and deep breaths
   c. Long, slow inspirations and short exhalations
   d. Expiratory dyspnea with increased abdominal effort

2. Increased bronchovesicular sounds indicate
   a. Diaphragmatic hernia
   b. Pulmonary edema
   c. Pneumothorax
   d. Pleural effusion

3. A weak, thready arterial pulse usually indicates
   a. Decompensated shock
   b. Anemia
   c. Compensated shock
   d. Aortic regurgitation

4. A patient with pronounced loss of skin turgor, dry mucous membranes, tachycardia, weak pulses, and sunken eyes, but not in shock or comatose is approximately _____ dehydrated.
   a. 5%
   b. 7%
   c. 10%
   d. >10%

5. An elevated blood lactate indicates
   a. Overhydration
   b. Brain injury
   c. Poor tissue perfusion
   d. Urinary blockage

6. Which of the following is a sign of compensated shock, but not a sign of decompensated shock?
   a. Pale mucous membrane color
   b. Tachycardia
   c. Hypotension
   d. Increased pulse pressure

7. A complication of shock that is characterized by widespread inflammation of tissues resulting from lack of oxygen is known as
   a. MODS
   b. DIC
   c. BAR
   d. SIRS

8. When performing a thoracentesis to diagnose or treat pneumothorax, prep the area around the
   a. Fourth to fifth intercostal space between the top one-third and bottom two-thirds of the thorax
   b. Fourth to fifth intercostal space between the top two-thirds and bottom one-third of the thorax
   c. Seventh to ninth intercostal space between the top one-third and bottom two-thirds of the thorax
   d. Seventh to ninth intercostal space between the top two-thirds and bottom one-third of the thorax

9. Cats with asthma will usually have
   a. Deep, slow breaths
   b. Rapid, shallow breaths
   c. Crackles heard during inspiration and expiration
   d. Increased respiratory effort and wheezing

10. Increased end-tidal carbon dioxide levels occur with
    a. Hypoventilation
    b. A leak in the anesthetic system
    c. An incompletely inflated endotracheal tube cuff
    d. Decreased cardiac output

11. PaO_2 is measured with
    a. End-tidal CO_2 monitoring
    b. Pulse oximetry
    c. Arterial blood-gas monitoring
    d. Oscillometry

12. The first priority when performing CPCR is considered by many critical care veterinarians to be
    a. Providing breaths
    b. Chest compressions
    c. Placing an endotracheal tube
    d. Running an ECG tracing

13. During cardiopulmonary arrest and subsequent CPCR, which of the following end-tidal carbon dioxide monitor values indicate that chest compressions are adequate?
    a. 0 mm Hg
    b. 5 to 10 mm Hg
    c. 10 to 15 mm Hg
    d. 20 to 30 mm Hg

14. Closed-chest compressions are often not effective in
    a. Animals with pneumothorax
    b. Small dogs
    c. Cats
    d. Animals that arrest because of anesthetic complications

15. During CPCR, stimulation of the Governor Vessel 26 acupuncture point is used to
    a. Stimulate the heart
    b. Increase tissue perfusion
    c. Increase blood oxygen
    d. Stimulate respirations

16. The drug most commonly used to treat asystole during CPCR is
    a. Lidocaine
    b. Naloxone
    c. Epinephrine
    d. Calcium gluconate

17. When administering advanced life support during CPCR, some drugs may be given via the endotracheal tube. Which drug cannot be given this way?
    a. Naloxone
    b. Vasopressin
    c. Epinephrine
    d. Sodium bicarbonate

18. Marked increased central venous pressure (CVP) is caused by
    a. Dehydration
    b. Heart failure
    c. Hypovolemia
    d. Venodilation

19. Hyperkalemia is often a feature of which emergency disease?
    a. Urethral obstruction
    b. Gastric dilation volvulus
    c. Heart failure
    d. Respiratory distress

20. The ECG electrode that should be placed on the right rear limb is
    a. Black
    b. Green
    c. White
    d. Red

21. Arrhythmias that originate from below the AV node are classified as
    a. Tachyarrhythmias
    b. Supraventricular arrhythmias
    c. Bradyarrhythmias
    d. Ventricular arrhythmias

22. A sinus arrhythmia is
    a. Normal in the dog and cat
    b. Normal in the dog, but not the cat
    c. Normal in the cat, but not the dog
    d. An abnormal rhythm in both cats and dogs

23. Which of the following cardiac rhythms commonly occurs in normal animals as a response to pain, excitement, stress, or anxiety?
    a. Sinus arrhythmia
    b. Atrial fibrillation
    c. Sinus tachycardia
    d. Atrial tachycardia

24. Which of the following is a QRS complex that occurs too soon and is of identical or nearly identical shape as a normal QRS complex?
    a. Atrial premature complex
    b. Junctional escape beat
    c. Ventricular premature complex
    d. Ventricular escape beat

25. A cardiac arrhythmia that appears on an ECG tracing as a flat line is called
    a. Atrial standstill
    b. Third-degree AV block
    c. Pulseless electrical activity
    d. Ventricular asystole

26. In equine medicine, emergencies involving three major organ systems make up a large part of the caseload. An organ system that is not one of the "big three" is the
    a. Gastrointestinal system
    b. Genitourinary system
    c. Musculoskeletal system
    d. Respiratory system

27. The 10-cm × 10-cm location that should be clipped and surgically prepped prior to performing an abdominocentesis in colic patients is usually located
    a. 3 to 5 cm caudal to the umbilicus and 3 to 5 cm to the left of the midline
    b. 3 to 5 cm caudal to the xiphoid and 3 to 5 cm to the left of the midline
    c. 3 to 5 cm caudal to the umbilicus and 3 to 5 cm to the right of the midline
    d. 3 to 5 cm caudal to the xiphoid and 3 to 5 cm to the right of the midline

28. The most common reason for surgical intervention in a colic patient is to
    a. Investigate a total absence of borborygmi
    b. Repair a rectal tear
    c. Investigate pain that is unresponsive to sedation
    d. Repair an intussusception

29. An upper respiratory tract obstruction in an equine patient is generally characterized by
    a. Rapid, shallow breathing and absent lung sounds
    b. Severe distress, inspiratory stridor, and normal lung sounds
    c. Abnormal lung sounds including crackles and wheezes
    d. Rapid, shallow breathing with abnormal lung sounds

30. Effective treatment of equine pneumonia may require a bacterial culture and cytologic evaluation of respiratory secretions. Samples for these tests are best obtained by
    a. Thoracocentesis
    b. Lower-airway endoscopy
    c. Transtracheal wash
    d. Tracheotomy

31. A bandage designed to stabilize a fracture of the proximal metacarpus of the horse must extend from the coronary band to the
    a. Highest point of the elbow
    b. Top of the metacarpus
    c. Top of the carpus
    d. Highest point of the shoulder

32. Equine patients with _____ should always be assessed for blood loss, which is commonly associated with this condition.
    a. Colic
    b. An upper respiratory obstruction
    c. A wound
    d. Heaves

33. A nonviable piece of bone that forms as a result of disruption of the blood supply is called a(n)
    a. Osteoblast
    b. Chondrocyte
    c. Bone fragment
    d. Sequestrum

34. A cow in hypovolemic shock should receive a rapid 1 L IV infusion of
    a. Normal (0.9%) saline
    b. Lactated Ringer solution
    c. Hypertonic (7%) saline
    d. Ringer solution

35. The area that must be prepared prior to abdominal surgery in cattle to correct GI abnormalities such as an abomasal volvulus or cecal volvulus, is typically
    a. The right paralumbar fossa
    b. The left paralumbar fossa
    c. The ventral midline
    d. The paramedian region

36. A large-bore tube used to remove ingesta, liquid, and gas from the rumen of a cow is called a
    a. Nasoesophageal tube
    b. Kingman tube
    c. Rumenostomy tube
    d. Urethrostomy tube

37. The term *down animal* or *downer* is usually used to describe _____ that are unable to stand.
    a. Dogs
    b. Cats
    c. Cattle
    d. Horses

38. The best option for supporting cows that can't stand for long periods of time is
    a. Hydroflotation
    b. Slings
    c. Hip lifters
    d. Water beds

39. A Krey hook is a device used to
    a. Support downer cows
    b. Correct a uterine torsion
    c. Retrieve foreign objects
    d. Perform a fetotomy

40. A "breech" presentation of a fetus during parturition is one in which
    a. The head presents first
    b. The front legs present first
    c. The rump presents first
    d. The hind legs present first

41. The "plank-in-the-flank" method is a technique used to correct a
    a. Uterine torsion in a cow
    b. Cecal impaction in a horse
    c. Uterine prolapse in a ewe
    d. Dystocia in a camel

42. Urolithiasis is a condition most often seen in
    a. Cows
    b. Bulls
    c. Male sheep and goats
    d. Female sheep and goats

43. The most common place for a urinary stone to lodge in a goat is the
    a. Sigmoid flexure of the urethra
    b. Neck of the bladder
    c. Prostatic urethra
    d. Urethral process

44. The procedure used to create a permanent opening from the skin into the bladder is called a
    a. Bladder marsupialization
    b. Cystocentesis
    c. Tube cystotomy
    d. Cystoscopy

45. To minimize the likelihood of development of urolithiasis in goats, it is most important to
    a. Decrease salt intake
    b. Limit hay intake
    c. Alkalinize the urine
    d. Feed no grain

EXERCISE 25.14 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. During an initial triage examination, the _____, _____, and _____ organ systems should be systematically and carefully evaluated.

2. Dogs that are in shock often have an abnormally fast heart rate (HR), also known as _____, whereas cats often have an abnormally slow HR, also known as _____.

3. A nonpalpable dorsal metatarsal arterial pulse in a dog indicates a mean arterial pressure (MAP) lower than _____ mm Hg, whereas a nonpalpable femoral pulse in a dog or cat indicates a MAP lower than _____ mm Hg.

4. Oxygen saturation of hemoglobin as measured with a pulse oximeter should be between _____% and _____% in normal animals, and levels below _____% should be addressed immediately.

5. Shock occurs as a result of altered blood flow, and ultimately impaired delivery of _____ to the tissues.

6. Typically, systolic arterial blood pressure is _____ mm Hg in dogs, and _____ mm Hg in cats. Typically, mean arterial blood pressure is _____ mm Hg in dogs and cats.

7. The heart, lungs, _____, and _____ are the organs most often affected by MODS.

8. A pulse oximeter measures the percentage of hemoglobin that is saturated with _____ as well as the _____ rate.

9. During CPCR, when performing chest compressions and interposed abdominal compressions, the abdomen is compressed during the _____ phase of the chest compression.

10. When providing ventilation during CPCR with an anesthetic machine, a rate of approximately _____ to _____ respirations per minute should be used.

11. Central venous pressure (CVP) is the pressure in the cranial _____ _____. In normal dogs, CVP is _____ to _____ cm H_2O.

12. Regarding arterial blood pressure; in dogs and cats, normal _____ pressure is 80 to 140 mm Hg, normal _____ pressure is 60 to 100 mm Hg, and normal _____ pressure is 50 to 80 mm Hg.

13. A blood pressure cuff is properly sized if the _____ of the cuff is approximately 40% of the _____ of the limb.

14. Patients with emergency respiratory disease are often treated with particular drugs related to the primary problem. For instance, patients in respiratory distress benefit from sedation with an opioid drug such as _____, cats suspected to have asthma should receive the drug _____ by inhalation, and patients suspected to be in heart failure should receive _____.

15. In a hospital, dogs are often induced to vomit by administering the opioid _____ subcutaneously, whereas cats are given the α-agonist _____ intramuscularly. If the initial agent does not work, dogs can be given the opioid _____, or a fast intravenous bolus of the antibacterial _____ can be used as an alternative.

16. The most commonly used electrocardiographic leads are I, II, III, aVR, aVL, and aVF. I, II, and III are known as _____ leads, and aVR, aVL, and aVF are known as _____ leads.

17. When acquiring an ECG, the tracing should be recorded at a paper speed of _____ or _____ mm/sec, and a calibration of _____ mm/mV.

18. On a diagnostic ECG tracing, the QRS wave is made up of three separate waveforms. The first negative deflection represents the _____ wave, the first positive deflection represents the _____ wave, and the first negative wave following the first positive wave is the _____ wave.

19. When a QRS complex is normal in shape, this suggests that it is _____ in origin, but if it is wide and bizarre in shape, this suggests that it is _____ in origin.

20. In a patient with a sinus arrhythmia, the HR typically increases during _____ and decreases during _____ .

21. Ventricular premature complexes (VPCs) may occur in groups of two, three, four, or more, and may occur in patterns. A group of two sequential VPCs is called a _____, and a group of three sequential VPCs is called a _____. A _____ is a rhythm in which every other beat is a VPC, and a _____ is a rhythm in which every third beat is a VPC.

22. Nasogastric intubation is typically performed in colic patients to remove excess gas and fluid from the stomach. This excess fluid is called _____ _____.

23. On physical examination, mucous membrane color is an important indicator of various conditions. For instance, blue mucous membranes, also known as _____ is indicative of _____.

24. In horses, thoracic problems, such as diaphragmatic hernia and pneumothorax, can lead to signs of respiratory distress or _____ (a disease of the gastrointestinal system).

25. _____ supplementation is required in patients with respiratory distress when the PaO_2 is less than 100 mm Hg.

26. When supplementing oxygen to an adult equine patient, a flow rate of at least _____ L/min should be used, whereas foals and miniature horses may require as little as _____ L/min.

27. Bovine patients with bloat may have respiratory compromise because the rumen becomes distended and pushes on the _____.

28. Microbial function of the ruminal contents can be determined by a methylene blue reduction test. If rumen flora is normal, the ruminal contents will change from a _____ color to a _____ color within 5 minutes.

29. In a ruminant, the incision for a C-section is usually made on the _____ _____ with the animal awake.

30. Cattle with metritis and mastitis can develop endotoxemia and may present with signs of _____ _____, which include tachycardia and tachypnea.

31. Animals with urinary obstructions frequently have serious electrolyte abnormalities. The most dangerous of these is _____ because it may lead to fatal _____ _____.

32. The surgical procedure performed to create an opening in the urethra proximal to an obstruction is called a _____.

EXERCISE 25.15 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 25.16 CASE STUDY: MANAGEMENT OF RECUMBENT PATIENTS

Leslie, a 10-year-old, spayed, female, Shepherd mix is presented for management of recumbency caused by paralysis secondary to a rupture of an intervertebral disc. She has not been eating well and has disturbed fluid balance. She is also in pain secondary to the disc rupture, and has developed several open ulcers over her elbows and other bony prominences. Because she is panting a lot, she has dry oral mucous membranes, and she also has red and irritated skin around her rear quarters because she is often lying in a pool of her own urine. In addition to these problems, if her recumbency is prolonged, she will be prone to loss of muscle mass, and contracture and edema of her limbs.

Recumbent patients may also require placement of an endotracheal tube or tracheostomy tube, may be on mechanical ventilation, and in some cases, may develop corneal damage. For the problems Leslie is facing, as well as the additional problems common to recumbent patients, indicate the reasons that each occurs, then summarize the care that must be provided to manage each problem appropriately and effectively.

1a. Inadequate nutritional intake

Reasons: _____

_____

Management: _____

1b. Dehydration or overhydration

Reasons: _____

Management: _____

1c. Pain

Reasons: _____

Management: _____

1d. Development of decubital ulcers

Reasons: _____

Management: _____

1e. Dry oral mucous membranes and other oral problems

Reasons: _____

Management: _____

1f. Peripheral edema, muscle wasting, and contracture

Reasons: _____

Management: _____

1g. Urine scald

Reasons: _____

Management: _____

1h. Placement of an endotracheal tube or tracheostomy tube and/or mechanical ventilation

Reasons: _____

Management: _____

1i. Corneal damage

Reasons: _____

Management: _____

EXERCISE 25.15 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. When performing triage over the phone, the technician must be able to recognize life-threatening conditions. List at least four common life-threatening conditions in small-animal patients that require immediate transport to a veterinary facility.

   i. _____

   ii. _____

   iii. _____

   iv. _____

2. Significantly decreased mentation can be caused by shock, or a brain injury, or other primary neurologic disorder. How can shock be differentiated from other causes?

   _____

   _____

3. Describe the typical postures small animals in severe abdominal pain will usually adopt to relieve the pain.

   _____

   _____

4. Review factors that will prevent accurate assessment of skin turgor when determining hydration status.

   _____

   _____

   _____

   _____

5. Review the basic differences between hypovolemia and dehydration in terms of causes, signs, and speed with which each condition develops.

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

6. After stabilization of a critically ill patient, a secondary examination should be performed.

   a. What is the difference between the focus of this examination and the focus of the initial triage examination?

   b. Why is it important to reassess pupils during this examination?

7a. What is a “crash cart”?

7b. Where should the crash cart be kept?

7c. What general supplies and equipment should be in the crash cart?

8. Briefly describe the sequence of events that occur in the body during disseminated intravascular coagulation (DIC).

9. Explain why patients with pleural effusion should have a thoracocentesis prior to thoracic radiographs.

10. Patients receiving mechanical ventilation require a lot of care. Briefly summarize the care they require.

11. Vagally mediated cardiac arrest may occur because of reflex bradycardia mediated by the vagus nerve. List the common causes of this type of arrest.

12. List the three most common cardiac rhythms seen during cardiopulmonary arrest, and briefly describe the electrocardiographic appearance of each.

    i. _____

    _____

    ii. _____

    _____

    iii. _____

    _____

13. Following successful CPCR, many of the major organs are subject to damage from a variety of factors. Review the main factors that damage each of the organs listed.

    a. Heart: _____

    _____

    _____

    _____

    _____

    b. Lungs: _____

    _____

    _____

    _____

    _____

    c. Gut: _____

    _____

    _____

    _____

    _____

    d. Kidneys: _____

    _____

    _____

    _____

    _____

e. Nervous system: _____

14. Briefly describe how arterial catheter placement differs from venous catheter placement in terms of (a) commonly catheterized arteries, (b) how the artery is located prior to placement, (c) preparation, (d) placement technique, and (e) common challenges during placement.

a. Commonly catheterized arteries: _____

b. How the artery is located: _____

c. Preparation: _____

d. Placement technique: _____

e. Common challenges during placement: _____

15. List considerations regarding safe use of arterial catheters, including complications that should be avoided, as well as steps that can be taken to prevent these complications.

Complications: _____

Prevention: _____

16. Trauma patients should be assumed to have pulmonary contusions and traumatic brain injury until proven otherwise. Describe initial steps that should be taken to manage these patients upon presentation.

17a. What are some common substances that most people have around the house that are toxic to animals?

17b. Describe how an owner can induce vomiting in a dog that has ingested a toxin.

17c. What strategies are commonly used to treat these patients?

18. Electrocardiograms are commonly performed in patients with cardiac arrhythmias. Arrhythmias are commonly caused by advanced cardiac disease and a variety of systemic diseases. List some of the systemic diseases that commonly cause arrhythmias.

19. Describe patient positioning when acquiring a diagnostic electrocardiogram in a small-animal patient, including limb position and special considerations for dyspneic patients.

20. Describe two different ways to count the heart rate on an ECG tracing.

    a. _____

    _____

    b. _____

    _____

21. Atrial tachycardia, junctional tachycardia, and ventricular tachycardia are three different cardiac arrhythmias in which four or more premature complexes occur in succession. Summarize the difference among the appearance of these rhythms.

    a. Atrial tachycardia _____

    _____

    _____

    b. Junctional tachycardia _____

    _____

    _____

    c. Ventricular tachycardia _____

    _____

    _____

22. Many colic cases that resolve with minimal or no treatment are believed to be caused by gas or spasmodic colic. Briefly describe the main components of treatment of these mild cases of colic, and what is done if the animal does not respond to conservative treatment.

    _____

    _____

    _____

    _____

    _____

23. Describe the typical sound of borborygmi detected during auscultation of a horse with normal large intestinal motility.

    _____

    _____

    _____

24. Rectal tears are the most serious complication of rectal examination. Summarize steps that must be taken to reduce the risk of this life-threatening complication.

25. Most respiratory emergencies present to the clinic because of a failure of oxygen exchange caused by (a) a primary lung disease, (b) upper airway obstruction, (c) a disease of the chest cavity, or (d) anemia. In the case of pneumonia, oxygen exchange is decreased because the primary disease process prevents diffusion of the oxygen across the alveoli. For each of the remaining three causes, state the reason that oxygen exchange is adversely affected.

    a. Upper airway obstruction:

    b. Disease of the chest cavity:

    c. Anemia:

26. When examining and treating equine patients with a respiratory emergency, it is important to secure the environment and maintain the safety of the clients, staff, yourself, and, if possible, the patient. Why are these patients a risk to people in the vicinity and to themselves?

27. When performing a thoracocentesis in a horse, why is location for placement of the needle important and dependent on the condition?

28. Patients with decreased blood oxygen content (hypoxemia) often need oxygen supplementation. Explain why hypoxemic patients with anemia will only get modest benefit from oxygen supplementation.

29. Briefly explain why tracheotomy tubes require cleaning as frequently as 2 to 4 times a day.

30. Wounds must be cleaned by irrigating or lavaging the wound with pressurized saline. Describe three simple methods that can be used to pressurize saline.

    i.

    ii.

    iii.

31. Explain why a volvulus of an abdominal structure such as the abomasum is more serious than many other abdominal disorders of the cow.

32. Briefly describe the process used to perform ruminal transfaunation including collection, processing the rumen contents, and administration.

    a. Collection:

b. Processing the rumen contents: _____

_____

c. Administration: _____

_____

33. List three reasons that orthopedic problems can be more problematic in large-animal species than in small-animal species.

i. _____

_____

ii. _____

_____

iii. _____

_____

34. When managing a large-animal dystocia, the veterinary technician may be the primary person to perform fetal extraction. Why is this the case?

_____

_____

35. When managing dystocias, care must be taken to prevent infection. Describe the steps required to prep the perineal area so that manure and dirt are not carried into the vagina.

_____

_____

_____

_____

36. Sheep and goats with urinary stones may require sedation to perform a thorough physical examination. Explain why the sedative acepromazine is a better choice than xylazine for these cases.

_____

_____

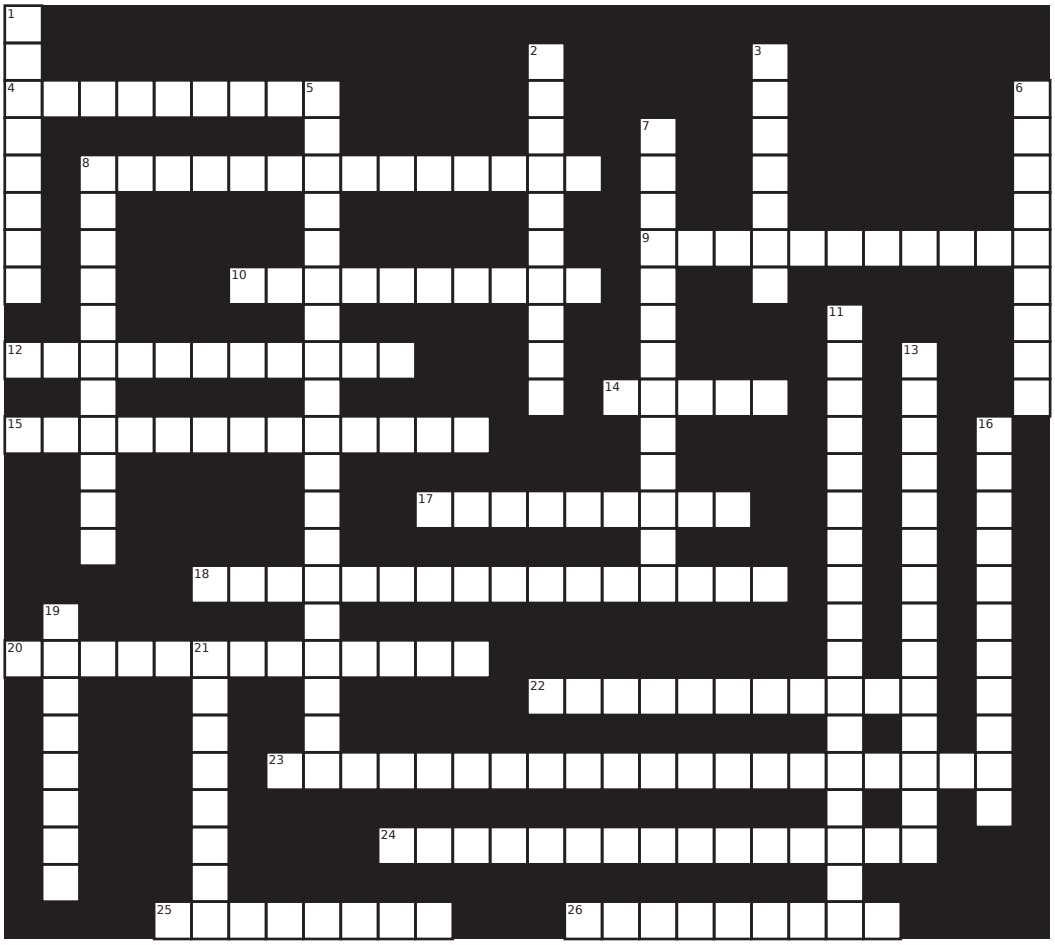
26 Wound Management and Bandaging

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all Key Terms in the chapter.
2. Identify the phases of wound healing, and describe patient, wound, and treatment factors that adversely affect wound healing.
3. Do the following regarding wound management in the small animal:
   - Describe the objectives of and principles of immediate wound care, including wound lavage.
   - Describe the goals of wound débridement and methods used to débride wounds.
   - Differentiate between primary, delayed primary, and secondary wound closure, and between primary, second, and third intention healing.
   - Compare and contrast methods of managing wound drainage and wound infection.
   - Explain the nature of and appearance of abrasions, lacerations, degloving injuries, bite wounds, burns, decubitus ulcers, and pressure sores, and discuss the methods used to treat each.
4. Identify the principles of bandaging, and discuss the purpose of the primary, secondary, and tertiary layers of a bandage, including the specific materials used for each.
5. Do the following regarding application of bandages, casts, splints, and slings in small animals:
   - Discuss uses for and characteristics of limb bandages and the technique used to place a Robert Jones bandage or a modified Robert Jones bandage on a small animal limb.
   - Discuss uses for and characteristics of casts and splints and the technique used to place a cast or splint on a small animal limb.
   - Discuss uses for and characteristics of small animal slings and the technique used to place hobbles, or an Ehmer, 90/90 flexion, Velpeau, and carpal flexion sling on a small animal.
   - Discuss techniques used to bandage the head, chest, abdomen, tail, and areas that are difficult to bandage such as the pelvis and the axilla.
   - Explain aftercare of bandages, splints, casts, and slings, including complications that may occur.
6. Discuss the principles of equine wound care, including treatment of exuberant granulation tissue.
7. Do the following regarding application of bandages, splints, and casts in horses:
   - Discuss uses for, characteristics of, and the technique used to place a lower limb wound bandage or a support bandage on an equine limb.
   - Discuss uses for and characteristics of equine casts and splints and techniques used to place a cast or a splint on an equine limb.
   - Describe the technique used to remove a cast.
8. Discuss uses for and characteristics of bandages, splints, and casts used for cattle and describe technique used to place a claw block or a modified Thomas splint on a ruminant limb.

EXERCISE 26.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

4 A wound dressing that is a primary layer impermeable to moisture.
8 Wound caused by pressure on skin over bony prominences. (2 words)
9 Cells recruited into a wound during the proliferative phase that help form granulation tissue.
10 Sharp cut or tear of skin.
12 Having an affinity for water.
14 Wound healing involving treatment that does not allow the wound to dry out.
15 A primary wound dressing that allows air and moisture to move through.
17 Closure of a wound by apposing the skin over healthy granulation tissue.
18 Healing of a wound across a surgically closed incision. (2 words)
20 The opposite side.
22 Vascularized fibrous tissue that covers a wound if left to heal by second intention.
23 Tissue also known as proud flesh. (2 words)
24 Healing of a wound by granulation tissue formation, epithelialization and contraction. (2 words)
25 Pertaining to the groin area.
26 Type of injury that features a large section of skin torn off the underlying tissue in a glove-like fashion.

Down

1 Having an osmotic pressure equivalent to that of blood plasma.
2 Having an osmotic pressure greater than that of blood plasma.
3 Surgical closure of a wound.
5 Meshwork-like substance in a wound, attached to the outer cell surface that provides support and anchorage. (2 words)
6 Space between tissues allowing accumulation of fluid. (2 words)
7 A cell with contractile properties that is responsible for wound contraction.
8 Removal of foreign matter and dead tissue from a wound.
11 The process in which skin cells advance in a single layer across the wound.
13 Wound healing by secondary closure after allowing granulation tissue to form. (2 words)
16 A Teflon pad is one example of this type of wound dressing.
19 Deposited into a wound by fibroblasts during the proliferative phase of healing.
21 An area of skin that has been superficially scraped.

EXERCISE 26.2 MATCHING #1: WOUND CLASSIFICATIONS

Instructions: Match each wound type in column A with its corresponding classification in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A

1. _____ A wound with a high bacterial count.
2. _____ Surgical wound that enters a hollow viscus.
3. _____ Surgical wound.
4. _____ An open traumatic wound.
5. _____ An old traumatic wound.
6. _____ A surgical wound with a minor break in sterile technique.
7. _____ A surgical wound into the colon.
8. _____ A natural wound with minor contamination.
9. _____ A surgical wound with a major break in sterile technique.

Column B

A. Clean wound
B. Clean-contaminated wound
C. Contaminated wound
D. Dirty and infected wound

EXERCISE 26.3 MATCHING #2: BANDAGES, SLINGS, SPLINTS, AND CASTS

Instructions: Match each device in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Carpal flexion sling
2. _____ Cast
3. _____ Ehmer sling
4. _____ Modified Thomas splint
5. _____ Modified Robert Jones bandage
6. _____ Robert Jones bandage
7. _____ Schroeder-Thomas splint
8. _____ Spica splint
9. _____ Velpeau sling
10. _____ 90/90 Flexion sling
11. _____ Hobbles

Column B

A. A traction splint constructed of rods used for stabilizing long bone fractures in large animals.
B. Maintains the limb in extension. Includes a lateral splint that reaches over the shoulder or hip.
C. Prevents abduction of the pelvic limbs. Primarily used after reduction of ventral hip luxations.
D. Used for the forelimb in any situation where weight bearing should be avoided but some movement of the elbow and shoulder joints is acceptable.
E. A very bulky bandage used to immobilize a limb distal to the elbow or stifle joint.
F. A device that prevents weight bearing of the pelvic limb. Frequently used after closed reduction of craniodorsal hip luxations.
G. A device that prevents weight bearing of the thoracic limb. Primarily used after reduction of medial shoulder luxations.
H. A device used to immobilize fractures that is most often made of fiberglass material.
I. Used in puppies after repair of distal femoral fractures to prevent quadriceps tie-down or contracture.
J. Also known as a "soft-padded bandage." The most commonly used distal limb bandage in small animals.
K. An immobilization device with a rigid metal frame. No longer recommended.

EXERCISE 26.4 MATCHING #3: WOUND CLOSURE AND HEALING

Instructions: Match each bandage material in column A with the corresponding type of wound healing that will follow in column B by writing the appropriate response in the space provided.

Column A	Column B
1. No closure of a wound will lead to _____	A. Primary intention healing
2. Primary closure of a wound will lead to _____	B. Third intention healing
3. Secondary closure of a wound will lead to _____	C. Second intention healing

EXERCISE 26.5 MATCHING #4: BURNS

Instructions: Match each type of burn in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ First-degree burn	A. Skin that is thick, leathery, often black.
2. _____ Second-degree burn	B. Burn with the presence of fluid-filled blisters.
3. _____ Third-degree burn	C. A burn that involves tissues deep to the skin.
4. _____ Fourth-degree burn	D. Skin is red and painful.

EXERCISE 26.6 MATCHING #5: BANDAGE MATERIALS

Instructions: Match each bandage material in column A with its corresponding characteristics in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A

1. _____ Elastikon elastic adhesive tape (Johnson & Johnson Medical, Arlington, TX)
2. _____ Curagel hydrogel (Kendall/Covidien, Mansfield, MA)
3. _____ Cotton sheets
4. _____ NU-GEL hydrogel (Johnson & Johnson Medical, Arlington, TX)
5. _____ Cast padding (3M Skin and Wound Care, St. Paul, MN)
6. _____ 20% Sodium chloride dressing
7. _____ Vetrap elastic bandage (3M Animal Care Products, St. Paul, MN)
8. _____ Hydrosorb Plus Foam (Kendall/Covidien, Mansfield, MA)
9. _____ Military field bandage
10. _____ Petrolatum-impregnated gauze
11. _____ Ultec Hydrocolloid Dressing (Kendall/Covidien, Mansfield, MA)
12. _____ Flannel track wrap
13. _____ Kling conforming gauze (Johnson & Johnson Medical, Arlington, TX)
14. _____ Honey
15. _____ Bioclusive polyurethane film (Johnson & Johnson Medical, Arlington, TX)
16. _____ Rolled cotton (Johnson & Johnson Medical, Arlington, TX)
17. _____ Teflon pads
18. _____ Tegaderm transparent dressing (3M Skin and Wound Care, St. Paul, MN)
19. _____ Quilted leg wraps
20. _____ Sterile wide-mesh gauze
21. _____ Tegaderm hydrocolloid (3M Skin and Wound Care, St. Paul, MN)
22. _____ Ace bandage
23. _____ Granulated sugar

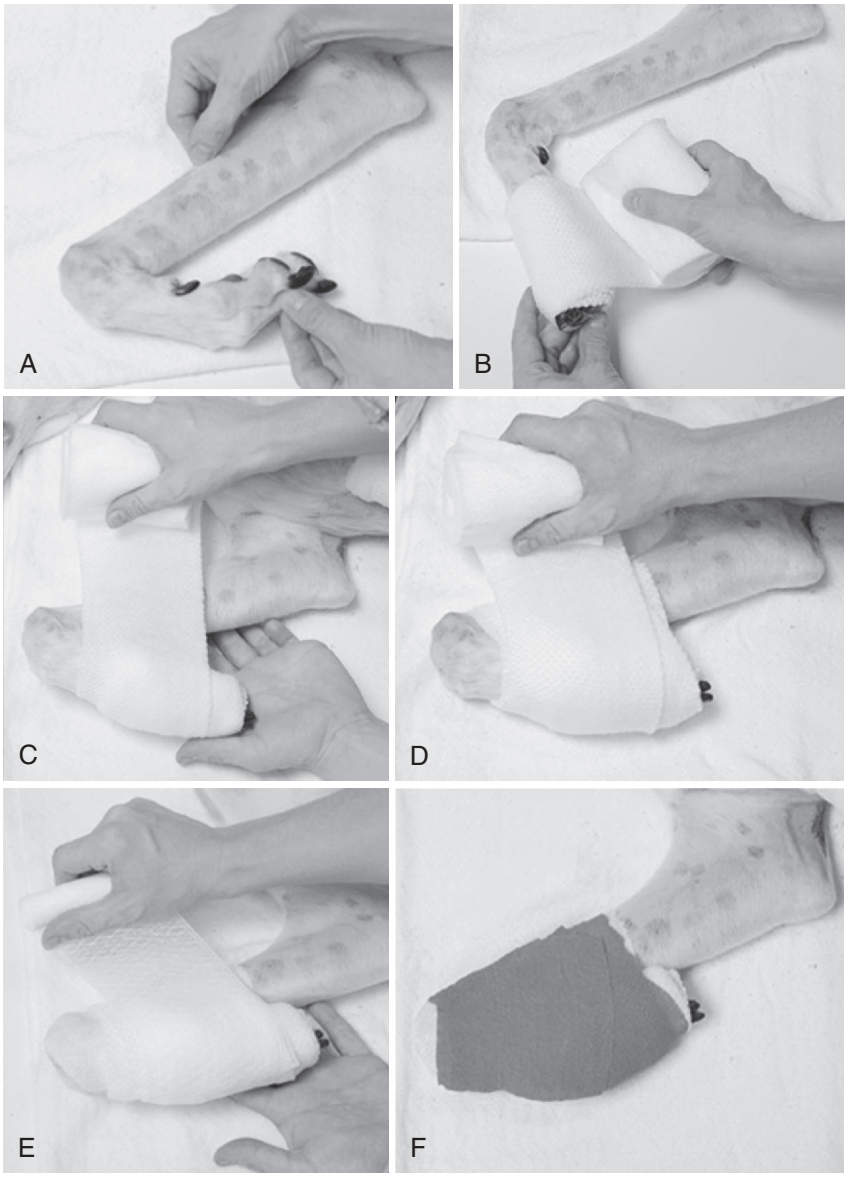
Column B

A. Primary layer adherent
B. Primary layer nonadherent nonocclusive
C. Primary layer nonadherent semiocclusive
D. Primary layer nonadherent occlusive
E. Primary layer hypertonic or hyperosmolar
F. Secondary layer
G. Tertiary layer

EXERCISE 26.7 PHOTO QUIZ: BANDAGES, CASTS, AND SLINGS

Instructions: Match each bandage, cast, or sling with its corresponding photo by writing the name in the space provided. Then list the primary indication(s) for each bandage, cast, or sling.

A. Hobbles
B. Modified Robert Jones bandage
C. Robert Jones bandage
D. Fiberglass cast
E. Velpeau sling
F. Carpal flexion sling
G. Ehmer sling



1. Name and primary indication(s): _____

2. Name and primary indication(s): _____

_____

4. Name and primary indication(s): _____

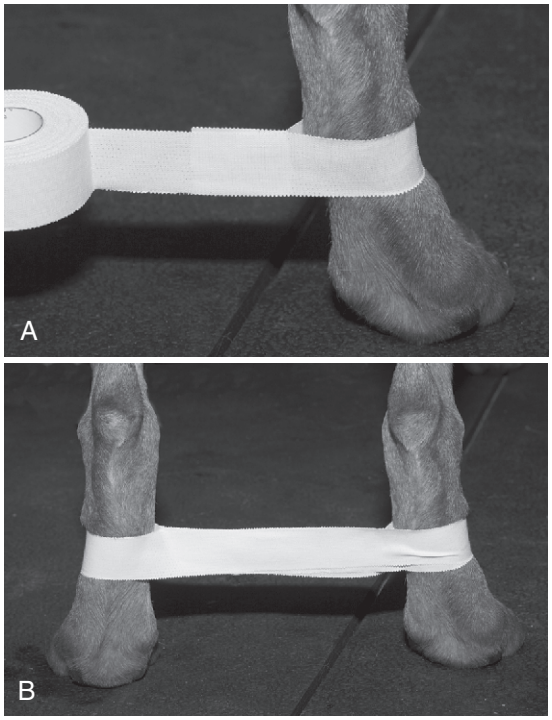
_____

3. Name and primary indication(s): _____

_____

5. Name and primary indication(s): _____

_____



6. Name and primary indication(s): _____

_____

7. Name and primary indication(s): _____

_____

EXERCISE 26.8 ORDERING: APPLYING A CAST TO A HORSE'S LIMB

A cast is the external coaptation most frequently used to manage various orthopedic injuries or problems in horses when maximum support and immobilization are required. Collecting all necessary materials is the first step when applying a cast. A number of other specific steps must be performed in the correct order to apply the cast properly.

Instructions: Place the steps of applying a cast to a horse's limb in the proper order from first to last by placing the appropriate number (2 through 15) in the space provided. The first step has already been done.

A. 1 Collect all necessary materials.

B. _____ Place wire traction loops through the hoof.

C. _____ Place a wooden wedge underneath the heel.

D. _____ Induce general anesthesia.

E. _____ Cover the limb with a double layer of stockinette.

F. _____ Clean the sole, remove the shoe, and trim the hoof.

G. _____ Cap the bottom of the cast with hard acrylic.

H. _____ Pack the frog with povidone-iodine.

I. _____ Apply two layers of 3-inch plaster material.

J. _____ Dry the skin and powder it with talcum or boric acid.

K. _____ Seal the top of the cast with stockinette and/or adhesive tape.

L. _____ Apply orthopedic felt at points of pressure.

M. _____ Apply two to three layers of 4- to 5-inch fiberglass material.

N. _____ Apply support foam.

O. _____ Apply two layers of 3-inch fiberglass material.

EXERCISE 26.9 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ During the maturation phase of wound healing, the tissue regains normal strength.

2. _____ Multiplication of bacteria beyond 10^5 organisms per gram of tissue will stop wound healing.

3. _____ When lavaging a highly contaminated wound for initial removal of debris and contamination, the type of fluid is more important than the amount you use.

4. _____ Fluid drainage from a wound is a reliable sign of infection and warrants antimicrobial therapy.

5. _____ Healthy granulation tissue is naturally resistant to infection and therefore does not require routine antimicrobial therapy.

6. _____ Bite wounds are usually relatively easy to assess because the extent of the damage is visually apparent.

7. _____ Bite wounds should always be considered contaminated.

8. _____ Most burns in domestic animals are a result of accidental or deliberate injury from things like stoves, electrical cords, or hot liquids.

9. _____ The best treatment for pressure sores arising from splints or casts is the use of occlusive, nonadherent dressings.

10. _____ The wet-to-dry bandage technique has largely been replaced by other techniques in recent years.

11. _____ The Robert Jones bandage is a frequently used bandage for small-animal patients.

12. _____ In general, small animals cannot tolerate excessive bandage tightness as well as large animals unless a thick secondary layer is used.

13. _____ As long as the device has been applied correctly, dogs with bandages, slings, and casts can be permitted to play in a fenced-in yard.

14. _____ To keep a bandage dry, it should be covered with a plastic bag or old IV bag at all times.

15. _____ Basic wound management in horses is very similar to that of small companion animals.

16. _____ Horses with open wounds on a limb below the carpus or tarsus are at risk for development of exuberant granulation tissue.

17. _____ Casts can easily be applied to a horse under standing sedation.

18. _____ Use of warm water is preferred for wetting fiberglass cast material.

19. _____ Stall confinement is mandatory after equine cast application.

20. _____ When applying bandages, splints, and casts, cattle often require less restraint than other animals.

EXERCISE 26.10 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. The inflammatory phase of wound healing is also known as the
   a. Lag phase
   b. Second phase
   c. Final phase
   d. Contraction phase

2. All of the following treatments but one, negatively impact wound healing. Which one does not negatively affect wound healing?
   a. Chemotherapy
   b. Corticosteroids
   c. Antimicrobials
   d. Radiation

3. The preferred antiseptic for wound lavage is
   a. 1:40 (0.05%) dilution of chlorhexidine solution and water
   b. Warm isotonic crystalloid fluid
   c. 1% Povidone-iodine solution
   d. 2% Chlorhexidine gluconate surgical scrub

4. Wound débridement by use of a wet-to-dry bandage causes débridement that is classified as
   a. Débridement "en bloc"
   b. Selective biologic débridement
   c. Staged selective surgical débridement
   d. Nonselective mechanical débridement

5. Surgical wounds closed by direct apposition heal by
   a. Moist wound healing
   b. Primary intention healing
   c. Second intention healing
   d. Third intention healing

6. Wound drains should be removed when the amount of fluid decreases. This is often after approximately
   a. 1 to 2 days
   b. 3 to 5 days
   c. 5 to 7 days
   d. 7 to 10 days

7. Patients with a severely infected wound and systemic signs (such as lethargy, pain, and decreased appetite) often require that antimicrobials be given
   a. Topically
   b. Orally
   c. Intramuscularly
   d. Intravenously

8. Burn wounds are classified based on
   a. The depth and size
   b. The size and duration
   c. The duration and location
   d. The location and depth

9. A partial-thickness burn that is characterized by blisters and discoloration would be classified as
   a. First-degree
   b. Second-degree
   c. Third-degree
   d. Fourth-degree

10. A full-thickness burn that is characterized by tough, discolored skin, but without involvement of deep tissues would be classified as
    a. First-degree
    b. Second-degree
    c. Third-degree
    d. Fourth-degree

11. Splints, casts, and slings can be used only to immobilize injuries below the
    a. Metacarpus and metatarsus
    b. Carpus and tarsus
    c. Elbow and stifle
    d. Hip and shoulder

12. There is a relatively low risk of complications from tightening the tertiary layer of a
    a. Modified Robert-Jones bandage
    b. Chest bandage
    c. Head bandage
    d. Robert-Jones bandage

13. In small animals, the most commonly used device for treatment of the distal limb is the
    a. Modified Robert-Jones bandage
    b. Fiberglass cast
    c. Schroeder-Thomas splint
    d. Robert-Jones bandage

14. When applying cast padding and conforming gauze that comes on a roll, often it should be overlapped by approximately
    a. 30%
    b. 50%
    c. 70%
    d. It should not be overlapped

15. Most forelimb splints should be applied to the
    a. Cranial surface
    b. Lateral surface
    c. Medial surface
    d. Caudal surface

16. Most rear limb splints (with the exception of metatarsal and foot splints) should be applied to the
    a. Cranial surface
    b. Lateral surface
    c. Medial surface
    d. Caudal surface

17. Non–weight-bearing slings, like the Ehmer and the Velpeau, should not be maintained for more than
    a. 7 to 10 days
    b. 1 to 2 weeks
    c. 2 to 3 weeks
    d. 4 to 6 weeks

18. The toes of an animal with a distal limb bandage must be monitored for complications daily. An increased distance between the toenails of a foot is a sign of
    a. Decreased viability
    b. Nothing, it is normal
    c. Swelling
    d. Skin maceration

19. Horses can get proud flesh in wounds on the distal limb. The term *proud flesh* refers to
    a. An infected wound
    b. Excessive granulation tissue
    c. A healthy looking wound bed
    d. A nonhealing open wound

20. Casting material used in horses may include
    a. Polyvinyl chloride (PCV) pipe
    b. Wooden slats
    c. Metal bars
    d. All of the above

21. When applying a cast to a limb, for optimal effectiveness, the cast must immobilize
    a. The joints proximal and distal to the injury
    b. All the joints of the limb
    c. Only the joint proximal to the injury
    d. Only the bone that is fractured

22. Application of excessive padding under a cast will
    a. Cause it to get wet
    b. Cause pressure necrosis of the skin
    c. Result in cast sores
    d. Not be a problem in most cases

23. When removing an equine distal limb cast, it should be split on the
    a. Medial and lateral surfaces
    b. Cranial and caudal surfaces
    c. Diagonal surfaces
    d. All four surfaces

24. The best method for controlling proud flesh in horses is usually
    a. Cryotherapy
    b. Electrocautery
    c. Topical treatment
    d. Surgical removal

25. Despite advances in external and internal skeletal fixation, modified Thomas splints are still often used in
    a. Horses
    b. Dogs
    c. Cattle
    d. Cats

26. A "beehive" and aluminum rod are used to construct a
    a. Coaptation splint
    b. Fiberglass cast
    c. Modified Thomas splint
    d. Robert-Jones bandage

EXERCISE 26.11 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. Wound strength is lowest during the _____ phase of healing.

