Estimated Normal Vital Signs

	Dog	Cat
HR	**Adults:** 60 to 160 beats/min (large and/or relaxed dogs have slower HRs) **Puppies:** up to 220 beats/min	**Adults and Kittens in hospital:** 140 to 220 beats/min (up to 240 beats/min if very stressed) **Adults and Kittens relaxed at home:** 100 to 140 beats/min
RR	10 to 30 breaths/min	15 to 40 breaths/min
TEMP	99.5 to 102.5 °F 37.5 to 39.2 °C	100.5 to 102.5 °F 38.1 to 39.2 °C
MM	pink & moist	
CRT	1 to 2 seconds	
BP Systolic Diastolic Mean	100 to 160 mm Hg 60 to 90 mm Hg 80 to 120 mm Hg	
SPO_2	95 to 100% (98 to 100% preferred)	

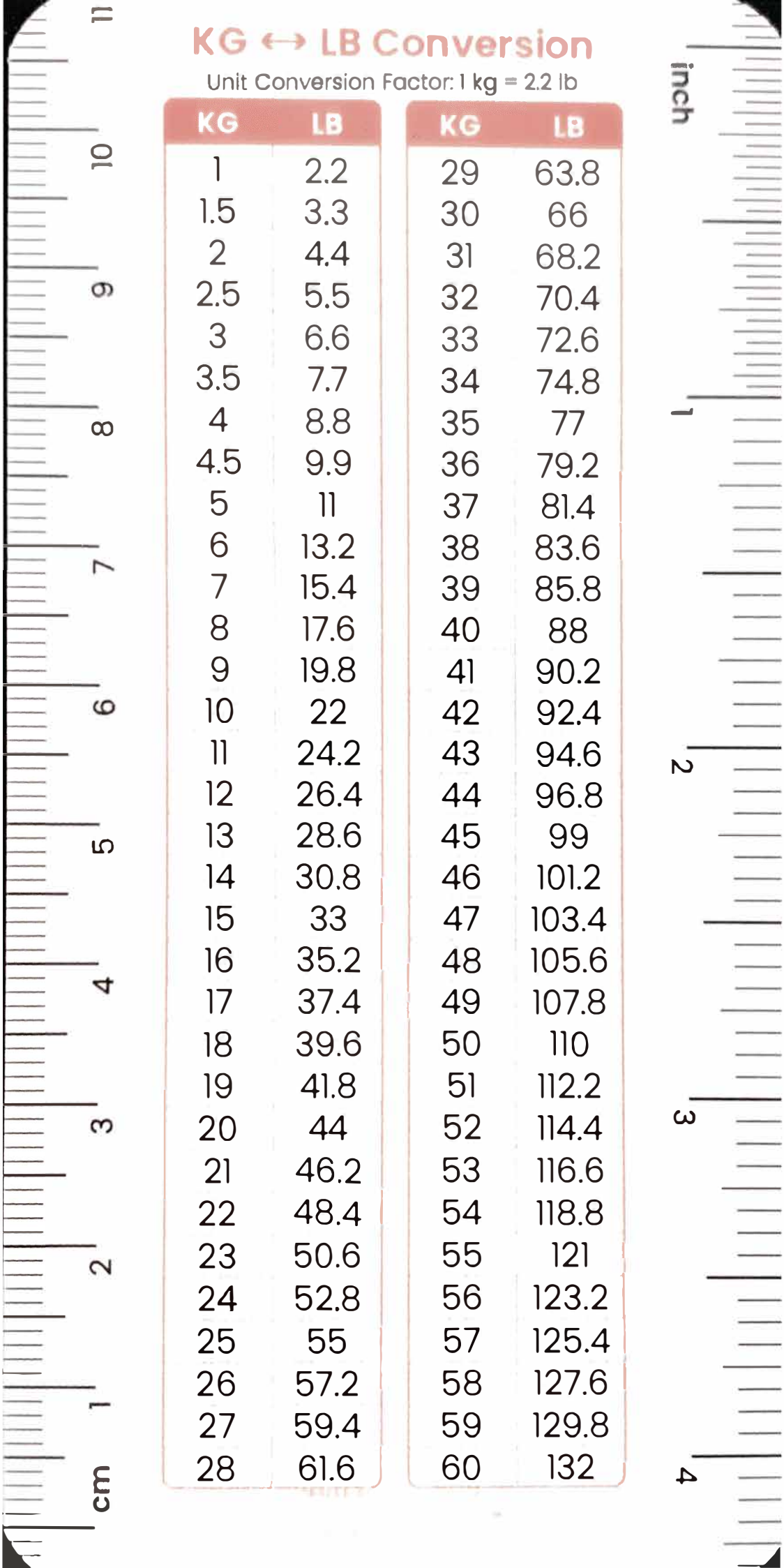
These estimated normal vital signs are for non-anesthetized patients. Keep in mind that factors such as fear, anxiety and excitement can affect vital signs. Ranges vary slightly among different sources. Check values and use at own risk. This card is to be used for educational purposes and as guidelines only.

KG ↔ LB Conversion

Unit Conversion Factor: 1 kg = 2.2 lb

KG	LB
1	2.2
1.5	3.3
2	4.4
2.5	5.5
3	6.6
3.5	7.7
4	8.8
4.5	9.9
5	11
6	13.2
7	15.4
8	17.6
9	19.8
10	22
11	24.2
12	26.4
13	28.6
14	30.8
15	33
16	35.2
17	37.4
18	39.6
19	41.8
20	44
21	46.2
22	48.4
23	50.6
24	52.8
25	55
26	57.2
27	59.4
28	61.6

KG	LB
29	63.8
30	66
31	68.2
32	70.4
33	72.6
34	74.8
35	77
36	79.2
37	81.4
38	83.6
39	85.8
40	88
41	90.2
42	92.4
43	94.6
44	96.8
45	99
46	101.2
47	103.4
48	105.6
49	107.8
50	110
51	112.2
52	114.4
53	116.6
54	118.8
55	121
56	123.2
57	125.4
58	127.6
59	129.8
60	132



Puppy Vaccination Guidelines

Dogs 16 weeks of age or younger

Vaccine	Route	8 weeks	12 weeks	16 weeks
DAPP	SC	x	x	x
Rabies	SC, IM			x
Bordetella	IN, PO		x	
Bordetella	SC		x	x
Leptospirosis	SC		x	x
Lyme	SC		x	x

Example of vaccination scheduling options.
Do not give unnecessary vaccines. Consider splitting up vaccines, especially in patients < 10 kg. Pre-treat and post-treat as indicated.

Notes

Core Vaccines: DAPP and Rabies.

Non-Core Vaccines: Bordetella, Leptospirosis and Lyme; these are geographical, lifestyle, etc. dependent.

DAPP: Can begin as early as 6 weeks of age. Booster every 2 to 4 weeks until at least 16 weeks of age.

Rabies: Pay attention to the route. Can begin as early as 12 weeks of age - follow local laws. Administer 1 dose.

Bordetella: Pay attention to the route. IN route can begin as early as 3 to 4 weeks of age. PO and SC routes can begin as early as 8 weeks of age. Administer 1 dose for the IN and PO routes. Administer 2 doses 2 to 4 weeks apart for the SC route.

Leptospirosis and Lyme: Can begin as early as 8 to 9 weeks of age. Administer 2 doses 2 to 4 weeks apart.

Kitten Vaccination Guidelines

Cats 16 weeks of age or younger

Vaccine	Route	8 weeks	12 weeks	16 weeks
FVRCP	SC, IN	X	X	X
Rabies	SC, IM			X
FeLV	SC		X	X

Example of vaccination scheduling options.
Do not give unnecessary vaccines. Consider splitting up vaccines, especially in patients < 10 kg. Pre-treat and post-treat as indicated.

Notes

Core Vaccines: FVRCP and Rabies. FeLV is considered a core vaccine for kittens and young adult cats less than 1 year of age due to age-related susceptibility.

Non-Core Vaccines: FeLV is considered a non-core vaccine for low-risk adult cats.

FVRCP: Pay attention to the route. Can begin as early as 6 weeks of age. Booster every 3 to 4 weeks until 16 to 20 weeks of age.

Rabies: Pay attention to the route. Can begin as early as 12 weeks of age - follow local laws. Administer 1 dose.

FeLV: Can begin as early as 8 weeks of age. Administer 2 doses 3 to 4 weeks apart.

These guidelines are based on 2017 AAHA Canine Vaccination Guidelines and 2020 AAHA/AAFP Feline Vaccination Guidelines.

Vaccination guidelines vary among different geographical regions. Adapt guidelines as needed and review vaccine manufacturer label instructions. Tailor vaccination protocol to the individual patient. Check information and use at own risk. This card is to be used for educational purposes and as guidelines only.

Anesthesia for Dogs and Cats

Estimated Normal Vital Signs Under Anesthesia

	Dog	Cat
HR	60 to 150 beats/min Investigate a sudden decrease or increase in HR or HR rate < 50 to 70 beats/min or > 150 to 190 beats/min	120 to 180 beats/min Investigate a sudden decrease or increase in HR or HR rate < 100 beats/min or > 180 to 220 beats/min
RR	8 to 20 breaths/min	12 to 24 breaths/min
TEMP	100 to 102.5 °F (37.8 to 39.2 °C) Investigate < 98 °F (36.7 °C) or > 102.5 °F (39.2 °C)	
MMC	pink	
CRT	1 to 2 seconds	
BP Systolic Diastolic Mean	90 to 140 mm Hg Investigate < 80 to 90 mm Hg or > 160 to 180 mm Hg 50 to 80 mm Hg Investigate < 40 mm Hg or > 90 to 110 mm Hg 70 to 110 mm Hg Investigate < 60 to 70 mm Hg or > 120 to 140 mm Hg	
SPO_2	95 to 100% (98 to 100% preferred)	
$ETCO_2$	35 to 45 mm Hg in awake patients Up to 55 mm Hg generally considered acceptable under anesthesia (Initiate IPPV if > 60 to 65 mm Hg)	

Treat the patient and trends, not the readings alone

Additionally: Monitor pulse quality, capnograph, ECG, eye position, palpebral reflex, jaw tone, etc. Monitor for any arrhythmias, murmurs, adverse or allergic reactions, signs of fluid overload, etc.

Anesthesia for Dogs and Cats

Safety Checklist Guidelines

- [ ] Confirm patient name, owner consent and procedure
- [ ] Pre-ax workup including signalment, hx (fasted, medications, comorbidities, allergies?), PE, BW, ASA
- [ ] Place patent IV catheter
- [ ] Calculate (based on ideal body weight) drug doses/ dosages including ER drugs and IV fluids
- [ ] Syringes, needles
- [ ] Stethoscope, watch, thermometer
- [ ] Crash cart
- [ ] Warming devices
- [ ] Laryngoscope
- [ ] ET tube pre-measure (tip of nose to thoracic inlet), leak check cuff, tube tie
- [ ] BP, pulse oximeter, ECG, capnograph
- [ ] O_2 mask, breathing circuit, reservoir bag
- [ ] Scavenging system
- [ ] Fluid and syringe pumps including priming lines
- [ ] O_2 cylinder > 200 psi
- [ ] CO_2 absorbent replace after 6 to 8 hr of use
- [ ] Vaporizer refill if below half-way full mark, turn vaporizer dial and O_2 flow off before filling, do not tip over or shake
- [ ] Flowmeters, pressure gauges
- [ ] Leak check everything ax machine, breathing circuit, reservoir bag, ET tube, etc.
- [ ] Ensure open APL valve
- [ ] Ensure sterility
- [ ] Obtain baseline vitals
- [ ] Pre-oxygenate ~5 min
- [ ] ET tube placement
- [ ] Lubricate eyes ~q 2 to 4 hr
- [ ] Record all readings and drugs
- [ ] Continuously monitor
- [ ] Count gauze pads, needles, blades, etc.
- [ ] Discharge instructions

Factors can affect vital signs. Ranges and values vary slightly among different sources. Check information and use at own risk. This card is to be used for educational purposes and as guidelines only.

Oxygen Cylinders

Pressure in full E and H cylinders: 2,200 psi
Full E cylinder O_2 capacity in liters: 660 L
Full H cylinder O_2 capacity in liters: 6,600 L

Calculating oxygen cylinder liters remaining:

E cylinder

Shortcut: 0.3 × psi reading = L remaining

$$\frac{2{,}200 \text{ psi}}{660 \text{ L}} = \frac{\text{psi reading on E cylinder}}{x \text{ L}}$$

Cross multiply and solve for *x*

H cylinder

Shortcut: 3 × psi reading = L remaining

$$\frac{2{,}200 \text{ psi}}{6{,}600 \text{ L}} = \frac{\text{psi reading on H cylinder}}{x \text{ L}}$$

Cross multiply and solve for *x*

Calculating oxygen cylinder time remaining:

$$\text{Time until } O_2 \text{ depleted (min)} = \frac{O_2 \text{ cylinder liters remaining (L)}}{O_2 \text{ flow rate (L/min)}}$$

Tidal Volume (V_T)

Based on ideal body weight

$$V_T = BW_{kg} \times (10 \text{ to } 20 \text{ mL/kg})$$

Minute Ventilation (V_E)

Shortcut: ~200 mL/kg/min

$$V_E = V_T \times RR$$

Reservoir Bag Size

Shortcut: ~BW_{kg} × 60 mL/kg

Reservoir bag size = V_T × (3 to 6)
Generally round up to the nearest reservoir bag size.

Anesthesia for Dogs and Cats

Breathing Circuits

Based on ideal body weight

Non-rebreathing circuit:
patients < 3 to 5 kg (6.6 to 11 lb) Note: some use < ~5 kg.

Adult rebreathing circuit (circle system):
patients > 3 to 5 kg (6.6 to 11 lb) Note: some use > ~10 kg.

Pediatric rebreathing circuit (circle system):
patients < 3 to 5 kg (6.6 to 11 lb) Note: some use ~5 to 10 kg.

Oxygen (Fresh Gas) Flow Rates

Based on ideal body weight

Non-rebreathing circuit:
High flow ~200 to 400 mL/kg/min
Note: some use Oxygen Flow Rate (FGF Rate) = V_E × Circuit Factor.

Rebreathing circuit (circle system):
Medium flow: ~20 to 40 mL/kg/min
Low flow: ~10 to 20 mL/kg/min
Closed flow (~metabolic O_2 requirement): ~3 to 10 mL/kg/min
A recommendation is to provide high flow ~100 to 200 mL/kg/min for the first 10 to 20 minutes (induction phase), then reduce to medium or low flow for maintenance phase.