2. Concerning the proliferative phase of wound healing, granulation tissue begins to form approximately _____ to _____ days after the injury, epithelialization begins approximately _____ to _____ days after the injury, and contraction of the wound begins approximately _____ days after the injury.

3. Healthy granulation tissue is _____ in color, but if it is unhealthy, it is _____ in color.

4. When caring for a wound in a patient first presented for treatment, the first objective is always to prevent further _____ of the wound.

5. _____ -intention healing is often used on the distal limb in situations where there is little available skin.

6. When treating patients with wound infections, antimicrobials are often chosen _____ [based on experience or observation]. If the correct medication was chosen, the infection should generally resolve within _____ to _____ days of initiation of treatment.

7. Gunshot wounds and wounds caused by sticks are often treated in a similar manner to _____ wounds.

8. You might know that a pressure sore is starting to form if you see _____ of the skin and _____ _____.

9. When treating wounds, once granulation tissue has formed and epithelialization begins, a _____ primary layer must be used to promote second-intention healing.

10. A cast that has been cut on both sides to create a top and bottom half is said to have been _____.

11. A properly applied Ehmer sling will internally _____ and _____ the femur, forcing it into the _____ and maintaining reduction.

12. After placing a tail bandage, a _____ _____ can be used to provide additional protection for the tip of the tail.

13. Bandages covering wounds with a lot of exudate should be replaced _____ to _____ times a day, whereas support bandages should be changed about every _____ days to check for complications.

14. A lower-limb wound bandage on a horse is defined as a bandage distal to the _____ in the forelimb, or the _____ in the rear limb.

15. When applying an equine cast to the forelimb, orthopedic felt must be placed over pressure points. These points include the most _____ limit of the cast, and the _____ _____ bone.

EXERCISE 26.12 SHORT ANSWER #1: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 26.13 SHORT ANSWER #2: WOUND HEALING

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 26.14 CASE STUDY: WOUND CARE

Signalment: Mindy, a 2-year-old, female, Spaniel mix.
History: The owner reported that Mindy jumped over the fence and disappeared from the yard 2 days ago. This morning, they found her lying on the front porch. She was covered with burs, and had a large laceration on her left forelimb. The owner isn't sure what happened, but it appears that she may have gotten caught on the fence and torn the skin as she jumped over.
Physical examination: Other than the laceration, and mats and burs in her hair, Mindy appears normal. The wound is approximately 10 cm long, there is a 1- to 2-cm gap between the edges of the wound, and the wound is visibly dirty, appears to have some dead tissue around the edges, and is covered with a thick discharge. It appears that some skin was torn away, and it does not appear that there will be enough skin to completely cover the wound. After talking with the doctor, the owner elected to treat it as an open wound, and let it heal by second intention. Answer the following questions regarding management of this case.

1. What type of bandage could be used to nonselectively débride this wound?

   _____

   a. Summarize the steps used to apply this bandage.

      _____

      _____

      _____

      _____

      _____

      _____

b. Briefly explain how this bandage works to débride the wound.

c. What precautions must you take when using this type of bandage?

d. How often do you estimate this bandage would have to be changed?

2. What type of primary layer is often preferred to prevent destruction of granulation tissue and other healthy tissue? Give a few examples of the specific types of materials that can be used for this alternative type of primary layer.

3. Mindy was kept for the day while the wound was treated and the bandage was applied. The attending veterinarian has now asked you to discharge Mindy from the hospital and speak with her owner about care of the bandage.

   a. What instructions would you need to give Mindy's owner regarding care of this bandage?

   b. What signs should Mindy's owner watch for that would alert her of a complication that would need to be addressed?

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EXERCISE 26.12 SHORT ANSWER #1: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. What are the differences between the way a surgical wound with direct apposition of the skin edges heals, and the way a traumatic wound that is not surgically closed heals?

2. When saline is used to lavage a wound, it will aid in removal of debris without damaging viable tissue when applied to the wound at a pressure of 8 to 12 psi. Because we don't usually use a manometer to measure lavage solution pressure, what commonly available equipment can be used that will approximate the desired pressure?

3. The goal of wound débridement is the removal of obviously contaminated, devitalized, or necrotic tissue, and elimination of foreign debris. Explain what "devitalized" tissue is and what "necrotic" tissue is.

4. When treating a wound with a lot of exudate or dead space, wound drains are often used to remove fluid. What is the difference between the way that a passive drain works and the way that an active drain works?

5. What is the difference in appearance between drainage from a healthy wound and an infected one?

6. Contrary to what one might think, honey and granulated sugar can be used as antimicrobials when incorporated into the contact layer of a bandage.

   a. Briefly explain what causes this antimicrobial effect.

   b. Why do these dressings have to be changed frequently?

7. Briefly describe the difference between abrasions, lacerations, and degloving injuries, and the general methods used to treat them.

   a. Abrasions:

   b. Lacerations:

   c. Degloving injuries:

8. Decubitus ulcers are common in recumbent, large patients. Describe the reason these wounds form and the most common areas in which they occur.

9. Briefly explain the purpose for primary, secondary, and tertiary layers of a bandage.

   a. The primary layer: _____

   _____

   b. The secondary layer: _____

   _____

   c. The tertiary layer: _____

   _____

10. When applying casts, it is important to avoid creases, folds, or wrinkles in the material. Why is this the case?

    _____

    _____

11a. Explain the principle of how a tie-over bandage works.

    _____

    _____

    _____

11b. Why is this bandage an advantage when used over the hip or in the axillary region?

    _____

    _____

    _____

12. When clipping hair from around a wound, cut hairs must be prevented from falling into the wound. What technique can be used to prevent this?

    _____

    _____

13. When applying a cast to the distal limb of a cow, a wooden block is applied to an unaffected claw. Explain the reasons for this.

    _____

    _____

    _____

EXERCISE 26.13 SHORT ANSWER #2: WOUND HEALING

Instructions: Respond to each of the following questions in the space provided.

1. List the three phases of wound healing, then briefly summarize each phase, including when it starts and ends, and the major events that occur.

   a. First phase: _____

   b. Second phase: _____

   c. Third phase: _____

2. There are a number of patient factors that negatively affect wound healing. These factors can be categorized as endocrinopathies, chronic viral infections, orthopedic or neurologic problems, diseases that cause low protein and albumin levels, and nutritional issues. List at least one common disease or condition in each of these categories and briefly review the specific effect of each on wound healing.

   a. Endocrinopathies: _____

   b. Chronic viral infections: _____

   c. Orthopedic or neurologic problems: _____

d. Diseases that cause low protein and albumin levels: _____

_____

_____

e. Nutritional issues: _____

_____

_____

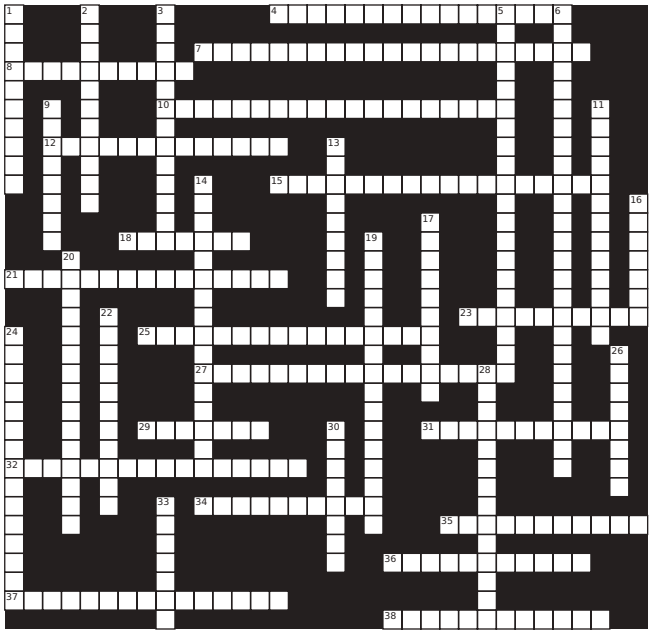
27 Pharmacology and Pharmacy

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all Key Terms in this chapter.
2. Describe the principles of basic pharmacokinetics and pharmacodynamics.
3. Describe the impact of cardiovascular, kidney, liver disease and aging on drug pharmacokinetics.
4. Compare and contrast dose-dependent drug reactions and idiosyncratic drug reactions, and explain the role of therapeutic drug monitoring in maximizing drug efficacy and minimizing drug toxicity.
5. Do the following regarding target organ/organ systems approach to drug classification:
   - List the major diseases affecting the endocrine, gastrointestinal, cardiovascular, and neurologic systems that are treated with pharmaceuticals; and the major immune-mediated, infectious, liver, and neoplastic diseases that are treated with pharmaceuticals.
   - List the main drug classes used to treat major animal diseases, and give examples of drugs in each class, including their mechanism of action and common side effects.
   - List the main classes of antimicrobial agents used in veterinary patients, and give examples of each, including their spectrum of activity and common side effects.
6. Do the following regarding regulatory pharmacology:
   - Summarize state and federal laws regulating drug use, and explain how they work together to ensure that available drugs are safe and effective, and are used appropriately to treat and prevent animal diseases.
   - List approval categories of drugs, and compare and contrast prescription drugs, over-the-counter drugs, and veterinary feed directive drugs.
   - Explain the concept of a valid veterinary-client-patient relationship, and explain how it affects the use of prescription drugs.
   - Discuss laws affecting the use of controlled substances, and list commonly used drugs that are classified as controlled substances.
   - Define extra-label drug use, and discuss circumstances under which drugs may or may not be used in this manner, including special restrictions on extra-label drug use in food-producing animals.
   - Discuss the significance of drug residues in food-producing animals and the importance of observing withdrawal times to keep the human food supply safe.
   - Define drug compounding and explain legal issues related to compounding of medications.
7. Describe regulatory issues related to procurement, storage, dispensing, and administration of pharmacologic agents; and, list the dosage forms of medications, the routes by which medications may be administered, and factors that affect route selection.
8. Perform dosage calculations required to dispense drugs and to administer drugs to patients.

EXERCISE 27.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

4 Any undesirable effect of a drug that may or may not be drug related and that results regardless of whether or not the drug is used according to the FDA-approved labeling. (3 words)
7 A drug will be expected to have the desired effect when the concentration in the bloodstream is within this level. (3 words)
8 Use of a formulation of human insulin to treat type I diabetes in a dog is an example of this drug use. (2 words)
10 A natural substance in the body that triggers a cascade of cellular events by binding to a cell receptor. (2 words)
12 A nondrug substance administered orally to provide substances required for normal body structure and function.
15 A group of hormones that regulate body water and electrolytes.
18 A substance capable of inducing antibody production.
21 A measure of the percentage of a drug dose that reaches the bloodstream.
23 Naloxone is one of these within the opioid family of drugs.
25 The range of concentrations in which a drug is effective with minimal toxicity to the patient. (2 words)
27 The chemical modification of a drug by the body.
29 Abnormal buildup of fluid in the abdominal cavity.
31 Soluble in water.
32 A term summarized by the phrase "what the drug does to the body."
34 Absorption across cell membranes is more efficient for these drugs, than for hydrophilic drugs.
35 A drug in the form of a freeze-dried, fine powder that requires reconstitution prior to administration.
36 Concurrent use of DOCP and prednisone to treat hypoadrenocortism is a form of this therapy.
37 A group of steroid hormones that are used as antiinflammatory or immunosuppressive agents.
38 Another name for an Rx drug.

Down

1 Another name for a prescription drug. (2 words)
2 When the amount of drug administered equals the amount of drug eliminated, the blood level is said to have reached _____. (2 words)
3 A predictable reaction to a drug, the likelihood of which increases as the drug dose increases. (2 words)
5 The relationship between the amount of drug in the body and the drug plasma concentration. (3 words)
6 The periodic measurement of the amount of a drug in the blood. (3 words)
9 Without a charge; lipophilic drugs have this characteristic.
11 An unpredictable reaction to a drug that does not occur immediately, but after several days of treatment, and that is often associated with an immune system response.
13 A measure of the efficiency of drug elimination.
14 Movement of an absorbed drug from the blood to the various tissues of the body. (2 words)
16 A drug that activates a receptor, producing the same action as an endogenous substrate.
17 The term for administration of a drug by injection.
19 The study of the movement of drugs in the body.
20 Use of a drug designed to act on a specific cellular molecule. (2 words)
22 The term for administration of a single drug to treat a particular condition.
24 Preparation of a flavored suspension of metronidazole to facilitate accurate oral dosing in a cat is a form of this. (2 words)
26 A drug's capacity, once bound to its receptor, to produce an effect.
28 A nonprescription drug as opposed to a legend drug. (3 words)
30 The time required for the amount of a drug in the body to decrease by 50%; used to estimate the dosing interval. (2 words)
33 D-penicillamine will do this to copper, enabling it to be excreted by the kidneys.

EXERCISE 27.2 MATCHING #1: TERMS RELATED TO REGULATORY ISSUES

Instructions: Match each term related to regulatory issues in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Animal Medicinal Drug Use Clarification Act (AMDUCA)
2. _____ Center for Veterinary Medicine (CVM)
3. _____ Controlled Substance Act (CSA)
4. _____ Environmental Protection Agency (EPA)
5. _____ Federal Food, Drug, and Cosmetic Act (FFD&C Act)
6. _____ Food and Drug Administration (FDA)
7. _____ United States Department of Agriculture (USDA)
8. _____ U.S. Pharmacopoeia (USP) – National Formulary (NF)
9. _____ Veterinarian–client–patient relationship (VCPR)
10. _____ Veterinary feed directive (VFD) drug

Column B

A. A set of requirements that must be met for a veterinarian to use a prescription or veterinary feed directive drug.

B. The federal law regulating drug approval, use, safety, and efficacy.

C. The governing body that regulates the manufacture and distribution of drugs, food additives, and medical devices used in veterinary species under the FFD&C Act.

D. The government agency that regulates veterinary biologics.

E. An amendment of the FFD&C Act that allows extralabel drug use for the treatment of veterinary species provided specific conditions are met.

F. The government agency charged with ensuring the safety and efficacy of human and animal drugs, and the safety of cosmetics, foods, and other consumer items.

G. A drug used under the order of a veterinarian in animal feed.

H. The government agency charged with overseeing and regulating pesticides.

I. The official legal drug compendium for the United States. A compilation of all drug substances and products focused on providing active ingredients.

J. A federal law regulating the manufacturing, distribution, and dispensing of substances like morphine, barbiturates, and hallucinogens.

EXERCISE 27.3 MATCHING #2: DRUGS AND THEIR PRIMARY INDICATIONS

Instructions: Match each drug class or group in column A with its corresponding primary indication in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ Chemotherapy drugs	A. Diabetes mellitus
2. _____ Mitotane or trilostane	B. Hyperadrenocorticism
3. _____ Immunosuppressive drugs	C. Liver disease
4. _____ Antifibrotics	D. Immune-mediated diseases
5. _____ Antibiotics	E. Dermatophyte infections
6. _____ Glucocorticoids and mineralocorticoids	F. Hypoadrenocorticism
7. _____ Methimazole or radioactive iodine	G. Neoplastic diseases (cancers)
8. _____ Hepatoprotectants	H. Hyperthyroidism
9. _____ Choleretic drugs	I. High blood pressure
10. _____ Insulin	J. Bile sludge (poor bile flow)
11. _____ Antihypertensive	K. Seizure disorders
12. _____ Chelating agents	L. Hepatic encephalopathy
13. _____ Antiparasitics	M. Edema
14. _____ Lactulose and neomycin	N. GI nematode and arthropod infestations
15. _____ Diuretics	O. Hypothyroidism
16. _____ L-thyroxine	P. Liver cirrhosis
17. _____ Antifungal drugs	Q. Decreased contractility of the heart
18. _____ Inotropic agents	R. Disturbances of heart rhythm
19. _____ Anticonvulsants	S. Copper-associated hepatopathies
20. _____ Antiarrhythmics	T. Bacterial infections

EXERCISE 27.4 MATCHING #3: ADVERSE DRUG REACTIONS

Instructions: Column A is a list of characteristics that apply to drug reactions. Indicate whether each characteristic applies to dose-dependent reactions, idiosyncratic reactions, or both by writing an "A," "B," or "C" in the space provided.

Column A

1. _____ Associated with an immune-system response.
2. _____ Caused by the drug itself or a metabolite.
3. _____ Unpredictable.
4. _____ Treatment requires drug avoidance.
5. _____ May be prevented by therapeutic drug monitoring.
6. _____ Affects all members of a species.
7. _____ Not dose dependent.
8. _____ Not related to the action of the drug.
9. _____ Predictable.
10. _____ Often affect more than one species.
11. _____ Therapeutic drug monitoring will not prevent them.
12. _____ May or may not be related to the action of the drug.
13. _____ Occur after several days of treatment.
14. _____ May or may not affect multiple species.
15. _____ More severe at higher doses.
16. _____ Often responds to dose reduction.
17. _____ Affects a small portion of treated animals.

Column B

A. Dose-dependent drug reactions
B. Idiosyncratic drug reactions
C. Both dose-dependent and idiosyncratic drug reactions

EXERCISE 27.5 MATCHING #4: ANTIBACTERIAL DRUGS

Instructions: Match each antibacterial drug in column A with the corresponding class to which it belongs in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A

1. _____ Cephalexin
2. _____ Marbofloxacin
3. _____ Oxytetracycline
4. _____ Amikacin
5. _____ Sulfamethoxazole
6. _____ Ampicillin
7. _____ Metronidazole
8. _____ Tilmicosin
9. _____ Florfenicol
10. _____ Gentamicin
11. _____ Amoxicillin
12. _____ Cefpodoxime
13. _____ Tylosin
14. _____ Enrofloxacin
15. _____ Erythromycin
16. _____ Trimethoprim
17. _____ Azithromycin
18. _____ Lincomycin
19. _____ Clindamycin
20. _____ Doxycycline

Column B

A. β-Lactams
B. Aminoglycosides
C. Sulfonamides
D. dihydrofolate reductase (DHFR) inhibitors
E. Fluoroquinolones
F. Amphenicols
G. Macrolides
H. Lincosamides
I. Tetracyclines
J. Nitroimidazoles

EXERCISE 27.6 MATCHING #5: DRUGS USED TO TREAT LIVER DISEASE

Instructions: Match each drug used to treat liver disease in column A with the corresponding class to which it belongs in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A

1. _____ Lactulose
2. _____ Colchicine
3. _____ S-adenosylmethionine
4. _____ Ursodiol
5. _____ D-penicillamine
6. _____ Neomycin
7. _____ Silymarin
8. _____ Zinc

Column B

A. Hepatoprotectant
B. Antifibrotic agent
C. Drug used to treat hepatic encephalopathy
D. Chelating agent
E. Choleretic

EXERCISE 27.7 MATCHING #6: MECHANISM OF ACTION

Instructions: Match each commonly used drug in column A with its mechanism of action in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A

1. _____ Benazepril
2. _____ NSAIDs
3. _____ Digitalis
4. _____ Neostigmine
5. _____ Morphine
6. _____ Trimethoprim
7. _____ Furosemide
8. _____ Procainamide
9. _____ Famotidine
10. _____ Fentanyl
11. _____ Aspirin
12. _____ Enalapril
13. _____ Omeprazole
14. _____ Naloxone
15. _____ Diphenhydramine
16. _____ Lidocaine
17. _____ Physostigmine
18. _____ Butorphanol

Column B

A. Inhibits stomach acid secretion by binding to H_2 histamine receptors.
B. Prevents synthesis of folate by inhibiting dihydrofolate reductase.
C. Suppresses prostaglandin synthesis by inhibiting cyclooxygenase.
D. Prevents synthesis of angiotensin II by inhibiting angiotensin-converting enzyme.
E. Prevents vomiting by binding to H_1 histamine receptors.
F. Prevents metabolism of acetylcholine by inhibiting acetylcholinesterase.
G. Decreases sensory input to the CNS by blocking voltage-gated Na^+ channels.
H. Produces analgesia by binding to opioid receptors.
I. Prevents sodium and water reabsorption by inhibiting the $Na^+/K^+/2Cl$ transporter in the loop of Henle.
J. Increases the strength of heart muscle contraction by inhibiting $Na^+/K^+/$ ATPase.
K. Antagonizes analgesia by binding to opioid receptors.
L. Decreases stomach acid production by inhibiting Na^+/H^+ ATPase.

EXERCISE 27.8 MATCHING #7: DRUGS USED TO TREAT GASTROINTESTINAL DISEASE

Instructions: Match each drug or group of drugs used to treat gastrointestinal disease in column A with the corresponding class to which it belongs in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A

1. _____ Dolasetron and ondansetron
2. _____ Cisapride
3. _____ Famotidine and ranitidine
4. _____ Sucralfate
5. _____ Maropitant
6. _____ Prochlorperazine and chlorpromazine
7. _____ Metoclopramide
8. _____ Omeprazole

Column B

A. Prokinetic
B. Antacid/ulcer therapy
C. Antiemetic
D. Antiemetic/prokinetic

EXERCISE 27.9 MATCHING #8: DRUGS USED TO TREAT CARDIOVASCULAR DISEASE

Instructions: Match each drug or group of drugs used to treat cardiovascular disease in column A with the corresponding class to which it belongs in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Atenolol and propranolol
2. _____ Pimobendan
3. _____ Diltiazem
4. _____ Furosemide and spironolactone
5. _____ Lidocaine and quinidine
6. _____ Benazepril and enalapril
7. _____ Hydralazine
8. _____ Amlodipine
9. _____ Digoxin
10. _____ Sotalol
11. _____ Sildenafil

Column B

A. Diuretic
B. ACE inhibitor (antihypertensive)
C. Positive inotrope
D. Calcium-channel blocker (Class IV antiarrhythmic)
E. β-Adrenergic blocker (Class II antiarrhythmic)
F. Phosphodiesterase V inhibitor (antihypertensive)
G. Fast sodium channel blocker (Class I antiarrhythmic)
H. Arteriolar dilator (antihypertensive)
I. Calcium-channel blocker (antihypertensive)
J. Phosphodiesterase III inhibitor (balanced vasodilator/positive inotrope)
K. β-Adrenergic blocker (Class III antiarrhythmic)

EXERCISE 27.10 MATCHING #9: DRUGS PROHIBITED FOR USE IN FOOD-PRODUCING ANIMALS

Instructions: Match each drug or drug class in column A with the reason that it is banned in food-producing animals in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A

1. _____ Fluoroquinolones
2. _____ Clenbuterol
3. _____ Chloramphenicol
4. _____ Glycopeptides (vancomycin)
5. _____ Diethylstilbestrol (DES)
6. _____ Nitrofurans
7. _____ Sulfonamides
8. _____ Nitroimidazoles

Column B

A. Microbial drug resistance in humans
B. Vaginal cancer in humans exposed in utero
C. Carcinogenicity
D. Toxicity and death of exposed humans
E. Carcinogenicity and mutagenicity
F. Idiosyncratic bone marrow toxicosis in humans

EXERCISE 27.11 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ To achieve therapeutic blood levels, hydrophilic drugs must be administered by injection.
2. _____ The volume of distribution of water-soluble drugs is generally greater than that of lipid-soluble drugs.
3. _____ Biotransformation tends to make most drugs more hydrophilic prior to elimination in the urine or bile.
4. _____ Drug metabolism most often occurs in the kidney.
5. _____ Drug side effects are commonly related to the drug's mechanism of action.
6. _____ Glucocorticoids are classified according to the receptor they bind to.
7. _____ The term *antibiotic* is equivalent to the term *antibacterial*.
8. _____ The most common side effects of antimicrobial drugs are vomiting and diarrhea.
9. _____ When treating disseminated fungal infections, most systemic antifungal drugs are given for approximately 10 days to 2 weeks.
10. _____ Treatment of feline hyperthyroidism with radioactive iodine is generally curative.
11. _____ Mitotane kills the cells in the adrenal gland that produce cortisol, whereas trilostane does not.
12. _____ The molecular structure of insulin varies widely among the common domestic species.
13. _____ Because insulin is usually given in very small doses, a tuberculin syringe should be used to administer it.
14. _____ Glargine insulin has a bioactivity of 40 U/mL.
15. _____ The drug zinc is used to bind copper in a form that allows it to be excreted.
16. _____ Treatment of congestive heart failure is one of the main indications for diuretics like furosemide.
17. _____ The class I antiarrhythmic lidocaine is administered orally to treat ventricular tachycardia.
18. _____ Potassium bromide may be used as an alternative to phenobarbital to control seizures in dogs with liver disease.
19. _____ Macrocyclic lactones such as ivermectin and milbemycin oxime, have a prolonged effect because they are packaged in a slow-release form.
20. _____ Collies and related breeds have a genetic predisposition for CNS toxicity to milbemycins and avermectins.
21. _____ State laws cover drug distribution within the state, whereas federal laws cover manufacture of the drug.
22. _____ A new drug intended for use in animals other than humans must be approved by the FDA, but a new drug intended for use in animal feed does not require FDA approval.
23. _____ The use of a veterinary feed directive (VFD) drug requires a valid veterinarian–client–patient relationship.
24. _____ An "adverse drug event" is confined to any adverse event associated with a drug that was used according to the instructions on the label.
25. _____ Drug compounding is a form of extralabel drug use.

26. _____ Vitamins, minerals, and herbs are considered to be dietary supplements, whereas nutraceuticals are classified as drugs.

27. _____ Internet companies are uniformly reliable sources of high-quality drugs and information about those drugs.

28. _____ A reverse distribution company (RDC) will dispose of expired drugs including controlled substances.

29. _____ The units used to express most drug dosages are gm/unit body weight (lb).

EXERCISE 27.12 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. A drug's pharmacokinetics are not used to determine its
   a. Dose
   b. Withdrawal time
   c. Dosing regimen
   d. Action

2. A drug will be 100% bioavailable when it is given
   a. SC
   b. Orally
   c. IV
   d. IM

3. Because of a genetic mutation, Collies and a few other dog breeds have a nonfunctional p-glycoprotein pump. This abnormality makes these breeds more sensitive to the drug ivermectin because it
   a. Decreases protein binding of the drug
   b. Decreases action of the blood–brain barrier
   c. Increases its lipid solubility
   d. Increases tissue binding of the drug

4. One example of a drug that is metabolized by the body into a toxic metabolite is
   a. Acetaminophen
   b. Digoxin
   c. Enalapril
   d. Selamectin

5. A natural deficiency in the ability to conjugate glucuronide makes some drugs, including salicylic acid (aspirin), more toxic to which of the following species?
   a. Dogs
   b. Cats
   c. Pigs
   d. Horses

6. The half-life of a drug is used to determine the
   a. Dose
   b. Length of time it needs to be given
   c. Length of time between doses
   d. Potency

7. A drug's pharmacokinetics are least likely to be affected by
   a. Kidney disease
   b. Liver disease
   c. Heart disease
   d. CNS disease

8. Blood flow to the kidneys is negatively impacted by
   a. NSAID-class drugs
   b. Penicillin-class drugs
   c. Benzodiazepine-class drugs
   d. Tetracycline-class drugs

9. When collecting serum for therapeutic drug monitoring of phenobarbital, the blood should be collected in a
   a. Serum separator tube
   b. EDTA tube
   c. Red-top tube
   d. Blue-top tube

10. "Dry eye" (a deficiency of the tear film) is a known dose-dependent adverse drug reaction to which class of antibacterial drugs?
    a. Potentiated sulfonamides
    b. Amphenicols
    c. Aminoglycosides
    d. Fluoroquinolones

11. Which immunosuppressive agent listed below is most commonly used to treat immune-mediated diseases, but has the widest range of adverse effects?
    a. Cyclosporine
    b. Chlorambucil
    c. Azathioprine
    d. Prednisolone

12. The glucocorticoid _____ has a long duration of action.
    a. Prednisone
    b. Betamethasone
    c. Hydrocortisone
    d. Triamcinolone

13. Which of the following immunosuppressive drugs causes a wide variety of adverse effects including polyphagia, polydipsia, polyuria, and panting?
    a. Azathioprine
    b. Cyclosporine A
    c. Prednisolone
    d. Chlorambucil

14. The penicillin-class drug or combination that has activity against Gram-negative aerobes is
    a. Ampicillin
    b. Penicillin G
    c. Amoxicillin
    d. Amoxicillin and clavulanate

15. Which class of antibacterial drugs is known for causing kidney and inner ear toxicity?
    a. β-Lactams
    b. Fluoroquinolones
    c. Tetracyclines
    d. Aminoglycosides

16. The cephalosporin-class antibacterials are classified according to
    a. The duration of action
    b. The subclass
    c. Generation (first, second, third, etc.)
    d. Strength

17. Which two classes of antibacterial drugs have efficacy against protozoa?
    a. Sulfonamides and nitroimidazoles
    b. Penicillins and cephalosporins
    c. Tetracyclines and amphenicols
    d. Aminoglycosides and lincosamides

18. Which class of antibacterials is known to damage cartilage in young animals and cause blindness in cats as a part of its adverse effect profile?
    a. Amphenicols
    b. Macrolides
    c. Fluoroquinolones
    d. Sulfonamides

19. Which two antibacterial drugs and/or drug classes are banned in food-producing animals?
    a. β-Lactams and enrofloxacin
    b. Tetracycline and the macrolides
    c. Chloramphenicol and nitroimidazoles
    d. Aminoglycosides and lincosamides

20. Which of the following drugs is an imidazole-class antifungal that is used to treat dermatophytes in addition to disseminated fungal infections?
    a. Fluconazole
    b. Amphotericin B
    c. Clotrimazole
    d. Ketoconazole

21. Which antifungal agent does not adversely affect the liver as a part of its adverse effect profile?
    a. Amphotericin B
    b. Itraconazole
    c. Ketoconazole
    d. Fluconazole

22. Hyperthyroidism is a condition that is seen most frequently in
    a. Cats
    b. Horses
    c. Dogs
    d. Cattle

23. Cells that require insulin for uptake of glucose include
    a. Red blood cells
    b. Liver cells
    c. Muscle cells
    d. Brain cells

24. Which of the following types of insulin can be given intravenously?
    a. NPH
    b. PZIR
    c. Glargine
    d. Regular

25. NPH insulin is an example of
    a. Intermediate-acting insulin
    b. Long-acting insulin
    c. Peakless insulin
    d. Short-acting insulin

26. Which of the following drugs used to treat liver disease should be given on an empty stomach to maximize absorption?
    a. Lactulose
    b. Ursodiol
    c. SAMe
    d. Neomycin

27. Which diuretic is used in horses to treat exercise-induced pulmonary hemorrhage?
    a. Hydrochlorothiazide
    b. Spironolactone
    c. Furosemide
    d. Mannitol

28. Amlodipine is most commonly used to treat
    a. Canine pulmonary hypertension
    b. Hypertension in cats and dogs
    c. Congestive heart failure
    d. CHF secondary to mitral insufficiency

29. Which of the following antiarrhythmics is a β-adrenergic blocker?
    a. Lidocaine
    b. Sotalol
    c. Diltiazem
    d. Quinidine

30. Which of the following chemotherapeutic agents must be given by IV injection taking extreme care to avoid extravasation?
    a. Vincristine
    b. Lomustine
    c. Chlorambucil
    d. L-asparaginase

31. Which of the following antiparasitics is effective against flukes?
    a. Pyrantel
    b. Fenbendazole
    c. Netobimin
    d. Praziquantel

32. Ectoparasite agents are most commonly given
    a. Subcutaneously
    b. Orally
    c. Topically
    d. Intramuscularly

33. Which of the following ectoparasiticides targets the parasite's growth and development by inhibiting development of the parasite's exoskeleton?
    a. Imidacloprid
    b. Lufenuron
    c. Fipronil
    d. Carbamate

34. Which agency regulates the manufacture and distribution of veterinary drugs and food additives?
    a. Environmental Protection Agency (EPA)
    b. Drug Enforcement Agency (DEA)
    c. U.S. Department of Agriculture (USDA)
    d. FDA's Center for Veterinary Medicine

35. The Drug Enforcement Agency (DEA) categorizes controlled drugs
    a. As Schedule I, II, III, IV, or V
    b. As Rx or non-Rx
    c. Based on their chemical structure
    d. Based on the severity of their side effects

36. Schedule II controlled substances have a high abuse potential, and require completion of a special form when ordering them. Which of the following controlled substances is classified as a Schedule II substance?
    a. Codeine
    b. Phenobarbital
    c. Fentanyl
    d. Ketamine

37. Nutraceuticals
    a. Are subject to safety evaluations by the FDA
    b. Are made using a standardized manufacturing process
    c. Are classified as over-the-counter drugs
    d. May be administered without medical supervision

38. Which of the following abbreviations used in prescription writing is not universally understood by human medical professionals?
    a. s.i.d.
    b. p.r.n.
    c. t.i.d.
    d. q.o.d.

39. Which of the following medications is available in a transdermal form?
    a. Buprenorphine
    b. Methimazole
    c. Phenobarbital
    d. Furosemide

40. Enteric-coated dosage forms should never be
    a. Crushed or split
    b. Taken orally
    c. Used in animals
    d. Given to cats

41. Percent solutions may be expressed as volume/volume ratio. For instance, a 5% solution contains
    a. 5 mL in 1 mL of solution
    b. 5 mL in 1 L of solution
    c. 5 mL in 100 mL of solution
    d. 5 mL in 100 L of solution

42. Which of the following metric system weight conversions is correct?
    a. 1 kg = 100 g
    b. 1 mcg = 1000 mg
    c. 10 ng = 1 mcg
    d. 1000 mg = 1 g

43. Which of the following metric system volume conversion is correct?
    a. 100 mL = 1 dL
    b. 100 mL = 1 L
    c. 1 mcL = 1000 mL
    d. 1000 mcL = 1 L

EXERCISE 27.13 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. The study of drugs used in the diagnosis, treatment, or prevention of disease is known as _____.
2. The relationship between the amount of drug in the _____ and the concentration in the _____ is measured by the volume of distribution (Vd).
3. The protein that protects the brain from exposure to various drugs and substances by actively pumping them out of the cells is referred to as the _____.
4. Most drugs are eliminated from the body by the _____ into the _____.
5. It takes approximately _____ half-lives for a drug to reach steady state after it is first administered.
6. Whereas the antiseizure drug _____ is known to cause a dose-dependent adverse drug reaction involving the liver in dogs, the antiseizure drug _____ is known to cause an idiosyncratic adverse drug reaction involving the liver in cats.
7. Immunosuppressive drugs are used to treat _____ diseases.
8. The use of glucocorticoids concurrently with _____ _____ drugs (NSAIDs) is contraindicated because of the increased risk of gastrointestinal bleeding, _____, or perforation.
9. The method of choosing a specific antibacterial based on observation and experience is called _____ antibacterial therapy.
10. The two specific classes of drugs that are part of the larger β-lactam class are the _____ and _____.
11. The adverse effects of antifungal drugs result from targeting the _____ in the cell membranes of the treated patient.
12. _____ and _____ are two topical antifungal drugs used to treat yeast otitis.
13. Medical therapies for feline hyperthyroidism include the drug _____ and radioactive _____ therapy.
14. One cause of hyperadrenocorticism is overproduction of ACTH in the brain (called _____- dependent hyperadrenocorticism), and the other cause is overproduction of cortisol by an _____ tumor.
15. The concentration of insulin is expressed in _____ of activity per mL.
16. _____ _____ is a disease in which nervous system signs (lethargy, ataxia, or seizures) occur in association with liver failure.
17. The drug colchicine is used to treat _____ of the liver.

18. In some liver diseases, the metal _____ accumulates in the liver tissue. D-penicillamine is used to _____ the metal, allowing it to be excreted.

19. The goal of therapy with lactulose in patients with hepatic encephalopathy is to make the stool _____, but not to produce _____.

20. Diuretic medications are intended to increase excretion of _____ and _____.

21. The diuretic spironolactone is used to treat edema formation with conditions that are associated with high _____ levels.

22. Digoxin has a narrow _____ _____ (a low ratio between the therapeutic plasma levels and toxic plasma levels).

23. The drugs enalapril and benazepril work by inhibiting _____ converting enzyme (ACE).

24. Whereas arrhythmias that originate from the atria are referred to as _____, arrhythmias that originate from the ventricles are referred to as _____.

25. The anticonvulsant of choice in cats is _____, because potassium bromide causes _____ symptoms in 40% of treated cats.

26. Endoparasites include three classes: (a) _____, (b) _____, and (c) _____.

27. Although used to control flies, ticks, mites, and mosquitoes, pyrethrins are not safe for use in _____.

28. The Animal Medicinal Drug Use Clarification Act (AMDUCA) enables veterinarians to use and prescribe animal and human drugs for _____ use under defined conditions.

29. The time interval between the last administered drug dose to a food-producing animal and the time that animal can be slaughtered or animal products such as eggs or milk can be used is known as the _____ _____.

30. The presence of a drug or its metabolite in cells, tissues, organs, or other edible products of an animal is referred to as a _____ _____.

31. An enteric coating is designed to prevent exposure of an oral medication to the acid environment of the _____, and delay absorption until it reaches the higher pH of the _____ _____.

32. Some injectable drugs are able to cross the oral mucous membranes of some species. An example of a drug that absorbs transmucosally in cats is the opioid analgesic _____.

33. No expiration date is required on the label of drugs regulated by the _____ [an acronym].

EXERCISE 27.14 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 27.15 DOSAGE CALCULATIONS: COMPREHENSIVE

Perform each of the following dosage calculations.

Specific instructions regarding this assignment:

A. When performing calculations involving administration of oral tablets, express answers that are less than 1 tablet as a fraction (e.g., "½ tablet" instead of "0.5 tablet").
B. When performing calculations involving administration of injectable medications, express fractions of a milliliter (mL) as a decimal (e.g., "2.5 mL" instead of "2½ mL").
C. When writing instructions for the client, write it as you would on the label (e.g., "Give 1 tablet by mouth twice daily for 10 days" instead of "1 tab. P.O. BID × 10 d").
D. When writing instructions for the client, only limit the duration of administration (e.g.,"Give 1 tablet once daily for 10 days" or "Give 1 tablet once daily until gone"), if the medication is being given for a limited time. If the medication is ongoing, and the client will need to come in for a refill, do not include either of these phrases.

1. **Order:** 22 mg/kg Amoxicillin P.O. The patient weighs 25 lb. The tablet strength is 100 mg, and the tablets are scored. How many tablets will you give? (Note: you may round your answer down to the nearest ½ tablet.)

_____ **Tablet(s)**

2. **Order:** 0.25 mg/lb Butorphanol P.O. The patient weighs 30 lb. The tablet strength is 5 mg, and the tablets are scored. How many tablets will you give? (Note: you may round your answer down to the nearest ½ tablet.)

_____ **Tablet(s)**

3. **Order:** 0.01 mg/lb Fludrocortisone P.O. The patient weighs 60 lb. The tablet strength is 0.1 mg. How many tablets will you give?

_____ **Tablet(s)**

4. **Order:** 0.5 mg/kg Prednisolone. The patient weighs 66 lb. The tablet strength is 5 mg. How many tablets will you give?

_____ **Tablet(s)**

5. **Order:** 62.5 mg Sulfasalazine. The tablet strength is 500 mg. How many tablets will you give?

_____ **Tablet(s)**

6. **Order:** 0.01 mg/lb Soloxine SID. *(Note that this drug will be given for the remainder of the patient's life.)* The patient weighs 34 lb. The tablet strengths available are 0.1 mg, 0.2 mg, and 0.6 mg. The pills are scored. Determine the patient's total dose in mg, the most convenient pill size to dispense to achieve this dose (you may round down to the nearest size), how many tablets the owner will need to give each dose, the number of tablets you will dispense to supply this patient for 30 days, and the instructions to the client.

This patient's total dose in mg (each time the drug is administered): _____

Pill size you would dispense: _____

Number of tablets the owner will give each dose: _____

The number of tablets to dispense: _____

Your instructions to the client:

7. **Order:** 5 mg/kg Amoxitabs BID for 10 days. *(This medication will not be ongoing.)* The patient weighs 25 lb. The tablet strengths available are 50 mg, 100 mg, 200 mg, and 400 mg. The pills are NOT scored. Determine the patient's total dose in mg, the most convenient pill size to dispense to achieve this dose (you may round down to the nearest size), how many tablets the owner will need to give each dose, the number of tablets you will dispense, and the instructions to the client.

This patient's total dose in mg (each time the drug is administered): _____

Pill size you would dispense: _____

Number of tablets the owner will give each dose: _____

The number of tablets to dispense: _____

Your instructions to the client:

8. **Order:** 15 mg Prednisolone BID for 2 weeks then 15 mg SID × 2 weeks, then 15 mg QOD for 2 weeks. *(This medication will not be ongoing.)* The tablet strength available is 5 mg only. The pills are scored. Determine how many tablets the owner will need to give each dose, the number of tablets you will dispense, and the instructions to the client.

   Number of tablets the owner will give each dose: _____

   The number of tablets to dispense: _____

   Your instructions to the client:

9. **Order:** 36 mg Prednisolone injectable SQ. The Prednisolone injection strength is 10 mg/mL. What volume will you administer expressed in mL?

   _____ mL

10. **Order:** 14 mEq of Potassium Chloride is to be added to a 1-L bag of fluids. The KCl solution strength is 20 mEq/10 mL. How many mL will you add to the bag of fluids?

    _____ mL

11. **Order:** 5 mg/kg Sodium Dexamethasone Phosphate injectable IV. The patient weighs 35 lb. The solution strength is 4 mg/mL. Determine the total dose for this patient (mg) and how many mL you will give.

    Total dose for the patient in mg: _____

    How many mL you will give: _____

12. **Order:** 1 mg/lb Lidocaine IV. The patient weighs 50 lb. The solution strength is 2%. How many mL do you give? Determine the total dose for this patient (mg) and how many mL you will give.

Total dose for the patient in mg: _____

How many mL you will give: _____

EXERCISE 27.16 CASE STUDY #1: SAFE USE OF CHEMOTHERAPY DRUGS

Allie, a 10-year-old, spayed, female, Golden Retriever is presented for treatment of lymphoma, a common cancer affecting the lymph nodes. With information gleaned from a complete work-up including blood work, a needle biopsy, and radiographs, an appropriate chemotherapy protocol is devised that includes L-asparaginase, cyclophosphamide, prednisolone, vincristine, and doxorubicin. As most of these drugs are extremely toxic, precautions must always be taken when handling them to avoid personal exposure.

1. Discuss the nature of the precautions you would take to limit your exposure.

2. It is very important that both doxorubicin and vincristine are given intravenously, and that no amount of either drug, no matter how little, contacts the surrounding tissues. Why is this the case, and what precautions must be taken to insure these drugs stay inside the vein?

EXERCISE 27.17 CASE STUDY #2: DISPENSING MEDICATIONS

Annie, a 4-year-old, spayed, female, black Labrador Retriever is presented for treatment of inhalant allergies. This is a recurrent problem in the fall, and allergy testing has indicated a sensitivity to several allergens, including ragweed pollen. At the height of the season, she often gets so itchy that she must be given both antihistamines and glucocorticoids to control it, or she will get a dermatitis with hair loss and a secondary pyoderma. At this point, Annie has no skin lesions, but is very pruritic. The doctor wants to prescribe antihistamines and prednisolone now, so that the itching can be brought under control before she develops skin lesions.

1. Consider the following written prescription:

   Disp. #30, 5 mg, prednisolone; Sig: Give 1 tab PO q 12 h × 2d, then 1 tab q.o.d. until gone.

   a. Use your knowledge of abbreviations used in prescription writing to interpret this order by writing the prescription out in long hand.

   _____

   _____

   _____

   b. Now prepare a label to be affixed to the bottle with all the required information for a noncontrolled substance.

St. Francis Veterinary Associates
10000 Main Ave.
Anywhere, USA 98765
987-000-1234

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EXERCISE 27.14 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. Why do most lipophilic drugs diffuse into tissues more effectively than hydrophilic drugs?

2. Why do many drugs absorb more readily in the small intestine than in the stomach?

3. Summarize the basic differences between Phase I and Phase II metabolism.

4. When given together, why will ketoconazole increase the amount of cyclosporine in the blood?

5. Most drugs work by interacting with various cellular components or proteins. Give an example of a drug that does not do this, but acts because of its physical properties.

6. In patients with cardiovascular disease, the brain and heart are often more susceptible to drug toxicity than other organs. Why is this the case?

7. Why should the doses of the fluoroquinolone- and aminoglycoside-class antibacterial drugs be reduced in patients with kidney disease?

8a. Drugs from which general classes should be reduced in dosage in geriatric patients?

8b. What physiologic changes occur in these patients that are responsible for this need to reduce the dose?

9a. What is therapeutic drug monitoring (TDM)?

9b. What is the primary goal of TDM?

9c. What two main properties of a drug warrant a recommendation for TDM?

i. _____

ii. _____

10. Immunosuppressive drugs are intended to control disease without producing significant adverse effects. Explain how the dosing regimen of these drugs is designed to accomplish this.

11. Why is the use of long-acting glucocorticoids avoided whenever possible?

12. What is the difference between antibacterial compounds and antibiotics?

13. Each of the drugs listed below requires therapeutic drug monitoring. Briefly describe the main indications for each drug or drug class.

    a. Aminoglycoside-class antibacterials

    _____

    b. Digoxin

    _____

    c. Potassium bromide

    _____

    d. Levothyroxine

    _____

    e. Phenobarbital

    _____

    f. Cyclosporine

    _____

14. What clinical signs would tell you that a canine patient is responding to L-thyroxine supplementation?

    _____

    _____

15a. What are the common side effects of mitotane treatment?

    _____

15b. Why do these signs occur?

    _____

16. Hypoadrenocorticism is an important endocrine disease that primarily affects dogs.

    a. What is hypoadrenocorticism?

    _____

    b. What are the two major causes of hypoadrenocorticism?

    i. _____

    ii. _____

c. Why can fludrocortisone be used alone to treat this condition, whereas desoxycorticosterone cannot?

d. What are the signs of an overdose of the drugs used to treat hypoadrenocorticism?

e. What are the signs of an underdose of these drugs?

17. Liver disease patients with hepatic encephalopathy require treatment with lactulose and neomycin. Explain how the drugs lactulose and neomycin minimize the neurologic signs caused by this condition.

18. The diuretic furosemide is called a "loop diuretic."

a. What is the origin of the term *loop diuretic*?

b. Why should potassium levels be monitored in patients receiving this drug?

19. The use of β-adrenergic blocking agents like atenolol causes a phenomenon known as "upregulation." Describe upregulation, including the mechanism by which it occurs, the risk associated with it, and the method used to manage it.

Description:

Risk:

Management:

20. The anticonvulsant phenobarbital is associated with significant interactions with a number of drugs, including digoxin and glucocorticoids. Describe the nature of these interactions, and explain why they occur.

21. Why do chemotherapy drugs affect cells of the gastrointestinal tract, bone marrow, and hair follicles more than some other cells?

22. How can you tell by looking at the label on a bottle of an approved animal drug or an approved human drug that it is a prescription drug (as opposed to an over-the-counter drug)?

23. Summarize in your own words, the three components of a valid veterinarian–client–patient relationship.

    i.

    ii.

    iii.

24. Describe the storage requirements for controlled substances.

25. Extralabel drug use is defined as: "Actual use or intended use of a drug in an animal in a manner that is not in accordance with the approved labeling." List at least four specific circumstances that would be classified as extralabel use.

    i.

    ii.

    iii.

    iv.

26. A drug can be used in an extralabel fashion only when certain criteria are met. One of these criteria is that "There is no approved new animal drug that is labeled for the intended use and that contains the same active ingredient which is in the required dosage form and concentration, except where a veterinarian finds, within a valid veterinary–client–patient relationship, that the approved new animal drug is clinically ineffective for the intended use." What other steps must a veterinarian take prior to using a drug in an extralabel fashion?

27. Drug compounding is defined as any manipulation of a drug other than that provided for on the approved drug label.

    a. What are some common reasons that drugs are compounded?

    b. Discuss some common problems associated with drug compounding.

    c. List some of the drugs that are commonly compounded to treat companion animals.

d. How can a veterinarian help to insure that a compounding pharmacy offers ethical, sound, and quality services?

_____

_____

28. When shopping for prescription drugs on the Internet, the consumer must be objective and cautious. List four characteristics that suggest an Internet pharmacy is reputable.

i. _____

ii. _____

iii. _____

iv. _____

29. List three reasons that injectable drugs are administered by CRI.

i. _____

ii. _____

iii. _____

28 Pain Management

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all key terms in the chapter.
2. Explain how the technician can use effective communication, observation, and interpretation skills to advocate for the patient and to help provide effective and appropriate analgesia.
3. List common causes and physiologic and behavioral signs of pain in small animals, including the negative effects of untreated pain.
4. Describe the physiologic aspects of pain, including the phases of nociception in mammals; and, compare and contrast acute, chronic, inflammatory, neuropathic, somatic, and visceral pain, and explain the significance of the "wind-up phenomenon."
5. Do the following regarding treatment of pain in small animals:
   - Describe the basic principles of effective analgesia protocol design and pain management, including the concepts of preemptive and multimodal analgesia.
   - Compare and contrast agents used to treat pain in small animals, including nonsteroidal anti-inflammatory drugs (NSAIDs), local anesthetics, opioids, and alpha$_2$ agonists.
   - List the analgesics commonly given by constant rate infusion (CRI), and perform the calculations required to administer a drug by CRI.
   - List the "adjunctive analgesics" and nonpharmacologic treatment options for pain control; describe the uses and benefits of each.
6. Do the following regarding the treatment of pain in large animals:
   - List causes and signs of pain in large animals, and explain why large animals often are undertreated for pain.
   - Compare and contrast agents used to treat pain in large animals, including NSAIDs, opioids, alpha$_2$ agonists, and local anesthetics.
   - Discuss the role of joint supplements, chondroprotective agents, miscellaneous agents, alternative and complementary therapy, and good husbandry in the treatment of pain in large animals.
7. Describe analgesic agents and techniques commonly used in horses, cattle, sheep, goats, camelids, and pigs; and, explain how economics and drug residues influence the decision to treat pain in food animals.

EXERCISE 28.1 MATCHING #1: TERMS AND DEFINITIONS

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Transduction
2. _____ Antagonist
3. _____ Agonist
4. _____ Nociception
5. _____ Breakthrough pain
6. _____ Transmission
7. _____ Agonist-antagonist
8. _____ Dysphoria
9. _____ Wind-up phenomenon
10. _____ Allodynia
11. _____ Neurotransmitters
12. _____ Hyperalgesia
13. _____ Multimodal analgesia
14. _____ Adjuvant analgesic
15. _____ Partial agonist
16. _____ Modulation

Column B

A. A drug that blocks receptors.
B. Agents that enhance analgesic drugs when coadministered, but with few or no analgesic properties when given alone.
C. Movement of a nerve impulse along peripheral nerves to the spinal cord.
D. A situation in which less and less stimulation is required to initiate pain.
E. A drug that stimulates some receptors and blocks others.
F. The combination of allodynia and hyperalgesia.
G. Transmission of pain impulses by fibers that normally carry pleasant or neutral impulses.
H. Conversion of mechanical, chemical, and thermal energy into electrical impulses.
I. Pain that occurs despite use of a usual protocol.
J. The process by which pain is detected by the nervous system.
K. Amplifying or dampening of a nerve impulse in the CNS.
L. The use of two or more analgesic drugs to alter more than one phase of the pain pathway.
M. An emotional state characterized by anxiety, depression, or unease.
N. A drug that causes overall decreased stimulation of receptors.
O. A drug that simulates receptors.
P. Chemicals that transmit nerve impulses between nerve cells.

EXERCISE 28.2 MATCHING #2: EXPECTED LEVEL OF PAIN ASSOCIATED WITH COMMON CONDITIONS AND PROCEDURES

Instructions: Match each condition or procedure in column A with its corresponding expected level of pain in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A

1. _____ Intervertebral disk herniation
2. _____ Laparotomy
3. _____ Castration
4. _____ Limb amputation
5. _____ Mass removal
6. _____ Declawing
7. _____ Fracture repair
8. _____ Dental procedures
9. _____ Ear canal ablation

Column B

A. Mild to moderate pain
B. Severe pain

EXERCISE 28.3 MATCHING #3: ANALGESICS AND ANALGESIC CLASSES

Instructions: Match each analgesic in column A with the corresponding class to which it belongs in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A	Column B
1. _____ Phenylbutazone	A. NSAID
2. _____ Morphine	B. α_2-Agonist
3. _____ Ketamine	C. α_2-Antagonist
4. _____ Naloxone hydrochloride	D. Local anesthetic
5. _____ Lidocaine	E. NMDA-receptor antagonist
6. _____ Romifidine	F. Joint supplement and chondroprotective agent
7. _____ Buprenorphine	G. Pure opioid agonist
8. _____ Carprofen	H. Partial opioid agonist
9. _____ Xylazine	I. Opioid agonist-antagonist
10. _____ Flunixin meglumine	J. Opioid antagonist
11. _____ Butorphanol	K. Synthetic opioid
12. _____ Mepivacaine	
13. _____ Atipamezole	
14. _____ Sodium hyaluronate	
15. _____ Ketoprofen	
16. _____ Dexmedetomidine	
17. _____ Fentanyl	
18. _____ Firocoxib	
19. _____ Hydromorphone	
20. _____ Tramadol	
21. _____ Bupivacaine	
22. _____ Detomidine	
23. _____ Polysulfated GAGs	
24. _____ Meloxicam	

EXERCISE 28.4 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Like people, domestic animals tend to readily show that they are in pain.

2. _____ Pain tolerance varies widely between species and individuals within a species.

3. _____ In animals, pain is usually easy to differentiate from normal postoperative behaviors.

4. _____ Although pain has many negative physiologic effects, these effects are confined to the nervous system.

5. _____ Nociceptors are specialized nerve fibers that carry pain information, but not pleasant or neutral sensations.

6. _____ Allodynia is the phase of windup in which less and less stimulation is required to initiate pain.

7. _____ Administering analgesics after pain occurs is often just as effective as giving them before it occurs.

8. _____ Lower doses of individual analgesics can be used when an analgesic protocol includes agents from multiple classes that attack more than one phase of the pain pathway.

9. _____ Even though pain has many damaging consequences, it can also be beneficial by limiting activity.

10. _____ Even though multiple analgesics are often given concurrently, it is recommended that no more than one NSAID be given to a patient at a time.

11. _____ Lidocaine with epinephrine is helpful for feline declaw blocks because it reduces bleeding.

12. _____ Lidocaine, bupivacaine, or tetracaine can be used topically to reduce pain associated with minor procedures such as urethral catheterization.

13. _____ A bilateral infraorbital dental block is a technique that can be used to provide analgesia for dental extractions of the upper and lower dental arcades.

14. _____ Opioids classified as partial agonists have a decreased effect, but very similar side effects to the pure agonists.

15. _____ Giving butorphanol with a fentanyl patch will maximize the analgesic effects of the patch.

16. _____ The drug tramadol is administered by constant rate infusion (CRI) for in-hospital management of acute pain.

17. _____ Because it can cause heart toxicity, lidocaine is not recommended for use in cats.

18. _____ Analgesics are generally used more often in large animals than in small animals.

19. _____ Large animals do not experience pain in the same way as small domestic animals and people.

20. _____ GI ulceration is the primary side effect of NSAIDs in large animals.

EXERCISE 28.5 – MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. Signs of pain can be classified as physiologic or behavioral. Examples of behavioral signs of pain are
   a. Tachycardia, dilated pupils, and howling
   b. Biting, hiding, and hypertension
   c. Tachypnea, reluctant to move, and failure to groom
   d. Screaming, escaping, and tucking the abdomen

2. During what phase of nociception does the mechanical, chemical, or thermal energy that causes tissue damage get turned into electrical impulses by the nerve endings?
   a. Transduction
   b. Transmission
   c. Modulation
   d. Perception

3. The drug gabapentin has particular efficacy for
   a. Acute pain
   b. Deep pain
   c. Neuropathic pain
   d. Abdominal pain

4. NMDA-receptor antagonists such as ketamine, have a particular place in preventing and treating
   a. Chronic pain
   b. Wind-up pain
   c. Neuropathic pain
   d. Preexisting pain

5. Drugs that provide analgesia by modifying inflammation are the
   a. Opioids
   b. α_2-Agonists
   c. NSAIDs
   d. Local anesthetics

6. The analgesics of choice for treatment of osteoarthritis are the
   a. NSAIDs
   b. Opioids
   c. Local anesthetics
   d. α_2-Agonists

7. Because of potential side effects of NSAIDs, patients should not receive them if they have
   a. Bleeding abnormalities
   b. Hypotension
   c. Stomach ulcers
   d. Any of the above

8. Dogs receiving NSAIDs are particularly prone to adverse effects relating to the GI system, whereas cats are particularly prone to adverse effects relating to the
   a. Liver
   b. CNS
   c. Kidneys
   d. Blood

9. Cats can be given NSAIDs when indicated, but should never be given
   a. Meloxicam
   b. Carprofen
   c. Acetaminophen
   d. Aspirin

10. Local anesthetics work by
    a. Decreasing inflammation
    b. Blocking mu receptors
    c. Inhibiting norepinephrine release
    d. Disrupting neural transmission

11. A circumferential ring block for declawing requires SQ injection of 0.5% bupivacaine at a dose of
    a. 1.0 mL/10 lb body weight
    b. 1.0 mL/10 kg body weight
    c. 1.0 mL per cat
    d. 0.1 mL/10 lb body weight

12. An epidural injection of lidocaine or morphine will provide analgesia to the
    a. Pelvis only
    b. Caudal abdomen only
    c. Tail only
    d. Caudal half of the body

13. The stinging sensation caused by injection of local anesthetics, can be reduced by adding 0.1 mL of _____ to 10 mL of the local agent.
    a. Bupivacaine
    b. Epinephrine
    c. Sodium bicarbonate
    d. Saline

14. The class of opioids with the most severe side effects are the
    a. Pure agonists
    b. Partial agonists
    c. Mixed agonist-antagonists
    d. Antagonists

15. One of the following species is more sensitive to morphine and therefore requires lower doses of this pure agonist. Which one is it?
    a. Dog
    b. Cat
    c. Cow
    d. Horse

16. An opioid that has a significantly longer duration of action than most is
    a. Morphine
    b. Hydromorphone
    c. Butorphanol
    d. Buprenorphine

17. This synthetic drug is available in oral form, produces opioid-like stimulation of the mu receptor, but with fewer side effects.
    a. Fentanyl
    b. Dexmedetomidine
    c. Tramadol
    d. Hydromorphone

18. The drug romifidine is an α_2-agonist analgesic. Which of the drugs listed below is also in this class?
    a. Ketamine
    b. Acepromazine
    c. Dexmedetomidine
    d. Morphine

19. This class of analgesics works by inhibiting release of the neurotransmitter norepinephrine.
    a. NMDA inhibitors
    b. α_2-Agonists
    c. NSAIDs
    d. Anticonvulsants

20. Which of the following drug combinations is representative of the anesthetic protocol known as "kitty magic"?
    a. Morphine, acepromazine, and ketamine
    b. Fentanyl, ketoprofen, and ketamine
    c. Buprenorphine, meloxicam, and dexmedetomidine
    d. Buprenorphine, dexmedetomidine, and ketamine

21. As compared with morphine, the main advantages of fentanyl are
    a. Shorter half-life and faster onset of action
    b. Faster onset of action and longer half-life
    c. Longer half-life and slower onset of action
    d. Slower onset of action and shorter half-life

22. Unlike many analgesics, one of the following drugs is safe for use in patients with GI disturbances, and so is a good choice for dogs with gastric dilation volvulus (GDV).
    a. Carprofen
    b. Hydromorphone
    c. Lidocaine
    d. Dexmedetomidine

23. An NMDA receptor antagonist used to prevent wind-up phenomenon is
    a. Gabapentin
    b. Xylazine
    c. Acepromazine
    d. Ketamine

24. In view of the efficacy gabapentin has in treating neuropathic pain, which of the following conditions would it be used to treat?
    a. Resistance to being touched at a location with no tissue damage
    b. Pain secondary to a severe infection
    c. Postsurgical incisional pain
    d. Limb pain resulting from trauma

25. The most commonly used NSAIDs in large animals are
    a. Flunixin meglumine and carprofen
    b. Carprofen and ketoprofen
    c. Ketoprofen and phenylbutazone
    d. Phenylbutazone and flunixin meglumine

26. The opioid most commonly used in large animals is
    a. Morphine
    b. Butorphanol
    c. Fentanyl
    d. Buprenorphine

27. Which of the following analgesic adjuncts is a nutraceutical, and consequently is not regulated by the FDA?
    a. Gabapentin
    b. Tramadol
    c. Chondroitin sulfate
    d. Phenylbutazone

28. The analgesic class most commonly used in horses is
    a. Opioids
    b. α_2-Agonists
    c. NSAIDs
    d. Local anesthetics

29. The analgesic class most commonly used in ruminants is
    a. Opioids
    b. α_2-Agonists
    c. NSAIDs
    d. Local anesthetics

EXERCISE 28.6 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. Signs of pain in animals can be categorized according to whether they are _____ (e.g., tachycardia or hypertension) or _____ (e.g., biting or guarding an incision).

2. Pain is now considered by some to be the fifth vital sign. The other four vital signs are _____, _____, _____, and _____.

3. Tissue damage results in inflammation. The classic signs of inflammation are localized _____, _____, and _____.

4. The phase of the pain pathway in which there is the awareness that something hurts is called _____.

5. Pain is subdivided into two categories based on the duration. The sensation experienced with each category differs. _____ pain is characterized by a sharp, stabbing sensation, whereas _____ pain is characterized by a dull, throbbing sensation.

6. An extreme form of pain sometimes occurs when the CNS is bombarded by persistent pain impulses. This extreme form is called "central sensitization" or _____ _____.

7. The four main categories of analgesic drugs are _____, _____, _____ _____, and _____ _____.

8. To prevent adverse effects on kidney function, patients that are receiving NSAIDs should always have _____ _____ _____ monitored intraoperatively.

9. Adding the drug _____ to lidocaine at a 1:200,000 dilution will increase its duration of action.

10. Most cases of local anesthetic toxicity are a result of accidental _____ or _____ administration.

11. A correctly performed declaw block using bupivacaine will provide analgesia for up to _____ hours after surgery.

12. Morphine can be injected intraarticularly to provide analgesia of the joint. Use of this technique results in maintenance of a smooth plane of anesthesia when the joint capsule is incised. When this technique is not used, an increase in the _____ _____ is often observed as the joint capsule is entered.

13. Analgesia can be provided to patients following thoracotomy by injecting bupivacaine in the pleural space. When using this technique, the drug is thought to work by directly blocking the _____ nerves.

14. The specific effects that a particular opioid will have are dependent on the specific _____ in the CNS that it binds to.

15. Analgesia provided by opioids is primarily a result of binding of the drug to the _____ receptors in the CNS.

16. Hydromorphone has similar analgesic effects as morphine, but is less likely to cause _____ or _____ (two adverse effects).

17. The injectable opioid _____ is readily absorbed across mucous membranes in cats as a result of the unique _____ _____ in this species and can, consequently, be given orally.

18. Analgesics in the class _____ work synergistically with opioids to _____ the intensity and duration of pain relief beyond what can be accounted for by the separate action of each drug.

19. The drug used to reverse the effects of the α_2-agonist dexmedetomidine is _____.

20. After giving any sedative, the patient should be placed in a quiet environment for _____ minutes to allow the drug(s) to take effect.

21. Different large animal species have different sensitivities to α_2-agonists. _____ are most resistant, _____ are moderately sensitive, and _____ are most sensitive.

EXERCISE 28.7 – SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 28.8 – CASE STUDY: ADMINISTERING ANALGESICS BY CONSTANT RATE INFUSION

Signalment: 4-year-old, 110-pound, neutered, male Bullmastiff.

History: This patient came up lame on the left rear limb while playing in the backyard 3 days ago. He has no history of previous medical problems.

Physical examination: The patient was three-legged lame on presentation, and physical findings were compatible with an anterior cruciate ligament rupture. All other findings were normal.

Pre-operative workup: Results of routine preoperative blood work were normal.

Treatment plan: This patient was admitted to the hospital for surgical management of the anterior cruciate ligament rupture. The doctor has asked you to give this patient a 5 mcg/kg loading dose of fentanyl, followed by a 12 mcg/kg/hr (or 0.2 mcg/kg/min) CRI intraoperatively. The patient will be receiving lactated Ringer solution in a 1-L bag at a rate of 10 mL/kg/hr. You are asked to calculate both the loading dose and the constant rate infusion for this patient.

1. Calculate the loading dose by following the steps below.

   a. Calculate this patient's body weight in kg.

      Patient's body weight: _____ kg

   b. Calculate the loading dose of fentanyl in mL. The concentration of fentanyl is 0.05 mg/mL. Set this problem up by multiplying the body weight and the dose, and divide the product by the drug concentration.

      Loading dose of fentanyl: _____mL

2. Now calculate the constant rate infusion by following the steps below.

   a. Calculate the fluid infusion rate for this patient in mL/hr. Set this problem up by multiplying the body weight and the prescribed fluid administration dosage.

      Fluid infusion rate during surgery: _____ mL/hr

   b. Calculate the number of hours the bag of lactated Ringer solution will last. Set this problem up by converting the fluid bag size to mL and then dividing by the figure from the previous step.

      Number of hours the bag will last: _____ hours

   c. Calculate the number of minutes the bag of lactated Ringer's solution will last. Set this problem up by converting the figure from the previous step into minutes.

      Number of minutes the bag will last: _____ minutes

d. Calculate the total number of micrograms of fentanyl to add to the bag. Set this problem up by multiplying the patient weight by both the prescribed dose in mcg/kg/min, and the figure from the previous step.

Number of micrograms to add to the bag: _____ micrograms

e. Convert this value to milligrams. Set this problem up by converting the figure from the previous step into milligrams.

Number of milligrams to add to the bag: _____ milligrams

f. Calculate the drug volume to add to the bag. Set this problem up by dividing the figure from the previous step by the drug concentration.

Drug volume to add to the bag: _____ mL

You will then add this volume of fentanyl to the bag after removing an equivalent volume of fluids from the bag, and then run the fluids for the duration of the surgery at the rate calculated in part 2a above using a controlled rate infusion pump.

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EXERCISE 28.7 – SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. Veterinary technicians play an important role in ensuring that patients receive appropriate analgesia. To successfully advocate for her or his patients, the technician must have the ability to effectively communicate with the attending veterinarian. Although just asking if you may give something for the pain is one possible way to handle a situation in which a patient's analgesic protocol is inadequate, this approach is generally not very successful. Please give an example of an alternative approach that is more likely to result in a positive outcome.

2. Pain affects many things in the body, including the levels of hormones and nervous system activity. Please indicate some negative effects directly resulting from the increased levels of cortisol and increased sympathetic nervous system activity associated with pain.

3. Although both are closely related, pain is not quite the same thing as nociception. What is the difference between the two? How does this explain why patients under general anesthesia don't experience pain?

4. Wind-up phenomenon occurs when pain sensations become exaggerated. This happens as a result of two specific changes in the nervous system. Briefly describe the two changes that result in wind-up phenomenon.

5. Environmental factors, such as the area where an animal is housed, seem to affect the perception of pain. Cage cleanliness is one specific example. Please briefly describe other environmental factors that can help to reduce stress and minimize pain.

6. The principles of providing analgesia include use of "preemptive analgesia" and "multimodal analgesia," matching analgesics with the patient's needs, maintaining analgesia, and sending patients home with pain relief.

   a. Please briefly describe what is meant by "preemptive analgesia" and "multimodal analgesia."

      Preemptive analgesia:

      Multimodal analgesia:

b. Briefly explain what is meant by the concept of "matching analgesics." When utilizing this principle, what are they matched with?

c. Now indicate techniques than can be used to maintain the analgesic plane once pain control is established.

d. Finally, indicate the commonly accepted standards for how long analgesics should be continued following patient discharge for common soft-tissue procedures such as spaying and neutering.

7. Cats can safely receive approved NSAIDs on a one-time basis, but repeat dosing is not recommended. Why is this the case?

8. Opioids are classified as pure agonists, partial agonists, mixed agonist-antagonists, and antagonists. Please differentiate these types in terms of the way they affect receptors.

9. How does the availability of opioid antagonists make pure opioid agonists safer to use than they would otherwise be?

10. The pure opioid morphine is often referred to as the "gold standard" for pure opioid agonists. What does this mean?

11. Why must the pure opioid agonist fentanyl be given by constant rate infusion (CRI) or as a transdermal patch to maximize its effectiveness?

12. Briefly explain the mechanism by which α_2-agonists initially cause bradycardia.

13. The α_2-agonist, dexmedetomidine, is often used as a "rescue drug." What does this mean?

14. What advantage does administration of a drug like morphine by constant rate infusion (CRI) have over bolus administration in terms of blood levels of the drug?

15. Briefly describe the nature of and advantages of each of the following nonpharmacologic treatment options for pain.

    a. Thermotherapy:

    b. Massage:

    c. Therapeutic exercises:

d. Aquatic therapy: _____

e. Acupuncture: _____

f. Electrical stimulation: _____

g. Therapeutic ultrasound: _____

h. Extracorporeal shockwave therapy: _____

i. Low-level laser therapy: _____

16. Even though most food-producing animals have an absolute economic value, and thus the individual animal is not a priority, the stress of pain in these patients has a real cost. Briefly explain the economic cost of untreated pain in food animals.

17. Briefly summarize the signs of GI ulceration in large animals, including its effect on appetite, energy level, and posture.

18. Like cats, horses often experience excitement from opioid agonists. What agents are often given with opioids to moderate this effect?

19. There are strict regulations regarding the use of analgesics in food animals. For instance, the use of phenylbutazone is completely prohibited in dairy cattle 20 months of age or older.

    a. What is the reason for these regulations?

    b. Where is the best source of information about these regulations?

20. Why are orally administered drugs not generally effective in camelids?

29 Veterinary Anesthesia

LEARNING OBJECTIVES

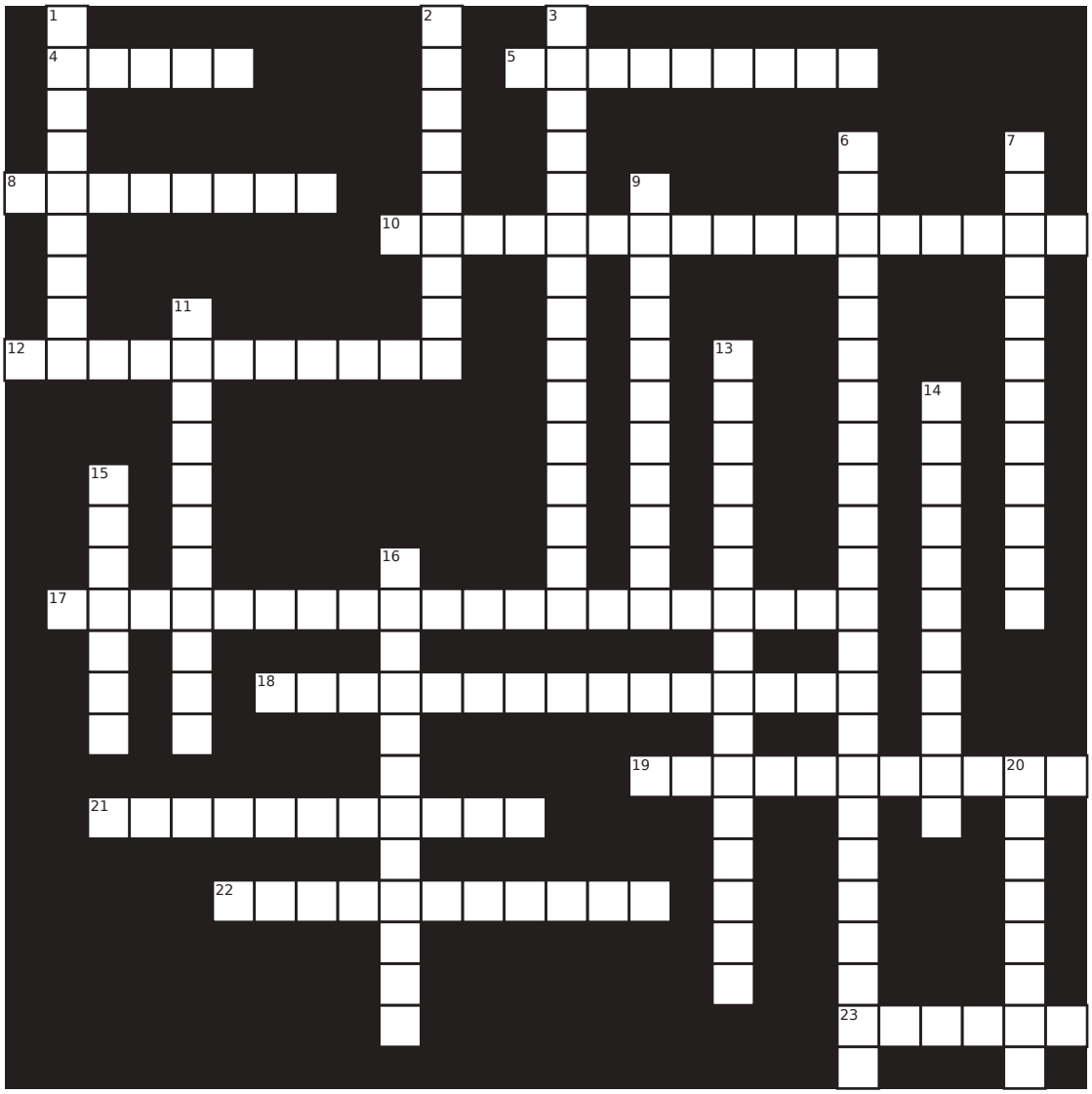
When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all key terms in the chapter.
2. Differentiate general anesthesia, sedation, tranquilization, neuroleptanalgesia, local anesthesia; differentiate the periods of a general anesthetic event (premedication, induction, maintenance); and list the objectives of anesthesia and techniques used to achieve these objectives, including the concept of balanced anesthesia.
3. Discuss each aspect of patient preparation for an anesthetic procedure, including fasting, gathering historical information, physical assessment, stabilization, and physical status classification.
4. Do the following regarding injectable anesthetic agents:
   - Describe the ways anesthetic agents are classified, and differentiate agonists, partial agonists, agonist-antagonists, and antagonists.
   - Describe the effects, adverse effects, properties, and uses of anticholinergics, phenothiazine and benzodiazepine tranquilizers, alpha2-adrenergic agents, opioids, propofol, dissociatives, barbiturates, etomidate, and guaifenesin.
5. Explain how vapor pressure, blood-gas partition coefficient, and minimum alveolar concentration (MAC) influence the way inhalant anesthetics are used; and, describe the effects, adverse effects, properties, and uses of halogenated inhalant anesthetics and nitrous oxide.
6. Do the following regarding the use of anesthetic equipment:
   - Discuss the characteristics, uses, and maintenance of endotracheal tubes, laryngoscopes, anesthetic masks, and anesthetic chambers.
   - Describe the characteristics of an anesthetic machine, including the four general machine systems.
   - Explain how to assemble an anesthetic machine, check for leaks, and set the pop-off valve before use.
   - Describe the structure, function, and use of each component of the carrier gas supply, including compressed gas cylinder, pressure gauge, pressure-reducing valve, flowmeter, and oxygen flush valve.
   - List and calculate the oxygen flow rates used for various species, systems, and periods of an anesthetic procedure.
   - Describe the structure, function, and uses of precision and nonprecision vaporizers.
   - Discuss rebreathing and non-rebreathing systems, and explain the criteria used to choose an appropriate breathing system for any given patient.
   - Describe the structure, function, and use of each component of the breathing system, including unidirectional flow valves, reservoir bag, pop-off valve, carbon dioxide absorber canister, pressure manometer, negative pressure relief valve, and breathing tubes.
   - Discuss the function and uses of passive and active scavenging systems.
   - Describe the procedures used to maintain anesthetic machines.
7. Do the following regarding endotracheal intubation:
   - Discuss the principles of endotracheal intubation, including the equipment needed to place an endotracheal tube and the criteria used to select and prepare an appropriate endotracheal tube for any given patient.
   - Describe placement of an endotracheal tube in a small animal, horse, adult ruminant, and small ruminant; how to check an endotracheal tube for proper placement; and how to inflate the cuff.
   - Discuss laryngospasm and other complications of intubation, including causes and methods of prevention.
8. Do the following regarding anesthetic monitoring:
   - Explain the principles of anesthetic monitoring and how monitoring parameters can be used to identify the classic stages and planes of anesthesia.
   - Identify physical monitoring indicators of circulation, oxygenation, and ventilation.
   - Discuss the methods used to assess vital signs, including normal values, and common causes of abnormal values.

- Describe methods used to assess reflexes and other monitoring indicators, and explain how they are used to determine anesthetic depth.
- Discuss the function and setup of monitoring equipment used to assess circulation, oxygenation, and ventilation, and interpretation of data generated by these instruments.

9. Do the following regarding small animal anesthesia:
   - Describe the sequence of events required to take a small animal patient from consciousness to surgical anesthesia and back to consciousness.
   - Describe agents and methods commonly used to induce a small animal patient by IM or IV injection, mask, or chamber.
   - Describe agents and methods used to maintain anesthesia in a small animal patient and considerations for patient positioning, comfort, safety, and recovery.
10. Explain the sequence of events for an anesthetic event in a horse, including ways in which an equine anesthetic procedure differs from that of a small animal patient.
11. Explain the sequence of events for an anesthetic event in a ruminant, including ways in which a ruminant anesthetic procedure differs from that for a small animal patient.
12. Differentiate manual, mechanical, periodic, and intermittent mandatory ventilation, and explain the indications for and principles of manual and mechanical ventilation.
13. List common anesthetic problems and emergencies, associated causes, and interventions.

EXERCISE 29.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

4 A respiratory rate of 0 breaths/min.
5 The opposite of miosis.
8 A drug that induces sleep.
10 Also known as a circle system. (2 words)
12 Increased heart rate.
17 An anesthetic machine configuration used for patients weighing less than 2.5 kg. (2 words)
18 Decreased respiratory rate and/or tidal volume.
19 Mapleson E nonrebreathing circuit. (2 words)
21 The volume of air breathed in during each breath. (2 words)
22 A body temperature of 97°F in a cat.
23 Constricted pupils.

Down

1 Increased respiratory rate.
2 Lack of pain sensation.
3 Decreased RR and/or VT.
6 The product of respiratory rate and tidal volume. (3 words)
7 Air in the chest cavity.
9 Collapse of a portion of the lung.
11 Elevated blood CO2.
13 The percentage of binding sites on the hemoglobin molecules occupied by oxygen. (2 words)
14 Modified Mapleson D circuit. (2 words)
15 Reduced oxygen in the tissues.
16 A side effect of acepromazine that leads to hypotension.
20 A physical indicator of hypoxemia.

EXERCISE 29.2 MATCHING #1: TERMS AND DEFINITIONS

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Sedation
2. _____ Anesthetic induction
3. _____ Neuroleptanalgesia
4. _____ General anesthesia
5. _____ Balanced anesthesia
6. _____ Anesthesia
7. _____ Premedication
8. _____ Anesthetic protocol
9. _____ Ventilation
10. _____ Anesthetic maintenance
11. _____ Local anesthesia
12. _____ Tranquilization
13. _____ Narcosis

Column B

A. A state of profound sedation and analgesia produced by simultaneous administration of an opioid and tranquilizer.
B. Use of several anesthetic drugs with complementary effects.
C. Relaxation and reduced anxiety.
D. A list of the anesthetic drugs that will be given including routes, amounts, and other details.
E. Going from a conscious state to Stage III anesthesia.
F. Artificial delivery of anesthetic gases into the patient's lungs.
G. A state of profound sedation, from which a patient can be aroused by loud noises or other stimulation.
H. Process used to keep a patient anesthetized.
I. The absence of sensation.
J. Unconsciousness and insensibility to feeling and pain.
K. A state of calm or drowsiness.
L. Loss of sensation in a small, isolated part or region of the body.
M. Administration of agents prior to the induction of anesthesia.

EXERCISE 29.3 MATCHING #2: ANESTHETIC MACHINE PARTS AND DESCRIPTIONS

Instructions: Match each anesthetic machine part in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Pressure manometer
2. _____ Compressed gas cylinder
3. _____ Oxygen flush valve
4. _____ Line pressure gauge
5. _____ Pressure reducing valve
6. _____ Vaporizer
7. _____ Carbon dioxide absorber canister
8. _____ Reservoir bag
9. _____ Yoke
10. _____ Negative pressure valve
11. _____ Tank pressure gauge
12. _____ Flowmeter
13. _____ Pop-off valve
14. _____ Exhalation unidirectional valve

Column B

A. This part reduces the pressure of the gas from 40 to 50 psi to approximately 15 psi.

B. Carrier gas enters this part through the inlet port.

C. This part is most commonly used when preparing a patient for recovery or when a crisis has arisen.

D. This part provides the patient an adequate volume of anesthetic gases during inspiration to fill the lungs.

E. This part prevents rebreathing of carbon dioxide and allows the anesthetist to tell if the patient is breathing.

F. This part reduces the pressure of the gas in the system from tank pressure to 40 to 50 psi.

G. When this part reads 1000 psi, there is 300 L of oxygen left in an "E" size tank.

H. This part measures pressure of the gases in the patient's lungs.

I. This part should be emptied and refilled after 6 to 8 hours of machine use.

J. This part indicates pressure in the line entering the flow meter.

K. This part should be closed while bagging or ventilating the patient.

L. When the oxygen pressure inside this part is 500 psi, it should be changed.

M. This part prevents asphyxiation if the bag is empty.

N. This part holds the oxygen tank on.

EXERCISE 29.4 MATCHING #3: COMPLICATIONS OF ENDOTRACHEAL INTUBATION AND CAUSES

Instructions: Match each complication of endotracheal intubation in column A with its corresponding cause in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A

1. _____ Aspiration of foreign material and fluid during dental cleaning.
2. _____ Dyspnea and hypoxia.
3. _____ Damage to the tube from chewing.
4. _____ Necrosis of the tracheal mucosa.
5. _____ Intubation of only one main stem bronchus leading to hypoxia and difficulty in keeping the patient anesthetized.
6. _____ Changes in patient position may dislodge the tube from the glottis.
7. _____ Trauma or tracheal rupture resulting in pneumomediastinum and/or pneumothorax.
8. _____ Pollution of the workspace with anesthetic gas.
9. _____ Increased resistance to breathing with increased respiratory effort.
10. _____ Transmission of infectious agents leading to tracheitis, bronchitis, or pneumonia.

Column B

A. Tube too short.
B. Cuff overinflated/tube diameter too large.
C. Tube kinked or obstructed.
D. Tube not cleaned and disinfected.
E. Tube too long.
F. Cuff not inflated/underinflated or tube diameter too small.
G. Tube not removed before return to consciousness.
H. Overzealous intubation.

EXERCISE 29.5 MATCHING #4: MONITORING EQUIPMENT AND PARAMETERS

Instructions: Match each monitoring device in column A with the corresponding parameter or parameters it detects in column B by writing the appropriate letter in the space provided.

Column A

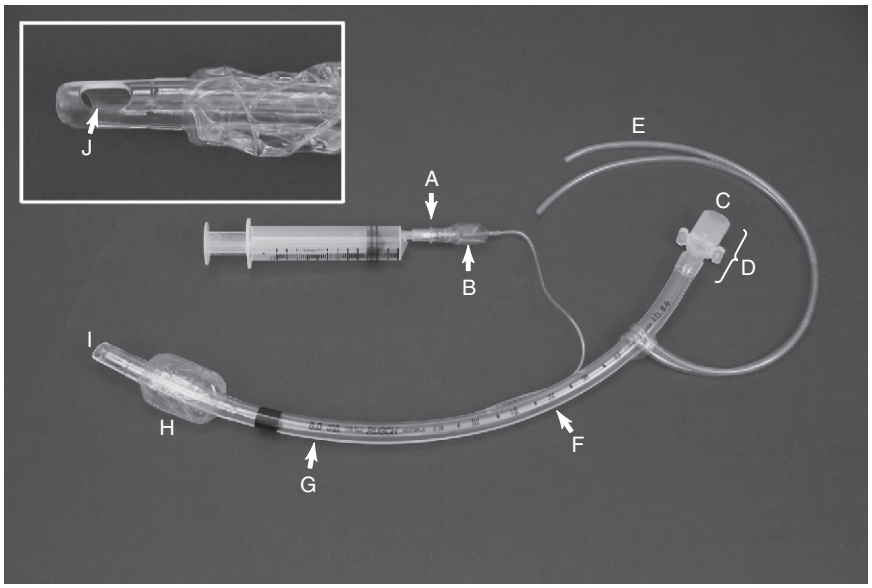
1. _____ Esophageal stethoscope
2. _____ Electrocardiograph
3. _____ Ultrasonic Doppler monitor
4. _____ Oscillometric monitor
5. _____ Pulse oximeter
6. _____ Apnea monitor
7. _____ Capnograph

Column B

A. Oxygen saturation and HR.
B. Relative HR and irregularity in heart sounds.
C. Carbon dioxide in inspired and expired air and RR.
D. Relative HR and systolic blood pressure.
E. Relative RR only.
F. Systolic, mean, and diastolic arterial blood pressure.
G. HR and rhythm.

EXERCISE 29.6 PHOTO QUIZ: ENDOTRACHEAL TUBE PARTS

Instructions: Match each endotracheal tube part (indicated by the arrow) with its corresponding name by writing the appropriate letter in the space provided.



Part Names

1. _____ Connector
2. _____ Cuff
3. _____ Pilot balloon
4. _____ Valve
5. _____ Patient end
6. _____ Measurement of the internal diameter
7. _____ Murphy eye
8. _____ Machine end
9. _____ Tie
10. _____ Measurement of tube length

EXERCISE 29.7 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Anticholinergics are expected to increase tear and salivary secretions because of their parasympathetic nervous system blockade.

2. _____ Adverse effects of the phenothiazine tranquilizer acepromazine include vomiting and cardiac arrhythmias.

3. _____ The benzodiazepine diazepam should not be given IM because of pain when given by this route and erratic absorption from this site.

4. _____ As a result of significant adverse cardiovascular effects, the benzodiazepines should be given with caution in old, young, or ill patients.

5. _____ Ruminants are very sensitive to the drug xylazine, and therefore need only approximately one-tenth of the dose used for horses.

6. _____ An advantage of using the antagonist yohimbine to reverse the effects of xylazine, is that dangerous adverse effects will be reversed, but the analgesic effects will persist.

7. _____ In addition to providing analgesia, opioid agonists produce cough suppression, respiratory depression, bradycardia, and hypotension.

8. _____ Most opioid agonists have a relatively long duration of action and must be administered only 2 to 3 times a day.

9. _____ Rapid IV administration of the ultrashort-acting anesthetic propofol can cause apnea, which may be severe.

10. _____ The barbiturate anesthetics are classified based on the receptors they affect.

11. _____ The intravenous, injectable anesthetic, etomidate is not commonly used in part because it has more significant adverse effects than other commonly used agents.

12. _____ Drugs that are milky in appearance should as a rule, not be administered intravenously. The drug propofol is no exception to this rule.