Most vaporizers require a minimum Oxygen Flow Rate (FGF Rate) of 500 mL/min (0.5 L/min) to ensure accuracy.
Unit conversion factor 1,000 mL = 1 L.

Vaporizer

Multimodal general anesthesia lowers MAC

Sevoflurane MAC: 2.1 to 2.4% in dogs, 2.6 to 3.4% in cats
Isoflurane MAC: 1.3 to 1.4% in dogs, 1.3 to 1.9% in cats
Surgical Plane = MAC × (1.2 to 1.5)

Ranges and values vary slightly among different sources. Check information and use at own risk. This card is to be used for educational purposes and as guidelines only.

Anesthesia for Dogs and Cats

General Anesthesia Fluid Rate Guidelines

Fluid Type: Balanced Isotonic Crystalloid (LRS, Hartmann's Solution, Normosol-R, Plasma-Lyte A, Plasma-Lyte 148).
Dogs: 5 mL/kg/hr IV recommended as initial fluid rate.
Cats: 3 mL/kg/hr IV recommended as initial fluid rate.
Add additional volume for correcting fluid deficits.
A recommendation is to reduce the fluid rate after 1 hr if patient is stable. Reduce by 25% every hr until achieving maintenance fluid rate, as long as patient remains stable. Hypotension requiring fluid therapy: a recommendation is fluid bolus dose 3 to 10 mL/kg IV in dogs and cats over 5 to 15 minutes, repeat once if needed; can consider synthetic colloid. Monitor patients with cardiac or renal dz, or cats closely for fluid overload. Tailor fluid therapy to each patient. Fluids are not benign and come with risks.

Cardiovascular

Cardiac Output (CO) = HR × Stroke Volume (SV)
MAP = CO × Systemic Vascular Resistance (SVR)
MAP =DAP + 1/3 (SAP-DAP)

ASA Classifications

American Society of Anesthesiologists

ASA I: Normal healthy patient.
ASA II: Patient with mild systemic disease.
ASA III: Patient with moderate to severe systemic disease.
ASA IV: Patient with severe systemic disease that is a constant threat to life.
ASA V: Moribund or dying patient, not expected to survive without the surgery.
ASA VI: Brain-dead patient, organs being removed for donor purposes.
E: can be added to denote emergency surgery.

Anesthesia for Dogs and Cats

Anesthetic Depth

Stage I: Voluntary movement and disorientation.
Stage II: Involuntary movement and delirium.
Stage III Plane I: Surgical - light anesthesic depth.
Stage III Plane II: Surgical - moderate anesthesic depth.
Stage III Plane III: Surgical - deep anesthetic depth.
Stage III Plane IV: Surgical - too deep.
Stage IV: Overdose, respiratory and cardiac arrest. Dying.

Extra Notes

Additional monitoring includes urinary catheter (urine output rate 1 to 2 mL/kg/hr), glucometer (neonates, patients with disease), CVP (pump failure, hypovolemia) and for regurgitation. Topical lidocaine helps prevent laryngospasm in cats. Do not overinflate or underinflate ET tube cuff. Pulse oximeter is sensitive and may need adjustment. Disconnect ET tube from breathing circuit when moving or repositioning patient. Breathing circuit pressure gauge should be zero unless performing leak check or IPPV. O_2 flush valve not to be used with patient connected to breathing circuit, never if connected to non-rebreathing circuit. Inflate reservoir bag by turning up O_2 flow rate, not by using O_2 flush valve. Blood volume ~90 mL/kg in dogs and ~66 mL/kg in cats. IPPV ~8 to 14 breaths/min. PIP in healthy patients ~10 to 20 cm H_2O. Continue O_2 ~5 min after turning off vaporizer. Wait until normal RR and SPO_2, patient swallowing, and deflate ET tube cuff prior to extubation. Wait until fully recovered before removing IV catheter. Monitor until alert, normothermic and sternal (or ambulatory).

General Anesthesia Fluid Rate for Dogs

Dog = 5 mL/kg/hr

KG	LB	GA (mL/hr)
1	2.2	5
2	4.4	10
3	6.6	15
4	8.8	20
5	11	25
6	13.2	30
7	15.4	35
8	17.6	40
9	19.8	45
10	22	50
11	24.2	55
12	26.4	60
13	28.6	65
14	30.8	70
15	33	75
16	35.2	80
17	37.4	85
18	39.6	90
19	41.8	95
20	44	100
21	46.2	105
22	48.4	110

KG	LB	GA (mL/hr)
23	50.6	115
24	52.8	120
25	55	125
26	57.2	130
27	59.4	135
28	61.6	140
29	63.8	145
30	66	150
32	70.4	160
34	74.8	170
36	79.2	180
38	83.6	190
40	88	200
42	92.4	210
44	96.8	220
46	101.2	230
48	105.6	240
50	110	250
52	114.4	260
54	118.8	270
56	123.2	280
58	127.6	290

General Anesthesia Fluid Rate for Cats

Cat = 3 mL/kg/hr *

KG	LB	GA (mL/hr)
1	2.2	3
1.5	3.3	4.5
2	4.4	6
2.5	5.5	7.5
3	6.6	9
3.5	7.7	10.5
4	8.8	12
4.5	9.9	13.5

KG	LB	GA (mL/hr)
5	11	15
5.5	12.1	16.5
6	13.2	18
6.5	14.3	19.5
7	15.4	21
7.5	16.5	22.5
8	17.6	24
8.5	18.7	25.5

* General Anesthesia Fluid Rate Guidelines

Fluid Type: Balanced Isotonic Crystalloid (LRS, Hartmann's Solution, Normosol-R, Plasma-Lyte A, Plasma-Lyte 148).

Dogs: 5 mL/kg/hr IV recommended as initial fluid rate.

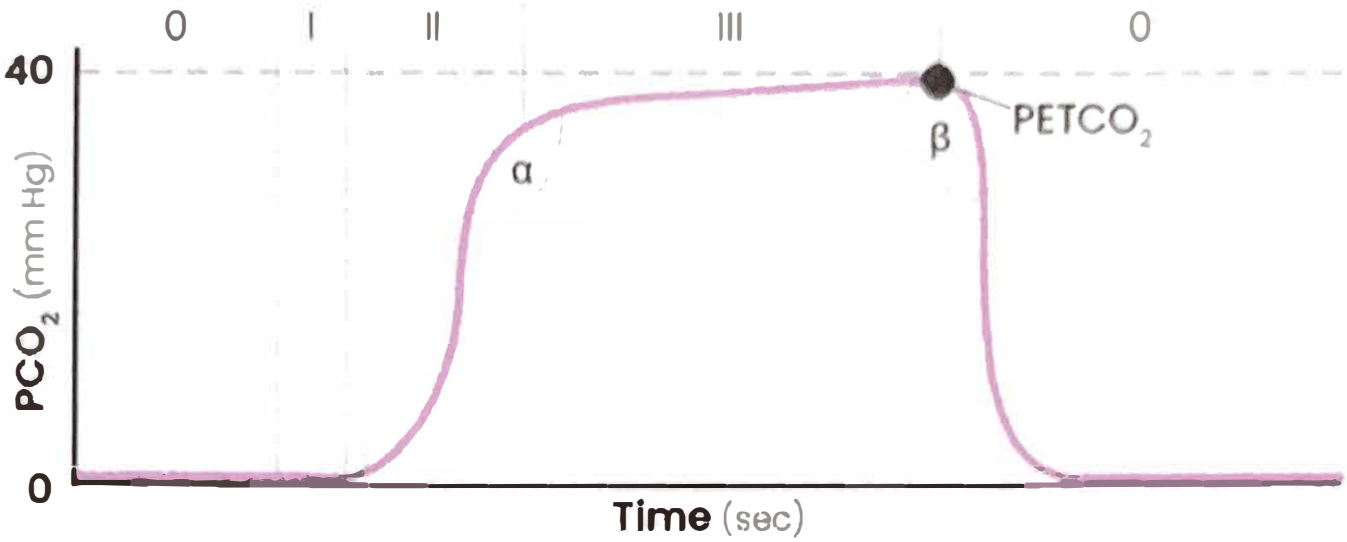
Cats: 3 mL/kg/hr IV recommended as initial fluid rate.

Add additional volume for correcting fluid deficits.

A recommendation is to reduce the fluid rate after 1 hr if patient is stable. Reduce by 25% every hr until achieving maintenance fluid rate, as long as patient remains stable. Hypotension requiring fluid therapy: a recommendation is fluid bolus dose 3 to 10 mL/kg IV in dogs and cats over 5 to 15 minutes, repeat once if needed; can consider synthetic colloid. Monitor patients with cardiac or renal dz, or cats closely for fluid overload. Tailor fluid therapy to each patient. Fluids are not benign and come with risks.

Capnography Waveforms

Normal Time Capnogram Components



Phase I (Expiratory Baseline): Expiration begins. Exhalation of CO_2-free gas from dead space. Should be zero PCO_2 (partial pressure of carbon dioxide).

Phase II (Expiratory Upstroke): Exhalation of mixed dead space and alveolar gases. Rapid PCO_2 increase. Steep positive slope.

Phase III (Expiratory/Alveolar Plateau): Exhalation of CO_2-rich alveolar gas. Near horizontal, very slight positive slope ending at $PETCO_2$ (end-tidal PCO_2).

Phase 0 (i. Inspiratory Downstroke and ii. Inspiratory Baseline): i. Inspiration begins. Inhalation of CO_2-free gas begins. Rapid PCO_2 decrease. Steep negative slope. Should return to zero PCO_2. ii. Inspiration continues. Inhalation of CO_2-free gas continues. Should be zero PCO_2.

$PETCO_2$: Peak PCO_2 at end of expiration. 35 to 45 mm Hg considered normal in awake patients. * 35 to 55 mm Hg considered acceptable under anesthesia, but caution with conditions such as neurologic dz. Initiate IPPV if > 60 to 65 mm Hg.

Alpha Angle: The transition from phase II to phase III. Should be ~100° to 110°. Alpha angle increases with less steep slope of phase II and steeper slope of phase III. V/Q status.

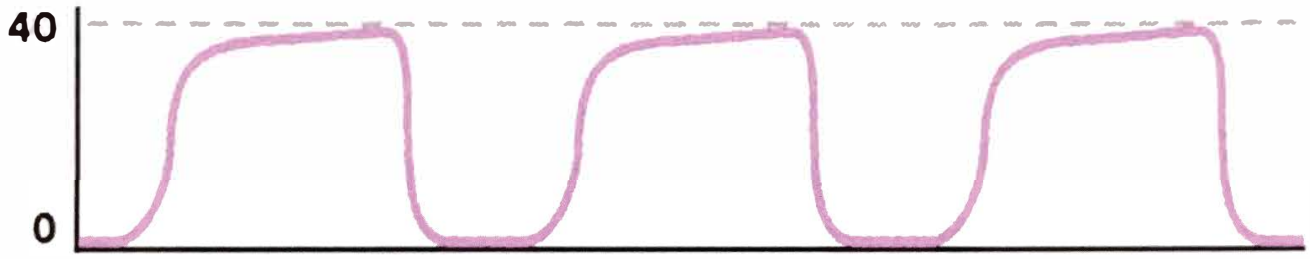
Beta Angle: The transition from phase III to phase 0. Should be ~90°. Beta angle increases with less steep slope of phase 0.

Capnography Waveforms

Capnography provides important information regarding the patient (ventilation, metabolism, circulation) and the circuit (malfunction, error).

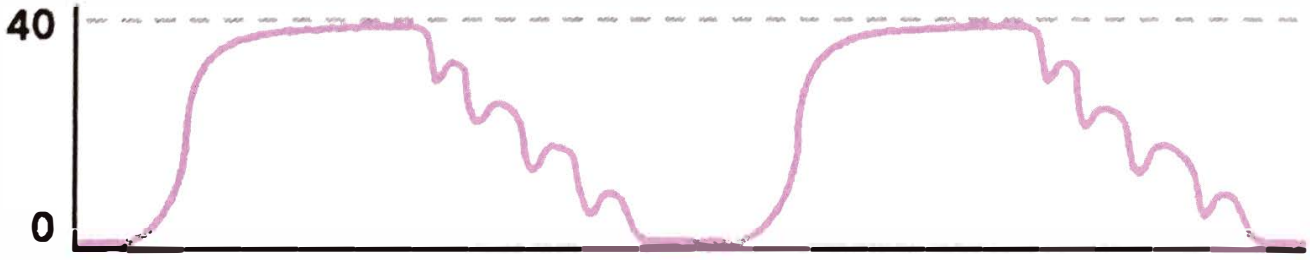
Bradypnea: abnormally low RR
Tachypnea: abnormally high RR
Hypoventilation: abnormally high CO_2 level ($PaCO_2$, $PETCO_2$)
Hyperventilation: abnormally low CO_2 level ($PaCO_2$, $PETCO_2$)
Hypocapnia: abnormally low CO_2 level in the blood ($PaCO_2$)
Hypercapnia: abnormally high CO_2 level in the blood ($PaCO_2$)
Hypoxemia: abnormally low O_2 level in the blood (PaO_2, SPO_2)

Normal Time Capnogram



Cardiogenic Oscillations

Ripple effect along downstroke.

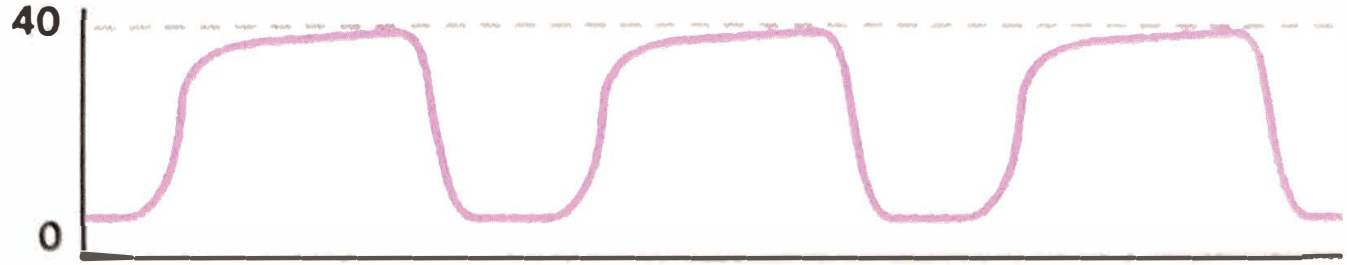


Common in large patients and patients with bradypnea. Ripples synchronized with HR. Check $PETCO_2$ (If normal, clinically insignificant, no treatment required. If abnormally high, causes include deep ax depth, significant bradypnea). Check patient, troubleshoot, correct (decrease inhalent, ventilate, increase IPPV, etc). Note: Ripple effect is due to each cardiac contraction causing a small amount of CO_2 to be expelled during the expiratory pause.