13. _____ An inhalant anesthetic with a high blood-gas partition coefficient produces faster inductions than one with a low blood-gas partition coefficient.

14. _____ The halogenated inhalant anesthetic sevoflurane induces a more significant dose-dependent hypotension than isoflurane, and so must be used with caution.

15. _____ Anesthetic masks may be used to induce, but not to maintain general anesthesia.

16. _____ Oxygen is the carrier gas used during all anesthetic procedures.

17. _____ Oxygen flowmeters have an indicator that either is shaped like a ball or like a "rotor" (a bobbin-like shape). When setting oxygen flow, read the center of either a ball or rotor indicator.

18. _____ Precision vaporizers are located in the breathing circuit so that the patient's respiratory drive is able to move the carrier gas through the vaporizer as the patient breathes.

19. _____ A semiclosed rebreathing system is a safe, practical system to use with all patients greater than or equal to 2.5 kg in body weight.

20. _____ Closed rebreathing systems are a practical and economical alternative for both small- and large-animal patients.

21. _____ When in use, a reservoir bag should be approximately one-quarter full at peak expiration.

22. _____ When using a semiclosed rebreathing system, the pop-off valve should be kept partially open except when providing manual ventilation.

23. _____ An endotracheal tube should extend from the tip of the nose to the larynx.

24. _____ Under the traditional system of stages and planes of anesthesia, there are four stages, and stage IV is divided into four planes.

25. _____ Physical status class P1 patients should be monitored every 5 minutes at a minimum.

26. _____ In general, vital signs are only loosely correlated with depth of anesthesia.

27. _____ Cyanotic mucous membranes are an early indicator of hypoxemia.

28. _____ Abdominal breathing is a breathing pattern in which there is a long pause after inhalation, and a short pause after exhalation.

29. _____ The corneal reflex is not reliable in small animals, but is useful to determine if a large-animal patient is too deep.

30. _____ The electrocardiogram is an accurate indicator concerning whether or not the heart is beating.

31. _____ When giving injectable anesthetics by the intramuscular route, generally they are given "to effect."

32. _____ When turning a patient from side to side, the endotracheal tube should be temporarily disconnected from the breathing circuit.

33. _____ As soon as the patient is in the recovery area, most of the danger is past, and the frequency of anesthetic monitoring can be decreased.

34. _____ Horses naturally can breathe only through their noses, and will become distressed and compromised if they are unable to.

35. _____ Many ruminants are difficult to handle, and require heavy sedation along with physical restraint prior to and during anesthetic induction.

36. _____ During surgery, all ruminants should have the head positioned higher than the body.

37. _____ During anesthetic recovery, once a ruminant is in sternal recumbency, does not require support, and is in no danger of bloating, it can be left unattended.

38. _____ Hypoventilation is an uncommon complication during equine and ruminant anesthetic procedures.

EXERCISE 29.8 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. Which of the following general fasting recommendations is **incorrect**?
   a. Dogs: No food × 8 to 12 hours
   b. Adult cattle: No food × 24 to 48 hours
   c. Adult equine: No food × 8 to 12 hours
   d. Pediatric patients: No food × 2 to 4 hours

2. A patient that has a life-threatening disease such as a ruptured bladder should be put in which of the following ASA physical status classifications?
   a. P1
   b. P2
   c. P3
   d. P4

3. Anticholinergics are expected to
   a. Decrease the heart rate in dogs
   b. Thicken the airway mucous in cats
   c. Constrict the bronchi in any species
   d. Protect against cardiac arrhythmias in cats

4. Which of the following drugs is commonly given in doses that are significantly lower than the doses listed on the label?
   a. Diazepam
   b. Dexmedetomidine
   c. Acepromazine
   d. Glycopyrrolate

5. Young, healthy dogs are resistant to the tranquilizing effects of
   a. Diazepam
   b. Acepromazine
   c. Xylazine
   d. Butorphanol

6. Which of the following agents often causes vomiting in cats?
   a. Acepromazine
   b. Xylazine
   c. Atropine
   d. Midazolam

7. α_2-Agonists have significant cardiovascular system effects. These drugs cause all of the following effects with the exception of one. Which one is it?
   a. High heart rate
   b. Decreased cardiac output
   c. Decreased blood pressure
   d. Heart block

8. All of the following are examples of pure opioid agonists except
   a. Fentanyl
   b. Hydromorphone
   c. Morphine
   d. Buprenorphine

9. This mixed opioid agonist-antagonist is used to treat mild to moderate pain, and as an antitussive.
   a. Hydromorphone
   b. Buprenorphine
   c. Butorphanol
   d. Fentanyl

10. The antagonist used to reverse the effects of opioid agonists such as morphine is
    a. Yohimbine
    b. Naloxone
    c. Tolazoline
    d. Flumazenil

11. Which of the following injectable drugs is NOT a controlled substance?
    a. Propofol
    b. Thiopental sodium
    c. Diazepam
    d. Methohexital

12. Which of the following drugs does not provide significant analgesia?
    a. Morphine
    b. Dexmedetomidine
    c. Fentanyl
    d. Propofol

13. Which of the following anesthetics can be given orally to restrain cats that are difficult to handle?
    a. Propofol
    b. Ketamine
    c. Dexmedetomidine
    d. Acepromazine

14. Which of the following drugs is an ultrashort-acting barbiturate that should not be given to sight hounds and must be injected in the vein?
    a. Methohexital
    b. Pentobarbital
    c. Phenobarbital
    d. Thiopental sodium

15. Which of the following barbiturate drugs is given to laboratory animals by the IP route to produce general anesthesia?
    a. Methohexital
    b. Pentobarbital
    c. Phenobarbital
    d. Thiopental sodium

16. Which of the following injectable anesthetics is the best one to use as an induction agent in patients with severe heart disease because it has little effect on cardiovascular function?
    a. Methohexital
    b. Propofol
    c. Thiopental sodium
    d. Etomidate

17. Which of the following properties of inhalant anesthetics reveals information regarding the type of vaporizer used to administer it?
    a. Minimum alveolar concentration (MAC)
    b. Vapor pressure
    c. Blood-gas partition coefficient
    d. Boiling point

18. The inhalant anesthetic nitrous oxide
    a. Is being used more frequently than it used to be
    b. Is administered with a precision vaporizer
    c. Does not produce general anesthesia by itself
    d. Is often used along with isoflurane

19. What specific type of endotracheal tube is designed specifically for birds and other animals that do not have an expandable trachea?
    a. Murphy tube
    b. Silicone tube
    c. Cuffed tube
    d. Cole tube

20. Laryngoscopes are most often used in
    a. Dogs, cats, and horses
    b. Pigs, small ruminants, and camelids
    c. Horses, pigs, and adult ruminants
    d. Cats, adult ruminants, and camelids

21. The force that moves the gases around a rebreathing circuit is
    a. The pressure in the oxygen tank
    b. The unidirectional valves
    c. The patient's lungs
    d. The flow meter

22. Which of the following is not the name of a nonrebreathing circuit?
    a. Lack
    b. Bain
    c. Murphy
    d. Jackson-Rees

23. The carbon dioxide absorbent granules should be changed at all of the following times except
    a. When they are soft and can be crushed with the fingers
    b. When they have turned violet or blue
    c. When they turn from white to off-white
    d. After 6 to 8 hours of use

24. An activated charcoal cartridge removes halogenated anesthetic from the waste gases. It should be changed
    a. After 6 to 8 hours of use
    b. When it gains 50 g of weight
    c. When it changes color
    d. After 6 to 8 uses

25. Using the guidelines listed in the text, a _____ mm endotracheal tube should be prepared for a 30-kg dog.
    a. 9.5 to 10
    b. 10.5 to 11
    c. 11.5 to 12
    d. 12.5 to 13

26. Which of the following is an indicator that the endotracheal tube is in the esophagus instead of the trachea?
    a. Only one firm tube-like structure is palpable in the neck
    b. The patient whines or cries following placement
    c. The reservoir bag expands and contracts with respiratory movements
    d. The patient coughs during placement

27. Laryngospasm is most commonly encountered in
    a. Dogs, cats, and horses
    b. Horses, pigs, and adult ruminants
    c. Cats, adult ruminants, and dogs
    d. Pigs, small ruminants, and cats

28. The stage of anesthesia during which the patient loses voluntary control, but has involuntary reactions such as vocalizing, reflex struggling, and paddling, and during which reflexes are present, and muscle tone is marked is
    a. Stage I
    b. Stage II
    c. Stage III
    d. Stage IV

29. Pedal and palpebral reflexes absent, corneal reflex present, midrange pupils, no voluntary movement, normal heart and respiratory rates that increase in response to surgical stimulation, indicates which of the following stages of anesthesia in a canine patient?
    a. Stage III, Plane 1
    b. Stage III, Plane 2
    c. Stage III, Plane 3
    d. Stage III, Plane 4

30. During anesthesia, a variety of heart rhythms may be seen depending on the species. Sinus arrhythmia is normal in
    a. Dogs, cats, and horses
    b. Horses, cats, and adult ruminants
    c. Cats, adult ruminants, and dogs
    d. Dogs, horses, and adult ruminants

31. Which equipment can be used to monitor blood pressure indirectly?
    a. Pulse oximeter and Doppler monitor
    b. Oscillometric monitor and capnograph
    c. Doppler monitor and oscillometric monitor
    d. Capnograph and pulse oximeter

32. Malignant hyperthermia is a complication of general anesthesia that is most commonly seen in
    a. Pigs
    b. Dogs
    c. Cats
    d. Horses

33. Which of the following is not a usual location for placement of an ultrasonic Doppler probe?
    a. The ventral surface of the forepaw proximal to the metacarpal pad
    b. The lateral surface of the tail
    c. The dorsomedial surface of the hock
    d. The ventral surface of the hind paw proximal to the metatarsal pad

34. Which of the following is not a usual location for placement of a blood pressure cuff?
    a. Around the foreleg
    b. Around the metatarsus
    c. Around the tail base
    d. Around the upper front limb (humerus)

35. Sensors from which of the following monitoring equipment increase mechanical dead space?
    a. Pulse oximeter and apnea monitor
    b. Apnea monitor and capnograph
    c. Capnograph and Doppler monitor
    d. Doppler monitor and pulse oximeter

36. Which of the following drugs or combinations is not commonly used for anesthetic induction in small-animal patients?
    a. Isoflurane
    b. Propofol
    c. Ketamine and diazepam
    d. Etomidate

37. All of the drugs listed below must be given IV except one, which can be given either IV or IM. Which drug can be given IM?
    a. Ketamine
    b. Etomidate
    c. Propofol
    d. Methohexital

38. During anesthetic recovery, the oxygen flow rate should be turned to
    a. 5 to 10 mL/kg/min
    b. 20 to 40 mL/kg/min
    c. 50 to 100 mL/kg/min
    d. 200 to 300 mL/kg/min

39. Which of the following is not a sign of normal recovery?
    a. Vocalization
    b. Excitement
    c. Hyperventilation
    d. Seizures

40. In contrast to most other domestic animals, many surgical procedures can be done using local or regional anesthetic techniques in this species.
    a. Feline
    b. Canine
    c. Bovine
    d. Equine

41. During general anesthesia, ruminants are less prone than other domestic species to
    a. Hypotension
    b. Hypoventilation
    c. Regurgitation
    c. Bloating

42. Animals of which species often breathe rapidly and shallowly, somewhat like a panting dog during general anesthesia?
    a. Horse
    b. Cow
    c. Pig
    d. Cat

43. To prevent atelectasis during general anesthesia, healthy small-animal patients should be bagged approximately every _____.
    a. 1 to 2 minutes
    b. 2 to 5 minutes
    c. 5 to 10 minutes
    d. 20 to 30 minutes

44. When anesthetizing a dog, to prevent regurgitation of stomach contents, you should
    a. Position the head level with, or slightly higher than the body
    b. Position the head lower than the body
    c. Pack gauze into the throat
    d. Position the patient in lateral recumbency

EXERCISE 29.9 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. Neuroleptanalgesia is a state of profound sedation and analgesia produced by simultaneous administration of an _____ and a _____.

2. The focus of a preanesthetic physical assessment should be the _____, _____, and _____ systems.

3. Drugs classified as agonists bind to receptors and exert one or more effects. Drugs classified as _____ _____ exert a decreased effect at the receptors, those classified as mixed _____ partially reverse the effects of pure agonists, and those classified as _____ completely block the action of the corresponding agonist.

4. The preanesthetic medications used to counteract bradycardia and excess salivation are called _____. The drugs _____ and _____ are examples of these agents.

5. The main adverse effect on the cardiovascular system caused by acepromazine is _____.

6. The two drugs contained in the combination telazol are the benzodiazepine _____ and the dissociative _____.

7. The reversal agent _____ is used in equal volumes with dexmedetomidine to sequentially sedate and then wake up patients for minor procedures such as wound bandaging.

8. Opioid drugs work by stimulating specific receptors in the brain and spinal cord. The effect of each opioid depends on its affinity for the various receptors. For instance opioid agonists primarily stimulate the _____ receptors.

9. The dissociative anesthetics most commonly used in veterinary patients are _____ and _____.

10. Dissociative anesthetics cause a unique state called _____, in which the patient appears to be awake, but is immobile and does not respond to its surroundings.

11. A combination of diazepam and ketamine is often used to induce general anesthesia in small animals. To do this, these drugs are mixed in a _____:_____ ratio by volume, and given at a dosage of about 1 mL of the mixture for every _____ pounds of body weight. So a 50-pound dog would need about _____ mL of this mixture for induction.

12. The drug combination "TKX" contains the drugs _____, _____, and _____.

13. The barbiturate drug _____ may be given to sight hounds because it is not only redistributed like thiopental sodium, but is also rapidly metabolized, and therefore is not cumulative.

14. A drug used as a muscle relaxant and sedative in large animals, is the drug _____ (also known as "GG" or glyceryl guaiacolate).

15. The anesthetic combination of xylazine, ketamine, and guaifenesin, used to maintain general anesthesia in horses is commonly called "_____ _____."

16. To produce surgical anesthesia in the average patient, you must select a vaporizer dial setting of approximately _____ times the minimum alveolar concentration (MAC).

17. The inhalant anesthetic _____ induces more rapid inductions and recoveries than any other halogenated agent, producing what is sometimes referred to as "one-breath anesthesia."

18. When checking a nonrebreathing system for leaks, the inflated reservoir bag should remain inflated for at least _____ seconds if no leaks are present.

19. When checking a rebreathing system for leaks, the reservoir bag should be inflated to a pressure of _____ cm of water. No leaks are present if the pressure decreases to no less than _____ cm of water over 10 seconds, or if an oxygen flow of no more than _____ mL/min is necessary to maintain pressure.

20. When setting the pop-off valve of a rebreathing system, the oxygen should be turned on to the maximum rate you anticipate will be needed for the procedure. The pop-off valve should then be opened until the pressure manometer indicates a pressure of _____ to _____ cm of water.

21. When turning on any dial or valve on an anesthetic machine, the dial or valve should be turned in a _____ direction.

22. An E-size oxygen cylinder with a pressure 500 psi contains approximately _____ L of oxygen. At a flow rate of 2 L/min, the oxygen will last approximately _____ minutes.

23. An H-size oxygen cylinder with a pressure of 500 psi contains approximately _____ L of oxygen, which will last approximately _____ hours at a flow rate of 2 L/min.

24. To avoid confusion, an isoflurane vaporizer is identified by the color _____, and a sevoflurane vaporizer is identified by the color _____.

25. A nonrebreathing circuit is recommended for patients weighing less than _____ kg of body weight, but is mandatory for patients weighing less than _____ kg of body weight.

26. If a rebreathing system is used for a 5-kg patient, it should be fitted with _____ breathing tubes.

27. A 45-pound patient requires use of a _____ L rebreathing bag.

28. The pressure manometer should read no more than _____ cm of water when providing manual or mechanical ventilation to small animals, and should read no more than _____ cm of water when providing manual or mechanical ventilation to large animals, unless the chest cavity is open.

29. The primary benefit of pediatric breathing tubes is that they decrease mechanical _____ _____.

30. The anesthetic machine should be professionally serviced at least _____.

31. When inflating the cuff of the endotracheal tube, compress the reservoir bag, and inflate the cuff until leak just ceases at a pressure of _____ cm of water.

32. Anesthetized patients often experience decreased respiratory rate, and approximately a _____% decrease in V_T. These patients often require periodic manual ventilation about every _____ to _____ minutes during anesthesia to prevent this complication.

33. Eye position is _____ during light anesthesia, gradually shifts to _____ position, and finally shifts back to _____.

34. The width of a blood pressure cuff should be _____% to _____% of the circumference of the extremity.

35. Oxygen saturation of hemoglobin greater than _____% is normal; between _____% and _____% indicates desaturation; less than _____% indicates hypoxemia; and less than _____% for longer than 30 seconds is a medical emergency.

36. In a normal anesthetized patient, the carbon dioxide level as measured with a capnograph should be _____ mm Hg during inspiration, and _____ to _____ mm Hg at the end of expiration.

37. When giving an injectable anesthetic IM, the onset of action will be _____ and the duration of action will be _____ than if the same drug were given IV.

38. When inducing a patient by chamber, use an oxygen flow rate of _____ L/min, and _____% to _____% isoflurane or _____% to _____% sevoflurane.

39. Hypotension in a horse is defined as a mean arterial blood pressure of less than _____ mm Hg.

40. Ruminants normally _____ gas to expel it from the rumen. Because this does not happen during anesthesia, _____ can occur.

41. Regurgitation of stomach contents is very common in ruminants during anesthesia, especially when the anesthetic depth is _____ or _____.

42. The best non-invasive anesthetic monitor for determining whether a patient is overventilating or underventilating is the _____. However, the "gold standard" method of monitoring ventilation is _____ analysis.

EXERCISE 29.10 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 29.11 CASE STUDY: COMPREHENSIVE

You are serving as an anesthetist for a 6-month-old, 48-pound, female, mixed-breed dog scheduled for an ovariohysterectomy. The doctor has prescribed the following anesthetic protocol:

Preanesthetic medications: Hydromorphone 0.1 mg/kg IM

Dexmedetomidine 0.005 mg/kg IM

Anesthetic induction: Propofol 4 mg/kg IV to effect

Anesthetic maintenance: Isoflurane 1.5% to 2.5% via endotracheal tube

You are expected to premedicate, induce, and maintain this patient, and to monitor it throughout the anesthetic event until fully recovered. Answer the following questions regarding anesthetic management of this case.

1. First you must prepare and administer the prescribed preanesthetic medications to this patient.

   a. Calculate the volume of each preanesthetic medication you will administer to this patient. (The concentration of hydromorphone is 2 mg/mL. The concentration of dexmedetomidine is 0.5 mg/mL.)

      Volume of hydromorphone you will administer (mL): _____

      Volume of dexmedetomidine you will administer (mL): _____

   b. What general effects would be expected from these premedications?

      Hydromorphone: _____

      _____

      Dexmedetomidine: _____

      _____

c. The patient should be placed in a quiet location while the preanesthetic medications take effect. Why is this necessary?

d. How much time should you allow for the medications to take effect before proceeding?

2. Next, you must prepare the anesthetic machine and associated equipment including the equipment required for endotracheal intubation.

a. Using the rules-of-thumb regarding selection of an endotracheal tube, what tube size (internal diameter in mm) would you prepare for this patient? _____ **mm**

b. What other equipment would you prepare for endotracheal intubation?

c. Would you select a rebreathing or a nonrebreathing circuit for this patient? Why?

d. What size of rebreathing bag would you prepare for this patient? _____ **L bag**

e. When using a semiclosed rebreathing system, what are the steps for setting the pop-off valve?

f. Calculate the oxygen flow rate for this patient following IV induction, during any change in anesthetic depth, or during recovery in L/min.

_____ **L/min**

g. Now calculate the oxygen flow rate for this patient during anesthetic maintenance.

_____ **L/min**

h. You are using a machine with size E oxygen tanks. The tank pressure gauge shows 1200 psi. Approximately how many liters of oxygen are left in the tank?

_____ **L**

i. At an oxygen flow rate of 2 L/min, approximately how long (in hours) would this oxygen supply last?

_____ **hours**

3. Now you must induce this patient with propofol.

a. Calculate the volume (in mL) of propofol you will draw up for this patient. The concentration of propofol is 10 mg/mL.

_____ **mL**

b. Will you administer the entire calculated dose to this patient? Why or why not?

c. Describe the specific technique you will use to administer the propofol.

d. What general effects do you expect from this agent?

e. What adverse effects may occur if the propofol is injected too rapidly?

4. During anesthetic maintenance, you will be monitoring this patient to be sure that it is safe, and to determine anesthetic depth.

a. Summarize the findings regarding vital signs and machine parameters you would expect to see during Stage III, Plane 2 general anesthesia (medium surgical anesthesia).

Vital Signs:

Heart rate/rhythm	
Respiratory rate	
Respiratory character	
Body temperature	
Mucous membrane color	
Capillary refill time	
Pulse quality	

Machine Monitoring Parameters

Oxygen saturation	
Systolic arterial blood pressure	
Diastolic arterial blood pressure	
Mean arterial blood pressure	
Minimally acceptable mean during anesthesia	

b. Which of these vital signs and machine parameters are indicators of circulation, which are indicators of oxygenation, and which are indicators of ventilation?

Indicators of circulation:

Indicators of oxygenation:

Indicators of ventilation:

c. Now summarize the findings regarding reflexes, ocular signs, and other indicators that would indicate that your patient is in Stage III, Plane 2 general anesthesia (medium surgical anesthesia).

Reflexes, Ocular Signs, and Other Indicators

Palpebral reflex	
Pedal reflex	
Swallowing reflex	
Corneal reflex	
Pupillary light reflex	
Pupil size	
Eyeball position	
Muscle tone	
Lacrimation	
Response to surgical stimulation	

5. The surgery was completed without incident, and the patient is ready for recovery.

   a. Indicate how you would prepare your patient for recovery including the appropriate oxygen flow rate for this patient.

b. Discuss steps you would take to hasten recovery.

c. What signs would tell you that the recovery is progressing normally?

d. How do you know when you can remove the endotracheal tube?

EXERCISE 29.10 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. The primary objective of anesthesia is to produce a loss of sensation in the whole body, or body part. But other effects may also be needed, depending on the procedure that is done. In addition to loss of sensation, what other effects may be needed that are achieved by use of balanced anesthetic protocols?

2. Describe the effects of the commonly used sedative xylazine in horses. What signs will the patient show that can be observed by the anesthetist?

3. The reversal agent naloxone can be given to neonates delivered by C-section if the mother received opioids as a part of the anesthetic protocol. What is unique about the route by which it is given for this indication?

4. Dissociative agents like ketamine produce a state called catalepsy in which the patient appears to be awake, but is immobile and does not respond to its surroundings. Briefly describe the effects of these agents on reflexes, muscle tone, the eyes, and breathing.

5. Between isoflurane and sevoflurane, which agent is best for mask inductions, and why?

6. Many clinicians recommend placing an endotracheal tube in all patients undergoing general anesthesia. What are the reasons for this?

7. Chamber inductions must be performed with extreme care. What are the main reasons that this caution is needed?

8. Anesthetic machines are used to deliver inhalant anesthetics and oxygen to patients during general anesthesia. Anesthetic machines have four general systems. List each system, and briefly describe the purpose for each system.

   a.

   b.

   c.

   d.

9. The following precautions must be taken when handling compressed gas cylinders.

   a. Never leave an unattended compressed gas cylinder unsupported or lying on its side, and never attempt to remove the valve.

   b. Never attempt to remove the index pins.

   c. When turning a tank on, keep skin and eyes clear of the valve port.

   d. Do not use oxygen near any source of ignition.

   What is the reason for each of these precautions? In other words, what could happen if these instructions were not followed?

   a.

   b.

c. _____

_____

d. _____

_____

_____

10. Nonrebreathing circuits do not have a carbon dioxide absorber. How is the carbon dioxide removed from these circuits?

_____

_____

_____

11. What is the difference between active and passive scavenging systems?

_____

_____

_____

12. Each species is intubated using a somewhat different technique (by feel, by sight, by use of a stylette or laryngoscope). Briefly review the basic technique used for small animals, horses, adult cattle, and small ruminants.

a. Small animals: _____

_____

_____

b. Horses: _____

_____

_____

c. Adult cattle: _____

_____

_____

d. Small ruminants: _____

_____

_____

13. During an anesthetic procedure on a middle-aged dog undergoing a dental cleaning, you notice that the anesthetist is using a monitoring device that generates multiple parameters including oxygen saturation, body temperature, heart rate, respiratory rate, an ECG tracing, arterial blood pressure, and end-tidal CO_2. You ask the anesthetist how the patient is doing, and the anesthetist looks at the monitor and says "he is doing fine." What error in patient monitoring did this anesthetist make?

14. Even though vital signs are only loosely correlated with anesthetic depth, there are trends in these parameters as the patient progresses from light to deep surgical anesthesia. Briefly summarize the changes in heart rate, respiratory rate, blood pressure, mucous membrane color, and capillary refill time (CRT) as a patient's anesthetic depth increases.

15. One cause of hypoventilation is postinduction apnea. Briefly explain what postinduction apnea is.

16. Hypothermia is common during anesthesia. What steps can be taken to reduce loss of body heat during anesthesia?

17. When monitoring an anesthetized patient, reflexes are used to answer the question, *"Is the anesthetic depth inadequate, excessive, or appropriate for the procedure being performed?"*

    a. How do you test each of the following reflexes?

    Palpebral reflex: _____

    Pedal reflex: _____

Muscle tone: _____

Corneal reflex: _____

Swallowing reflex: _____

b. How do you interpret each of the reflexes listed previously?

Palpebral reflex: _____

_____

_____

Pedal reflex: _____

_____

_____

Muscle tone: _____

_____

_____

Corneal reflex: _____

_____

_____

Swallowing reflex: _____

_____

_____

18. "Response to surgical stimulation" is an important monitoring parameter. What is meant by this?

_____

_____

_____

19. Consider the pulse oximeter.

a. What two general types of probes are used with a pulse oximeter?

i. _____

ii. _____

b. How are they different in terms of the locations where they are placed?

c. What factors will give a false result when using a pulse oximeter?

20. Following IM injection of a preanesthetic combination, the patient should be left in a quiet location where it can be observed for 15 to 20 minutes. Why is this important?

21. Intravenous general anesthetics are most often given to a patient "to effect." Explain what "to effect" means.

22. Describe the gradual method of anesthetic induction by mask focusing on the dial settings for both oxygen and anesthetic.

23. When the dial on the anesthetic vaporizer is adjusted, there is a delay before the corresponding change in the anesthetic depth occurs. The duration of this delay depends on several factors. What are they?

24. When preparing a horse for anesthesia, a jugular IV catheter must be placed, and several other things must be attended to that are not an issue with a small animal patient. Briefly summarize these components of patient preparation that are specific to horses.

25. Small animals can be induced using a variety of techniques. Some (such as IV induction) result in a rapid loss of consciousness, and others (such as mask induction) result in a more gradual loss of consciousness. What is different about the goal of anesthetic induction in horses, and why?

26. During anesthetic maintenance of an equine patient, it is important that attention be paid to protect major muscle groups and nerves. What steps are taken to do this?

27. Why should an arterial catheter be placed in a horse that is undergoing a general anesthetic procedure that will last more than 1 hour?

28. Hypotension is a common complication of general anesthesia in horses. What steps are taken if an equine patient becomes hypotensive?

29. Horses are challenging to anesthetize for a number of reasons. One reason is that sudden unexpected movement can occur without an apparent change in anesthetic depth. Why is this a challenge to manage, and what can be done to prepare for this possibility?

30. Hypoxemia is a common complication in anesthetized equine patients. List some patient characteristics or conditions that can predispose to this complication.

31. Horses undergoing field anesthesia frequently receive "triple drip" for anesthetic maintenance. When using this combination, monitoring parameters are somewhat different than when using inhalants. What differences are expected when using this combination?

32. Injury during anesthetic recovery is always a significant risk with equine patients. What signs warn the anesthetist that a horse may have a "rough recovery"?

33. The combination “double drip” is often given IV to cattle to maintain anesthesia for short procedures. What is “double drip”? How does it differ from “triple drip,” an agent used in horses?

34. When the normal vacuum is lost from the chest cavity, a patient must be ventilated throughout the procedure. List some conditions that can cause loss of the vacuum in the chest cavity.

35. Mechanical ventilators come in three different types: (a) pressure cycle, (b) volume cycle, and (c) time cycle. What is the difference among these types in terms of criteria used to determine the volume of air that is forced into the patient’s lungs?

36. Excess pressure exerted during ventilation can cause several complications relating to heart or lung function. List one complication affecting each of these organs.

    Heart function: _____

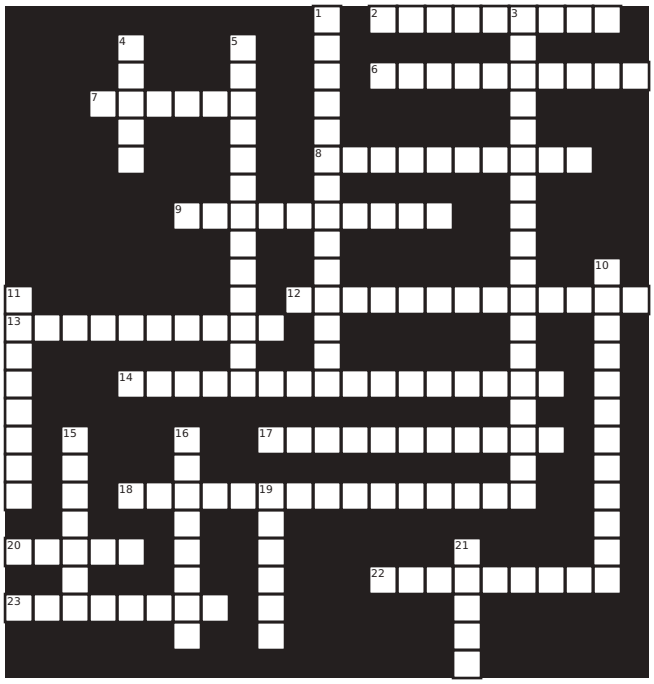
    Lung function: _____

30 Surgical Instruments and Aseptic Technique

LEARNING OBJECTIVES

1. Pronounce, define, and spell all Key Terms in this chapter.
2. Do the following regarding general surgery instruments and stapling equipment:
   - Name and describe commonly used surgical instruments
   - Know the basic operation and properties of CO2 and diode lasers and develop a basic knowledge of laser safety protocol.
   - State advantages of surgical stapling and list common surgical stapling devices.
3. List commonly used instruments and equipment for ophthalmic, orthopedic, arthroscopic, and laparoscopic procedures.
4. Do the following regarding surgical instrument packs, instrument care, and the use of surgical drapes and gowns:
   - List surgical instruments and supplies routinely included in general and emergency surgical packs for small and large animals.
   - Describe procedures for cleaning, packing, and sterilizing instruments.
   - Describe procedures for folding and packing cloth surgical drapes and gowns.
5. Do the following regarding the processes of sterilization and disinfection as part of aseptic technique:
   - Differentiate between sterilization and disinfection.
   - List and describe physical and chemical methods of sterilization and methods of quality control of sterilization methods.
   - Know the appropriate sterilization processes for sensitive equipment.
   - State safe storage times and conditions for sterile packs.
   - List and describe common antiseptic and disinfectant agents.
   - Describe requirements for preparation of the operating room and maintenance of operating room sterility.
6. Describe preparation requirements for patients, including skin preparation, patient positioning, and draping.
7. Describe preparation requirements for the surgical team and explain the procedures that may be used for hand scrubbing before surgery, the procedure for donning surgical attire, and the procedures for opening sterile items.

EXERCISE 30.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

2 One of the two self-retaining retractors commonly used to retract muscle during orthopedic and neurologic surgical procedures.
6 A group of surgical instruments named _____ forceps are used to crush blood vessels and tissues in order to stop the source of bleeding.
7 The common name for the frequently used disinfectant, sodium hypochlorite.
8 The general name for instruments, the primary function of which is to improve visualization in the surgical field during soft-tissue and orthopedic procedures.
9 Partially or fully threaded bone screws that comprise wider threads designed to increase gripping in soft bone.
12 An antiseptic agent that has effective antimicrobial properties as well as a rapid onset and long-lasting residual activity.
13 The type of cleaning unit designed to remove debris that is tightly bound to instruments and clean areas on the instruments that cannot be reached by scrub brushes.
14 Large hemostatic forceps with longitudinal grooves in the jaws and cross-grooves at the tip.
17 The type of cloth drape that comes premade with an opening in the center for easy placement over the predetermined incision site.
18 The jaws of needle holders that are of high quality often contain replaceable _____ _____ inserts that help grip needles and prevent wear. (2 words)
20 Another name for emergency sterilization.
22 The smooth, stainless steel bone pins that can range in diameter from 1/16 to 1/4 inch.
23 The iodine solution for skin that is not commonly used in veterinary medicine, and is comprised of 50% alcohol and 2% iodine.

Down

1 A disinfectant solution that is used for cold sterilization. Can cause chemical synovitis and chondrocyte damage if not rinsed off.
3 A cannula type instrument into which the obturator is placed for arthroscopic procedures. (2 words)
4 One of the two self-retaining retractors commonly used to retract muscle during orthopedic and neurologic surgical procedures.
5 The chemical gas that is capable of killing all microorganisms. (2 words)
10 The process that allows one to create and maintain a desired level of abdominal distention during laparoscopic procedures.
11 Instruments designed with small cup-like formations on one or both ends used to scrape dense tissues like cartilage or bone.
15 The retractor that comprises one single blade and a handle; used to lever tissues out of the line of view.
16 The handheld instrument characterized by sharp tips that appear cupped; used for cutting small pieces of dense tissues like cartilage, bone, or fibrous tissues.
19 The sharp pointed instrument inserted inside an arthroscope sleeve.
21 Surgical wire with T-shaped handles used in orthopedic procedures for cutting bone in a saw-like motion.

EXERCISE 30.2 DEFINITIONS: KEY TERMS

Instructions: Define each term in your own words.

1. Coherent light: _____

2. Latent thermal damage: _____

3. Collateral thermal damage: _____

4. External fixation: _____

5. Asepsis: _____

6. Aseptic technique: _____

7. Exogenous route: _____

8. Endogenous route: _____

9. Sterilization: _____

10. Filtration: _____

11. Disinfectant: _____

12. Antisepsis: _____

13. Antiseptic agents: _____

14. Cold trays: _____

15. Quarter drapes: _____

_____

16. Towel clamps: _____

_____

EXERCISE 30.3 MATCHING: SURGICAL INSTRUMENTS

Instructions: Match each definition in column A with its corresponding word in column B by writing the appropriate letter in the space provided.

Column A

1. _____ "Heavy-duty" operating scissors commonly used for cutting dense tissues.
2. _____ Instruments used to grasp needles and pass suture material through tissues in addition to aiding with suture tying.
3. _____ Thumb forceps with delicate intermeshing teeth, which make them good for grasping delicate tissues atraumatically.
4. _____ The needle holder that is equipped with scissors built into the instrument.
5. _____ Thumb forceps that are relatively atraumatic with multiple sets of delicate teeth and long narrow jaws that are often used for vascular surgeries.
6. _____ A traumatic type of thumb forceps with a broad curved surface that is good for handling needles.
7. _____ The classification of instruments with a locking mechanism that are used to clamp tissues.
8. _____ The self-retaining retractor that facilitates retraction of the ribs for surgical site exposure within the thoracic cavity.
9. _____ Traumatic tissue forceps that is used to securely grasp tissues, but that leaves the tissues "crushed." Therefore, this forceps should only be used on tissues that are to be removed during the procedure.
10. _____ The hemostatic forceps designed with large transverse grooves used to clamp bundles of tissues and large vessels.
11. _____ Thumb forceps with jaws comprised of large interdigitating teeth that are primarily used for fascia or skin.
12. _____ One of the two types of hemostatic forceps that are similar in design to Halsted mosquito forceps but that differ from one another slightly in jaw-tooth pattern. Used to perform the function of crushing medium vessels and tissues.
13. _____ Intestinal tissue forceps designed with atraumatic flexible jaws, which allows for safe clamping of viable portions of the bowel in addition to other delicate tissues.
14. _____ Hemostatic forceps that is relatively small in size and designed to occlude small vessels.
15. _____ The general type of forceps used for tissue manipulation that is designed with a "spring action." Used by compressing the two metal handles together to make the jaws meet.
16. _____ Hemostatic forceps similar to the Rochester-Pean, but which have interdigitating teeth at the tips used for grasping tissues. They are commonly utilized in orthopedic or large-animal surgery.
17. _____ The tissue forceps similar to Allis tissue forceps, but which provides less tissue security as a result of having a less traumatic effect on tissues.

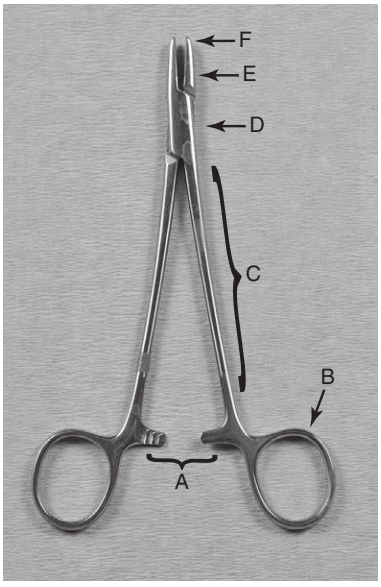
Column B

A. Kirschner wire
B. Rochester-Ochsner
C. Allis
D. Adson
E. Babcock
F. Halsted mosquito
G. Jamshidi
H. DeBakey
I. Kelly
J. Russian
K. Rochester-Carmalt
L. Mayo dissecting scissors
M. Rochester-Pean
N. Conical
O. Olsen-Hegar
P. Army-Navy
Q. Needle holders
R. Malleable
S. Finochietto
T. Rat-tooth
U. Kerrison
V. Doyen
W. Trephine
X. Tissue forceps
Y. Thumb forceps

18. _____ Hemostatic forceps that are large in size with longitudinal grooves and cross-grooves at the tip of the jaws which aid in traction for crushing and clamping across vessels. They are commonly used in spay procedures.
19. _____ A handheld surgical retractor that is designed with smooth blades and used to retract skin, fat, or muscles.
20. _____ A specific type of rongeurs used for spinal surgeries with a "gun-shaped" appearance.
21. _____ T-shaped stainless steel instrument that has a cutting cylindrical blade. Similar to the appearance of a general biopsy punch.
22. _____ The type of bone pin that is similar to an intramedullary pin, but is smaller in size and may be used to pin small fragments of bone.
23. _____ The type of needle that shares similarities with a trephine, but is often disposable, making it only good for a single use.
24. _____ An atraumatic handheld surgical retractor comprised of specialized metal that allows the retractor to be bent into a desired shape making it especially useful for retracting thoracic and abdominal organs.
25. _____ The type of obturator used to penetrate the synovial membrane of the joint capsule to allow further advancement of the arthroscope sleeve into the joint space. Provides a reduced risk of causing articular cartilage damage.

EXERCISE 30.4 PHOTO QUIZ #1: SURGICAL INSTRUMENT PARTS

Instructions: Name each surgical instrument part (indicated by the arrows).



Part Names

A. _____

B. _____

C. _____

D. _____

E. _____

F. _____

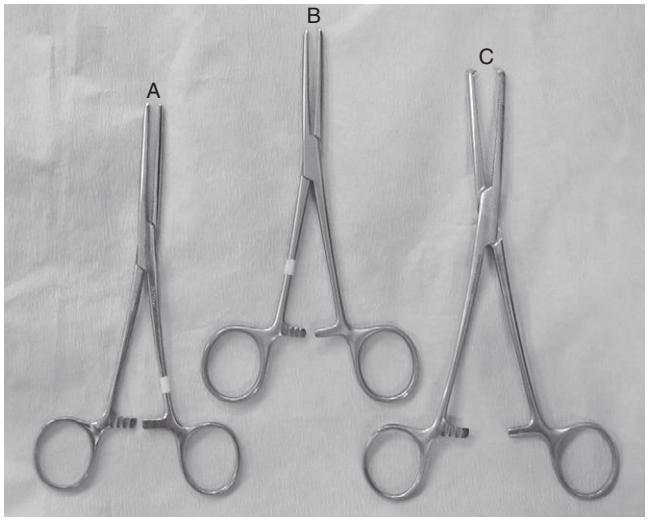
EXERCISE 30.5 PHOTO QUIZ #2: SURGICAL INSTRUMENTS

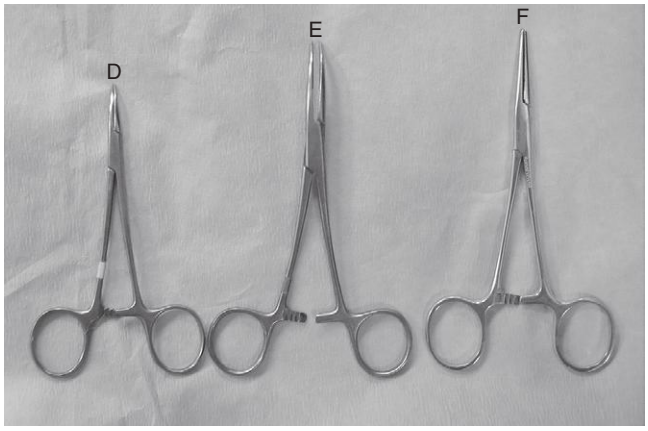
Instructions: Match each general class of surgical instruments with its corresponding photo by writing its name in the space provided. Then respond to each of the follow-up queries.

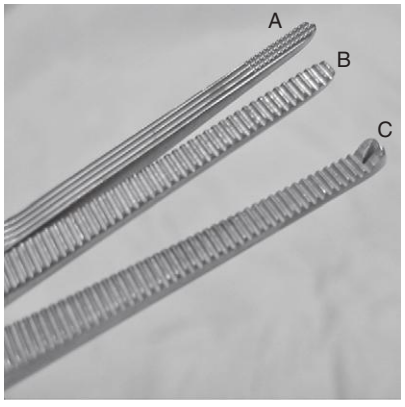
General Classes of Surgical Instruments

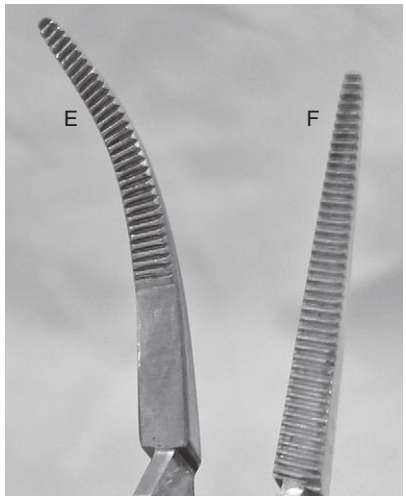
A. Suction tips
B. Scissors
C. Self-retaining retractors
D. Thumb forceps
E. Scalpel handles and blades
F. Tissue forceps
G. Hemostatic forceps
H. Needle holders
I. Hand-held retractors

1.





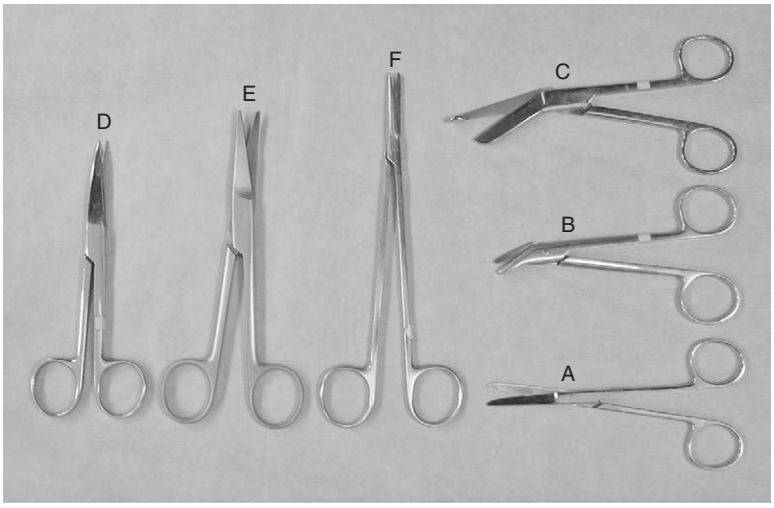




1. General class of instruments: _____

Name each instrument and then indicate how you can differentiate each by its size and jaw pattern.

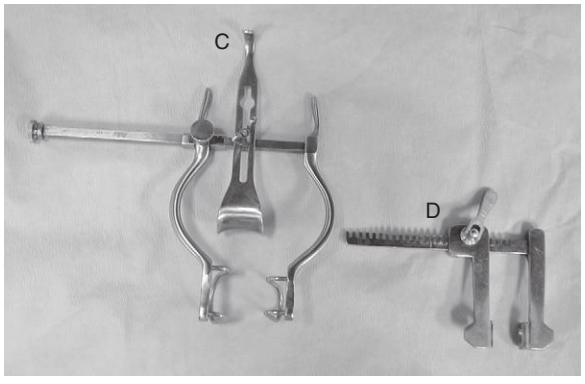
Name:	**Criteria used to differentiate:**
A. _____	_____
B. _____	_____
C. _____	_____
D. _____	_____
E. _____	_____
F. _____	_____

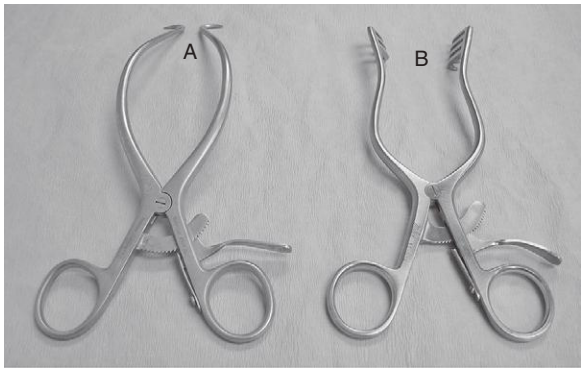
2. 

2. General class of instruments: _____

Name each instrument and then indicate whether it is primarily used to cut wire suture, delicate tissue, bandage material, suture, fascia and other dense tissue, or for general-purpose cutting.

Name:	**Primary use:**
A. _____	_____
B. _____	_____
C. _____	_____
D. _____	_____
E. _____	_____
F. _____	_____

3. 

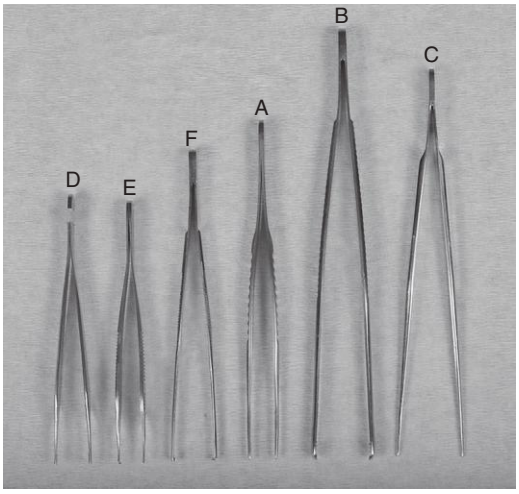


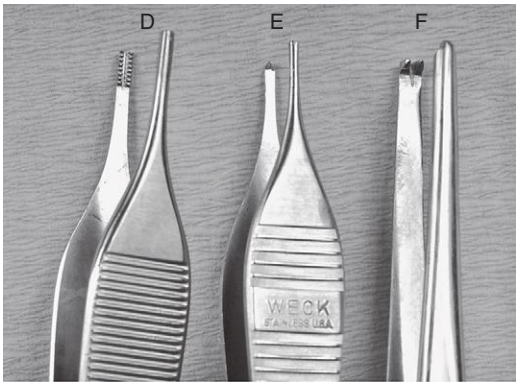
3. General class of instruments: _____

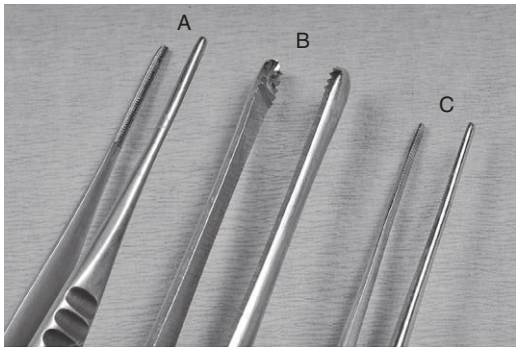
Name each instrument and then indicate whether it is primarily used to expose the abdominal cavity, expose the thoracic cavity, or to retract muscle for orthopedic and neurologic surgeries.

Name:	**Primary use:**
A. _____	_____
B. _____	_____
C. _____	_____
D. _____	_____

4.





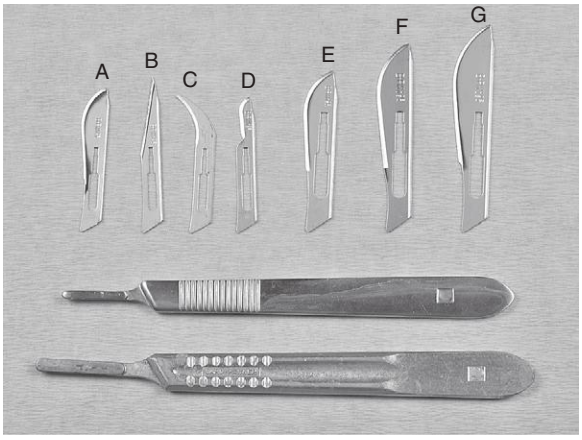


4. General class of instruments: _____

Name each instrument and then indicate whether it is primarily used to hold tissue and needles, skin and fascia, delicate tissue, vessels, needles only (because of tissue trauma), or wound dressing.

Name:	Primary use:
A. _____	_____
B. _____	_____
C. _____	_____
D. _____	_____
E. _____	_____
F. _____	_____

5.



5. General class of instruments: _____

Indicate the number of each blade.

A. _____ B. _____ C. _____ D. _____

E. _____ F. _____ G. _____

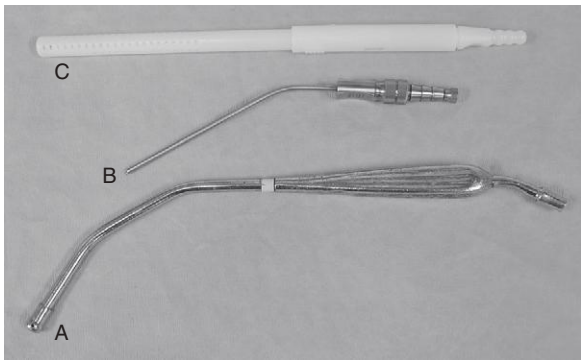
Indicate the number of the scalpel handle on the bottom: _____

Which blades will fit on this handle? _____

Indicate the number of the scalpel handle on the top: _____

Which blades will fit on this handle? _____

6.

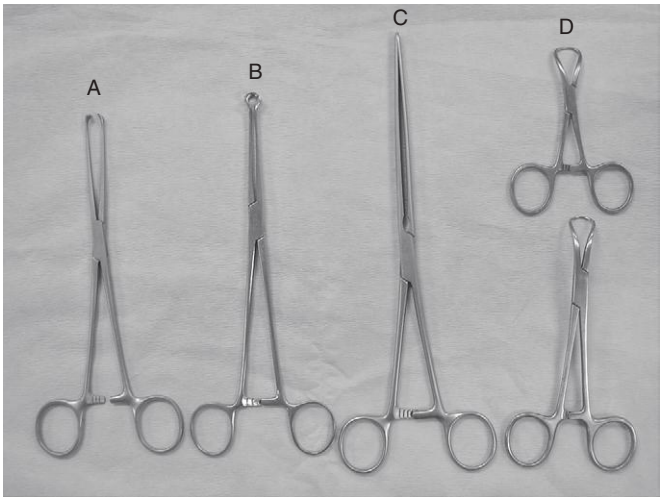


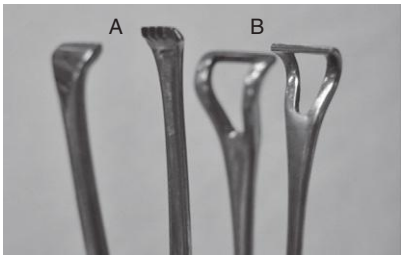
6. General class of instruments: _____

Name each instrument and then indicate whether it is primarily used to suction fluid from a body cavity, a joint, or for general-purpose suctioning.

Name:	**Primary use:**
A. _____	_____
B. _____	_____
C. _____	_____

7.



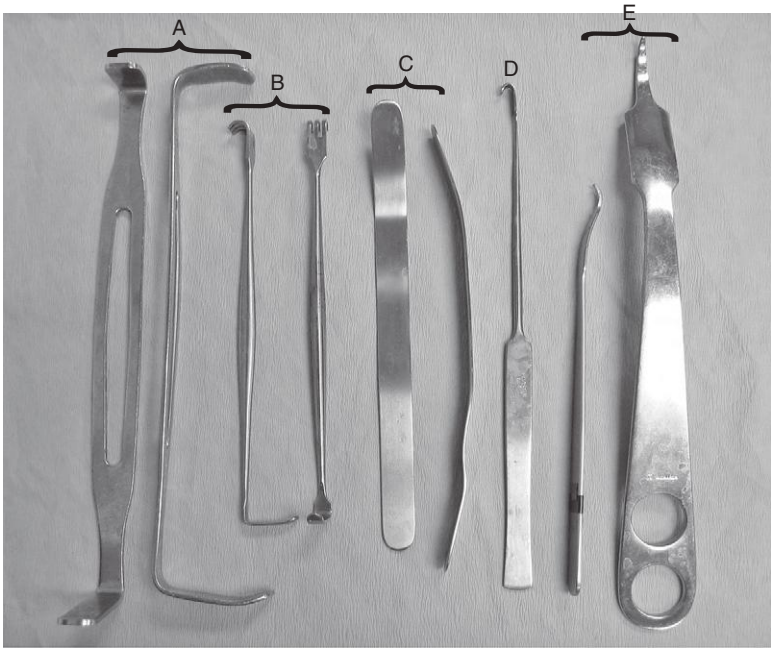


7. General class of instruments: _____

Name each instrument and then indicate whether it is primarily used to hold tissue that will be removed, bowel and other delicate tissues, tissue that will not be removed, or surgical drapes.

Name:	Primary use:
A. _____	_____
B. _____	_____
C. _____	_____
D. _____	_____

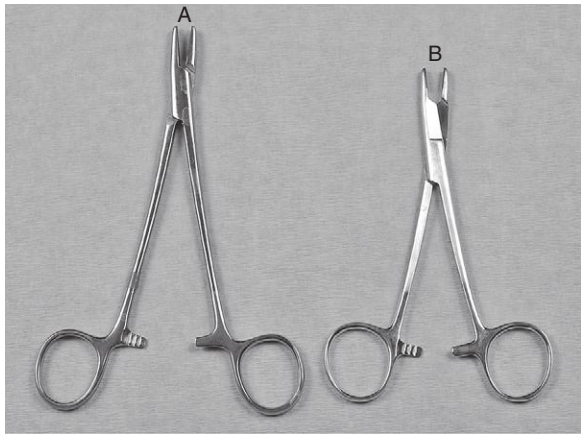
8.



8. General class of instruments: _____

Name each instrument and then indicate whether it is primarily used to retract skin, fat and muscle, abdominal and thoracic organs, the horn of the uterus, or tissues during orthopedic surgery.

Name:	Primary use:
A. _____	_____
B. _____	_____
C. _____	_____
D. _____	_____
E. _____	_____

9. 

9. General class of instruments: _____

What is the specific name of each instrument?

Name:

A. _____

B. _____

What is the difference between these two instruments?

_____

EXERCISE 30.6 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ It is necessary to shave between the patient and the ground plate when using electrocautery technology in order to prevent the occurrence of burns.
2. _____ The use of a ground plate is required for bipolar electrosurgery.
3. _____ The wavelength and frequency of light emitted by a laser is uniform.
4. _____ When using a laser, adipose (fat) tissue is more likely to cause scatter radiation than bone.
5. _____ CO_2 laser beams are produced from a liquid medium.
6. _____ CO_2 lasers emit a "free" laser beam.
7. _____ The diode laser and YAG laser have similar wavelengths.
8. _____ The beam of the YAG or diode laser is transmitted by fibers.
9. _____ CO_2 lasers create greater collateral and latent thermal damage compared to Nd:YAG and diode lasers.
10. _____ The majority of lasers used in the medical field are class IV and are capable of causing damage to the skin and eyes.

11. _____ Certain laser types can penetrate through clear glass.

12. _____ Lasers generate a potentially toxic substance called "plume" when used on tissues.

13. _____ Brown-Adson thumb forceps are not commonly used in the veterinary field.

14. _____ Surgeons commonly hold thumb forceps in their dominant hand to grasp tissues for dissection or suturing.

15. _____ Kelly forceps are characterized by transverse grooves that extend along the entire length of the jaw, whereas the jaws of Crile forceps only contain grooves on the distal aspect.

16. _____ Another name for the "spay hook" is the Snook ovariohysterectomy hook.

17. _____ Most bone-holding forceps are self-retaining.

18. _____ Chisels and osteotomes are produced from a hard metal and therefore can be used to cut other materials besides bone.

19. _____ The threads of bone pins are located only on the end of the pin.

20. _____ External fixators are used to hold bone pins in position and can be made of metal or acrylic material.

21. _____ Bone screws should never be used in conjunction with a bone plate or interlocking nail.

22. _____ Large bone screws commonly have a slotted head.

23. _____ Arthroscopes are used to examine joint structures of large and small animals.

24. _____ The majority of arthroscopic equipment is designed specifically for veterinary use.

25. _____ Once a fibrous joint capsule has been penetrated by a sharp trocar, the trocar is replaced with the arthroscope.

26. _____ Gas insufflation with the use of CO_2 or nitrous oxide is an acceptable method of joint distention.

27. _____ Pressurized bag systems are used to deliver fluid into the joint.

28. _____ Arthroscopy may be performed on horses with the use of local anesthetics and sedatives.

29. _____ Nitrous oxide gas is used to insufflate the abdomen when performing laparoscopy.

30. _____ Stainless steel surgical instruments with a polished finish are preferred over those with a satin finish.

31. _____ Only surgical instruments made from the same material should be ultrasonically cleaned at the same time.

32. _____ Oil is used to lubricate and maintain proper function of surgical instruments.

33. _____ Cloth drapes and gowns are designed for repeated use.

34. _____ Radiation is a safe alternative for sterilizing certain materials that would otherwise be damaged by other methods of sterilization.

35. _____ As compared with dry heat, wet heat requires a greater period of time to achieve sterilization and is also more difficult to control.

36. _____ Wet heat sterilization with boiling water at ambient pressures is a reliable method to achieve sterilization.

37. _____ After the sterilization process is finished, the pack should be allowed to self cool prior to handling, by fully opening the autoclave door for at least 20 minutes.

38. _____ It is common among veterinary practices to use a combination of autoclave tape on the outside of a surgical pack as well as a chemical indicator strip in the center of the pack to assure proper sterilization was achieved.

39. _____ Liquid chemicals should not be used for instrument sterilization.

40. _____ Ethylene oxide is a toxic, colorless, and explosive gas used for instrument sterilization.

41. _____ Ethylene oxide gas is capable of penetrating through paper and plastic packaging materials.

42. _____ Proper placement of surgical packs and materials in the sterilization chamber is extremely important in order for effective sterilization to take place with the use of ethylene oxide gas.

43. _____ Disinfectants are capable of killing vegetative bacteria as well as effective at destroying spores.

44. _____ Iodine compounds are antimicrobial agents that are extremely effective against bacterial spores.

45. _____ Aqueous iodine solutions contain a lower level of free iodine then iodophors, resulting in less bactericidal activity.

46. _____ By diluting iodophor stock solutions, the bactericidal activity will increase and the cytotoxicity will decrease.

47. _____ Povidone-iodine is commonly used in the veterinary field as a surgical scrub and is effective in reducing bacteria.

48. _____ The residual bactericidal effect of povidone-iodine is greatly reduced by the presence of organic matter.

49. _____ Chlorhexidine is an antiseptic agent that provides effective antimicrobial activity without causing significant skin irritation or complications seen with povidone-iodine solutions.

50. _____ Methyl alcohol is more effective than ethyl and isopropyl alcohol when used as a disinfectant.

51. _____ Glutaraldehyde is an effective antimicrobial agent that can be used on living tissues.

52. _____ Arthroscope and laparoscope components (light cable and camera) should be cleaned only by gas or cold sterilization.

53. _____ A presurgical scrub is performed on the patient either in the surgical preparation room or inside the operating room to maintain asepsis.

54. _____ The final sterile scrub should be performed on the patient just before entering the operating room.

55. _____ "One-step prep" skin preparation solutions may be used in place of traditional scrubs for preparing surgery sites as they have comparative antimicrobial killing capabilities.

56. _____ Feline castration surgical prep involves shaving the scrotum.

57. _____ Lateral recumbency is the most desirable position for most abdominal surgeries.

58. _____ The sleeves, the front of the gown, and the neckline are considered to be sterile on a "scrubbed-in" person.

59. _____ "Scrubbed-in" assistants are responsible for opening all sterile items for the surgeons.

EXERCISE 30.7 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. The laser energy applied to tissue is measured in
   a. Volts
   b. Watts
   c. Joules
   d. Amperes

2. Which of the following laser types is not commonly used in the veterinary field?
   a. CO_2
   b. Nd:YAG
   c. Argon
   d. Diode

3. CO_2 lasers are primarily used for
   a. Vaporization of tissues
   b. Precise cutting and vaporization of tissues
   c. Transendoscopic surgery
   d. Deep-tissue penetration

4. Which of the following is most susceptible to damage from laser injury?
   a. Thyroid glands
   b. Eyes
   c. Reproductive organs
   d. Hands

5. The surgical scissors most commonly utilized for soft-tissue dissection.
   a. Metzenbaum scissors
   b. Mayo dissecting scissors
   c. Iris scissors
   d. Operating scissors

6. The type of surgical instrument sometimes used to secure surgical drapes and instrument cords (such as those used for cautery).
   a. Allis tissue forceps
   b. Babcock forceps
   c. Doyen forceps
   d. Russian thumb forceps

7. Tissue forceps are used for
   a. Cutting and clamping tissues
   b. Occluding and grasping vessels
   c. Crushing and cutting tissues
   d. Clamping and holding tissues

8. Which of the hemostatic forceps listed below is most commonly used for large-animal surgery or orthopedic procedures?
   a. Rochester-Ochsner forceps
   b. Rochester-Pean forceps
   c. Crile forceps
   d. Kelly forceps

9. The Poole suction tip is primarily used in the
   a. Abdominal cavity
   b. Thoracic cavity
   c. Joints
   d. Both a and b

10. Which of the following is not a recognized material used for orthopedic implants?
    a. Cobalt-chromium alloys
    b. Titanium
    c. Stainless steel alloy
    d. Aluminum alloys

11. The most commonly used arthroscope for canine arthroscopy is
    a. 4-mm outer diameter, and a 25-degree angled lens
    b. 4-mm outer diameter, and a 30-degree angled lens
    c. 5-mm outer diameter, and a 10-degree angled lens
    d. 2.7-mm outer diameter, and a 30-degree angled lens

12. The inner pressure of an insufflated abdominal cavity should not exceed
    a. 10 to 15 mm Hg
    b. 15 to 20 mm Hg
    c. 20 to 25 mm Hg
    d. 25 to 30 mm Hg

13. Which of the following is not classified as an exogenous source of contamination?
    a. Air
    b. Surgical instruments
    c. Patient skin
    d. Oral cavity bacteria

14. Which of the following is not a surgical wound classification used to determine the degree of vigilance required regarding aseptic technique?
    a. Sterile
    b. Clean
    c. Clean-contaminated
    d. Contaminated

15. Which of the following is not classified as a general type of physical sterilization?
    a. Filtration
    b. Radiation
    c. Heat
    d. Ethylene oxide

16. Which of the following statements is true regarding radiation sterilization?
    a. Materials that are easily damaged should not be sterilized by radiation
    b. Radiation destroys microorganisms
    c. Radiation produces high temperatures during the sterilization process
    d. Radiation is not used for sterilization of medical supplies

17. The most common sterilization method is
    a. Wet heat
    b. Filtration
    c. Radiation
    d. Hydrogen peroxide gas plasma

18. Which of the following products is most effectively sterilized by dry heat?
    a. Rubber
    b. Fabrics
    c. Metals
    d. Oils

19. Reliable methods of heat sterilization for fabrics and metals include
    a. Saturated steam under pressure
    b. Boiling water
    c. Dry heat
    d. Both a and b

20. Which of the following products is most effectively sterilized by moist heat?
    a. Powders
    b. Petroleum products
    c. Oils
    d. Rubber

21. The adequate amount of spacing between each pack in an autoclave chamber to ensure proper steam penetration is
    a. 2.5 to 7.5 cm
    b. 3.5 to 8.5 cm
    c. 5.0 to 10 cm
    d. 7.5 to 12 cm

22. The recommended exposure time and temperature for flash-sterilization is
    a. 2 minutes at 250°F
    b. 3 minutes at 131°C
    c. 4 minutes at 270°F
    d. 5 minutes at 131°F

23. To prevent rapid cooling of packs after a sterilization cycle has finished, the autoclave door should be slightly cracked open for a minimum of
    a. 5 minutes
    b. 10 minutes
    c. 15 minutes
    d. 20 minutes

24. Fusible pellet glass indicators provide evidence that a(n)
    a. Pressure of 27 psi was reached
    b. Adequate level of steam saturation was achieved
    c. Time of 15 minutes passed
    d. Temperature of 118°C was reached

25. Which of the following statements is false in regards to culture test indicators?
    a. They use spores of a particular strain of bacteria.
    b. They yield rapid results.
    c. They are the only type of indicator that provides evidence that microorganisms were destroyed.
    d. They do not indicate if proper steam penetration has been achieved.

26. Which of the following events would render a sterile surgical pack contaminated?
    a. The pack was stored in an open cabinet.
    b. The pack was stored in an upside-down position.
    c. The outside of the pack came in contact with a nonsterile instrument.
    d. The pack was dropped but the tape sealing the pack remained intact.

27. The general operating temperature for ethylene oxide is between
    a. 21°C and 140°C
    b. 15°C and 60°C
    c. 21°C and 60°C
    d. 21°F and 70°F

28. The minimal humidity requirement for effective sterilization to occur by the use of ethylene oxide is
    a. 20%
    b. 25%
    c. 30%
    d. 35%

29. Which of the following statements is not true of hydrogen peroxide gas plasma sterilization?
    a. Gas plasma is capable of inactivating mycobacteria and bacterial spores.
    b. Gas plasma is capable of inactivating viruses and fungi.
    c. Gas plasma is considered to be safer for the environment when compared with ethylene oxide.
    d. Gas plasma sterilization is considered to be a more hazardous form of chemical sterilization when compared with ethylene oxide.

30. The residual bactericidal activity of povidone-iodine when left on the skin is
    a. 2 to 4 hours
    b. 4 to 6 hours
    c. 6 to 8 hours
    d. 8 to 10 hours

31. Skin irritation or acute dermatitis related to the use of povidone-iodine iodophors in veterinary practice can affect up to
    a. 10% of canine patients
    b. 25% of canine patients
    c. 50% of canine patients
    d. 75% of canine patients

32. The proper dilution for chlorhexidine antiseptic agents in order to produce a 0.05% lavage solution for open wound treatment is
    a. 1:40 with sterile water
    b. 1:40 with saline
    c. 1:20 with sterile water
    d. Both a and b

33. The required exposure time when soaking instruments to achieve cold sterilization should exceed
    a. 30 minutes
    b. 1 hour
    c. 2 hours
    d. 3 hours

34. For which of the following procedures is it not acceptable to use cold-sterilized instruments?
    a. Dental surgery
    b. Superficial laceration
    c. Abscess debridement
    d. Lumpectomy

35. The general rule of thumb for clipping the perimeter around the incision site is
    a. 2 to 5 cm
    b. 3 to 10 cm
    c. 5 to 15 cm
    d. 10 to 20 cm

36. The general recommendation for initial skin preparation of a surgical site consists of scrubbing and rinsing
    a. 2 times
    b. 3 times
    c. 4 times
    d. 5 times

37. Which of the following statements is not true regarding the surgical hand scrub?
    a. The two basic methods include "counted brush strokes" and "timed."
    b. The "counted brush stroke" method is more commonly used.
    c. 10 to 25 brush strokes are performed on the all surfaces prior to rinsing.
    d. The initial scrub of the day should be at least 5 minutes.

38. Which of the following is not acceptable for scrubbed-in personnel?
    a. Resting gloved hands on a sterile drape
    b. Clasping gloved hands in front of the body between shoulders and waist
    c. Crossing arms at chest height
    d. Touching the gown within the sterile zone while wearing gloves

39. Which of the following is a false statement regarding towel clamps?
    a. The Roeder towel clamp has a metal ball stop on the jaws.
    b. The Backhaus towel clamp prevents deep tissue penetration.
    c. Towel clamps are designed to secure drapes to the patient.
    d. Towel clamps have tips that join together like "tongs."

EXERCISE 30.8 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. Lasers emit energized light produced from a crystal, a _____, or a _____.

2. A laser's _____ within the light spectrum determines the effect it will have on tissue.

3. The result of laser-tissue interaction is dependent on the tissue's _____ and _____.

4. In addition to the expected effect of a laser on the surgery site, lasers also cause thermal tissue damage that is classified either as _____ or _____.

5. The two most commonly utilized needle holders in the veterinary field are _____ and _____.

6. Adson thumb forceps are commonly used for the dissection of delicate _____ tissue and _____.

7. _____ and _____ hemostatic forceps share similarities in appearance but differ in their jaw tooth pattern, which covers the entire jaw in one, and only the distal aspect of the jaw in the other.

8. The _____ _____ is a specialized surgical instrument designed to act as a handheld retractor that is used to grasp uterine horns during ovariohysterectomy procedures.

9. The suction tip designed for general purpose use is referred to as a _____ tip.

10. The periosteal elevator most commonly utilized in small-animal orthopedics is known as the _____ elevator.

11. The type of bone-holding forceps equipped with a ratcheted handle for secure bone clamping is known as the _____ bone-holding forceps.

12. Two surgical devices made from soft metals that are used for bone cutting are the _____ and _____.

13. The points of bone pins come in varieties like the _____, trocar, or _____ trocar.

14. The most commonly used sizes of stainless steel cerclage wire for small-animal surgery are _____ gauge, _____ gauge, and _____ gauge.

15. The two basic types of bone screws are the _____ and the _____.

16. When using a laparoscope, the abdominal cavity is accessed through the _____ _____ in horses or through the _____ _____ in both dogs and horses.

17. The use of a sharp _____ and a cannula is needed to penetrate subcutaneous tissues and the lining of the peritoneum in order to create a portal for a laparoscope.

18. The most commonly used gas for insufflation is _____ because it is noncombustible, making it relatively safe.

19. The box lock of instruments should remain in the _____ position when going through the ultrasonic cleaner.

20. Instruments with a _____ finish are less resistant to discoloration and spotting caused by cleaning.

21. After instruments are cleaned, they should be rinsed thoroughly with _____ water and allowed to completely dry prior to autoclaving to prevent _____ formation.

22. _____ and _____ heat are the two general types of heat sterilization.

23. The two primary methods of sterilization used by manufacturers for packaging and the production of certain surgical supplies are _____ and _____.

24. Downward displacement or _____ displacement sterilizers use steam introduced into the top of the autoclave chamber to push air to the bottom.

25. Rapid and even penetration of steam by use of a _____ sterilizer is achieved by a vacuum pump that evacuates air before steam is allowed to enter the chamber.

26. Ethylene oxide and _____ _____ are the two most commonly used agents for gas sterilization.

27. Ethylene oxide sterilization is slowly being overtaken by _____ _____ sterilization because it is safer for personnel and the environment.

28. _____ indicators are used to test to evaluate exposure to saturated steam for an adequate period of time, whereas _____ indicators are used to test for sterility.

29. The quaternary ammonium compound most commonly used as a disinfectant is _____ chloride.

30. The two most commonly used aldehydes in veterinary medicine are _____ and _____.

31. The _____ skin preparation is performed in the patient preparation room to remove gross contamination.

32. _____ recumbency means the animal is placed on its back.

33. _____ recumbency means the animal is laying on either the right or left side of the body.

34. _____ recumbency means the animal is lying on its belly.

35. The two methods for donning surgical gloves are _____ gloving and _____ gloving.

EXERCISE 30.9 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 30.10 CASE STUDY: INSTRUMENT CLEANING AND PACKING

Signalment: Mary, a 1-year-old, female, domestic short hair tabby.

Chief complaint: Mary is being admitted to the hospital for a routine spay.

Minimum database: Mary's database is normal including physical examination findings, and basic lab work. There is no history of previous medical problems.

Disposition of the case: Mary's surgery went well with no complications. Now you are responsible for cleaning, maintaining, repacking, and sterilizing the instruments used for this case. Your goals are to ensure efficient operation of the surgery suite, prevent instrument damage, and, ultimately, to prepare the instruments in such a way that makes them safe for use on the next surgical case.

Please answer the following questions related to this case.

1. What should be done with the instruments immediately after the surgery to prevent instrument corrosion?

2. Explain how you will clean the instruments, listing each step in the proper order. Include information regarding both hand cleaning and ultrasonic cleaning, including the agents and equipment used.

3. How will you rinse, dry, and lubricate the instruments?

4. Instruments should always be inspected before repacking them. During this inspection what will you look for?

5. What are the principles of packing the instruments in preparation for sterilization? What instruments would be in a typical pack?

6. Explain the principles of using an autoclave to sterilize the pack, including preparation, loading the autoclave, maintenance, and ensuring safety.

EXERCISE 30.11 WORD SEARCH: TERMS

Find the words listed below. The words may be located horizontally, vertically, or diagonally, and may be reversed.

G E S T E I N M A N N P I N U H A D A O A S
R B A A N I A O A R T H R O S C O P E L I Y
H S R N I O S O E L E C L Q L E N T C A C E
E B N Q D P S S R O N G E U R S H O L P D L
L R O R I O L T E R S D E A I Y H O E A C N
E D R N X P R P E O P G H T L O H H E R S T
E I O P E R I O S T E A L E L E V A T O R B
R S E G H C Q G E A C N N R T T Y C S S E L
O I O C R C U L S N R E L N S D A G S C I I
R N L C O O A T R U O F L A B T L E S O R P
R F L N L D I I T X F I T R A U I T E P H C
N E I I H I U I I I G O T Y T A L Y L E O L
S C R A C U I D F O N A V A S O P I N A C D
N T D F E I E I I N I G R M L O R O I C A S
A A R R L I H C E A D A F M O U L E A C E Y
G N I N I A T E R F L E S O O S G A T O P O
E T A S R O H P O D O I G N R G S N S R P H
Y L L O I I O T E T H R F I I C A E A D O A
A R L E T I H H F O E O O U R A E O N I E F
E N A T R N Y O L F N O E M P U R P S O R S
L C H H N D E T I R O L H C O P Y H S N O T
L E O N E L L Y N O B S R U D H I D P P C B

Selfretaining
Phenols
Balfour
Hypochlorite
Periostealelevator
Alcohol
Bonecuttingforceps
Quaternaryammonium
Boneholdingforceps
Hallairdrill
Steinmannpin
Arthroscope
Triangulation
Rongeurs
Laparoscope
Stainlesssteel
Accordion
Glutaraldehyde
Ethyleneoxide
Disinfectant
Iodophors
Chlorhexidine

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EXERCISE 30.9 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. What is the primary advantage associated with the use of electrocautery technology?

_____

2a. Why is it important for the patient's skin to make contact with the ground plate during unipolar electrocautery procedures?

_____

2b. Name two methods that will create adequate contact between the ground plate and patient.

i. _____

ii. _____

3. What is bipolar cautery most commonly used for?

_____

4. What does the acronym LASER stand for?

_____

5. Explain the difference between light emitted by a laser as compared with the light emitted from a flashlight.

_____

_____

6. List four possible outcomes that can arise from laser–tissue interaction.

i. _____

ii. _____

iii. _____

iv. _____

7. What are the four thermal effects of a laser?

i. _____

ii. _____

iii. _____

iv. _____

8. How many joules of energy will be applied to the tissue if the laser unit is set at 10 watts for 4 seconds?

_____ joules

9. Explain why laser units are manufactured with a helium-neon guide light.

10. List the two types of lasers that transmit the beam through a quartz fiber.

    i. _____

    ii. _____

11. Lasers are grouped into four classes (I, II, III, and IV). What property of lasers is this classification system based on?

12. How can plume generated from a laser during tissue application be controlled?

13. Why should sterile saline always be readily available for the surgeon during surgical procedures involving the use of a laser?

14. List and briefly explain all the important safety measures that must be observed to ensure the safety of personnel and patients when using lasers.

15. Surgical staples are being used more in recent years in place of sutures. What are the primary advantages of using surgical staples?

16. What characteristics are used to classify operating scissors?

17. What is the primary difference between Olsen-Hegar and Mayo-Hegar needle holders?

18. Why do different types of tissue forceps vary in jaw tooth patterns?

19. What characteristics are used to classify hemostatic forceps?

20. What are Rochester-Carmalt hemostatic forceps most commonly used for?

21. How do single-action and double-action rongeurs differ from one another?

22. How are curettes utilized during arthroscopic procedures?

23a. What are osteotomes and chisels used for?

23b. What is the difference between osteotomes and chisels in terms of their design?

23c. How are osteotomes and chisels used?

24. What characteristics are used to classify bone plates?

25. List and explain the benefits associated with the use of a video camera in conjunction with arthroscopic procedures.

26. What are some of the common procedures performed with arthroscopic surgery?

27. What are intraarticular electrosurgical cutting and coagulation devices used for?

28. What are some of the common uses for laparoscopes?

29. Summarize the primary differences between the instruments and supplies included in large-animal general instrument packs and those included in small-animal general instrument packs.

30a. Why should the use of tap water be avoided when cleaning surgical instruments?

30b. Why should surgical instruments be air dried instead of wiped dry?

31. What is the most commonly used method of moist heat sterilization?

32. What is "accordion folding" and why is it used to fold surgical drapes?

33. List the four types of sterilization indicators used in autoclaves.

i.

ii.

iii.

iv.

34. What can be done to enhance the activity of ethylene oxide gas?

35. Which type of sterilization indicator is commonly used to evaluate sterilization systems and why?

36. What general types of microorganisms are killed by chlorhexidine?

37. Why should alcohols never be used in open wounds?

38a. What are the two most commonly used aldehyde disinfectants in the veterinary field?

i.

ii.

38b. What is the primary use for each?

i. _____

ii. _____

39. In what way do surgical masks protect the surgical field?

_____

_____

40. Describe the attire of operating room personnel.

_____

41. What is the primary purpose for using sterile drapes during surgical procedures?

_____

42. Explain what the term *strike-through* means as it pertains to aseptic technique.

_____

31 Surgical Assistance and Suture Material

LEARNING OBJECTIVES

When you have completed this chapter, you will be able to:

1. Pronounce, define, and spell all Key Terms in this chapter.
2. Describe the role of the veterinary technician in surgical assistance for large- and small-animal patients.
3. Explain preoperative preparation, including preoperative preparation of the surgical patient, clipping, and surgical scrub techniques. Discuss considerations for operating room sterility and instrument table organization.
4. Discuss the following intraoperative techniques of the surgical assistant: surgical lighting, instruments, hemostasis, suture cutting, lavage and suction, camera manipulation, tissue manipulation, retraction, and organ positioning.
5. Describe the most common permanent and temporary forms of surgical implants and their uses.
6. Describe the role of the surgical assistant in the postoperative management of patients.
7. Discuss the considerations involved in choosing a type of suture material, and list and describe commonly used suture materials, needles, and their application.
8. Discuss the differences of surgical assisting in equine patients, including draping techniques, instrument set up, tissue handling, and suture materials used in horses.

EXERCISE 31.1 MATCHING #1: TERMS AND DEFINITIONS

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ Fenestrated	A. Does not allow water to penetrate.
2. _____ Impervious	B. Surgical incision into the abdominal cavity.
3. _____ Ingesta	C. Term referring to an internal organ.
4. _____ Laparotomy	D. Relating to surgery on the skeleton.
5. _____ Orthopedic	E. Having a window or one created in a surgical drape.
6. _____ Swaged	F. "Squeezed on" as with a suture needle onto suture.
7. _____ Viscus	G. Food material in the intestinal tract.

EXERCISE 31.2 MATCHING #2: CHARACTERISTICS OF SUTURE MATERIAL

Instructions: Match each characteristic of suture material in column A with its corresponding classification in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ Passes more easily through tissue.	A. Monofilament
2. _____ Better knot security.	B. Multifilament
3. _____ Greater capillary action.	
4. _____ More susceptible to bacterial colonization.	
5. _____ Made of a single strand.	

EXERCISE 31.3 MATCHING #3: TRADE AND GENERIC NAMES OF SUTURE MATERIAL

Instructions: Match each trade name in column A with its corresponding generic name in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ Vicryl™	A. Polydioxanone
2. _____ Dexon™	B. Polybutester
3. _____ Monocryl™	C. Polyglyconate
4. _____ PDS®	D. Polyglactin 910
5. _____ Maxon™	E. Polypropylene
6. _____ Nylon	F. Polyester
7. _____ Prolene®	G. Poliglecaprone 25
8. _____ Novafil®	H. Polyamide
9. _____ Mersilene®	I. Polyglycolic acid

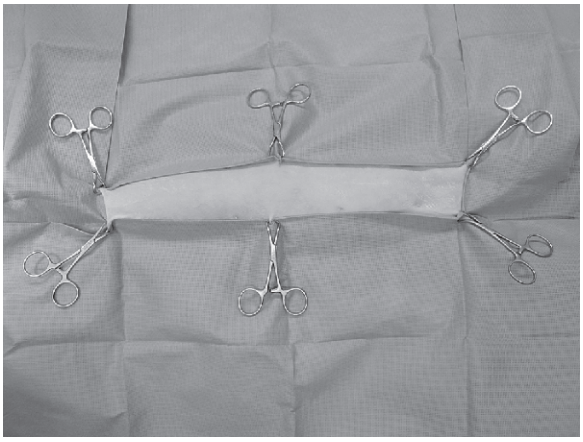
EXERCISE 31.4 MATCHING #4: CLASSIFICATION OF SUTURE MATERIAL

Instructions: Match each suture material in column A with its corresponding classification in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A	Column B
1. _____ Polyglyconate	A. Monofilament, absorbable
2. _____ Stainless steel	B. Monofilament, nonabsorbable
3. _____ Polybutester	C. Multifilament, absorbable
4. _____ Silk	D. Multifilament, nonabsorbable
5. _____ Polypropylene	E. Monofilament or multifilament, absorbable
6. _____ Polydioxanone	F. Monofilament or multifilament, nonabsorbable
7. _____ Polyglycolic acid	
8. _____ Poliglecaprone 25	
9. _____ Polyglactin 910	
10. _____ Polyamide	
11. _____ Polyester	

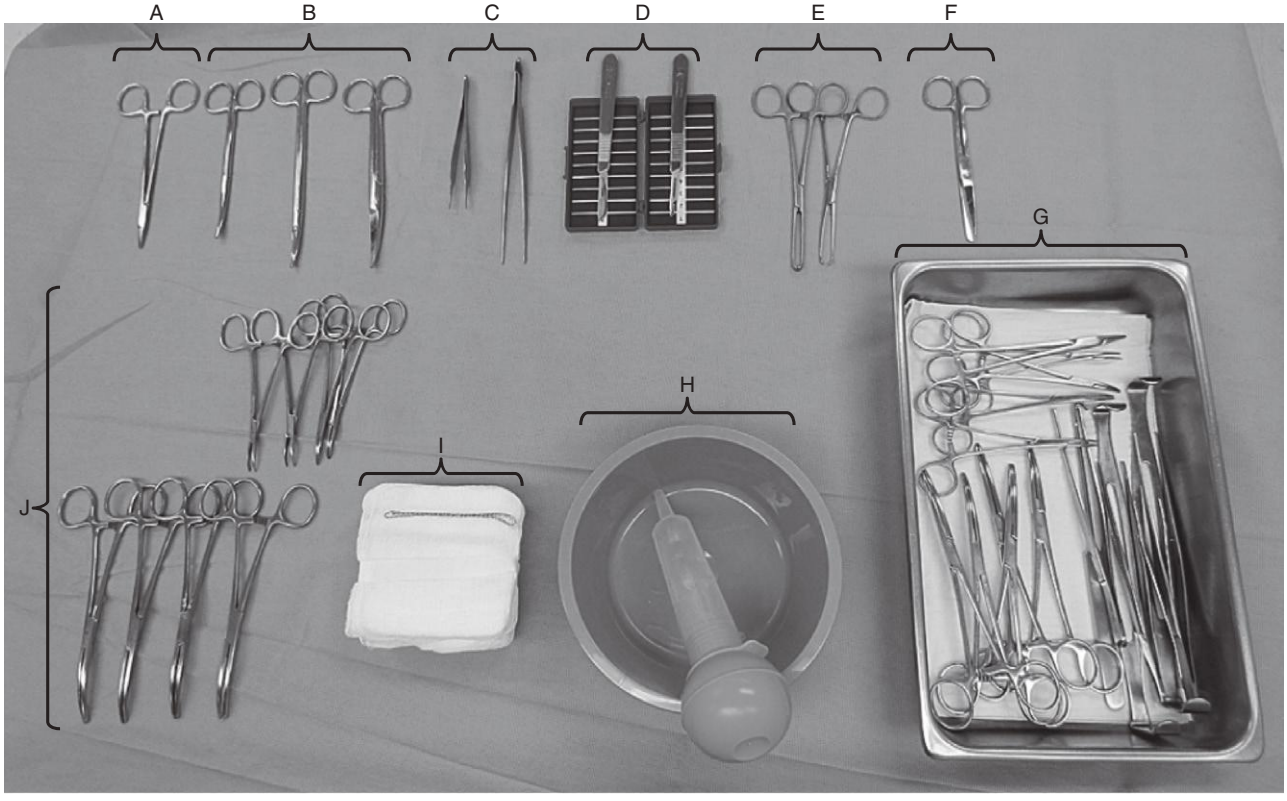
EXERCISE 31.5 PHOTO QUIZ: SURGICAL ASSISTANCE

Instructions: Respond to the queries associated with each photo in the spaces provided.



1. Identify the instruments in this image.

2. What are the principles that must be followed when placing these clamps?



1. Examine this sterile field, identify the labeled instruments and supplies according to general type, and describe the primary purpose for each. *(For instance the needle holders on the upper left [A] are used to handle suture needles and material while suturing tissue.)*

A. _____

Primary purpose: _____

B. _____

Primary purpose: _____

C. _____

Primary purpose: _____

D. _____

Primary purpose: _____

E. _____

Primary purpose: _____

F. _____

Primary purpose: _____

G. _____

Primary purpose: _____

H. _____

Primary purpose: _____

I. _____

Primary purpose: _____

J. _____

Primary purpose: _____

1a. Identify the type of drain used in this image.

_____

1b. What is the purpose for this drain in this case?

_____

1c. Is this drain passive or active? What does this mean regarding the way that it works?

_____

_____

1d. What are some of the principles of caring for this drain?

_____

_____

EXERCISE 31.6 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ The main purpose for drapes is to cover the hair, which is not sterile.
2. _____ Once a towel clamp is removed from the patient, it is considered contaminated and must be removed from the surgery site and instrument table.
3. _____ Sterile stockinettes can be used as an additional drape material to allow the surgeon and surgical assistant to maneuver a leg without continually touching the skin.
4. _____ When a surgery is performed on an extremity, it is often desirable for the limb to be prepped using the hanging-limb technique.
5. _____ Oral surgeries are considered sterile procedures.
6. _____ Between uses, instruments should be placed back on the surgical table in the same location from which they came in order to have them readily accessible for both surgeon and surgical assistant.
7. _____ The handles used to adjust operating room lights should be placed before the patient is draped.
8. _____ Utilizing a surgical assistant to pass instruments is convenient for the surgeon, but increases surgery time.
9. _____ Any portion of the scissors may be used for cutting suture as long as you are not in the surgeon's way.
10. _____ Bipolar (as opposed to unipolar) electrocautery is used when extreme precision is necessary.
11. _____ Iso-osmotic fluids are used for lavage of wounds and surgical sites.
12. _____ Once prepped, the skin is considered sterile.
13. _____ The urinary bladder is located in the cranial part of the abdomen.
14. _____ USP 2-0 suture is smaller in diameter than USP 2 suture.
15. _____ Suture with high memory holds knots better than suture with low memory.
16. _____ Suture material classified as absorbable loses the majority of its breaking strength in 21 days.

17. _____ Catgut absorbs in an unpredictable fashion.

18. _____ Polypropylene suture has the greatest tensile strength of any of the nonabsorbable sutures.

19. _____ Swaged needles are more traumatic to tissue.

20. _____ A taper-point needle would be the most appropriate choice for subcutaneous tissue.

21. _____ Formation of a watertight seal is an advantage of continuous suture patterns.

22. _____ The surgical nurse is vital to decreasing surgery and anesthesia time in the large-animal patient.