Capnography Waveforms

Rebreathing CO_2

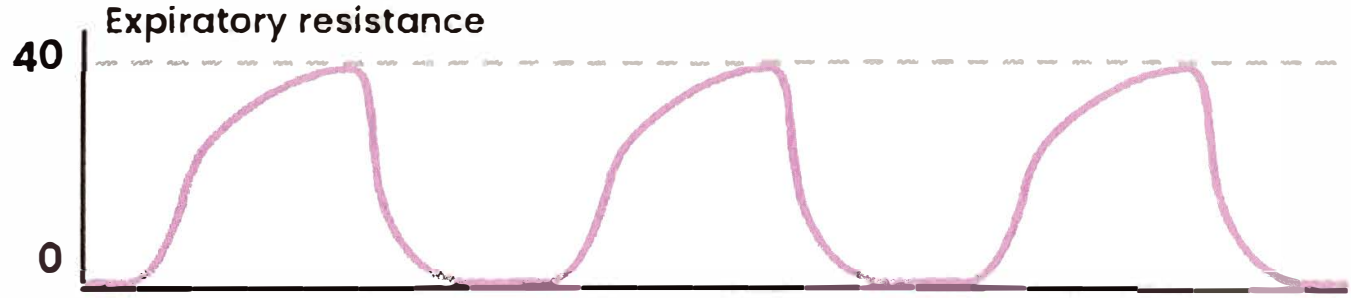
Baseline does not return to zero (inspired PCO_2 > 0 mm Hg), less steep slope of downstroke, increased beta angle.



Causes include inadequate O_2 flow rate especially in patients with tachypnea and inappropriate I:E ratio, excessive dead space, exhausted CO_2 absorbent, increased circuit resistance, malfunctioning unidirectional valve, circuit too large for patient, coaxial tube leak. Check patient, troubleshoot, correct (increase O_2 flow rate, ventilate, reduce dead space, change CO_2 absorbent, replace unidirectional valve, change circuit esp if small patient on circle system, etc). Note: Leads to light ax depth, increasing elevation of baseline (increasing inspired PCO_2), increasing $PETCO_2$ and abnormally high CO_2.

Obstruction

Less steep slope of upstroke, steeper slope of plateau, increased alpha angle. Shark fin appearance.

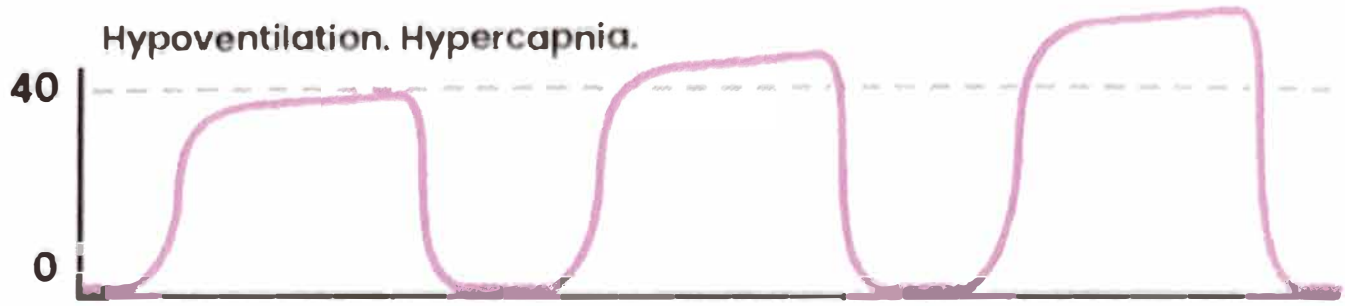


Causes include kinked or obstructed ET tube (mucus plug), bronchospasm or bronchoconstriction (anaphylaxis, asthma, COPD), malfunctioning expiratory valve, closed APL valve. Check patient, troubleshoot, correct (ventilate, reintubate, bronchodilator, replace expiratory valve, open APL valve, etc). Note: Leads to abnormally high CO_2. Monitor cats closely.

Capnography Waveforms

Abnormally high CO_2

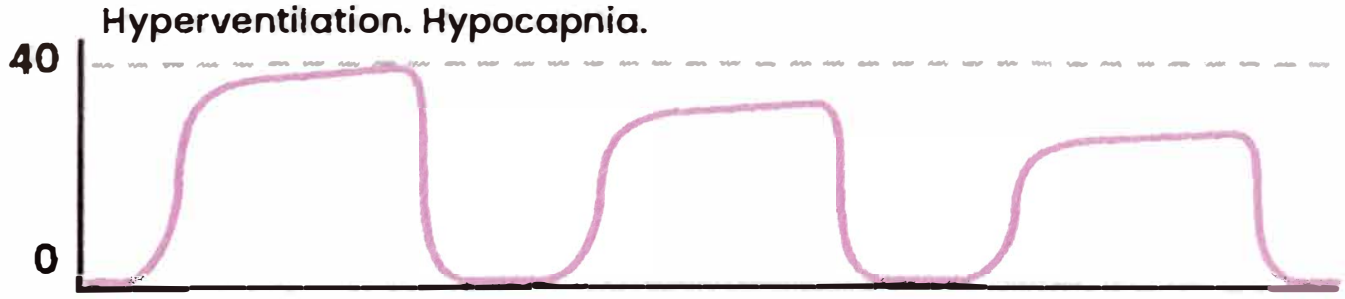
Increasing $PETCO_2$, waveform becomes taller and $PETCO_2$ > 45 mm Hg.



Causes include deep ax depth, inadequate IPPV, bradypnea, abnormally low tidal volume, lung dz, atelectasis, chest expansion interference (body position, obesity, abdominal mass, GDV, pneumothorax), hyperthermia, hypermetabolism, shivering, sodium bicarbonate. Check patient, troubleshoot, correct (decrease inhalent, ventilate, increase IPPV, reposition, cool, check ABG, etc). Note: Leads to hypoxemia, respiratory acidosis and (cerebral) vasodilation - caution with neurologic dz. Causes such as increased cardiac output during effective CPR and ROSC can result in a sudden increase in $PETCO_2$.

Abnormally low CO_2

Decreasing $PETCO_2$, waveform becomes shorter and $PETCO_2$ < 35 mm Hg.



Causes include light ax depth, excessive IPPV, tachypnea, abnormally high tidal volume, pain, hypothermia, hypometabolism, hypoxemia, metabolic acidosis, poor cardiac output, pulmonary embolism. Check patient, troubleshoot, correct (increase inhalent, reduce IPPV, warm, check ABG, treat poor cardiac output, etc). Note: Leads to respiratory alkalosis and (cerebral) vasoconstriction. Causes such as cardiopulmonary arrest can result in a rapid or sudden decrease in $PETCO_2$ to 0 mm Hg. Check patient, troubleshoot, correct (CPR).