23. _____ Irrigation during bone drilling is helpful in removing debris, but is not required.

24. _____ Self-retaining retractors are critical to adequate organ exposure in equine abdominal surgery.

25. _____ Gauze sponges are an essential tool for providing hemostasis in both large- and small-animal patients.

EXERCISE 31.7 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1.When placing quarter drapes, the drape should be placed
   a. A few cm from the incision, and pulled closer to the incision if needed to adjust it
   b. A few cm from the incision, and pulled further away from the incision if needed to adjust it
   c. Five to 10 cm from the incision, and pulled closer to the incision if needed to adjust it
   d. Five to 10 cm from the incision, and pulled further away from the incision if needed to adjust it

2. If a surgical glove becomes contaminated during surgery, it should be
   a. Removed and replaced
   b. Covered
   c. Flushed with sterile saline
   d. Wiped clean

3. Quarter drapes are held in place by
   a. Allis tissue forceps
   b. Babcock forceps
   c. Rochester forceps
   d. Backhaus towel clamps

4. When preparing for an abdominal exploration, the patient should be placed in
   a. Right lateral recumbency
   b. Dorsal recumbency
   c. Sternal recumbency
   d. Left lateral recumbency

5. The proper patient position for a right lateral intercostal thoracotomy is
   a. Dorsal recumbency
   b. Left lateral recumbency
   c. Right lateral recumbency
   d. Sternal recumbency

6. A break in aseptic technique is most likely to occur
   a. As the patient is being prepped
   b. Interoperatively
   c. As the patient is being draped
   d. During suturing and as the drapes are being removed

7. Surgical instruments that are most commonly used should be placed in a location that the surgeon can easily access. These instruments most commonly include
   a. Retractors, scalpel, and hemostats
   b. Hemostats, needle holders, and retractors
   c. Scalpel, tissue forceps, and scissors
   d. Scissors, needle holders, and thumb forceps

8. The portions of the surgery gown that are considered sterile are
   a. Front from waist to shoulders
   b. Front and sides from waist to shoulders
   c. Front and sides from mid-chest to waist
   d. Front from midchest to waist

9. Scalpel blades are placed on the scalpel handle using
   a. Halstead mosquito forceps
   b. Allis tissue forceps
   c. Your fingers
   d. A needle holder

10. The suction tip that is best for suctioning large volumes of fluid out of body cavities is called the
   a. Yankauer tip
   b. Hohmann tip
   c. Poole tip
   d. Frazier tip

11. Which organ can be lifted out of the abdomen during an exploratory laparotomy, because it is very mobile?
    a. Liver
    b. Spleen
    c. Kidney
    d. Stomach

12. A dog's left kidney can be best viewed by retracting the
    a. Duodenum ventrally and to the left
    b. Descending colon and spleen to the right
    c. Ascending colon to ventrally and caudally
    d. Spleen cranially

13. Which retractors are the most appropriate choice to retract lungs when performing a thoracotomy?
    a. Gelpi
    b. Army-Navy
    c. Malleable
    d. Senn

14. Which of the following tissues heals more slowly and therefore requires the use of nonabsorbable suture?
    a. Tendon
    b. Stomach
    c. Bladder
    d. Uterus

15. Which of the following sutures is available with an antibacterial coating?
    a. Silk
    b. Polydioxanone
    c. Catgut
    d. Polyglactin 910

16. Which suture has the best handling characteristics, but stimulates inflammation?
    a. Catgut
    b. Polyglycolic acid
    c. Silk
    d. Polydioxanone

17. The most commonly used curved needles are
    a. 1/4-circle and 5/8-circle
    b. 3/8-circle and 1/2-circle
    c. 5/8-circle and 1/2-circle
    d. 3/8-circle and 1/4-circle

18. A cutting needle would be the most appropriate choice for
    a. Skin
    b. Intestine
    c. Fascia
    d. Bladder wall

19. The suture needle point recommended for suturing an organ like liver and kidney.
    a. Cutting
    b. Reverse cutting
    c. Taper
    d. Blunt

20. Closure of the equine abdominal wall usually requires
    a. USP 4-0 or 5-0 suture
    b. USP 2-0 or 3-0 suture
    c. USP 0 or 1 suture
    d. USP 2 or 3 suture

EXERCISE 31.8 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 31.9 CASE STUDY: SUTURE NEEDLES

You are working at a busy multiple-doctor practice as the head surgery technician. A new veterinary assistant has come to talk to you because she is confused about the different suture needles. The doctor asked her to get one earlier in the day, and she had no idea what to do. She asks you to give her some information about needles so she will have a better understanding of them and can get the proper one when asked. Explain the structure and function of suture needles, including the general shapes they come in, the different types of points, and the methods of suture attachment. In each case, discuss the circumstances under which each type is used.

a. Shapes: _____

_____

_____

b. Needle points:

c. Suture attachment:

EXERCISE 31.8 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. How do the duties of the operating room technician and the surgical assistant differ?

2. List the three stages of the perioperative period that the surgical assistant should be proficient in.

   i. _____

   ii. _____

   iii. _____

3. When positioning a surgery patient, why must an electrocautery plate be in direct contact with the patient at all times?

4. What factors should be considered when determining patient position?

5. Describe two ways a surgical patient's position can be maintained.

   i. _____

   ii. _____

6. Describe the purpose of a perineal stand and how to properly position a patient in one.

7a. Which operating room personnel are responsible for maintaining sterility of all the people in the surgery room?

7b. Which operating room personnel are responsible for maintaining sterility of gowns, gloves, drapes, and the instruments?

8. Describe what a "pick sheet" is used for in the surgery area.

9. When an instrument is contaminated with tumor cells, the instrument should be removed from the instrument table or placed on an isolated region of the instrument table that will not be accessed again. Why is this the case?

10. Explain the rationale for counting surgical sponges and gauze at the beginning and end of a surgical procedure.

11. List several examples of surgical equipment that requires tubes and/or cords that must be secured to the drape or table to avoid contamination.

12a. Describe two ways to achieve hemostasis during surgery.

i. _____

ii. _____

12b. When using gauze to provide hemostasis, why is it important to use a blotting motion as opposed to a wiping motion?

13. Bone wax and gelatin foams are two agents used to control intraoperative bleeding. What is the difference between the way these agents work?

14. Explain why the pancreas should have minimum handling during an exploratory laparotomy.

15. Why should the surgeon's or surgical assistant's gloves be wet when touching intestine?

16. What are stay sutures and how are they used?

17. Explain the difference between permanent and temporary surgical implants, and give at least one example of each.

18. Explain the difference between passive and active drains.

19. Penrose drains must exit the body from a dependent location. What does this mean, and why is it important?

20. Briefly describe how a blood collection tube can be used to make an active drain.

21. What are some of the tasks that a surgical assistant may be asked to perform in the immediate postoperative period?

22. Describe the purpose of suture.

23. Briefly explain the system used to designate suture sizes.

24. Describe factors that can weaken a suture.

25. Define suture "memory."

26. List the three basic systems used to classify a suture.

    i. _____

    ii. _____

    iii. _____

27. Explain how draping a horse for abdominal surgery is different from draping a small-animal patient for abdominal surgery.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

28. Review ways in which hollow organ surgery in a horse is different from hollow organ surgery in a small animal.

_____

_____

_____

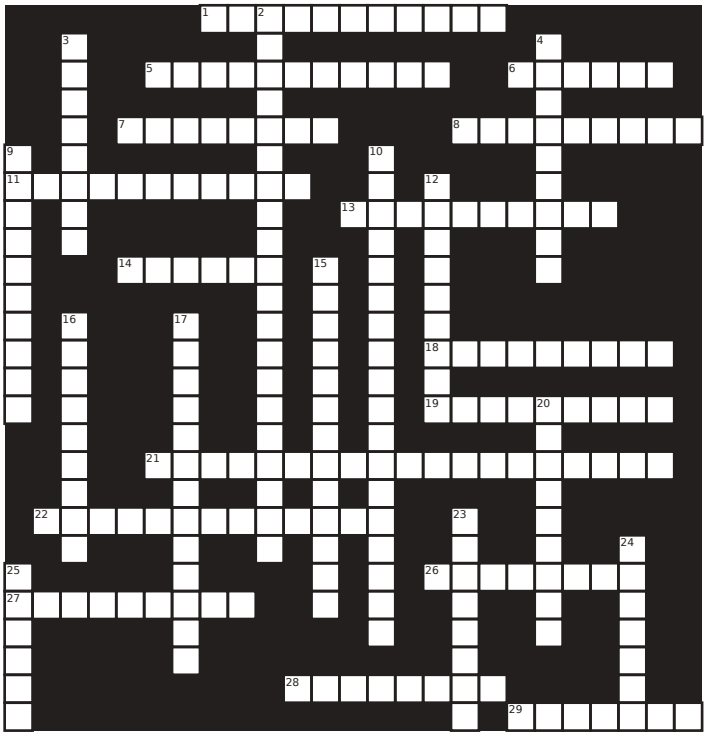
_____

32 Small Animal Surgical Nursing

LEARNING OBJECTIVES

1. Pronounce, spell, and define all Key Terms in the chapter.
2. Do the following regarding surgical preparation and animal positioning:
   - Describe the preoperative, intraoperative, and postoperative responsibilities of the veterinary technician in surgical assistance.
   - Describe indications and use of prophylactic antibiotics for surgical patients.
   - Describe signs of blood loss in the postoperative patient.
   - Discuss concerns related to hypothermia in anesthetized patients and describe methods for increasing patient body temperature intraoperatively and postoperatively.
   - Describe postoperative abnormalities that can occur in surgical incisions, the procedure for removal of skin sutures, and general considerations for care of bandages and drains.
   - Discuss the proper use of animal restraint with regard to surgical technique, and patient safety and comfort.
3. Differentiate between elective and non-elective surgery.
4. List and describe indications and preoperative, intraoperative, and postoperative considerations for the following procedures in dogs and cats: tail docking and dewclaw removal in puppies and adults, feline onychectomy, and celiotomy.
5. List and describe indications and preoperative, intraoperative, and postoperative considerations for the following procedures in dogs and cats: gastrointestinal surgery, gastric dilatation-volvulus, ovariohysterectomy, and pyometra.
6. List and describe indications and preoperative, intraoperative, and postoperative considerations for the following procedures in dogs and cats: canine and feline castration, cesarean delivery, cystomy, and urethrostomy.
7. List and describe indications and preoperative, intraoperative, and postoperative considerations for the following procedures in dogs and cats: hernia repair, lumpectomy, removal of mammary neoplasia, amputation, neurologic patient care, and orthopedic surgery.
8. List considerations related to client education for discharged surgical patients.

EXERCISE 32.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

1 The term used to describe low blood pressure.
5 Male cats with urologic syndrome may experience urethral _____.
6 A dog should be placed in _____ recumbency for a simple orchidectomy procedure.
7 The name of the hernia found more commonly in female dogs.
8 A common symptom of cats with urologic syndrome.
11 A specific type of collar used to prevent animals from licking and/or chewing at an affected area.
13 A term that means surgical removal of the testicles.
14 The term cesarean delivery was derived from the name of _____, who was thought to be the first person to be born by this surgical technique.
18 A specific type of hernia in which omentum and intraabdominal fat protrudes through a defect in the abdominal wall.
19 A syndrome associated with a loss of stamina in working breeds that is a complication of ovariohysterectomy.
21 A surgical procedure performed in male dogs with penile scar tissue to establish normal urine flow. (2 words)
22 The name of the hernia where a classic visual sign is a "tucked-up" abdomen.
26 Cesarean delivery is usually performed on animals experiencing _____.
27 The most critical anesthetic period for an animal with a diaphragmatic hernia.
28 _____ radiographs should be taken to confirm the diagnosis of a diaphragmatic hernia.
29 During an ovariohysterectomy procedure, before closing the abdominal wall, the _____ stump must be visualized to check for hemorrhage.

Down

2 A surgical procedure performed in male cats that experience urethral obstruction secondary to feline urologic syndrome. (2 words)
3 The removal of the scrotum at the same time as removing the testicles is called scrotal _____.
4 Some animals experiencing urologic syndrome may need lifesaving measures to protect their heart if this electrolyte value is too high.
9 A term used to describe general bleeding.
10 The surgical treatment recommended for an animal with a pyometra.
12 The term used to describe narrowing of the opening of the urethra because of excessive formation of scar tissue.
15 A complication of an umbilical hernia in which there is a loss of intestinal blood supply.
16 A term used to describe bloody urine.
17 A term used for intestinal entrapment.
20 A surgical procedure performed to remove bladder stones.
23 The drug used to increase uterine muscular contractions.
24 An alternative name for bladder stones.
25 The medical term for an internal organ.

EXERCISE 32.2 DEFINITIONS: KEY TERMS

Instructions: Define each term in your own words.

1. Abdominocentesis: _____

2. Capillary refill time: _____

3. Anastomosis: _____

4. Arthrodesis: _____

5. Enterotomy: _____

6. Onychectomy: _____

7. Strangulation: _____

8. Urethrostomy: _____

EXERCISE 32.3 MATCHING: TERMS AND DEFINITIONS

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ Evisceration	A. The telescoping of one portion of an animal's bowel into another.
2. _____ Gastrotomy	B. The surgical removal of part of a bone.
3. _____ Intussusception	C. The surgical removal of an animal's testicles.
4. _____ Ileus	D. Surgical incision into the abdominal cavity.
5. _____ Osteochondrosis	E. The uncontrolled exposure of abdominal organs through a surgical incision as a result of trauma or dehiscence.
6. _____ Ostectomy	F. Temporary loss of intestinal motility.
7. _____ Celiotomy	G. A surgical incision made into the stomach.
8. _____ Orchidectomy	H. Abnormally thickened portion of the articular cartilage.
9. _____ Dehiscence	I. Separation of the sutured layers of an incision.

EXERCISE 32.4 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ It is acceptable for surgical patients to have access to water prior to surgery.
2. _____ It is best to vaccinate a puppy or kitten the day of surgery rather than before.
3. _____ Prophylactic antibiotics should be given to all animals undergoing surgery.
4. _____ To achieve therapeutic drug levels in a surgical wound, antibiotics should be administered no less than 20 minutes prior to the first incision.
5. _____ It is not unusual for a patient's PCV and TP to drop to 10% as a result of anesthesia and surgery.
6. _____ The size of the surgical incision can affect the patient's body temperature during a surgical procedure.
7. _____ Heat lamps are a safe alternative to heating blankets to maintain adequate body temperature in an anesthetized patient.
8. _____ For small dogs and cats, it is acceptable to use a warm water bath postoperatively to raise their body temperature quickly.
9. _____ During an anesthetic procedure, the combination of an increased heart rate and low blood pressure is a direct indicator of pain, which should be managed by increasing the anesthetic levels.
10. _____ It is best to assess how much pain an animal is in postoperatively prior to administering pain medication.
11. _____ Topical antibiotic ointments can delay the healing process when applied directly to incision sites.
12. _____ Noxious-tasting agents should be placed directly on an incision to prevent licking and chewing.
13. _____ Tail docking is most commonly performed for aesthetic reasons to conform to breed standards.
14. _____ Tail docking should always be performed under anesthesia.
15. _____ Ideally, dew claws should be removed during the first week of the animal's life.
16. _____ The medical term for surgical removal of the claw and the third phalanx associated with it is "onychectomy."
17. _____ Gastric dilation-volvulus is a condition commonly seen in toy dog breeds.
18. _____ Spaying a dog or cat during estrus does not affect the potential risks of the surgical procedure.
19. _____ Remaining ovarian tissue left from a spay procedure may result in recurrent heat cycles and stump pyometra.
20. _____ Animals that have been spayed may have an increase in body weight after the surgery.
21. _____ In preparation for canine castration, the scrotum is normally shaved and draped into the surgical field.
22. _____ Alcohol should not be used when preparing the scrotum for castration in male dogs and cats.
23. _____ Shaving scrotal hairs is an acceptable alternative to plucking scrotal hair when prepping for feline castration.

EXERCISE 32.5 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. The surgical procedure that is most likely to require the veterinary technician to act as a surgical assistant is a(n)
   a. Orthopedic procedure
   b. Hernia repair
   c. Feline ovariohysterectomy
   d. Laceration or abscess repair

2. At what body temperature is it safe to stop using heat sources to warm the patient postoperatively?
   a. 103°F
   b. 102°F
   c. 101°F
   d. 100°F

3. Which of the following procedures would be considered least painful?
   a. Fracture repair
   b. Amputation
   c. Declaw
   d. Mass removal

4. What is the earliest that it is safe to remove sutures after a surgical procedure?
   a. 6 to 8 days
   b. 10 to 14 days
   c. 20 to 24 days
   d. 25 to 30 days

5. Which surgery would be considered a nonelective procedure?
   a. Declaw
   b. Splenectomy
   c. Castration
   d. Ovariohysterectomy

6. What is the ideal age to perform tail docking on puppies?
   a. 2 to 3 days
   b. 3 to 5 days
   c. 6 to 10 days
   d. 10 to 12 days

7. What are three known techniques used for feline claw removal?
   a. Rescoe nail trimmers, #12 scalpel blade, CO_2 laser
   b. Surgical scissors, #15 scalpel blade, CO_2 laser
   c. #12 scalpel blade, surgical scissors, Rescoe nail trimmers
   d. Rescoe nail trimmers, #15 scalpel blade, CO_2 laser

8. Postoperative bandages placed after an onychectomy should be removed how many hours after surgery?
   a. 12 hours
   b. 24 hours
   c. 6 hours
   d. 8 hours

9. What is not a typical early complication of an onychectomy procedure?
   a. Loose bandage
   b. Removal of the bandage by the patient
   c. Skin sloughing
   d. Hemorrhage

10. What is the proper name for surgical incision into the abdominal cavity?
    a. Celiotomy
    b. Gastrotomy
    c. Pyometra
    d. Orchidectomy

11. The most common approach to the abdominal cavity is
    a. Ventral midline
    b. Paramedian
    c. Paracostal
    d. Flank

12. What is the standard clipping for ventral midline celiotomy surgery?
    a. 2 cm cranial to xiphoid to 2 cm caudal to pubis, and to the nipples laterally
    b. 2 cm cranial to the umbilicus to 2 cm caudal to pubis, and 2 to 4 cm lateral to the nipples
    c. 2 cm cranial to xiphoid to 2 cm caudal to pubis, and 2 to 4 cm lateral to nipples
    d. 2 cm cranial to umbilicus to 2 cm caudal to pubis, and to the nipples laterally

13. What is the proper term used to describe an incision that is made into the stomach?
    a. Enterotomy
    b. Cystotomy
    c. Perineal urethrostomy
    d. Gastrotomy

14. What color should a normal gastrointestinal track be when viewed in an open abdominal surgery?
    a. Pale tan
    b. Brown
    c. Gray
    d. Pink

15. Devitalized intestinal track can be recognized by
    a. Bleeding of the cut surface
    b. Decreased motility
    c. Red discoloration
    d. Lack of fluorescein dye uptake

16. Which of the following is not a classic clinical sign of gastric dilation-volvulus?
    a. Vomiting
    b. Retching
    c. Increased appetite
    d. Distention of stomach

17. Which radiographic view of the abdomen is most beneficial when evaluating stomach rotation or bloat on a dog?
    a. Left lateral
    b. Right lateral
    c. VD
    d. DV

18. Which of the following is not a good indication for castrating a dog or cat?
    a. Decreasing population growth
    b. Treatment of perineal hernias
    c. Elimination and/or correction of aggression
    d. Prevention of reproductive system tumors

19. Which of the following is removed during a spay?
    a. Broad ligament and the ovaries
    b. Ovaries and uterus
    c. Suspensory ligament and uterine horn
    d. Oviducts and ovaries

20. A spay hook is a surgical instrument that is specifically used to
    a. Exteriorize the uterine horns
    b. Elevate the ovaries to the level of the incision
    c. Immobilize the uterine vessels
    d. Ligate the uterine body

21. When performing a spay after parturition, it should be done when the puppies or kittens are weaned and lactation ceases, or approximately
    a. 2 to 4 weeks later
    b. 4 to 6 weeks later
    c. 6 to 8 weeks later
    d. 8 to 10 weeks later

22. A condition of the uterus involving endometrial hyperplasia, increased uterine secretions, and accumulation of fluid in the uterus with secondary infection is known as
    a. Pyometra
    b. Uterine prolapse
    c. Mucometra
    d. Hydrometra

23. Which is not a major indication for feline castration?
    a. Prevent fighting
    b. Decrease urine odor
    c. Prevent roaming
    d. Decrease vocalization

24. What is the most common indication for cystotomy in small animals?
    a. Remove tumors
    b. Correct congenital defects
    c. Remove cystic calculi
    d. Repair traumatic rupture in bladder

25. The name for a hernia in which abdominal contents protrude into the thoracic cavity.
    a. Umbilical hernia
    b. Diaphragmatic hernia
    c. Inguinal hernia
    d. Abdominal hernia

26. Approximately what percentage of mammary tumors in cats are malignant?
    a. 10% to 15%
    b. 25% to 50%
    c. 50% to 60%
    d. 80% to 90%

27. The most common neurologic disorder involving the spine in dogs is
    a. Atlantoaxial subluxation
    b. Spinal trauma
    c. Lumbosacral stenosis
    d. Spontaneous intervertebral disk rupture

28. What are the first three steps that should always be performed when encountering an animal with a long-bone fracture?
    a. (1) Stabilize the animal, (2) check for open wounds associated with the fracture, (3) immobilize the fracture.
    b. (1) Administer pain medication, (2) assess the fracture, (3) immobilize the fracture.
    c. (1) Anesthetize the animal for emergency surgery, (2) administer pain medication, (3) immobilize the fracture.
    d. (1) Manipulate the bones back into place, (2) administer pain medication, (3) immobilize the fracture.

29. After long bone or joint surgery, what level of activity is most appropriate for optimal recovery?
    a. Leash walking
    b. Playing with other dogs
    c. Cage confinement
    d. Off-leash activities

EXERCISE 32.6 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. Evisceration is the uncontrolled exposure of organs through a surgical incision because of _____ of the wound.

2. Ileus is the term used to describe temporary loss of _____ motility.

3. _____ is an infection along tissue planes.

4. The _____ _____ _____ is the required time it takes for blood to refill small capillary beds of mucus membranes after digital blanching has occurred.

5. _____ is the term used to describe accumulation of blood serum beneath an incision site after surgery.

6. Onychectomy is the removal of the claw and the associated _____ phalanx.

7. Celiotomy (laparotomy) is a surgical incision into the _____ cavity.

8. Vomiting, retching, and severe distention of the stomach are classic signs of _____ _____.

9. Animals suffering from GVD are usually in _____ and if left untreated, the animal will die as a result of cardiovascular collapse.

10. A gastropexy is performed on the _____ ventrolateral aspect of the body wall near the last rib.

11. The primary indication for ovariohysterectomy is the prevention of _____ and subsequent production of unwanted puppies and kittens.

12. Ovariohysterectomy performed before the animal's first estrus cycle will greatly decrease the risk of _____ neoplasia in dogs.

13. Another name for false pregnancy is _____.

14. There is not an optimal age for canine castration, but it is often performed around _____ months of age.

15. _____ is the term used to describe a bacterial infection in the uterus with purulent fluid accumulation.

16. The accumulation of sterile fluid within the uterus causing a mild to moderate distention, is known as _____ or _____.

17. In addition to preventing unwanted pregnancies, major indications for feline castration are to decrease urine odor, and to prevent fighting, roaming, and _____ _____.

18. _____ delivery is when an incision is made into the abdominal cavity, then into the uterus to deliver a neonate.

19. Cesarean delivery is usually performed on animals that are experiencing _____.

20. _____ is the incision into the urinary bladder to expose the interior contents or lumen of the urinary bladder.

21. Perineal urethrostomy in male cats is often recommended to manage multiple episodes of _____ associated with feline urologic syndrome.

EXERCISE 32.7 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 32.8 CASE STUDY #1: DELIVERY OF PUPPIES BY CESAREAN SECTION

A 3-year-old, pregnant, female, Mastiff is scheduled for a planned cesarean section tomorrow at the practice where you were recently hired. You are going to be a part of a small team that will receive and care for the newborn puppies. Wanting to provide competent care, you study your notes the night before to be sure you are prepared to assist. Also, because time is of the essence when reviving puppies delivered by cesarean, you want to prepare the necessary equipment well beforehand.

1. Besides the equipment necessary to clamp and tie off the umbilical cords, what other equipment would you prepare?

2. What exactly will you do when you are handed the first neonate?

EXERCISE 32.9 CASE STUDY #2: MONITORING FOR POSTOPERATIVE BLEEDING

You have just completed an ovariohysterectomy on a 1-year-old, female, bearded Collie mix named Mandy. This patient was in heat at the time of the surgery and there was more bleeding than usual during the procedure. Although the surgery went well, the doctor has asked you to monitor this patient for intraabdominal hemorrhage postoperatively. Answer the following questions regarding management of this case.

1. What changes in this patient's vital signs and general physical findings would alert you that this serious postoperative complication was occurring?

2. What general diagnostic tests could be done to help determine if intraabdominal bleeding was occurring?

3. If signs of hemorrhage were observed, what general types of treatment strategies may be used for Mandy?

4. Mandy recovered uneventfully and was ready for discharge the following day. Discuss in detail the appearance of a normal incision postoperatively between the time of surgery and suture removal. Then discuss the signs that an incision is not healing normally.

   a. Appearance of a normal incision postoperatively:

b. Signs that an incision is not healing normally:

5. When Mandy's incision is healed the sutures or staples will need to be removed.

a. Typically, how many days after surgery are sutures or staples removed?

b. Describe the procedure that will be used to remove her sutures or staples.

EXERCISE 32.10 WORD SEARCH: TERMS

Find the words listed below. The words may be located horizontally, vertically, or diagonally, and may be reversed.

A E O E U Y P Z E T E E I R E G R A T U
I S A O T M R L N H V L A A M O R E S L
M E E N R O M D E E U D V N P S A L Y C
E A R C Z T T S O M I E G A S C L I B E
O P L S N C A L P A C I G L H T L S G A
A C T I V E T E L T S E I G A E O S E E
G M E C N R C T A O R N U E U X C E M O
C C T I T T I S S M E O Z S A D N A A O
C Y A N O S I S I A R I M I A T A E E E
Y R A M M A M N A H S T E C I L H E N P
D A Y V S G A L T A E T E S G S T M Y S
A I A A A L B E T U M D M F T M E D M R
R T E S L A K S Q R A A I O Y C B M E V
S G R A T I A I Y X E P O R T S A G R C
M H S I R T N I E O I E Y M L I Z R S I
I I N T E R V E R T E B R A L D I S K O
E L S M U A B G L A A S S L T O L U G I
L N D O Q P A S S I V E O I G V E E I A
A Z T V R E M D A A R S I N T C A B O O
E U L L E A R R D R A A O G O M R R L A

Seroma
GDV
Hematoma
Nose
Dehiscence
Mammary
Drain
Neoplasia
Elizabethancollar
Lumpectomy
Active
Metastasize
Passive
Analgesics
Strikethrough
Intervertebraldisk
Formalin
Tourniquet
Radial
Germinal
Laser
Cyanosis
Ileus
Lineaalba
Gastropexy
Partialgastrectomy

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EXERCISE 32.7 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. Careful postoperative monitoring is required for all surgery patients. In fact, continuous monitoring should be provided until certain criteria are met. What are the criteria that signal that continuous monitoring is no longer needed?

2. What is the primary reason that food must be withheld from a patient before surgery?

3. Use of prophylactic antibiotics

   a. What is meant by the term *prophylactic antibiotics*? For what surgeries should they not be routinely used?

   b. What are the reasons that prophylactic antibiotics should not be given indiscriminately?

   c. Discuss circumstances under which prophylactic antibiotics are recommended.

4. A patient that experiences pain while anesthetized will have certain changes in vital signs that can alert the anesthetist to this fact. What are the changes in vital signs that may occur during anesthesia when a patient is experiencing pain?

5. Bandages are a necessary part of the postoperative wound care associated with some surgeries and require careful monitoring by the veterinary health-care team to prevent a variety of complications ranging from minor to serious.

   a. What are some of the things you might notice that would alert you to a potential complication of bandage placement?

   b. What care is necessary to prevent complications associated with bandage placement?

6. The use of passive or active drains is also necessary for some surgical wounds. Summarize the care required to keep a drain functioning optimally and to prevent complications.

7. What is the difference between elective and nonelective surgical procedures? Give a few examples of each.

8a. How is hemorrhage controlled during a feline onychectomy?

8b. What complication may occur if a tourniquet is placed too tightly?

9a. Animals undergoing intestinal surgery must be monitored postoperatively for intestinal leakage. What are signs of leakage, and why is this so important?

9b. What diagnostic tests can be performed to confirm intestinal leakage?

10. Gastric Dilation-Volvulus

    a. What are some of the factors that predispose a patient to GDV?

    b. When treating a GDV patient for shock, why is it important to place multiple IV catheters in the forelimbs or jugular veins as opposed to a rear limb?

    c. What are some of the postoperative complications of GDV and what are the signs of each?

    d. What long-term dietary management is recommended for these patients?

11. What basic postoperative care and monitoring is required following a cystotomy to remove bladder stones?

12. Patients that have undergone orthopedic surgery often need intensive postoperative care. It is important that they do not place undue stress on the surgery site, but controlled activity is required for recovery.

    a. Discuss the required immediate postoperative care.

    b. Discuss discharge recommendations regarding patient activity.

    c. Rehabilitation is an important part of recovery. Discuss the nature of this rehabilitation.

13. Discharge instructions are necessary to ensure that the patient received the required care at home.

    a. Are discharge instructions the same for all surgeries? If not, how are they determined?

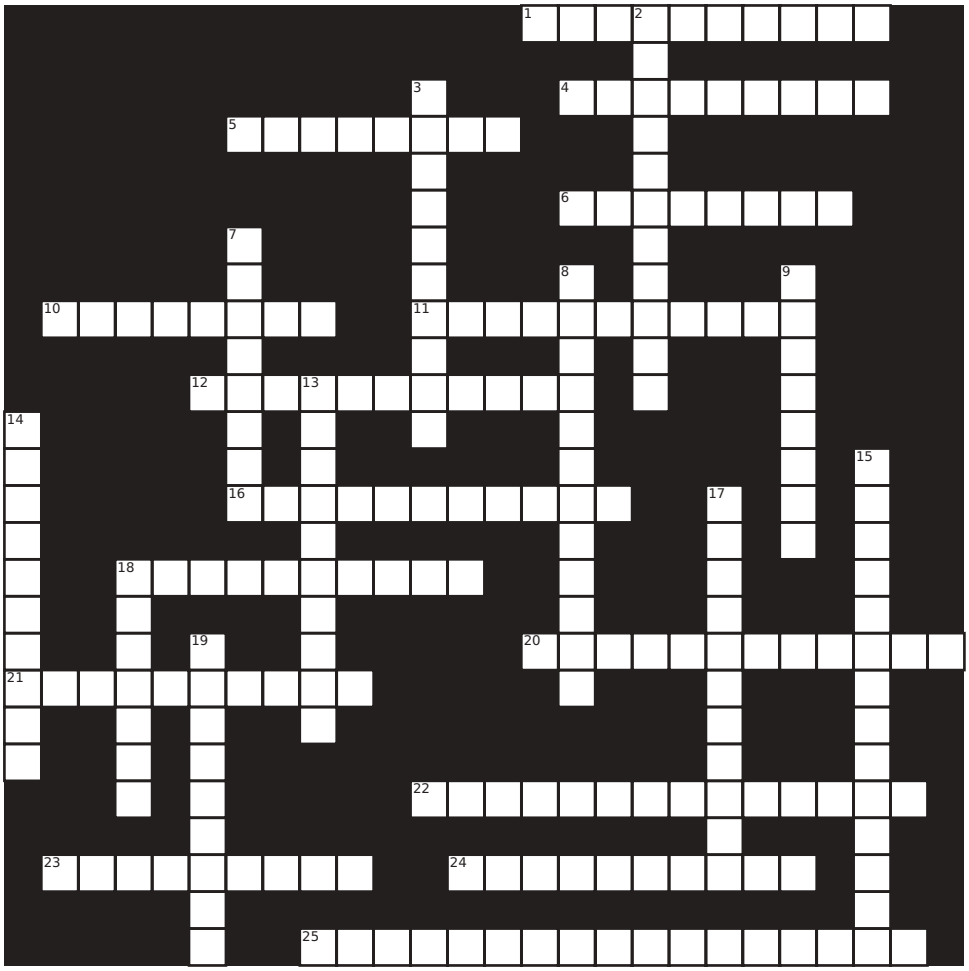
b. Why should a copy of the discharge instructions be placed in the patient's medical record?

33 Large Animal Surgical Nursing

LEARNING OBJECTIVES

1. Pronounce, spell, and define all Key Terms in this chapter.
2. Describe the preoperative preparation needed for equine patients, as well as the responsibilities of the veterinary technician before, during, and after equine surgery, including postoperative monitoring, medication administration, bandage care, and grooming.
3. List surgical procedures commonly performed in equine patients, and describe indications and preoperative, intraoperative, and postoperative considerations for common surgical procedures in equine patients.
4. List surgical procedures commonly performed in bovine patients, and describe indications and preoperative, intraoperative, and postoperative considerations for common surgical procedures in bovine patients.
5. List surgical procedures commonly performed in small ruminants, and describe indications and preoperative, intraoperative, and postoperative considerations for common surgical procedures in small ruminants.

EXERCISE 33.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

1 Disease of nerve tissue.
4 Bloody urine.
5 Process in which a dead foal is cut into pieces while within the uterus and removed.
6 Disease of muscle tissue.
10 Inability to extend the penis from the prepuce.
11 Surgical fixation of the abomasum to the body wall.
12 Frequent urination
16 A surgical connection between parts of the intestine.
18 Surgical fixation of the omentum to the body wall.
20 Arthritis of the equine proximal interphalangeal (pastern) joint. (3 words)
21 Surgical incision into the rumen.
22 The breakdown of striated muscle that leads to excretion of myoglobin in the urine.
23 Inward rolling of the eyelid.
24 Surgical fixation of the pylorus to the body wall.
25 Removal of a cryptorchid testicle.

Down

2 Surgical procedure used for creation of a permanent or semipermanent ruminal fistula.
3 Arthritis of the distal intertarsal and tarsometatarsal joints of the equine hock. (2 words)
7 Difficult birth.
8 Inability to retract the penis into the prepuce.
9 Inflammation of muscle.
13 A transabdominal incision into the peritoneal cavity.
14 Slow/difficult urination.
15 Condition of having an undescended testicle.
17 Arthritis of the equine distal interphalangeal (coffin) joint. (3 words)
18 Arthritis of the equine metacarpophalangeal or metatarsophalangeal (fetlock) joint.
19 Incision through the wall of the vagina.

EXERCISE 33.2 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Especially when there are multiple veterinarians in a hospital, there needs to be an organized system to keep track of instrument preferences and glove sizes used.

2. _____ An Esmarch bandage is wrapped around the limb in a spiral fashion moving from proximal to distal to a point below the surgery site.

3. _____ When performing lower limb surgery in a horse, a tourniquet may be used to assist with hemostasis. To prevent any potentially serious side effects, a tourniquet should be applied for a maximum period of 2 hours.

4. _____ To help prevent myositis during general anesthesia in the equine patient, the down forelimb should be pulled forward to minimize the pressure on the triceps and radial nerve.

5. _____ Shoes are generally removed from an equine patient before surgery to prevent them from falling off and contaminating the surgery site.

6. _____ Postoperative myopathies are painful, whereas postoperative neuropathies are not as painful for the patient.

7. _____ When a bandage is placed on an equine limb, it should be monitored for swelling only below the bandage.

8. _____ Urinary calculi occur frequently in the equine patient.

9. _____ Urinary calculi in the equine patient may develop in the kidney or the urinary bladder.

10. _____ Equine castration requires extensive surgical facilities and specialized equipment.

11. _____ Dystocia is very common in horses when compared with cattle.

12. _____ The best way to repair major fractures of long bones in horses is with screws and bone plates.

13. _____ Treatment of flexural and angular deformities is dependent upon the severity of the deformity.

14. _____ Laminitis, a serious, often life-threatening disease in the horse, is defined as inflammation of the lamina in the spine.

15. _____ Equine upper airway diseases are often diagnosed using endoscopy. Sedation is used to make sure the expensive equipment is not damaged.

16. _____ Left laryngeal hemiplegia results in the paralysis of the left arytenoid cartilage, which prevents it from being adducted during inspiration.

17. _____ After surgical repair of a left arytenoid paralysis, the laryngotomy incision is left open to heal by second intention.

18. _____ Dorsal displacement of the soft palate in the equine patient is usually intermittent, appears during exercise, and dissipates when the horse swallows.

19. _____ The principal function of the veterinary technician in a food-animal practice is to make sure the veterinarian has everything she needs.

20. _____ When placing a jugular catheter in the bovine patient, it is advisable to make a stab incision in the skin to prevent burring of the catheter.

21. _____ Many anesthetic agents used in the bovine patient are used off-label.

22. _____ Drug withdrawal times are not important in the food-animal patient.

23. _____ Padding for the bovine patient undergoing general anesthesia is not as important as for the equine patient.

24. _____ With appropriate wound care, many oral lacerations in the bovine patient will resolve without much treatment because of the flushing effect of the saliva, which prevents food from building up.

25. _____ The majority of flank laparotomies in the bovine patient are performed while the patient is standing, using local anesthetic techniques.

26. _____ The majority of lameness in cattle is caused by foot problems.

27. _____ If a bovine patient has an acute lameness, septic arthritis is a common cause.

28. _____ A caudal epidural provides a loss of sensation to everything caudal to the tuber coxae and udder.

29. _____ After removal of an ovary in the bovine patient, you need to monitor for signs of hemorrhage as this may be a serious post-operative complication.

30. _____ An advantage of performing a C-section in the left flank of the bovine patient is that the abomasum will obstruct other viscera and prevent them from eviscerating through the incision.

31. _____ Uterine prolapse commonly occurs in first-calf heifers and often recurs in subsequent calvings.

EXERCISE 33.3 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. Which animal cannot regurgitate?
   a. Bovine
   b. Porcine
   c. Equine
   d. Caprine

2. What bandage material is used to seal the top and bottom of an equine limb bandage?
   a. White tape
   b. Elastikon
   c. Vet Wrap
   d. Ace bandage

3. Horses are administered NSAIDs postoperatively for which of the following reasons?
   a. Antifungal and analgesic properties
   b. Antibacterial and antiinflammatory properties
   c. Antiemetic and analgesic properties
   d. Antiinflammatory and analgesic properties

4. Equine limb bandage layers are placed in which order?
   a. Nonadherent dressing; sterile roll gauze; sterile soft combine; roll gauze; sheet cotton; roll gauze; Vet Wrap
   b. Sterile soft combine; sterile roll gauze; nonadherent dressing; roll gauze; sheet cotton; roll gauze; Vet Wrap
   c. Nonadherent dressing; sterile roll gauze; sheet cotton; roll gauze; sterile soft combine; Vet Wrap
   d. Nonadherent dressing; roll gauze; sterile soft combine; sterile roll gauze; sheet cotton; Vet Wrap

5. The most common surgical approach to the equine abdominal cavity is through a
   a. Lateral flank incision
   b. Ventral midline incision
   c. Paramedian incision
   d. Paracostal incision

6. Which type of hernia is usually congenital?
   a. Umbilical
   b. Inguinal
   c. Incisional
   d. Hiatal

7. One of the most common intravenous drug combinations used for equine castration is
   a. Xylazine/lidocaine
   b. Lidocaine/ketamine
   c. Xylazine/ketamine
   d. Lidocaine/thiobarbiturate

8. The most common cause of equine ovarian disease necessitating removal of the ovary is
   a. Benign tumors
   b. Neoplasia
   c. Ovarian cysts
   d. Ectopic pregnancy

9. Mares with abnormal conformation can develop
   a. Pneumovagina and vaginal prolapse
   b. Pneumovagina and pneumouterus
   c. Pneumouterus and uterine prolapse
   d. Vaginal prolapse and uterine prolapse

10. Vesicovaginal reflux can lead to
    a. Endometrial inflammation
    b. Vaginal inflammation
    c. Bladder inflammation
    d. Kidney inflammation

11. In a "true" breech in the mare, the foal presents
    a. Forelimbs first, head back
    b. Hind limbs first
    c. Tail first
    d. Head first

12. One of the most expensive pieces of equipment for an arthroscopic surgery is the
    a. Arthroscope
    b. Cannula
    c. Rongeur
    d. Curette

13. Prior to general anesthesia, feed should be withheld from an adult food animal patient for
    a. 6 to 12 hours
    b. 12 to 24 hours
    c. 18 to 36 hours
    d. 36 to 48 hours

14. The NSAID that is licensed for use in the bovine patient is
    a. Flunixin
    b. Phenylbutazone
    c. Rimadyl
    d. Aspirin

15. Which regional analgesic technique involves injection of lidocaine cranial to transverse processes of L1, L2, and L3 in the bovine patient?
    a. Line block
    b. Inverted-L block
    c. Distal paravertebral block
    d. Proximal paravertebral block

16. Which regional analgesic technique involves injection of lidocaine vertically behind the last rib and horizontally below the transverse processes of the lumbar vertebrae?
    a. Line block
    b. Inverted-L block
    c. Distal paravertebral block
    d. Proximal paravertebral block

17. Which regional analgesic technique involves injection of lidocaine directly over the incision?
    a. Line block
    b. Inverted-L block
    c. Distal paravertebral block
    d. Proximal paravertebral block

18. Which regional analgesic technique involves injection of lidocaine parallel to transverse processes of the vertebrae L1, L2, and L4?
    a. Line block
    b. Inverted-L block
    c. Distal paravertebral block
    d. Proximal paravertebral block

19. What bovine disease may lead to peritonitis, liver or reticular abscesses, pericarditis, or vagal indigestion?
    a. Traumatic reticuloperitonitis
    b. Abomasal displacement
    c. Rumenotomy
    d. Abomasal volvulus

20. A rumenotomy is performed by entering the patient's abdomen from an incision made in the
    a. Right flank
    b. Left flank
    c. Ventral midline
    d. Dorsal midline

21. For a patient with traumatic reticuloperitonitis, the surgery is performed by entering the patient's abdomen from an incision made in the
    a. Right flank
    b. Left flank
    c. Ventral midline
    d. Dorsal midline

22. Abomasal displacements are most likely to occur in the first _____ weeks after parturition.
    a. 6
    b. 8
    c. 12
    d. 16

23. In a bovine patient with foot problems, which claws are most likely involved because they are the weight-bearing claws?
    a. Front lateral and hind medial
    b. Front medial and hind medial
    c. Front lateral and hind lateral
    d. Front medial and hind lateral

24. In obstructive urolithiasis, the most common site of obstruction in cattle is the
    a. Tip of the prepuce
    b. Proximal sigmoid flexure
    c. Glans penis
    d. Distal sigmoid flexure

25. The procedure used as a salvage surgery in feedlot steers with obstructive urolithiasis is the
    a. Ischial urethrostomy
    b. Perineal urethrostomy
    c. Ischial urethrectomy
    d. Perineal urethrectomy

26. What specific retention suture is used in cows with vaginal or uterine prolapse?
    a. Buhner
    b. Mattress
    c. Inverted
    d. Everted

27. Cattle with pendulous sheaths, long prepuces, large preputial orifices, and the absence of retractor prepuce muscles are prone to
    a. Obstructive urolithiasis
    b. Preputial prolapse
    c. Paraphimosis
    d. Phimosis

28. The best time to dehorn a calf with a dehorning iron is at an age of
    a. 1 month
    b. 3 months
    c. 6 months
    d. 12 months

29. Which bovine castration method has been linked to the development of tetanus?
    a. Pulling the testicles until cord breaks
    b. Crushing the cord with an emasculotome
    c. Application of an elastrator band
    d. Transecting and breaking the cord

30. Entropion is the most common ocular disease of:
    a. Neonatal calves
    b. Neonatal lambs
    c. Neonatal goats
    d. Neonatal foals

EXERCISE 33.4 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 33.5 CASE STUDY #1: EPIDURAL ANESTHESIA IN A MARE

A 3-year-old mare is presented with breeding problems. Upon examination, the veterinarian diagnoses urine pooling in her cranial vaginal cavity. After discussing the situation with the owner, the veterinarian decides to perform standing surgery on the mare the following day to repair the floor of the vagina, so that potentially she still can be used this breeding season. She informs you that you will be administering the epidural anesthesia on the mare.

1. A veterinary assistant who is new to the practice asks you to explain what supplies you will need, what agent will you use, how you will do the epidural, what area will be numb, and if she needs to be aware of any side effects as she will be holding the mare at the front of the stocks. How would you answer these questions?

    a. Supplies you will need: _____

    _____

    _____

    b. The agent you will use: _____

    _____

c. How you will do the procedure: _____

d. The area that will be affected: _____

e. Side effects: _____

EXERCISE 33.6 CASE STUDY #2: FORELIMB FRACTURE IN A HORSE

Your clinic receives a call that a 4-year-old thoroughbred stallion has injured his right forelimb. You and the DVM jump in the truck and drive to the track to evaluate the horse. Once radiographs are taken and processed, the DVM determines that the patient has a phalangeal fracture of his right forelimb, but can be transported to the clinic for surgical repair. The owner agrees and the DVM instructs you to place a splint on the horse for transport to the clinic.

1. What type of splint will you use for this limb?

2. You then discuss with the owner the safest way to trailer the horse for the ride to the clinic. What do you tell him?

EXERCISE 33.7 CASE STUDY #3: LEFT DISPLACED ABOMASUM (LDA) IN A COW

The clinic veterinarian is out on a farm call and calls to tell you she is sending in a cow she suspects of having an LDA. The "ping" was not as definitive as she would have liked and she wants to be sure of the diagnosis before surgery. She asks you to perform a Liptak test to confirm what she heard. She is sending the cow in for the test, as the farm she is from is all muddy from the recent heavy rain, and she is concerned about contamination. The cow will have surgery if the test confirms the diagnosis. She wants you to call her when you are done with the test so she is aware of the results. If the results are positive, she wants you to get the cow ready for surgery so that she can perform the surgery as soon as she arrives back at the clinic, before completing the rest of her appointments.

1. Explain how to do the Liptak test and what the test will show if the cow does indeed have an LDA.

   a. Liptak test procedure: _____

   b. What the test will show: _____

2. You call the veterinarian to tell her the results of the test and she tells you to go ahead and get the cow ready for surgery. She will be using a left flank approach and wishes you to use the distal paravertebral technique to anesthetize the area. She is confident in your ability to perform this block and have the cow ready when she comes back.

   a. Describe the procedure for performing this block.

   b. What nerves are blocked using this technique?

EXERCISE 33.4 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. Your equine patient is just about ready for surgery and you ask the veterinary assistant (VA) to find the bucket and dose syringe to wash the patient's mouth. The VA doesn't understand why you are doing this. Explain to the VA why it is important to make sure the mouth of the equine patient is clear of debris.

2. The veterinarian has requested an Esmarch bandage for a limb surgery later in the day. Describe the purpose of the Esmarch bandage.

3. Explain the importance of grooming the equine patient prior to surgery.

4. When positioning an equine patient in dorsal recumbency for surgery, attention must be paid to padding, limb position, and other details. Describe all aspects of appropriate positioning for a patient in dorsal recumbency.

5. Following equine limb surgery, a bandage is usually placed. Describe the clinical signs of postoperative complications that should be looked for when performing an examination of the incision during a postoperative limb bandage change.

6. Using correct anatomic terms, describe the area that should be clipped when preparing an equine patient for a colic surgery.

7. What are common clinical signs of an umbilical remnant infection in a foal?

8. What causes a patent urachus to develop in a foal?

9. Describe where the testicle is located in an equine patient that is defined as a "high flanker."

10. What is the difference between a closed castration and an open castration in the horse?

11. Describe two types of abnormal behavior that may be displayed by a mare with granulosa theca cell tumor.

12. What are two reasons that perineal surgery is performed on a mare?

    i.

    ii.

13. Describe vesicovaginal reflux.

14. Explain why a Caslick procedure is performed in a mare and what the procedure is meant to prevent.

15. Explain the three factors that must be evaluated before choosing a method to correct dystocia in a mare.

    i.

    ii.

    iii.

16. Describe the postoperative monitoring that is required for an equine orthopedic patient with a cast.

17a. What are the most common spots where cast sores will develop when an equine patient is wearing a half-limb cast?

17b. Why do cast sores develop and how can they be prevented?

18. Name two reasons that an arthroscopic surgery may be performed on an equine patient.

i.

ii.

19. Explain why the joint of interest is distended with sterile fluid at the start of arthroscopic surgery.

20. What is the reason for using a fenestrated cannula at the end of an arthroscopic surgery?

21. What are the three types of flexural deformities that can occur in the equine patient and how are the limbs affected in each?

i.

ii.

iii.

22. What is the difference between an angular limb deformity and a flexural limb deformity?

23a. Describe the characteristic stance for an equine patient with laminitis.

23b. Why would a horse with laminitis be called a "sinker"?

24. When there is a bounding pulse and heat in the hoof of an equine patient, what is one way it can be determined that the horse has a subsolar abscess and not laminitis?

25. Why are horses with left laryngeal hemiplegia called "roarers"?

26. What are the clinical signs associated with a bacterial infection in the guttural pouch of the equine patient?

27a. What is guttural pouch tympany?

27b. At what age is a horse most susceptible to guttural pouch tympany?

27c. What is the usual predisposing factor for guttural pouch tympany?

28. Which guttural pouch disease can be life-threatening and why?

29. Describe the equipment a food-animal practice should have to restrain patients for examination and why this equipment is necessary.

30. If a food-animal patient is going to have surgery for a complicated gastrointestinal problem, what blood tests should be performed to evaluate for any electrolyte abnormalities or an underlying infection?

31. Explain why, prior to general anesthesia, food and water should be withheld from food-animal patients for a long period of time.

32. Because the bovine patient lives in a dirty environment, surgical preparation is done somewhat differently than it is in other species. Describe how the process used to prepare a bovine patient for surgery is impacted by this issue.

33. Describe the two clinical signs you will see if you have successfully placed a paravertebral block in the bovine patient.

    i. _____

    ii. _____

34. Describe what needs to be done to correctly position the limbs of a large-animal patient placed in right lateral recumbency.

35. The veterinarian tells you that a heifer coming into the clinic may have a left displaced abomasum. He wants you to be sure to check and see if that is true. Describe how you will determine if the abomasum is displaced and why.

36. Explain how to perform regional analgesia of the foot in a bovine patient.

37. Describe how "calving paralysis" may occur.

38. What is interdigital hyperplasia and why does it occur?

39. What is the purpose for a wooden or acrylic block in the bovine patient with foot disease?

40. If a large-animal patient has radial nerve paralysis, what clinical signs will it exhibit?

41. Describe how to perform a caudal epidural in the cow, beginning with how to identify the correct location.

42. What is the difference between urolithiasis and obstructive urolithiasis?

43. Describe how to perform the Peterson block in a bovine patient undergoing extirpation of the eye.

44. What is the most common tumor in cattle, occurring mostly in older Herefords?

45. Describe how to perform a cornual nerve block.

46. What is the difference between open castration and closed castration in cattle?

47. Explain how to perform a lumbosacral epidural in a small ruminant.

48. What factors may cause rectal prolapse in sheep?

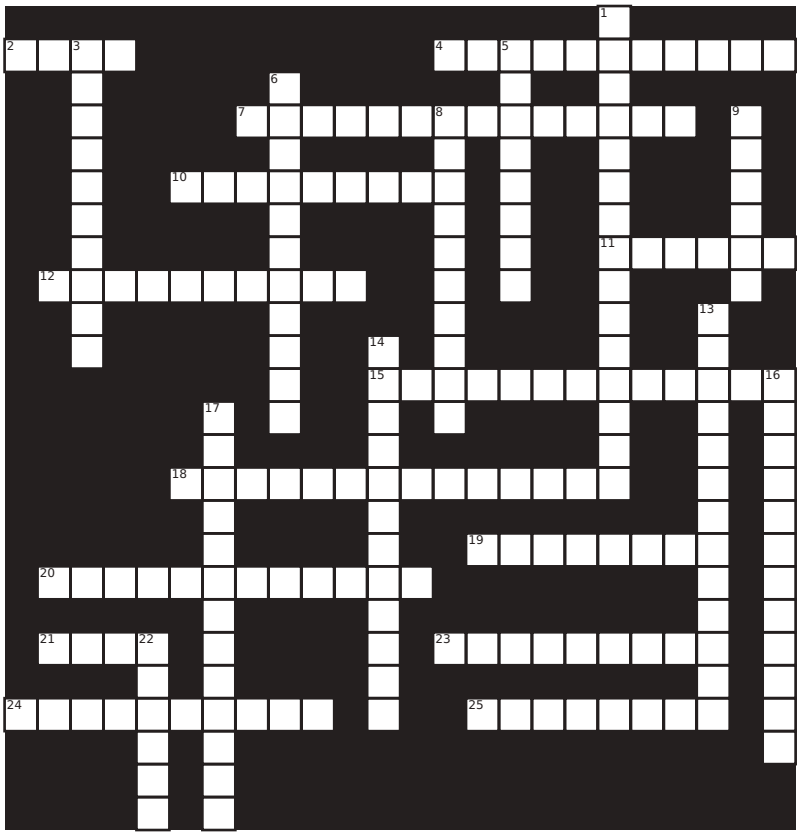
49. When working on a goat with a urethral obstruction, why would you perform a lumbosacral epidural prior to the examination?

34 Veterinary Dentistry

LEARNING OBJECTIVES

1. Pronounce, spell, and define all Key Terms in this chapter.
2. Describe ethical and legal issues related to dental procedures performed by veterinary technicians, and list professional organizations related to veterinary dentistry.
3. Be familiar with terminology used in veterinary dentistry to designate location and direction; describe the modified Triadan system for numbering teeth; and, describe normal occlusion in dogs and cats, common malocclusions, and orthodontic treatment in small animals.
4. Discuss aspects of the complete medical history as they relate to veterinary dentistry. and describe aspects of extraoral and intraoral examinations in dogs and cats.
5. Describe equipment and supplies used for dental radiography (both film and digital radiography); and, compare and contrast paralleling, bisecting angle, and occlusal techniques in dental radiography.
6. Differentiate between the types of periodontal disease seen in dogs and cats, including stomatitis, gingivitis, and periodontitis; and, state the goal of periodontal débridement.
7. Describe equipment and procedures for professional dental cleaning using power and hand scalers, and explain methods for sharpening dental instruments.
8. Discuss the rationale and procedures for polishing teeth.
9. Compare and contrast regional nerve blocks for oral surgery for dogs and cats.
10. Explain the grading system for periodontal disease and the importance of home care in veterinary dentistry.
11. Discuss indications for restorative dentistry, endodontics, and exodontics.
12. Describe common dental problems seen in small animals.
13. List and describe equine dental clinical practices, as well as common problems and treatments.

EXERCISE 34.1 CROSSWORD PUZZLE: TERMS AND DEFINITIONS



Across

2 The tip of the tooth root.
4 The study and treatment of the inside of the tooth and periapical tissues.
7 The condition in which the mandible is abnormally short in relation to the maxilla.
10 The area between the roots of a multirooted tooth.
11 Tooth decay that results from demineralization of hard tooth structures by acid-producing oral bacteria.
12 Term for mammals that have two sets of teeth (primary and deciduous).
15 The term used to indicate an upper jaw that is wider than the lower jaw (normal in most species).
18 Having a wide skull and a short maxilla.
19 Light brown or yellow, raised, mineralized deposit adherent to the tooth and root surfaces.
20 Anatomic term describing the attachment structures of the teeth.
21 Tooth structure that consists of nerves, blood vessels, lymphatics, and connective tissue.
23 Tooth type that has a large reserve crown and root structure that allows for continued growth over an animal's lifetime.
24 Diffuse inflammation of the entire oral cavity.
25 Hard layer covering the surface of the root of a tooth.

Down

1 Having a narrow skull and long maxilla.
3 The extraction of diseased teeth.
5 Gap between teeth seen normally in many species.
6 Tooth type in which the crown is relatively small compared with the size of the well-developed roots.
8 Inflammation of the gingiva.
9 Thin layer covering the crown that is the hardest tooth substance.
13 The most commonly used system of numbering teeth. (2 words)
14 Misalignment of the teeth or jaws.
16 Having a well-proportioned skull width and maxillary length.
17 Inflammation of the gingiva and other supporting tooth structures.
22 A white-tan film that collects on teeth and is composed of bacteria, exfoliated cells, food debris, and saliva.

EXERCISE 34.2 MATCHING #1: DENTAL ANATOMIC AND DIRECTIONAL TERMINOLOGY

Instructions: Match each description in column A with its corresponding anatomic or directional term that is used to describe the location of a structure or lesion in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Portion of the tooth that is closest to the most caudal portion of the dental arch.
2. _____ Structure that is closer to the front of the head in comparison with another structure.
3. _____ A portion of the tooth closer to the tip of the root.
4. _____ The surface facing the lips that is visible from the front (in the case of incisors).
5. _____ The surface of the mandibular teeth adjacent to the tongue.
6. _____ Closer to the crown of the tooth in relation to another structure.
7. _____ The surface facing the lips or vestibule (also called buccal or labial).
8. _____ The surface of maxillary teeth adjacent to the palate.
9. _____ Toward the back of the head in comparison with another structure.
10. _____ Portion of the tooth in line with the dental arcade that is closest to the most rostral portion of the midline of the dental arch.

Column B

A. Rostral
B. Caudal
C. Vestibular
D. Facial
E. Lingual
F. Palatal
G. Mesial
H. Distal
I. Apical
J. Coronal

EXERCISE 34.3 MATCHING #2: TRIADAN NUMBERING SYSTEM

Instructions: Using the numeric Triadan system for tooth identification saves time when performing detailed dental charting. Match each canine or feline tooth listed with its corresponding Triadan number by writing the appropriate number in the space provided. (Refer to Figures 34-3 and 34-4 for these numbers.) Recall that not all teeth are present in a normal adult cat and should be noted accordingly as "not present" if the tooth listed is not present in a normal adult cat.

1. _____ Canine left maxillary second incisor tooth.
2. _____ Feline right mandibular third premolar tooth.
3. _____ Canine left maxillary second molar tooth.
4. _____ Canine right maxillary canine tooth.
5. _____ Feline left mandibular second premolar tooth.
6. _____ Feline right mandibular third incisor tooth.
7. _____ Canine right maxillary fourth premolar tooth.
8. _____ Feline right maxillary first premolar tooth.
9. _____ Canine right mandibular third molar tooth.
10. _____ Feline left mandibular fourth premolar tooth.
11. _____ Canine deciduous right maxillary first incisor tooth.
12. _____ Feline deciduous left mandibular canine tooth.

EXERCISE 34.4 MATCHING #3: CLINICAL STAGES OF PERIODONTAL DISEASE

Instructions: Match each clinical description in column A with its corresponding grade of periodontal disease in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A

1. _____ Root debridement, gingival curettage, and periodontal surgery are often required.
2. _____ Inflammatory changes are confined to the gingiva (gingivitis).
3. _____ Root debridement or subgingival curettage *may* be required.
4. _____ Periodontitis where 50% or more of the attachment structures of the tooth have been lost.
5. _____ Early form of periodontitis.
6. _____ This grade is easily reversible with a routine dental cleaning.
7. _____ Periodontitis where 25% to 50% of attachment structures of the tooth have been lost.
8. _____ Epithelial attachment loss is present.
9. _____ Fair to guarded prognosis to save affected teeth.
10. _____ Frequently affected teeth cannot be saved.

Column B

A. Grade I periodontal disease
B. Grade II periodontal disease
C. Grade III periodontal disease
D. Grade IV periodontal disease

EXERCISE 34.5 MATCHING #4: HOME DENTAL CARE BRUSHING TECHNIQUES

Instructions: Match each description in column A with its corresponding brushing technique in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A

1. _____ Tooth brush bristles are placed along the gingival margin and the sulcus.
2. _____ A gentle sweeping motion of tooth brush bristles are directed apical to coronal.
3. _____ Tooth brush bristles do not enter the sulcus.
4. _____ The bristles are directed at a 45-degree angle toward the marginal gingiva.
5. _____ Tooth brush bristles are placed apical to the gingival margin.
6. _____ Tooth brush bristles enter the gingival sulcus.
7. _____ A mesial to distal motion of brushing is employed.
8. _____ Sometimes used in areas of periodontal surgery.

Column B

A. Bass brushing technique
B. Modified Stillman brushing technique

EXERCISE 34.6 MATCHING #5: LOCAL ANESTHETIC AGENTS

Instructions: Match each characteristic in column A with its corresponding local anesthetic agent in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A

1. _____ Onset of effect in 4 to 20 minutes.
2. _____ Onset of effect in 3 to 5 minutes.
3. _____ Duration of action 1.5 to 2 hours.
4. _____ Duration of action 4 to 10 hours.
5. _____ Most commonly used local anesthetic in veterinary dentistry.

Column B

A. Bupivacaine 0.5%
B. Lidocaine 2%

EXERCISE 34.7 MATCHING #6: DENTAL NERVE BLOCKS

Instructions: Match each description in column A with its corresponding dental nerve block in column B by writing the appropriate letter in the space provided. (Note that responses may be used more than once.)

Column A

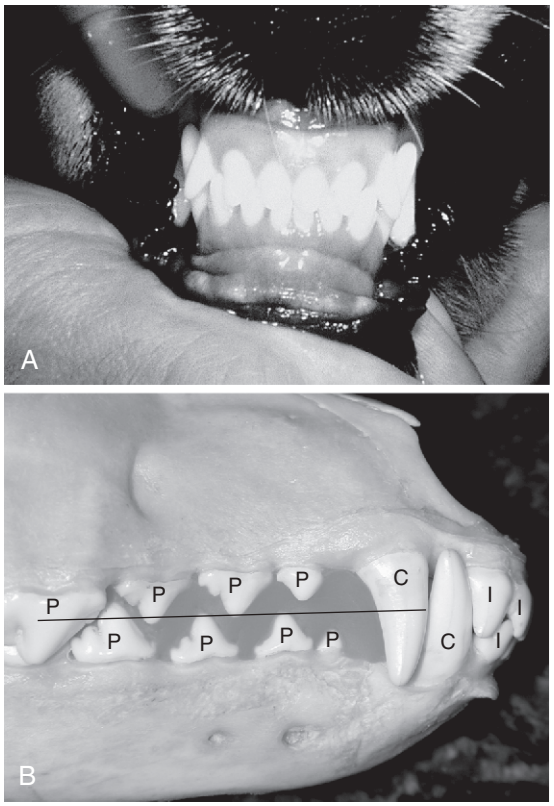
1. _____ For this block the needle is placed 0.5 cm deep into the caudal hard palate of the cat and 1 cm deep into the caudal hard palate of the dog.
2. _____ The foramen for this block is located dorsal to the maxillary third premolar**.**
3. _____ This block affects sensation of the soft tissue and bone of the entire ipsilateral mandible.
4. _____ This block may cause numbness of the tongue and therefore self-inflicted trauma.
5. _____ The foramen for this block is located ventral to the mesial root of the mandibular second premolar.
6. _____ The foramen for this block is located caudal and ventral to the mandibular third molar in the dog and the mandibular first molar in the cat.
7. _____ This block requires a needle that is bent 1 cm from the tip.
8. _____ This block is placed just caudal to the maxillary second molar in the dog or the maxillary first molar in the cat.
9. _____ This block helps prevent sensation to the ipsilateral mandible rostral to the labial frenulum.
10. _____ Lidocaine may be the preferred local anesthetic for this block.
11. _____ This block causes a loss of sensation rostral only to the third premolar on the ipsilateral maxilla.
12. _____ This block prevents sensation of the entire maxillary quadrant on the buccal and palatal sides of the teeth.
13. _____ This block has an intraoral and extraoral approach described.

Column B

A. Infraorbital nerve block
B. Middle mental nerve block
C. Inferior alveolar nerve block
D. Maxillary nerve block

EXERCISE 34.8 PHOTO QUIZ: COMPREHENSIVE

Instructions: Answer the questions for each picture.

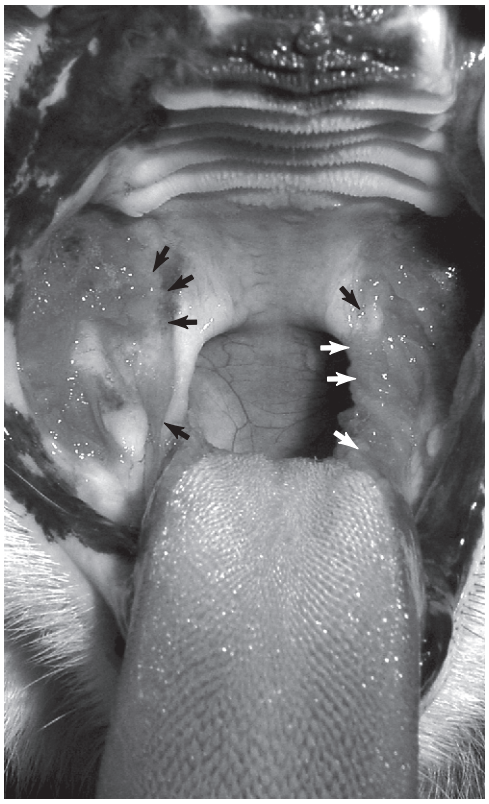


1. Identify this type of occlusion.

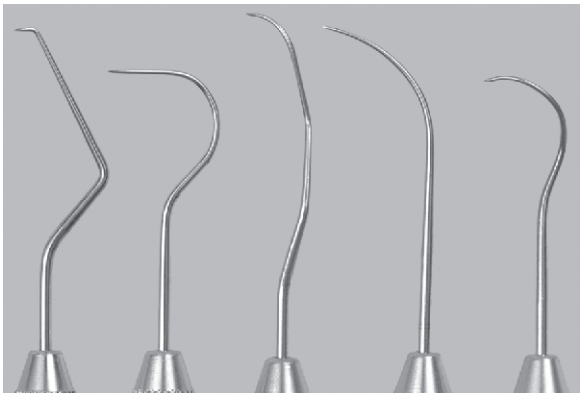
_____

2. Identify this lesion in the dog.

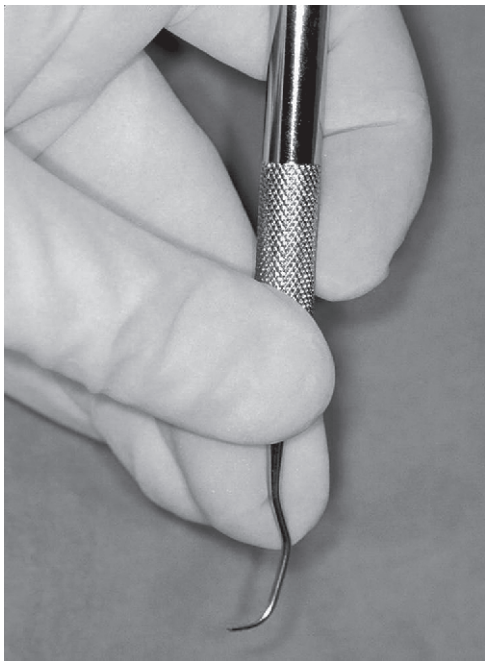
_____



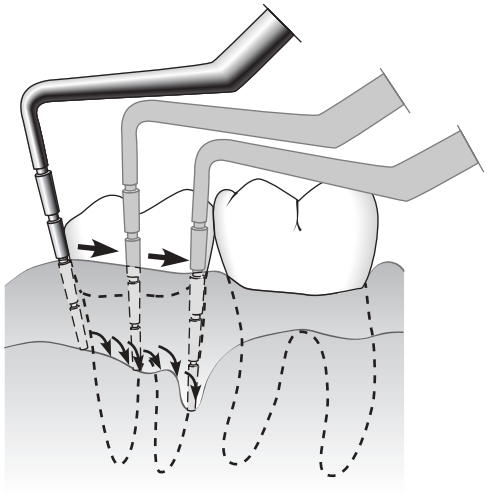
3. Identify this lesion in the cat that is lateral to the palatoglossal folds (see arrows).



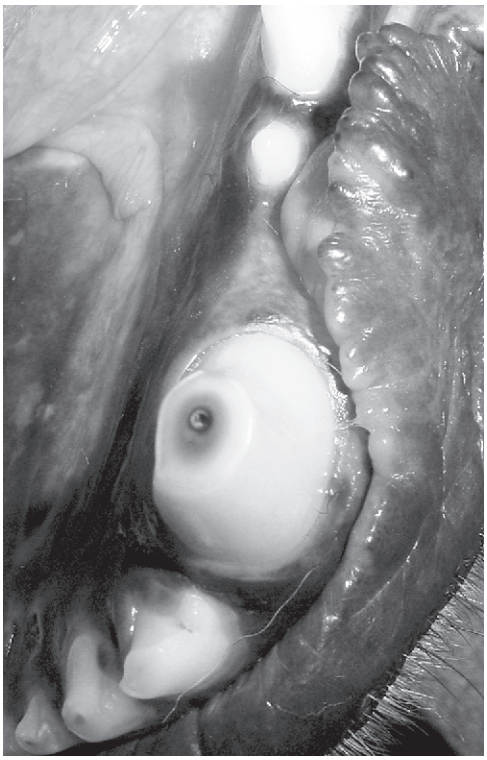
4. Identify these instruments and their uses.



5. Identify this method of holding a dental instrument.

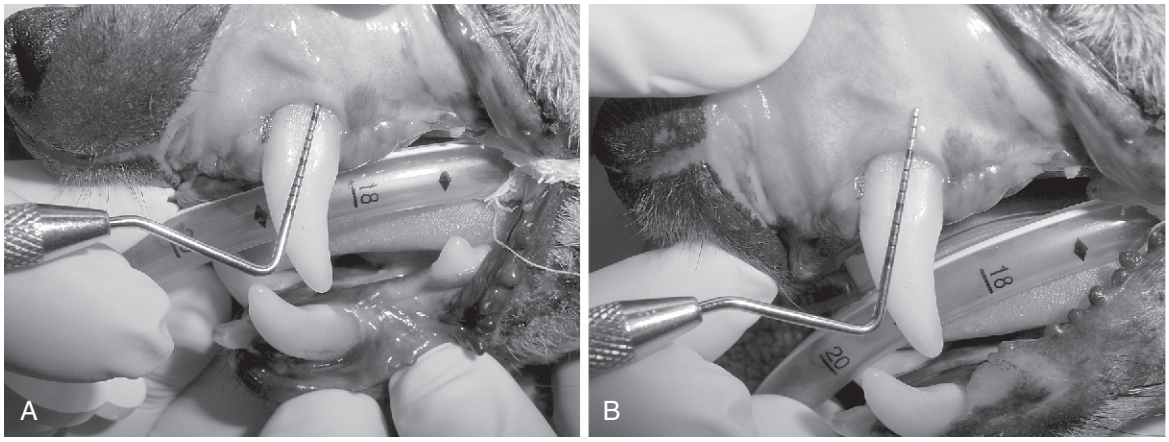


6. Identify this instrument and describe its proper use.



7. Identify this lesion. What instrument is used to confirm the diagnosis?

8. Identify this radiographic technique.

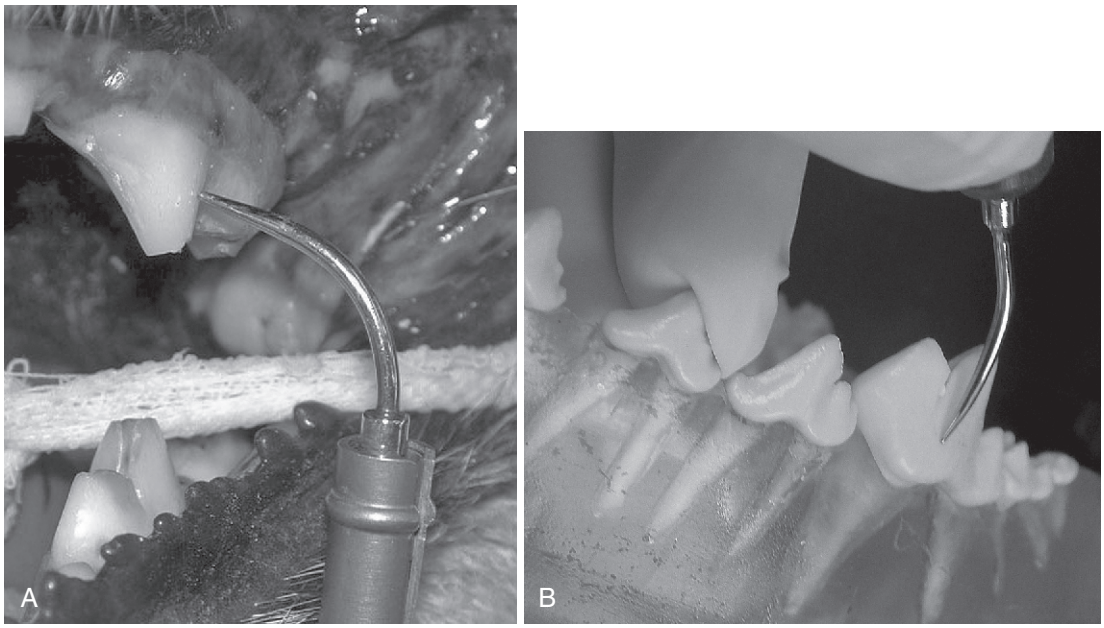


9. Based on this picture, what is the measurement of the gingival sulcus of this patient?

_____ mm

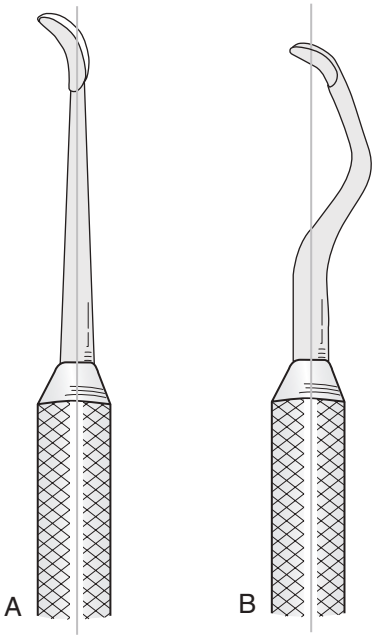
10. Based on this picture what type of bone loss is occurring? How do you differentiate this from other types of bone loss?

_____



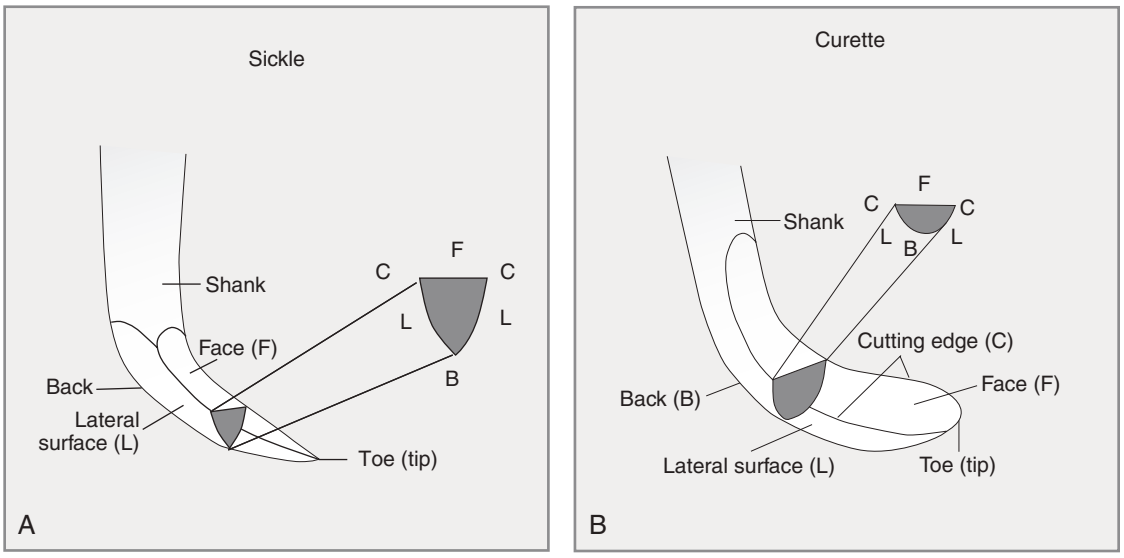
11. Which picture (A or B) depicts the correct angulation of the ultrasonic scaler tip?

_____



12. Which instrument (A or B) is better used for scaling the rostral portion of the mouth?

_____



13. Identify where you would use each instrument (A and B) and the shape of the toe, the back, and the cross-sectional shape.

    a. Sickle Scaler:

        i. Location of use _____

        ii. Toe shape _____

        iii. Back shape _____

        iv. Cross-sectional shape _____

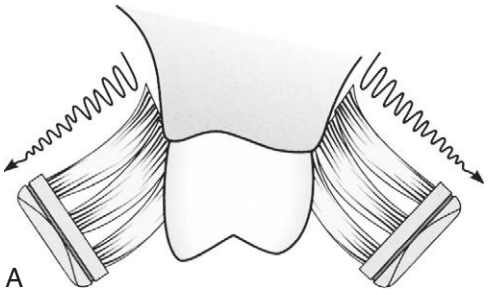
    b. Curette:

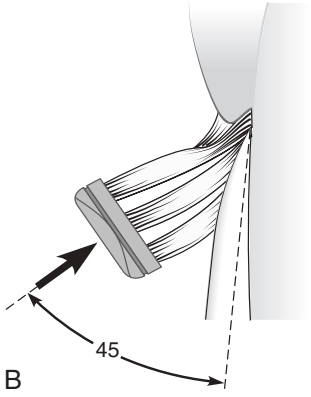
        i. Location of use _____

        ii. Toe shape _____

        iii. Back shape _____

        iv. Cross-sectional shape _____





14. Identify the brushing techniques in A and B.

A. _____

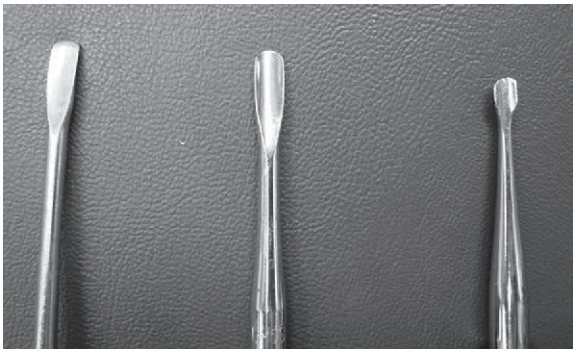
B. _____

15. Which patient is older: A or B? How do you know this from looking at the radiographs?

_____

_____

_____



16. Identify each instrument form left to right.

    Left: _____

    Middle: _____

    Right: _____

17. Identify this malocclusion by class.

    _____

18. Identify this malocclusion by class.

    _____

19. Identify the two disease states present in this patient.

    i. _____

    ii. _____

20. Describe this therapy and the most likely reason for its use.

    a. Therapy: _____

    b. Reason for its use: _____

21. Identify these instruments, their use, and the species in which they are used.

    a. Instruments: _____

    b. What they are used for: _____

    c. Species: _____

EXERCISE 34.9 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ Each dental or oral surgical procedure should begin with a comprehensive extraoral and intraoral examination.

2. _____ Alveolar mucosa refers to the mucosa that begins at the mucocutaneous junction and lines the cheeks and lips.

3. _____ When performing an intraoral examination, missing teeth should be documented on the dental chart by placing an "X" through the missing tooth.

4. _____ The normal gingival sulcus depth is 0 to 3 mm in dogs and 0 to 1 mm in cats.

5. _____ Probing depths greater than normal should be documented on the dental chart as pockets.

6. _____ Abrasion refers to the normal wear associated with tooth-to-tooth contact of a patient over time with normal mastication.

7. _____ During periodontal examination of multirooted teeth, a bifurcation should be assessed from the buccal and lingual-palatal surfaces.

8. _____ Many dental x-ray units have an internally set level of kilovoltage and milliamperes, and only exposure time may be changed for a darker or lighter technique.

9. _____ A raised dot is present on the colored surface of nonscreen dental film wrappers and is placed so that it faces the x-ray beam.

10. _____ To ensure good diagnostic quality, dental x-ray film may be held in the patient's mouth provided appropriate protective gear is worn by the handler.

11. _____ Direct method computed digital radiography involves the use of an electronic intraoral sensor, a computer, and the x-ray machine to capture the image and convert it to the digital format of pixels.

12. _____ The epithelial attachment to the tooth crown forms the bottom of the gingival sulcus, which is a moat-like structure surrounding the tooth.

13. _____ Early in the formation of plaque, the bacterial population consists mainly of endotoxin producing Gram-positive anaerobic rods and spirochetes.

14. _____ When performing a dental cleaning, the most important patient safety precaution is to intubate the patient and check to ensure that the endotracheal tube cuff is fully inflated.

15. _____ Standard-size universal and broad-tip ultrasonic scalers are designed to provide better access to subgingival pockets and furcation areas.

16. _____ The ultrasonic scaler tip should be directed at a 90-degree angle toward the tooth surface to avoid damaging the enamel.

17. _____ A curette with a straight shank in relation to the long axis of the handle is best suited for use on rostral teeth.

18. _____ If the face of a curette is offset at an angle of 60 to 70 degrees, as in Gracey curettes, the instrument is considered to be area specific, and only one of the cutting edges may be adapted to the tooth.

19. _____ Sickle scalers are used to scale the crowns of the teeth and have a sharp tip that will cause lacerations if the instrument is used subgingivally.

20. _____ When sharpening hand instruments, the angle between the stone and the face should be no greater than 85 degrees.

21. _____ Sharpening stones typically used for dental instruments include Arkansas, India, ceramic, and a synthetic composition that differ in coarseness and the type of lubricant required to reduce heat friction.

22. _____ There are no restorative materials that are as strong as the original tooth structure.

23. _____ Pins and posts used in restorative dentistry add strength to the restoration.

24. _____ As an animal ages the pulp chamber and root canal become narrower as a result of the continued production of secondary dentin.

25. _____ Dental radiographs are not needed when performing endodontics.

26. _____ Exodontics is a relatively straightforward and complication-free procedure.

27. _____ Complicated tooth fractures can lead to the formation of a periapical abscess, facial swelling, and draining tracts.

28. _____ Complicated tooth fractures should be monitored for a period of time before endodontic or exodontic therapy is performed.

29. _____ Tooth root abscesses in the horse have similar causes as seen in the dog and cat.

30. _____ Horses do not get dental caries.

EXERCISE 34.10 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. The radicular hypsodont type of dental morphology is found in which species?
   a. Rabbits
   b. Horses
   c. Cats
   d. Pigs

2. The canine and feline teeth used for shearing and grinding are the
   a. Canines
   b. Molars
   c. Premolars
   d. Both b and c

3. How many permanent teeth are there in the normal adult canine dentition?
   a. 32
   b. 36
   c. 42
   d. 44

4. At what age would a cat be expected to have all of its permanent teeth erupted?
   a. 6 months
   b. 8 months
   c. 10 months
   d. 12 months

5. Which of the clinical symptoms of oral disease may be manifested later in the disease process?
   a. Rubbing the face along furniture
   b. Anorexia
   c. Dropping food
   d. Pawing at the mouth

6. The only easily palpable major salivary gland of the dog and cat is the
   a. Sublingual
   b. Parotid
   c. Zygomatic
   d. Mandibular

7. Which tissue would not be considered part of the periodontium?
   a. Alveolar bone
   b. Gingival connective tissue
   c. Dentin
   d. Cementum

8. The instrument used to measure gingival sulcus depth is a periodontal
   a. Explorer
   b. Curette
   c. Probe
   d. Scaler

9. When performing dental radiographs, which technique is most useful for obtaining images of the mandibular teeth caudal to the second premolars?
   a. Bisecting angle technique
   b. Occlusal technique
   c. Paralleling technique
   d. Cone-cutting technique

10. Which anatomic structure would be the most radiopaque on a dental radiograph?
    a. Cementum
    b. Enamel
    c. Dentin
    d. Lamina dura

11. Once plaque has formed on a tooth, how long does it take to mineralize if left undisturbed?
    a. 1 day
    b. 3 days
    c. 7 days
    d. 2 weeks

12. For operator safety, what is the appropriate protective equipment that should be worn during a dental cleaning procedure?
    a. Gown, mask, gloves
    b. Cap, eye protection, gloves
    c. Mask, eye protection, gloves
    d. Gown, eye protection, gloves

13. Intrinsic staining of the teeth that is often seen on the occlusal surface of maxillary molars in dogs would not be caused by
    a. Trauma
    b. Tetracycline antibiotics during tooth development
    c. Food pigments
    d. Developmental defects

14. According to the Mobility Scoring Index, how would a patient's tooth be classified if mobility were increased in any direction other than axial over a distance of more than 0.5 mm and up to 1.0 mm?
    a. Stage 0 (M0)
    b. Stage 1 (M1)
    c. Stage 2 (M2)
    d. Stage 3 (M3)

15. Which form of local anesthetic delivery is most commonly used in veterinary dentistry?
    a. Splash block
    b. Local infiltration
    c. Regional anesthesia
    d. Both b and c

16. Which of the following is an example of regional anesthesia?
    a. Placing bupivacaine in an open wound to provide topical anesthesia
    b. Placing lidocaine at the foramen of the infraorbital nerve
    c. Placing bupivacaine into the periodontal ligament of the left maxillary fourth premolar
    d. Placing lidocaine into the periodontal ligament of the right mandibular first molar

17. Which of the following is/are reasons that bupivacaine 0.5% is commonly used in veterinary dentistry?
    a. Long duration of action
    b. Intraoperative pain management
    c. Postoperative pain relief
    d. All of the above

18. What is the maximum safe dose for bupivacaine 0.5% for the dog?
    a. 1 mg/kg
    b. 1.5 mg/kg
    c. 2 mg/kg
    d. 3 mg/kg

19. What is the maximum safe dose for bupivacaine 0.5% for the cat?
    a. 1 mg/kg
    b. 1.5 mg/kg
    c. 2 mg/kg
    d. 3 mg/kg

20. Which grade of periodontal disease often requires tooth extraction?
    a. I
    b. II
    c. III
    d. IV

21. What is the minimum depth of a periodontal pocket in which doxycycline can be placed?
    a. 3 mm
    b. 4 mm
    c. 6 mm
    d. 7 mm

22. Why is doxycycline gel a drug of choice for the treatment of periodontal pockets?
    a. It has good antimicrobial spectrum against periodontal pathogens.
    b. It has antiinflammatory effects.
    c. It has a space-occupying effect, which prevents food and debris from filling the pocket.
    d. All of the above are reasons for using doxycycline gel.

23. What is recommended as an antibacterial oral rinse when treating periodontal disease?
    a. 0.12% chlorhexidine
    b. 1.2% chlorhexidine
    c. 0.2% chlorhexidine
    d. 2% chlorhexidine

24. Attempts to save teeth with advanced periodontal surgery should not be performed unless the client is able to
    a. Apply a 2% chlorhexidine rinse.
    b. Consent to doxycycline gel therapy.
    c. Perform daily tooth brushing.
    d. Provide a soft-food diet for the rest of the patient's life.

25. Why are human toothpastes not used for tooth brushing in veterinary patients?
    a. They cause gingival ulceration.
    b. The mint flavoring is toxic.
    c. They can cause stomach upset if swallowed.
    d. Both b and c

26. Which type of diet is best to help control plaque?
    a. A diet that has been manufactured and tested to reduce plaque accumulation
    b. Any hard diet is appropriate.
    c. Soft diets are best in order to avoid gingival trauma from hard abrasive foods.
    d. All veterinary diets now provide plaque control.

27. Which organization has been established to recognize products that have been shown to meet predetermined standards of plaque and calculus retardation?
    a. The Veterinary Oral Health Council (VOHC)
    b. The American Veterinary Medical Association (AVMA)
    c. The American Veterinary Dental College (AVDC)
    d. The Food and Drug Administration (FDA)

28. How do mechanical cleansing diets help prevent plaque and tartar accumulation?
    a. Long fibers oriented in one direction within a large kibble are designed to scrape the side of teeth as the teeth penetrate the kibble.
    b. Crisscrossed fibers oriented in a large kibble are designed to scrape the side of teeth as the teeth penetrate the kibble.
    c. Small particles of digestible vegetable carbohydrate are placed in the large kibble designed to scrape the side of the teeth as the teeth penetrate the kibble.
    d. Microscopic particles of inert silica are placed in the large kibble designed to scrape the side of the teeth as the teeth penetrate the kibble.

29. What is the function of HMP in a chemical cleansing diet that helps prevent plaque and tartar accumulation?
    a. HMP decreases the production of saliva, which contains the minerals associated with tartar accumulation.
    b. HMP sequesters calcium in plaque fluids effectively preventing the mineralization of plaque.
    c. HMP binds with magnesium in order to decrease mineral deposition in plaque.
    d. HMP generates a thermal response in the oral cavity that effectively kills plaque-forming organisms.

30. Which of the following chew toys has no potential for harmful effects when used to help prevent plaque and tartar accumulation?
    a. Rawhide chews
    b. Cow hooves
    c. Hard nylon bones
    d. All of the choices listed above have some potential harmful effects.