Capnography Waveforms

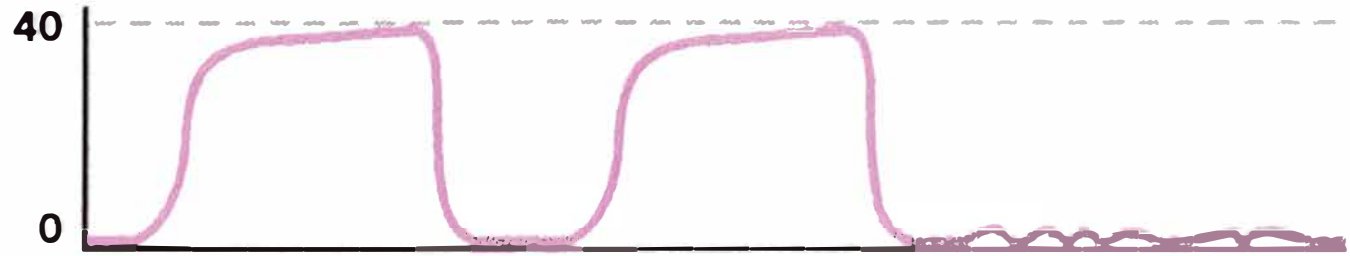
Absent Waveform

States "no breaths" or "apnea", or $PETCO_2$ = 0 mm Hg.

Causes include apnea, disconnection, esophageal intubation, extubation, obstruction, cardiopulmonary arrest. Check patient, troubleshoot, correct (ventilate, reconnect, reintubate, CPR, etc). Note: Leads to light ax depth and hypoxemia.

Loss of Waveform

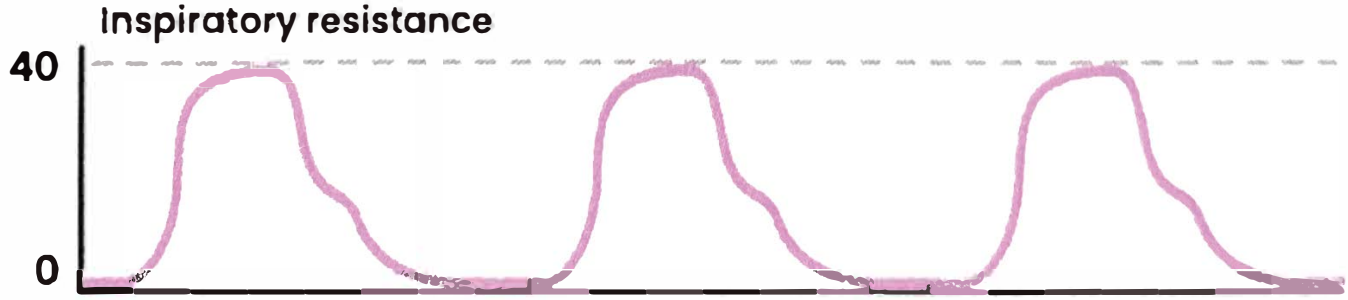
Waveform disappears. $PETCO_2$ to 0 mm Hg.



Causes include apnea, disconnection, extubation, obstruction, cardiopulmonary arrest. Check patient, troubleshoot, correct (ventilate, reconnect, reintubate, CPR, etc). Note: Leads to light ax depth and hypoxemia.

Circuit Leak

Narrow plateau, less steep slope of downstroke, increased beta angle. Rounded appearance.

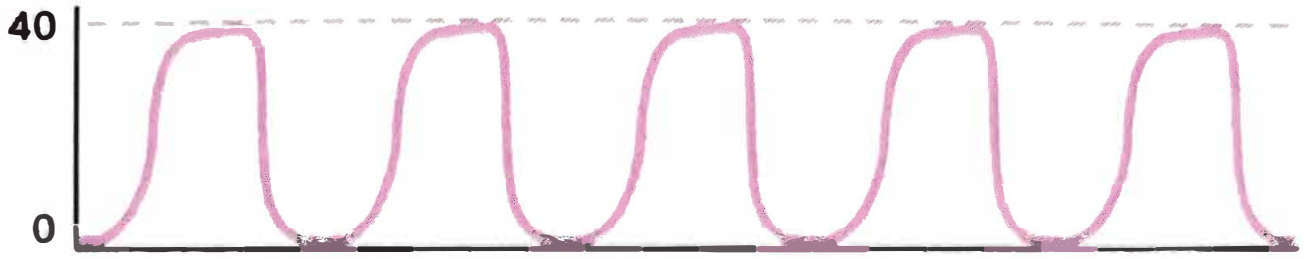


Causes include ET tube cuff leak. Check patient, troubleshoot, correct (resize or resposition ET tube, reinflate ET tube cuff, etc). Note: Leads to light ax depth, environmental contamination, decreased $PETCO_2$ reading due to dilution.

Capnography Waveforms

Tachypnea

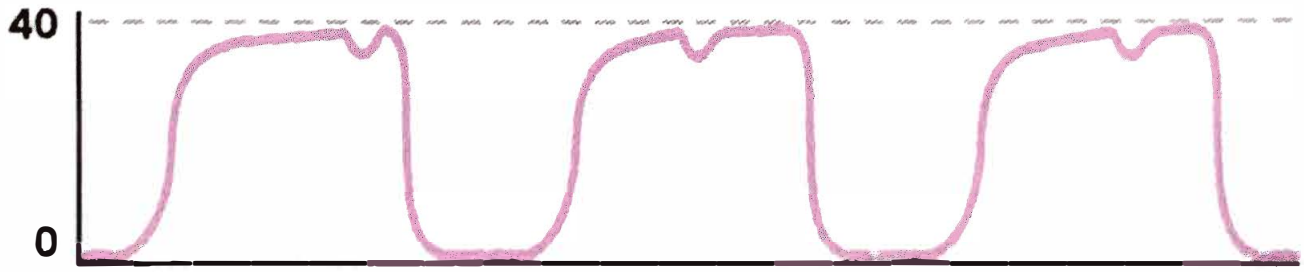
Abnormally high RR, narrow plateau. Tall peak appearance



Causes include light ax depth, pain, hyperthermia, hypoxemia, metabolic acidosis. Check patient, troubleshoot, correct (increase inhalent, analgesic, cool, ventilate, check SpO_2, check ABG, etc). Note: Leads to light ax depth, $PETCO_2$ can be normal, but can also lead to decreasing $PETCO_2$ and abnormally low CO_2, or rebreathing CO_2 with increasing $PETCO_2$ and abnormally high CO_2.

Curare Cleft

Dip or notch along plateau.



Causes include patient fighting ("bucking") mechanical ventilator as muscle relaxant starts to wear off, artifact with surgeon pressing on patient. Check patient, troubleshoot, correct (increase IPPV, increase inhalent, neuromuscular blocking agent, etc). Note: Instead of curare cleft, can also see normal waveform followed by additional peak.

Remember to ensure proper calibration, and to check for cracks or condensation. Treat the patient, not the machine readings alone.