31. Which of the following are indications for restorative dentistry?
    a. Dental caries
    b. Fractured teeth
    c. Endodontically treated teeth
    d. All of the above

32. Which type of dental crown has greater strength and requires less tooth removal?
    a. Porcelain
    b. Metal
    c. Zirconium
    d. Both a and c

33. On which teeth of the dog are crowns more commonly placed?
    a. Canines and mandibular first molars
    b. Maxillary fourth premolars and mandibular first molars
    c. Canines and maxillary fourth premolars
    d. Canines and maxillary first molars

34. What is the usual minimal age that conventional root canal therapy is usually performed on dogs and cats?
    a. 6 months of age
    b. 12 months of age
    c. 15 months of age
    d. 18 months of age

35. Which type of cleaning and shaping file used in endodontics is most susceptible to breakage?
    a. H
    b. I
    c. J
    d. K

36. Which of the following are indications for exodontics?
    a. A grave prognosis for saving a tooth
    b. Owner financial constraints that preclude use of salvage techniques
    c. Multiple anesthetic episodes are contraindicated.
    d. All of the above are indications for exodontics.

37. Once exodontia is performed what is recommended as a lavage solution?
    a. Sodium hypochlorite
    b. Isotonic saline
    c. 0.12% chlorhexidine solution
    d. Both b and c

38. What is the suture type and pattern recommended to close an exodontic area?
    a. 4-0 or 5-0 absorbable braided in a simple interrupted pattern
    b. 4-0 or 5-0 absorbable monofilament in a simple interrupted pattern
    c. 4-0 or 5-0 nonabsorbable monofilament in a simple continuous pattern
    d. 4-0 or 5-0 nonabsorbable braided in a simple continuous pattern

39. In what location are feline resorptive lesions usually seen clinically?
    a. Cervical (neck) region
    b. Apex of the root
    c. Occlusal surface of the crown
    d. All locations are equally seen

40. What is the treatment of choice for cats with tooth resorption?
    a. Deep root planing followed by fluoride gel
    b. Root canal followed by crown restoration with glass ionomer
    c. Exodontics
    d. Nothing, because cats rarely have clinical sign with tooth resorption

41. Which of the following is NOT an example of a class I malocclusion (neutroclusion)?
    a. The mandible is relatively shorter than the maxilla.
    b. Lingually displaced mandibular canines
    c. Maxillary incisors are positioned lingual to the mandibular incisors.
    d. A maxillary premolar is positioned lingual to the opposing mandibular premolar.

42. Mandibular brachygnathism (mandibular distoclusion) belongs to which class of malocclusion?
    a. I
    b. II
    c. III
    d. IV

43. Mandibular prognathism (mandibular mesioclusion) belongs to which class of malocclusion?
    a. I
    b. II
    c. III
    d. IV

44. Dolichocephalic skull types are typical of
    a. Persian cats
    b. Labrador Retrievers
    c. Greyhounds
    d. Boxers

45. Which of the following is/are true for dental impressions?
    a. Dental impressions are important in the treatment plan for orthodontic disease.
    b. Alginate is the material used to fill the dental impression tray.
    c. Dental stone is used to fill the impression so as to create a positive image of the mouth.
    d. All of the above are true.

46. Which teeth in dogs are most commonly fractured?
    a. Maxillary fourth premolar
    b. Canine teeth
    c. Incisors
    d. Both a and b

47. Discolored teeth in the dog are most commonly a result of what disease condition?
    a. Canine distemper
    b. Pulpitis (pulp necrosis)
    c. Periodontal disease
    d. Class IV malocclusion

48. Stomatitis, seen most commonly as lymphocytic-plasmacytic stomatitis in cats, has what cause?
    a. Immune-mediated
    b. Uremia
    c. Viral disease
    d. Foreign-body reaction

49. What therapy provides resolution to stomatitis in approximately 80% of cases in cats?
    a. Doxycycline at 2 mg/kg for 14 days
    b. Dental cleanings every 3 months
    c. Full mouth or nearly full mouth extractions
    d. Crown restorations

50. What is the cause of masticatory myositis?
    a. Viral infection of the muscle of mastication
    b. Antibody formation toward a specific component of myosin found only in the muscles of mastication
    c. A caustic reaction to a 2% chlorhexidine oral rinse
    d. Periapical abscess formation from an untreated complicated fracture of the maxillary fourth premolar

51. What is the definitive method of diagnosis for masticatory myositis?
    a. Serum and muscle tissue antibody analysis
    b. Viral isolation with electron microscopy
    c. History of inappropriate use of chlorhexidine with cytology of oral mucosa
    d. Internal oral examination and dental radiography of the maxillary fourth premolar

52. What is the usual treatment of choice for masticatory myositis?
    a. Saline rinses of the oral cavity twice daily for 2 weeks
    b. Acyclovir orally once daily for 1 month
    c. Endodontic or exodontic treatment of the maxillary fourth premolar fracture
    d. An immunosuppressive dose of steroids tapered to a maintenance dose

53. What is the most common type of jaw fracture in the dog and cat?
    a. Temporomandibular disarticulation
    b. Ramus fracture
    c. Symphyseal separation of the mandible
    d. Fracture of the angle of the mandible

54. What is the structure of food prehension in the horse?
    a. Lips
    b. Premolar and molar teeth
    c. Tongue
    d. Both a and c

55. What is the purpose the varied grooves and ridges on the occlusal surfaces of the premolars and molars in the horse?
    a. Determination of age
    b. Grinding of food
    c. Defense against predators
    d. Prehension of food

56. Which of the following are clinical signs of severe dental disease in the horse?
    a. Ocular, nasal, or oral discharge
    b. Weight loss
    c. Head shaking or tilting
    d. All of the above

57. To perform a thorough oral examination in the horse, which of the following procedures is necessary?
    a. General anesthesia
    b. Local anesthesia
    c. Sedation
    d. Both b and c

58. What is the term used to describe the process of mechanically adjusting the occlusal surface of horse teeth by removing raised areas?
    a. Floating
    b. Bishoping
    c. Curettage
    d. Sailing

59. What are some of the clinical signs associated with wry nose in the horse?
    a. Difficulty suckling
    b. Difficulty prehending food
    c. Severe dyspnea
    d. All of the above

60. What is the mechanism by which horses teeth are kept clean?
    a. Daily brushing
    b. Placement of HMP in drinking water
    c. Normal mastication of abrasive substances
    d. All of the above

EXERCISE 34.11 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. Because of the variation in severity of disease at the time of treatment, the term *dental prophylaxis* is largely being replaced with the term _____ _____ _____.
2. Members of the _____ of _____ _____ technicians have completed a credentialing process and passed a specialty examination to verify an advanced level of dental knowledge.
3. The root apices of _____ teeth, are open for a limited time during tooth eruption and development, and therefore do not continually grow or erupt.
4. The smooth, convex bulge located on the palatal side of the gingival third of incisor teeth is called the _____.
5. The adjective _____ is used to describe the maxillary fourth premolar and mandibular first molar of dogs and cats, which play a significant role in shearing food during mastication.
6. A history of sneezing after drinking water may indicate the presence of a(n) _____ _____, which is a common problem in small-breed dogs with advanced periodontal disease.
7. An important component of the extraoral examination is a technique called _____ _____ that involves gently pushing on the closed eyelids with your thumbs to assess ability of the globes to move caudally in the orbit.
8. The _____ _____ is a raised structure located on the midline behind the maxillary incisors of dogs and cats.
9. The rostral two-thirds of the hard palate is covered by palatal mucosa that has hard ridges or _____, ranging from 8 to 10 in number.
10. Radiographic evaluation of areas that have missing teeth is imperative because _____ _____ can develop as a result of an unerupted tooth.
11. Dental instruments are held with a _____ _____ _____ in which the first three fingers are in a triangular position on the instrument and the ring finger is used as a rest on an adjacent oral structure.
12. The _____ _____ is a cribriform plate of bone lining the tooth socket and appears radiographically as a white line adjacent to the periodontal space.
13. The term _____ _____ more truly describes the periodontal health of a tooth because it accounts for both pocket depth and gingival recession.
14. A component of the dental x-ray machine called the _____ device contains a collimator to control the beam's size and aid in minimizing scatter radiation.
15. Inaccurate vertical angulation of the x-ray beam causes the resultant image to appear shortened, which is termed _____, or lengthened, which is termed _____.
16. The _____ _____ is composed of strong fibers that connect the tooth to alveolar bone.

17. A normal anatomic structure called the _____ _____ _____ is located apical to the mandibular second premolar in dogs and can be misinterpreted as periapical pathology when superimposed over a tooth root.

18. The term _____ _____ refers to the use of nonsurgical instrumentation to remove hard and soft deposits from all tooth surfaces along with the disruption of nonadherent bacteria within the gingival sulcus.

19. In today's veterinary practices, _____ _____ are the instruments primarily used for routine debridement and advanced periodontal therapy.

20. The portion of an ultrasonic scaler handpiece that converts electrical energy into mechanical energy is called the _____.

21. In general, dental hand instruments consist of three parts: (1) the _____, (2) the _____, and (3) the _____ _____.

22. Designed for subgingival scaling and root planing, a _____ _____ has two cutting edges and can be adapted for all surfaces of the teeth.

23. Three benefits of nerve blocks in veterinary dentistry are _____ analgesia, _____ analgesia, and a decreased concentration of _____ _____ agents.

24. One should aspirate prior to injecting local analgesic when performing a dental nerve block to ensure that the needle is not in a _____ _____.

25. A _____-gauge needle is most commonly used for dental nerve blocks.

26. _____ materials are those that do not induce new bone, but act as a scaffold to allow existing bone cells to fill the defect.

27. _____ materials are those that will induce new bone growth by stimulating osteoblast precursors to form.

28. The three basic categories of home dental care intended to reduce oral bacteria are _____, _____, and use of _____.

29. Of the three basic categories of home dental care listed previously, _____ provides the most thorough method of plaque control for pets.

30. A _____ _____ is used in endodontic therapy to remove pulp.

31. _____ _____ are small pieces of rubber that go around an endodontic file in order to mark a specific length in the canal.

32. The distance from the tip of the endodontic file and the rubber stop is known as the _____ _____.

33. Sodium hypochlorite is the most common irrigant in endodontic therapy because it has excellent _____ properties and the ability to break down _____ _____.

34. During endodontic therapy, _____ is defined as filling the canal with material that will seal it from the periapical area.

35. When performing endodontic therapy _____ _____ should make up the bulk of the filling agent.

36. An endodontic irrigation needle has a _____ end and an opening on the _____ to prevent forcing irrigant periapically.

37. When performing endodontics a _____ is used to push the filling material apically and a _____ is used to push the filling material laterally.

38. When significant periodontal disease exists, an iatrogenic jaw fracture more easily occurs when extracting the _____ mandibular molar and the mandibular _____ in cats and small-breed dogs.

39. When performing exodontia, the handle of the dental elevator should rest securely in the palm of the hand, and the _____ _____ is placed at the tip of the dental elevator to prevent inadvertent advancement of the tip into deeper structures.

40. _____ extraction is a type of tooth extraction that uses dental elevators placed in the periodontal space on the mesial or distal surface of the crown to fatigue the periodontal ligament.

41. _____ extraction is a type of tooth extraction in which a gingival flap is created and then a window is created in the buccal bone over the tooth to be extracted.

42. A gingival flap with no releasing incision is called an _____ flap, a gingival flap with one releasing incision is called a _____ flap, and a gingival flap with two releasing incisions is called a _____ flap.

43. The _____ is the animal species that is most commonly affected with tooth resorption.

44. There are _____ classes of malocclusion.

45. Class _____ malocclusion is the most common type receiving orthodontic correction in pets.

46. _____ _____ is a nonspecific term for a form of unilateral maxillary-mandibular asymmetry.

47. _____ _____ is the term used to describe the extraction of persistent deciduous or adult teeth that are problematic because of malocclusion.

48. Mandibular permanent canines erupt _____ in relationship to the persistent deciduous teeth, whereas maxillary permanent canines erupt _____ in relationship to the persistent deciduous teeth.

49. The best time to remove persistent deciduous teeth is before they cause _____ of their permanent counterparts.

50. The three typical types of dental trauma in dogs and cats are _____, an _____ tooth fracture (in which there is no pulp exposure), and a _____ tooth fracture (in which there is pulp exposure).

51. The most common oral tumor in the cat is _____ _____ _____.

52. The most common benign oral tumor in the dog are _____.

53. The four common malignant oral tumors in the dog are malignant _____, _____ _____ _____, _____, and _____.

54. A _____ muzzle may be the treatment of choice in young animals with jaw fractures.

55. "Wolf teeth" is a term used to describe the permanent _____ _____ in the horse and are more commonly seen in the _____ arcade.

56. The premolars and molars in the horse are collectively known as _____ _____.

57. _____ is the term used for the dropping of food by the horse.

58. In the equine, intraoral dental radiographs are limited to evaluation of the incisors because of the large size of the _____, the small size of the _____, and limited _____ access.

59. Sinusitis and chronic unilateral nasal discharge related to dental disease in the horse usually affects the maxillary fourth _____, the first, second, and third _____ teeth and the _____ sinus.

60. Extraoral exodontia is usually performed on the _____ teeth in the horse.

61. _____ _____ is the term for deviation of the incisive bone, maxilla, and nasal septum laterally from midline in the foal.

EXERCISE 34.12 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 34.13 CASE STUDY: PROFESSIONAL DENTAL CLEANING

You have just been hired as a veterinary technician in a small animal practice that emphasizes quality dental care. On your first day on the job, you are directed to the dental suite and asked to perform a professional dental cleaning on a 9-year-old, neutered, male, Toy Poodle. Wanting to make a good impression by providing excellent care to your patient, you mentally review the procedure. Respond to each of the following queries about the professional dental cleaning.

1. Power scaling instruments use a water-cooled vibrating tip to remove hard and soft deposits from the teeth and periodontal pockets.

   a. Explain how the vibrations of power scalers are measured.

b. Briefly describe the two types of power scalers and how each operates.

i. _____

ii. _____

c. Explain the disadvantage of using a sonic scaler.

_____

2. The ultrasonic scaling unit contains an electronic generator inside plastic housing attached to a foot pedal by a cable. The handpiece is also attached by tubing to a water supply to provide a water stream from the ultrasonic scaler tip.

a. List the benefits of the water stream that comes from the ultrasonic scaler tip.

_____

b. Identify the patient and human safety precautions that should be taken to reduce the amount of aerosolized bacteria caused by the ultrasonic scaler's water mist.

_____

c. How should the patient's eyes be protected during ultrasonic scaling?

_____

d. Why is it important to intubate the patient and ensure that the endotracheal cuff is fully inflated prior to ultrasonic scaling?

3. The magnetostrictive scaler is the most common type of power scaler used in human and veterinary dentistry. Describe how the tip of a magnetostrictive scaler functions and how the tip should be properly used on tooth surfaces.

4. The power and water knobs of magnetostrictive units must be properly adjusted prior to the periodontal debridement procedure.

   a. What does the power knob do?

   b. When should the high-power versus low-power setting be used?

   c. Why is it necessary to have adequate water flow through the ultrasonic scaler handpiece?

5. Describe the proper technique required for removal of dental calculus using a supragingival hand scaler.

6. Angulation refers to the relationship of the face of a hand scaling instrument to the tooth. Explain proper curette angulation and the technique for removal of dental deposits from the gingival sulcus.

7. Polishing is the final but critical step performed on a dental patient as part of routine cleaning or advanced periodontal therapy.

   a. Explain the rationale for dental polishing.

   b. Describe proper polishing technique when using a motor-driven handpiece and rubber cup, including desired polishing paste, cup pressure, speed setting, and polishing time per tooth surface.

   c. After polishing, what is the final step that should be performed to finish the complete dental cleaning procedure?

EXERCISE 34.12 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer/essay for each of the following questions in the spaces provided.

1. When taking a medical history, it is very important to inquire about oral home care. Why is this the case?

2. Dental radiographs provide veterinarians with an important diagnostic tool to detect pathologic conditions that are not clinically visible in the mouth. List six types of pathologic findings for which dental radiographs are useful.

   i. _____

   ii. _____

   iii. _____

   iv. _____

   v. _____

   vi. _____

3. Periodontal debridement involves the removal of bacterial plaque, endotoxins, and hard calculus deposits, which is essential to halting the dental disease process. State the overall goal of periodontal debridement for improving oral health.

4. What are the concerns and treatment options for lingually displaced permanent mandibular canine teeth (base narrow canine teeth).

5. Explain which teeth are most commonly subjected to attrition, the physiologic response to attrition, the intraoral findings of those affected teeth compared to fractured teeth.

6. Although canine acanthomatous ameloblastomas are considered benign, why is mandibulectomy or maxillectomy often the treatment of choice?

35 Geriatric and Hospice Care: Supporting the Aged and Dying Patient

LEARNING OBJECTIVES

1. Pronounce, define, and spell all Key Terms in the chapter.
2. List the life stages of dogs and cats, and describe the effects of aging on body systems.
3. Identify and explain the oral, cardiac, respiratory, orthopedic, renal, neoplastic, neurologic, and endocrine disorders commonly seen in geriatric dogs and cats.
4. Explain the changing nutritional needs of aging pets.
5. Discuss components of hospice nursing care for geriatric dogs and cats, including how to identify the appropriate time to discuss euthanasia with a pet's owner.
6. Discuss components of the physical examination of a geriatric horse.
7. List and describe disorders commonly seen in geriatric horses, including oral/nasal, vision, cardiac, respiratory, gastrointestinal, kidney, skin, neurologic, and orthopedic problems.
8. Identify and explain the chronic conditions that most commonly affect geriatric horses such as equine Cushing's disease, heaves, laminitis, dental problems and sinusitis, equine recurrent uveitis (ERU), and neurologic and musculoskeletal defects.
9. Discuss the management, nutrition, and nursing care of geriatric horses, including end of life issues.

EXERCISE 35.1 DEFINITIONS: TERMS AND DEFINITIONS

Instructions: Define each term in your own words.

1. Founder: _____

2. Geriatric: _____

3. Hirsutism: _____

4. Hospice: _____

5. Incontinence: _____

6. Life stage: _____

_____

7. Wave mouth: _____

_____

EXERCISE 35.2 MATCHING: SIGNS OF EQUINE RECURRENT UVEITIS (ERU)

Instructions: Match each sign of ERU in column A with its corresponding description in column B by writing the appropriate letter in the space provided.

Column A	Column B
1. _____ Corneal edema	A. Constricted pupils.
2. _____ Hyphema	B. Cellular debris in the eye.
3. _____ Photophobia	C. Blood vessel growth on cornea.
4. _____ Miosis	D. Blue tint caused by increased fluid content.
5. _____ Hypopyon	E. Discomfort upon exposure to light.
6. _____ Neovascularization	F. Inflammation of the tissues in the forward chamber.
7. _____ Corneal ulceration	G. Loss of the epithelium on the front of the eye.
8. _____ Anterior uveitis	H. Hemorrhage in the eye.

EXERCISE 35.3 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ The effects of aging in people are very different from the effects of aging in animals.

2. _____ The speed with which the aging process occurs in animals varies according to the species and breed.

3. _____ Geriatric animals that are ill most often have relatively specific symptoms that can be traced to a particular disease condition.

4. _____ At-home dental prophylaxis is not helpful in a geriatric patient with established dental disease.

5. _____ Signs of mild coughing and exercise intolerance in geriatric animals are most likely associated with muscle fatigue or arthritis that develops with age, and does not necessarily warrant further investigation.

6. _____ Chronic renal disease is very common in geriatric cats.

7. _____ Orthopedic disease is a common geriatric condition often successfully managed with appropriate care.

8. _____ Hypothyroidism is a common disease in middle-aged and geriatric cats that is characterized by increased appetite with weight loss, vomiting, and lack of grooming behavior.

9. _____ Life-threatening complications can develop with untreated hyperthyroidism in cats.

10. _____ Pain is more difficult to assess in animals than in humans because the signs of pain are more subtle.

11. _____ An increased heart rate or an increased respiratory rate can be a sign that an animal is in pain.

12. _____ A feeding tube should be placed in any ill patient that is not eating to ensure adequate caloric intake.

13. _____ Slings are used in animals with functional forelimbs, but little or no function of their hind limbs.

14. _____ Heaves in horses is often related to a dust or mold allergy.

15. _____ Dyspnea, especially during inhalation, is a typical sign of heaves.

16. _____ In an aged horse, laminitis usually develops as a secondary condition to a preexisting problem.

17. _____ Eye pain and swelling in an aged horse requires treatment, but is usually not serious.

18. _____ Geriatric horses often develop degenerative joint disease in the coxofemoral joints, stifles, and lumbar vertebrae.

19. _____ A horse may have gastrointestinal parasites even when the fecal examination is negative.

20. _____ A dog is no longer classified as pediatric after reaching 1 year of age.

21. _____ A large-breed dog ages more rapidly than a small-breed dog or a cat.

22. _____ In general, an animal needs more energy from food as it ages.

23. _____ Reduced dietary protein may decrease the risk of developing kidney disease and slow its progression in geriatric patients.

24. _____ All aging patients need the amount of fiber in their diet increased significantly.

25. _____ Home-cooked diets are a very acceptable alternative for senior pets.

26. _____ Dehydration may be seen in animals that are drinking less as well as in animals that are drinking more than normal.

EXERCISE 35.4 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. A cat that is 8 years of age is considered to be a
   a. Young adult
   b. Mature adult
   c. Senior
   d. Geriatric

2. A Great Dane that is 8 years of age is considered to be a
   a. Young adult
   b. Mature adult
   c. Senior
   d. Geriatric

3. Which of the following is not a change you would expect to see in an aging patient?
   a. Decrease in caloric needs by 30% to 40%
   b. Decreased activity of the immune system
   c. Development of an immune-mediated disease
   d. Decreased susceptibility to infections

4. Which of the following is not a physical change you would expect to see in an aging patient?
   a. Decreased percentage of body fat
   b. Thickening and darkening of the skin
   c. Loss of muscle mass
   d. Thickened footpads

5. All geriatric animals are prone to heart disease, but the exact nature of cardiac disease varies among species and even among breeds. For instance, small-breed dogs are most prone to _____ although large-breed dogs and cats are not.
   a. Chronic valvular disease
   b. Hypertrophic cardiomyopathy
   c. Atrial fibrillation
   d. Dilated cardiomyopathy

6. Polyuria and polydipsia are commonly noted in animals with all of the following diseases but one. Which is it?
   a. Diabetes mellitus
   b. Hyperadrenocorticism
   c. Hypothyroidism
   d. Chronic renal disease

7. Interleukin 1 receptor antagonist protein (IRAP) therapy is being used in horses to treat
   a. Heaves
   b. Cushing disease
   c. Degenerative joint disease
   d. Equine recurrent uveitis

8. This endocrine disease is much more commonly seen in geriatric cats than in other species.
   a. Hyperadrenocorticism
   b. Diabetes mellitus
   c. Hypothyroidism
   d. Hyperthyroidism

9. Common signs of hyperthyroidism do NOT include
   a. Polyuria
   b. Increased appetite
   c. Heat seeking
   d. Weight loss

10. "Cushing disease" is an alternative name for
    a. Hyperadrenocorticism
    b. Diabetes mellitus
    c. Hypothyroidism
    d. Hyperthyroidism

11. The class of analgesic drugs that can cause significant side effects, especially with long-term use, and should only be used as a last resort is the
    a. Nonsteroidal antiinflammatory drugs
    b. Glucocorticoids
    c. Opiates
    d. α_2-Agonists

12. A geriatric horse with a long, wavy hair coat that does not shed completely in the spring is likely to have
    a. Hypothyroidism
    b. Laminitis
    c. Cushing disease
    d. Heaves

13. The most common abnormal heart rhythm in geriatric horses is
    a. Ventricular tachycardia
    b. First-degree AV heart block
    c. Sinus arrhythmia
    d. Atrial fibrillation

14. The development of hypertrophied external abdominal oblique muscles as a result of increased effort on exhalation is typically seen in horses with
    a. Recurrent airway obstruction
    b. Sinusitis
    c. Pneumonia
    d. Laryngeal paralysis

15. Pituitary pars intermedia dysfunction (PPID) is an alternative name for
    a. Recurrent airway obstruction
    b. Equine recurrent uveitis
    c. Cushing disease
    d. Hirsutism

16. The reluctance of a horse to touch its nose to its shoulder is generally indicative of pain affecting the
    a. Nose
    b. Neck
    c. Jaw
    d. Shoulder

17. The signs of Cushing disease in horses include hirsutism, patchy sweating, polyuria, polydipsia, and
    a. Weight loss
    b. Laminitis
    c. Muscle hypertrophy
    d. Hyperactivity

18. The most important aspect of treatment for horses with heaves is
    a. Minimizing contact with allergens
    b. The bronchodilator clenbuterol
    c. Injections of steroids
    d. Regular use of an inhaler

19. Serial measurement of ACTH, insulin, and dextrose is used to diagnose
    a. Hyperthyroidism in cats
    b. Hypothyroidism in dogs
    c. Cushing disease in horses
    d. Diabetes in dogs

20. An NSAID used to treat DJD in the horse, that is less likely than other NSAIDs to cause adverse effects because it is a COX-2 inhibitor is
    a. Phenylbutazone
    b. Flunixin meglumine
    c. Dexamethasone
    d. Firocoxib

21. A geriatric horse that lives in a barn with poor air circulation, has a history of allergic reactions, and exhibits tachypnea and dyspnea may be exhibiting signs of
    a. Laminitis
    b. Heaves
    c. Sinusitis
    d. DJD

22. Pretreatment with a(n) _____ is recommended in horses with a history of vaccine reactions.
    a. Steroid
    b. Bronchodilator
    c. NSAID
    d. Antibiotic

EXERCISE 35.5 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. Many veterinarians recommend that healthy geriatric small animals (those over _____ years of age) should be examined _____ time(s) a year.
2. Glucose is the necessary nutrient for the body's cells to perform their normal functions. For glucose to enter cells, the hormone _____ is required.
3. As a cat ages, it is prone to a(n) _____ in body weight, until approximately 11 to 12 years of age, when it is prone to a(n) _____ in body weight.
4. The most commonly used class of analgesics used to treat pain associated with degenerative joint disease and other forms of osteoarthritis is the _____.
5. To prevent formation of decubital ulcers, a recumbent patient should be turned from side to side every _____ hours.
6. A few hours after giving subcutaneous fluids between the shoulder blades, the fluids will usually shift to the _____ surface of the body, because of the force of _____.
7. Position for bladder expression may vary patient to patient. For instance the bladder can usually be expressed when a patient is in _____ recumbency, or when it is _____.
8. Geriatric horses are generally considered to be those older than _____ years of age.
9. A systolic murmur auscultated on the left side of the equine thorax suggests a common valvular disease of the geriatric horse known as _____ _____.
10. Common tumors in horses include squamous cell carcinomas, which often develop on the _____, and melanomas, which often develop around the _____ area.
11. Cushing disease in horses is caused by decreased production of the neurotransmitter _____ in the hypothalamus.

12. Cushing disease in horses is treated with the dopamine agonist _____.

13. To maintain health and keep the horse comfortable, a geriatric horse should have its hooves trimmed every _____ weeks, and dental floating every _____ months.

14. Inflammation of the right dorsal colon and renal failure are potential adverse effects of _____ class drugs in the horse.

EXERCISE 35.6 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 35.7 CASE STUDY: "MISSY"

1. *Read Case Presentation 35-1 in the textbook about Missy, the geriatric cat.*

   Additional History: At the time Missy was diagnosed with renal disease (3 years prior to the date of presentation described), she was exhibiting the following signs:

   - She was eating less than normal and was somewhat thin (body condition score 2/5) having lost about a pound of body weight since her previous visit.
   - She was stiff after waking up from a nap and was reluctant to jump up on the furniture or the bed.
   - As mentioned in the case history, she also had periodic episodes of constipation and occasional vomiting.
   - Physical examination revealed mild hypovolemia associated with dehydration.
   - In addition to the abnormal kidney tests (BUN and creatinine) and thyroid tests, Missy's serum phosphorus was high.

   a. Using information from the textbook in Box 3-4 ("Examples of Patient Evaluations Listed Alphabetically"; page 96) and in Table 3-1 ("Prioritization of Technician Evaluations"; page 97), list and prioritize technician evaluations that would apply to Missy, and summarize the prescribed treatments and other actions taken to help her. (e.g., Missy was vomiting occasionally [technician evaluation: vomiting/nausea] and the doctor prescribed famotidine.)

As you do this, be aware that the treatments prescribed by the attending veterinarian are NOT the same as technician interventions. The technician caring for this patient would use the patient evaluations to develop a separate list of technician interventions and a plan of care. These interventions would include things like educating the client about the patient's disease, monitoring and recording fluid intake and output, and administering fluids and medications as ordered by the veterinarian. *(For more information about implementation of the Veterinary Technician Practice Model, see Rockett J, Lattanzio C, Anderson K: Patient assessment, intervention and documentation for the veterinary technician: a guide to developing care plans and SOAP's, Florence, KY, 2008, Delmar Cengage Learning.)*

Patient Evaluations	Treatments and Actions

3 years prior to presentation (at the time of diagnosis of chronic renal failure)

Upon presentation (at the time of diagnostic evaluation for heart disease)
Additional Information: At this time, the cardiac evaluation showed high blood pressure as well as several findings (e.g., fluid in the lungs, heart enlargement) that supported a decrease in cardiac function. Based on these findings, the doctor diagnosed congestive heart failure.

3 months after presentation (at the time follow-up blood work was taken, described under the heading "Outcome")
Additional history: At this time, Missy also exhibited an inability to engage in normal activities (she spent a lot of time lying down and didn't want to get up).

A few weeks later (at the time of esophagostomy tube placement)

b. At what point do you think Missy's quality of life had deteriorated to the point that euthanasia was the right choice? What is the reason for your decision?

EXERCISE 35.6 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. The need for hospice care for veterinary patients has increased in recent years. Describe some of the factors that has led to this increase.

2. As would be expected, difficulty chewing and dropping food from the mouth are signs of a deterioration of oral health (dental disease, gingivitis, a tumor, etc.). What are other signs of disease that may or may not be associated with oral disease, but should trigger an examination of the mouth?

3. What are some of the general signs that would indicate that a geriatric animal might have respiratory disease?

4. What is "cognitive dysfunction," and why does it sometimes strain the attachment between a pet and an owner?

5. Before giving any pain medication to a geriatric patient, and periodically while it is being given, blood work should be performed. Why is this necessary?

6. Decubital ulcers are a common complication in patients that cannot walk, such as those with spinal trauma or intervertebral disc disease.

   a. At what locations on the body do these ulcers most commonly form? What is it about these locations that predisposes them to ulcer formation?

b. What are some of the strategies that can be used to prevent decubital ulcers in recumbent patients? Include information about bedding, hygiene, and preventing undue pressure on the areas that are most at risk.

7. What conditions or factors predispose a patient to urine scalding?

8. Aging horses can develop one of a number of chronic diseases. For each of the following chronic diseases of the aged equine patient, indicate the part of the body that it effects and three common clinical signs associated with the condition. Because there are more than three clinical signs that may indicate each disease, pick three that you think are most important.

Disease Condition	**Part of the Body Affected by this Condition**	**Three Important Signs of this Condition**
Cushing disease		
Heaves		
Laminitis		
Wave mouth		
Chronic sinusitis		
Equine recurrent uveitis		
Neurologic deficits		
Osteoarthritis (DJD)		

9. Geriatric horses may have problems resulting from an overly long hair coat.

   a. What is the nature of the problems this can cause?

b. What can be done to keep these animals comfortable?

10. Geriatric horses with a poor body condition as a consequence of inadequate caloric intake may require dietary changes or supplementation. What specific dietary changes can be employed to maintain body weight in these patients?

36 The Human–Animal Bond, Bereavement, and Euthanasia

LEARNING OBJECTIVES

1. Pronounce, define, and spell each of the Key Terms in this chapter.
2. Discuss aspects of strong attachments to animals.
3. List and describe the stages of grief and the role of veterinary professionals in grief counseling.
4. Do the following regarding euthanasia:
   - Discuss the impact of euthanasia and client grief on members of the veterinary health care team.
   - Discuss the legal and ethical issues related to euthanasia.
   - Discuss the role of the veterinary health care team in counseling owners considering euthanasia of their pet, and factors that owners need to consider when making decisions regarding euthanasia.
   - Describe considerations in scheduling euthanasia appointments and in preparing for unexpected events during euthanasia.
   - List signs and symptoms of staff burnout.
   - List and describe acceptable methods of euthanasia in animals.
   - Discuss special considerations related to euthanasia of large animals.

EXERCISE 36.1 MATCHING: TERMS AND DEFINITIONS

Instructions: Match each term in column A with its corresponding definition in column B by writing the appropriate letter in the space provided.

Column A

1. _____ Denial
2. _____ Catharsis
3. _____ Resolution
4. _____ Bargaining
5. _____ Validation
6. _____ Compassion
7. _____ Depression
8. _____ Anger

Column B

A. This manifestation of grief may be evident as irritability, sleep irregularity, restlessness, and an inability to concentrate.

B. The point in the grief process when the client's routines are reestablished, and the pet is not forgotten but has been assigned to a special place in the bereaved individual's heart.

C. Guilt may be defined as this emotion turned inwards.

D. Assuring a client that they made the right decision following euthanasia of a pet, and affirming that it is OK to grieve, are examples of this.

E. Focusing on a minor problem, such as a matted hair coat, after just having been given a poor prognosis for an animal with a terminal disease is a form of this.

F. Attempting to replace an animal that has died without grieving for the pet that was lost is a form of this.

G. Understanding the suffering of others.

H. A release of emotion necessary to work through one's grief.

EXERCISE 36.2 DEFINITIONS: KEY TERMS

Instructions: Define each term in your own words.

1. Barbiturate: _____

2. Bereavement: _____

3. Drug Enforcement Agency (DEA): _____

4. Euthanasia: _____

5. Grief: _____

6. Grief process: _____

EXERCISE 36.3 TRUE OR FALSE: COMPREHENSIVE

Instructions: Read the following statements and write "T" for true or "F" for false in the blanks provided. If a statement is false, correct the statement to make it true.

1. _____ People often view their pets as filling the role of partner, child, or best friend.
2. _____ Pet ownership can be good for human health, as it has been shown to be an important predictor of survival for people with heart disease.
3. _____ The attachment of an owner to his or her guide dog is usually less strong than the attachment of an owner to his or her family pet.
4. _____ People who make up a person's support systems often do not fully understand the importance of the bond between a pet and its owner.
5. _____ Most people in the United States are reasonably comfortable with talking about death.
6. _____ Veterinary professionals usually receive extensive training on how to counsel grieving clients in professional or technical school as a part of the regular curriculum.
7. _____ People usually experience the stages of grief in a specific order (first denial, then bargaining, anger, depression, and, finally, resolution).
8. _____ Clients experiencing denial will often never fully accept the reality of the situation they are experiencing.
9. _____ Clients going through the denial stage of the grief process can often get to a stage of acceptance only when they are forced to face the truth by a professional.
10. _____ When a client is going through the anger stage of grief, it is best that the veterinarian not allow the client to express his or her anger in front of the staff.
11. _____ Children usually are able to accept a loss more quickly than an adult.
12. _____ Once a client has made the decision to euthanize a pet, you are obligated to let the client know if you don't agree with the decision.

13. _____ In the event that a client does not want to be present during euthanasia, it is also best that he or she not be permitted to see the body after the animal is dead, as this tends to increase anxiety and grief.

14. _____ When performing euthanasia by injection of sodium pentobarbital, the animal may struggle or vocalize even though it is not conscious.

15. _____ The Drug Enforcement Agency (DEA) of the U.S. Department of Justice requires that an accurate record be kept of the amount of barbiturate-class drug you use for each patient.

16. _____ Following euthanasia, once death has been confirmed by the vet, it is best to tell the client that the patient is dead.

17. _____ The use of dark humor by the staff to cope with the stress of euthanasia is an unfeeling action that has been shown to be ineffective.

EXERCISE 36.4 MULTIPLE CHOICE: COMPREHENSIVE

Instructions: Circle the one correct answer to each of the following questions.

1. The proportion of households in the United States that own at least one pet is approximately
   a. 1/10
   b. ¼
   c. ½
   d. ¾

2. During which stage of grief will a client often act in a way that makes him or her seem out of touch with reality?
   a. Anger
   b. Denial
   c. Depression
   d. Bargaining

3. A client comes into your practice to euthanize her pet. During the process she says, "If only I had fed a better quality food, maybe this would not be happening." This statement best characterizes which stage of the grief process?
   a. Denial
   b. Bargaining
   c. Anger
   d. Depression

4. In general, the best way to assist a client who is experiencing guilt is to say something like
   a. "I know how you feel."
   b. "We have a pet right here that is looking for a home and really needs you."
   c. "You did everything you could to help him."
   d. "Don't do this to yourself!"

5. A client comes into your practice to euthanize his pet. During the process he says, "I'm thinking euthanasia may be a mistake. Rover seemed to be making a turn for the better this morning and I think he can pull through." This statement best characterizes which stage of the grief process?
   a. Denial
   b. Bargaining
   c. Anger
   d. Depression

6. In general, the best way to assist a client who is expressing strong anger at the staff would be to
   a. Say "If you're going to threaten me, you just need to leave now!"
   b. Say "Please control yourself!"
   c. Say "There's no need to be angry, you did everything you could to help him."
   d. Just listen attentively and don't say anything.

7. Clients most often may be reluctant to pay the bill when they are going through which stage of grief?
   a. Denial
   b. Bargaining
   c. Anger
   d. Depression

8. A client comes into your practice to euthanize his pet. During the process he says, "Just last month I lost my wife, now I'm losing my dearest Buffy. I just don't know how I can go on without them." This statement best characterizes which stage of the grief process?
   a. Denial
   b. Depression
   c. Bargaining
   d. Anger

9. What is the best way to help a client make a decision whether or not to elect to euthanize a pet?
   a. Tell him or her what you would do if it were your pet.
   b. Give them information about euthanasia and treatment alternatives.
   c. Don't say anything, just listen.
   d. Make the decision for him or her.

10. A client comes into your practice to euthanize her pet. During the process she says, "Isn't there any other treatment we can try? Just yesterday my neighbor was telling me about an herbal remedy that completely cured her cat's cancer." This statement best characterizes which stage of the grief process?
    a. Denial
    b. Bargaining
    c. Anger
    d. Depression
    e. Resolution

11. Identify the preferred route of sodium pentobarbital administration for euthanasia.
    a. Intravenous
    b. Intrahepatic
    c. Intracardiac
    d. Intraperitoneal

12. Which of the following is usually the most helpful in coping with the stress associated with euthanasia?
    a. Take time off.
    b. Do something that you enjoy.
    c. Talk with colleagues about it.
    d. Make time for yourself.

13. The most commonly used drug for euthanasia is
    a. Sodium pentothal
    b. Phenobarbital sodium
    c. Thiopental sodium
    d. Sodium pentobarbital

EXERCISE 36.5 FILL-IN-THE-BLANK: COMPREHENSIVE

Instructions: Fill in each of the spaces provided with the missing word or words that complete the sentence.

1. The person who first described the five stages of grieving (denial, bargaining, anger, depression, and resolution) was _____ _____.

2. A change in appetite, decreased energy level, withdrawal from others, irritability, sleep irregularity, restlessness, and inability to concentrate are signs of the stage of grief known as _____.

3. The grief process is quite variable in length, and can last anywhere between a few _____ and many _____.

4. The word *euthanasia* is derived from the Greek root *eu*, meaning _____, and *thanatos*, meaning _____.

5. The most commonly used euthanasia solution is a barbiturate drug called _____ _____.

6. A factor that is much more important to consider when euthanizing large animals than when euthanizing small animals is _____.

EXERCISE 36.6 SHORT ANSWER: COMPREHENSIVE

To complete this exercise, please visit http://evolve.elsevier.com/Bassert/McCurnin/

EXERCISE 36.7 CASE STUDY #1: HELPING ADULTS THROUGH THE GRIEVING PROCESS

Mrs. Andreas came into your clinic today with her 12-year-old, female, Golden Retriever, Goldie. Goldie had not been feeling well for about a week, and the owner noticed a few large lumps under her jaw. A physical examination revealed generalized enlargement of the peripheral lymph nodes. A complete diagnostic workup was done, including a needle biopsy of the right submandibular lymph node. The tests revealed lymphoma (cancer of the lymph nodes). While the doctor was explaining the disease and the prognosis, Mrs. Andreas looked away and seemed preoccupied with other thoughts. The doctor then tried to discuss treatment options, but Mrs. Andreas cut him off and said she had to leave or Goldie would be late for an appointment at the groomers.

1. What stage of grief do you think Mrs. Andreas is in?

2. Your initial feelings are irritation and frustration. Should you express these feelings to Mrs. Andreas? Why or why not?

3. What are some constructive steps you could take to help Mrs. Andreas come to terms with the diagnosis?

EXERCISE 36.8 CASE STUDY #2: HELPING CHILDREN THROUGH THE GRIEVING PROCESS

You have just returned home from the animal hospital. Bonnie, your 19-year-old Siamese cat was euthanized as a result of complications related to chronic kidney failure. It has been a difficult few weeks as Bonnie was failing for some time, and required a lot of care. Her condition deteriorated very suddenly this morning, and so you had to make arrangements for the euthanasia sooner than you had anticipated and did not have the opportunity to prepare your 6-year-old daughter, Lizzy. When you returned home, Lizzy had just come home from school. She noticed immediately how upset you were, and started to cry. Even before today, she had been acting more clingy and quiet than usual.

1. What are some of the emotions that Lizzy may be feeling?

2. When explaining Bonnie's death, is it preferable to be honest, or to make up a story that will "soften the blow" and why?

3. In what way might Lizzy view Bonnie's death differently than an older child?

4. When talking with Lizzy about Bonnie's death, it is important that you avoid using euphemisms. What is a euphemism, and why is it best you do not use them around children?

5. After telling Lizzy that Bonnie died, you are feeling unbelievably weary and tired of the whole ordeal, and tell her you don't really want to talk about it anymore. Why might this approach intensify Lizzy's feelings?

6. The next day, you notice Lizzy acting out a funeral for Bonnie in the back yard. It seems a little weird to you. Should this concern you? Why or why not?

EXERCISE 36.6 SHORT ANSWER: COMPREHENSIVE

Instructions: Provide a short answer to each of the following questions in the space provided.

1. In recent years, the relationship between humans and animals has shifted as social norms, average family size, gender roles, and living circumstances have changed. Discuss the ways in which urbanization, the increase in the number of women working outside the home, the increase in the frequency that people move, and the decrease in the number of people per household has changed the relationship between animals and people.

2. What are some of the differences in societal expectations about the way a person will act and conduct himself or herself when an animal dies as opposed to when an immediate family member dies?

3. Bereaved individuals may at times appear to the veterinary team as out of control or out of touch with reality. What types of behaviors may they exhibit that can give this impression?

4. As a veterinary technician, why will you often have to repeat instructions to a client who is in bereavement?

5. Clients who are in the anger stage of grief will often direct their anger toward the veterinary professionals who were caring for their pet. What kinds of things would you expect they might say in these circumstances?

6. What types of clients are generally at higher risk for severe depression following the loss of a pet?

7. Just as clients experience grief following the death of a beloved pet, members of the veterinary staff experience similar feelings, although they may not be as intense.

   a. Describe some of the emotions a veterinary technician may feel when a beloved patient dies.

   b. What are some situations that can increase the stress a technician may feel?

   c. What are some of the coping mechanisms that the technician can engage in to manage the stress associated with euthanasia?

8. List some of the factors that may influence a client's decision to euthanize a pet.

9. What is "convenience euthanasia"?

10. Why is it best not to use euphemisms like "put to sleep," "put down," "put away," or "humanely destroy" when discussing euthanasia with a client?

11. A number of decisions must be made when preparing to euthanize a pet. What are some of these decisions, and why are they important?

12. Unexpected reactions (such as vocalization) to injection of a euthanasia agent can be very upsetting for the client, unless they are prepared in advance. List some other possible reactions that you may want the client to be aware of, and indicate what you might say to the client to prepare them for this possibility.

13. After euthanasia, when allowing a client to view their pet's body, it is important to clean the body and make it as aesthetically presentable as possible. What are some of the things you should check and do before presenting the body to a client?

14. It is often helpful to a client to do something to memorialize their pet after euthanasia.

    a. What does this mean?

    b. List some examples of how a pet can be memorialized.

15. The stress associated with euthanasia is often more severe for those working in shelters than for those working in a general practice.

    a. Why is this the case?

b. What steps can be taken regarding the way euthanasia is carried out to help lessen this stress? _____

_____

_____

_____

_____