Maintenance IV Fluid Rate for Cats

$$\text{Cat} = 80 \times BW_{kg}^{0.75} \text{ mL/day}$$

KG	LB	Maint. (mL/hr)
1	2.2	3
1.5	3.3	5
2	4.4	6
2.5	5.5	7
3	6.6	8
3.5	7.7	9
4	8.8	9
4.5	9.9	10

KG	LB	Maint. (mL/hr)
5	11	11
5.5	12.1	12
6	13.2	13
6.5	14.3	14
7	15.4	14
7.5	16.5	15
8	17.6	16
8.5	18.7	17

Maintenance Crystalloid Types for Dogs and Cats

Normosol-M | Plasma-Lyte 56 + 5% Dextrose

Note: 0.45% NaCl + 5% dextrose may be sufficient for maintenance if supplemented with appropriate K^+ and a buffer. If the patient is able to excrete the extra Na^+, then may consider a balanced isotonic crystalloid (LRS, Hartmann's Solution, Normosol-R, Plasma-Lyte A, Plasma-Lyte 148) for short-term maintenance if supplemented with appropriate K^+ and electrolytes monitored. Normal Saline (09% NaCl) is not recommended for maintenance since risks include hyperNa^+, hyperCl^-, metabolic acidosis, acute kidney injury (AKI) & mortality.

Maintenance IV Fluid Rate for Dogs

$$\text{Dog} = 132 \times BW_{kg}^{0.75}\ \text{mL/day}$$

KG	LB	Maint. (mL/hr)
1	2.2	6
2	4.4	9
3	6.6	13
4	8.8	16
5	11	18
6	13.2	21
7	15.4	24
8	17.6	26
9	19.8	29
10	22	31
11	24.2	33
12	26.4	35
13	28.6	38
14	30.8	40
15	33	42
16	35.2	44
17	37.4	46
18	39.6	48
19	41.8	50
20	44	52
21	46.2	54
22	48.4	56

KG	LB	Maint. (mL/hr)
23	50.6	58
24	52.8	60
25	55	61
26	57.2	63
27	59.4	65
28	61.6	67
29	63.8	69
30	66	71
32	70.4	74
34	74.8	77
36	79.2	81
38	83.6	84
40	88	87
42	92.4	91
44	96.8	94
46	101.2	97
48	105.6	100
50	110	103
52	114.4	107
54	118.8	110
56	123.2	113
58	127.6	116

Medical Calculations

Estimated Manual WBC Count

40x objective field

$$\frac{\text{total WBC count in } n \text{ fields}}{n} \times 1{,}500 \text{ WBCs}/\mu\text{L}$$

to

$$\frac{\text{total WBC count in } n \text{ fields}}{n} \times 2{,}000 \text{ WBCs}/\mu\text{L}$$

Estimated Manual PLT Count

100x objective field

$$\frac{\text{total PLT count in } n \text{ fields}}{n} \times 15{,}000 \text{ PLTs}/\mu\text{L}$$

to

$$\frac{\text{total PLT count in } n \text{ fields}}{n} \times 20{,}000 \text{ PLTs}/\mu\text{L}$$

Blood Transfusion

Dog

$$\text{mL to be transfused} = 90 \text{ mL/kg} \times Bw_{kg} \times \frac{\text{desired PCV - patient PCV}}{\text{PCV of donor blood}}$$

Cat

$$\text{mL to be transfused} = 66 \text{ mL/kg} \times Bw_{kg} \times \frac{\text{desired PCV - patient PCV}}{\text{PCV of donor blood}}$$

Check values and use at own risk. This card is to be used for educational purposes and as guidelines only.

Medical Calculations

Fluid Rate

total = maintenance + dehydration + ongoing losses

Maintenance Fluid Rate

Dog: $132 \times BW_{kg}^{0.75}$ mL/day

Cat: $80 \times BW_{kg}^{0.75}$ mL/day

divide mL/day by 24 hr to obtain mL/hr

Fluid Deficit

BW_{kg} × % dehydration = L of fluid deficit

$$L \times \frac{(1{,}000)\ mL}{(1)\ L} = mL$$

divide mL by hr to correct the fluid deficit to obtain mL/hr

Ongoing Losses Fluid Rate

$$\frac{\text{estimated ongoing losses (mL)}}{\text{time period to correct the ongoing losses (hr)}} = mL/hr$$

Drip Rate

$$\frac{mL}{hr} \times \frac{drops}{mL} \times \frac{(1)\ hr}{(60)\ min} = \frac{drops}{min}$$

$$\frac{mL}{hr} \times \frac{drops}{mL} \times \frac{(1)\ hr}{(60)\ min} \times \frac{(1)\ min}{(60)\ sec} = \frac{drops}{sec}$$

Constant Rate Infusion

Drug Rate

kg × mg/kg/hr ÷ mg/mL = **mL/hr**

Fluid Bag Hours

mL ÷ mL/hr = **hr**

Drug Volume

mL/hr × **hr** = mL

1st remove the same volume of fluids from the fluid bag

Medical Calculations

Drug Dose/Dosage

dose: kg × mg/kg = mg
mg ÷ mg/tablet = tablet(s)
mg ÷ mg/capsule = capsule(s)
mg ÷ mg/mL = mL(s)

dose × dose(s) per day × day(s) = total tablet(s) or capsule(s) or mL(s) of drug required for entire **dosage**

Energy Requirements

RER = $70 \times BW_{kg}^{0.75}$ kcal/day

MER = Life Stage Factor × RER

Dry Matter

$$\%\ DM = 100\% - \%\ moisture$$

$$\%\ nutrient\ on\ a\ DMB = \frac{\%\ nutrient\ \text{“as is”}\ on\ G.A.\ label}{\%\ DM} \times 100\%$$

Urine Output

Estimated normal urine output rate in adequately hydrated dogs and cats:
1 to 2 mL/kg/hr (24 to 48 mL/kg/day)

Check values and use at own risk. This card is to be used for educational purposes and as guidelines only.

Medical Calculations

Volume Conversion

1 L = 1,000 mL
1 mL = 1,000 µL
1 metric tsp = 5 mL
1 metric tbsp = 15 mL
1 fl oz* = 29.57 mL
1 pt* = 473.18 mL
1 qt* = 0.946 L
1 gal* = 3.785 L

U.S. customary system

Weight and Mass Conversion

1 kg = 2.2 lb
1 kg = 1,000 g
1 g = 1,000 mg
1 mg = 1,000 mcg or µg
1 lb = 16 oz
1 oz = 28.35 g
1 g = 15.43 gr
1 gr = 64.8 mg

Temperature Conversion

$$°F = (°C \times \frac{9}{5}) + 32 \qquad °C = (°F - 32) \times \frac{5}{9}$$

Heart and Respiratory Rates

beats or breaths per min = beats or breaths in 10 sec × 6

beats or breaths per min = beats or breaths in 15 sec × 4

Solutions and Dilutions

$$w/v = \frac{\text{weight of solute}}{\text{volume of solution}}$$

$$x\% = \frac{x\ g}{100\ mL}$$

$$C1 \times V1 = C2 \times V2$$

Energy Requirements

MER = Life Stage Factor × RER

Life Stage	Life Stage Factor
Intact Adult Dog	1.8
Neutered Adult Dog	1.6
Inactive Obese Prone Dog	1.2 to 1.4
Weight Loss Dog	1
Weight Gain Dog	1.2 to 1.8
Active Working Dog	2 to 5
0 to 4 Month Old Puppy	3
4 Month to Adult Size Puppy	2
Intact Adult Cat	1.4
Neutered Adult Cat	1.2
Inactive Obese Prone Cat	1
Weight Loss Cat	0.8
Kitten	2.5

Life stage factors vary slightly among different sources. Check values and use at own risk. This card is to be used for educational purposes and as guidelines only.

Energy Requirements

$$RER = 70 \times BW_{kg}^{0.75} \text{ kcal/day}$$

KG	LB	RER (kcal/day)
1	2.2	70
1.5	3.3	95
2	4.4	118
2.5	5.5	139
3	6.6	160
3.5	7.7	179
4	8.8	198
4.5	9.9	216
5	11	234
6	13.2	268
7	15.4	301
8	17.6	333
9	19.8	364
10	22	394
11	24.2	423
12	26.4	451
13	28.6	479
14	30.8	507
15	33	534
16	35.2	560
17	37.4	586
18	39.6	612

KG	LB	RER (kcal/day)
19	41.8	637
20	44	662
21	46.2	687
22	48.4	711
23	50.6	735
24	52.8	759
25	55	783
26	57.2	806
28	61.6	852
30	66	897
32	70.4	942
34	74.8	986
36	79.2	1,029
38	83.6	1,071
40	88	1,113
42	92.4	1,155
44	96.8	1,196
46	101.2	1,236
48	105.6	1,277
50	110	1,316
52	114.4	1,356
54	118.8	1,394

Dentistry for Dogs

Deciduous Teeth Eruption Times

Incisors	3 to 6 weeks of age
Canines	3 to 5 weeks of age
Premolars*	4 to 6 weeks of age
Molars	No deciduous molars

*Note: there are no deciduous P1.

Permanent Teeth Eruption Times

Incisors	3 to 5 months of age
Canines	3 to 7 months of age
Premolars	4 to 7 months of age
Molars	4 to 7 months of age

Dental Formulae

Deciduous

$$2 \times \left(i \frac{3}{3} \; c \frac{1}{1} \; p \frac{3}{3} \right) = 28$$

Permanent

$$2 \times \left(I \frac{3}{3} \; C \frac{1}{1} \; P \frac{4}{4} \; M \frac{2}{3} \right) = 42$$

Roots

Carnassial teeth are upper P4 and lower M1.

1 Root: I1 (101, 201, 301, 401), I2 (102, 202, 302, 402), I3 (103, 203, 303, 403), C (104, 204, 304, 404), P1 (105, 205, 305, 405), lower M3 (311, 411)

2 Root: P2 (106, 206, 306, 406), P3 (107, 207, 307, 407), lower P4 (308, 408), lower M1 (309, 409), lower M2 (310, 410)

3 Roots: upper P4 (108, 208), upper M1 (109, 209), upper M2 (110, 210)

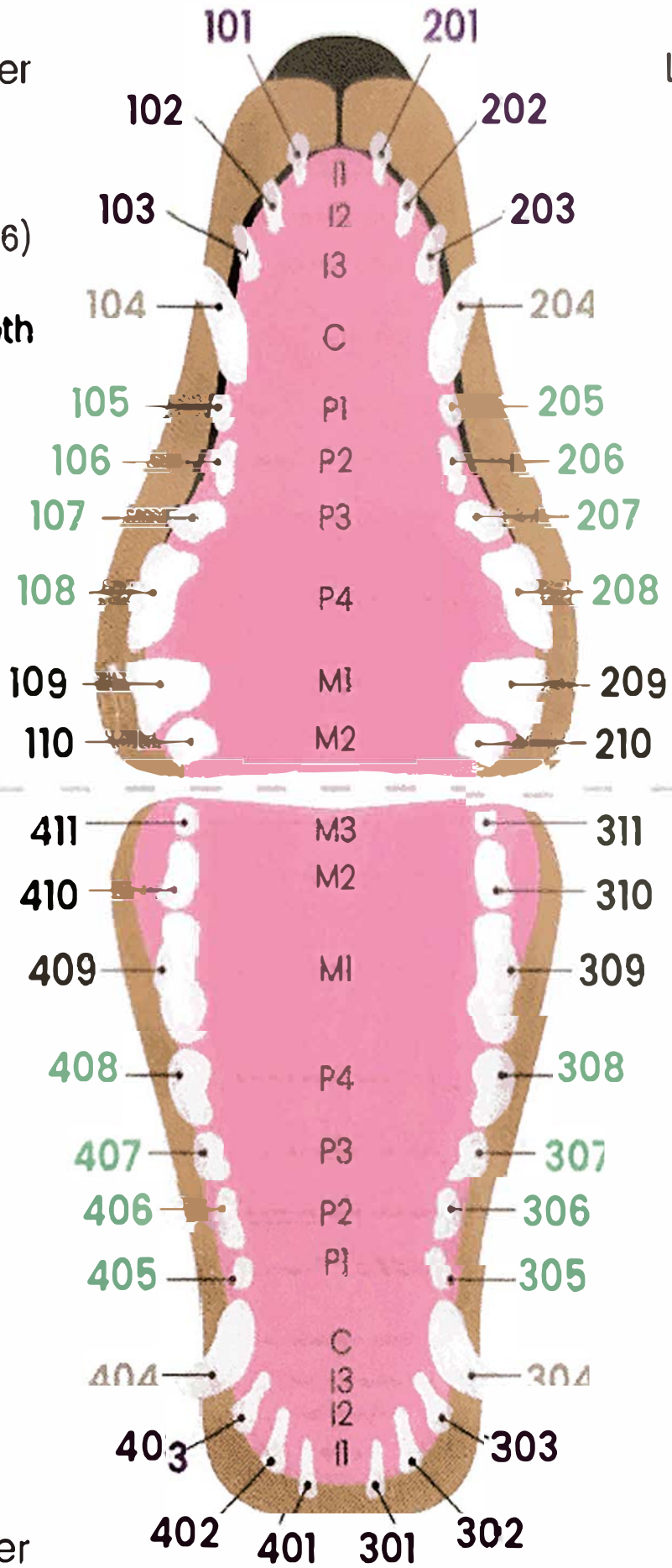
Teeth eruption times are estimates and vary considerably based on factors such as breed and nutrition. Check values and use at own risk. This card is to be used for educational purposes and as guidelines only.

Dental Chart for Dogs (Triadan System)

Q1
Right Upper

Q2
Left Upper

Incisor (12)
Canine (4)
Premolar (16)
Molar (10)
42 total teeth



Maxilla

Right — Left

Mandible

Q4
Right Lower

Q3
Left Lower

Vetpocket™

@vetpocket

Dentistry for Cats

Deciduous Teeth Eruption Times

Incisors	2 to 4 weeks of age
Canines	3 to 4 weeks of age
Premolars*	4 to 6 weeks of age
Molars	No deciduous molars

Permanent Teeth Eruption Times

Incisors	3 to 4 months of age
Canines	3 to 5 months of age
Premolars*	4 to 5 months of age
Molars	4 to 6 months of age

*Note: there are no deciduous nor permanent P1 nor lower P2.

Dental Formulae

Deciduous

$$2 \times \left(i\frac{3}{3}\ c\frac{1}{1}\ p\frac{3}{2} \right) = 26$$

Permanent

$$2 \times \left(I\frac{3}{3}\ C\frac{1}{1}\ P\frac{3}{2}\ M\frac{1}{1} \right) = 30$$

Roots

Carnassial teeth are upper P4 and lower M1.

1 Root: I1 (101, 201, 301, 401), I2 (102, 202, 302, 402), I3 (103, 203, 303, 403), C (104, 204, 304, 404), upper P2 (106, 206), upper M1 (109, 209) Upper P2 and upper M1 may have 2 roots.

2 Root: P3 (107, 207, 307, 407), lower P4 (308, 408), lower M1 (309, 409) Upper P3 may have 3 roots.

3 Roots: upper P4 (108, 208)

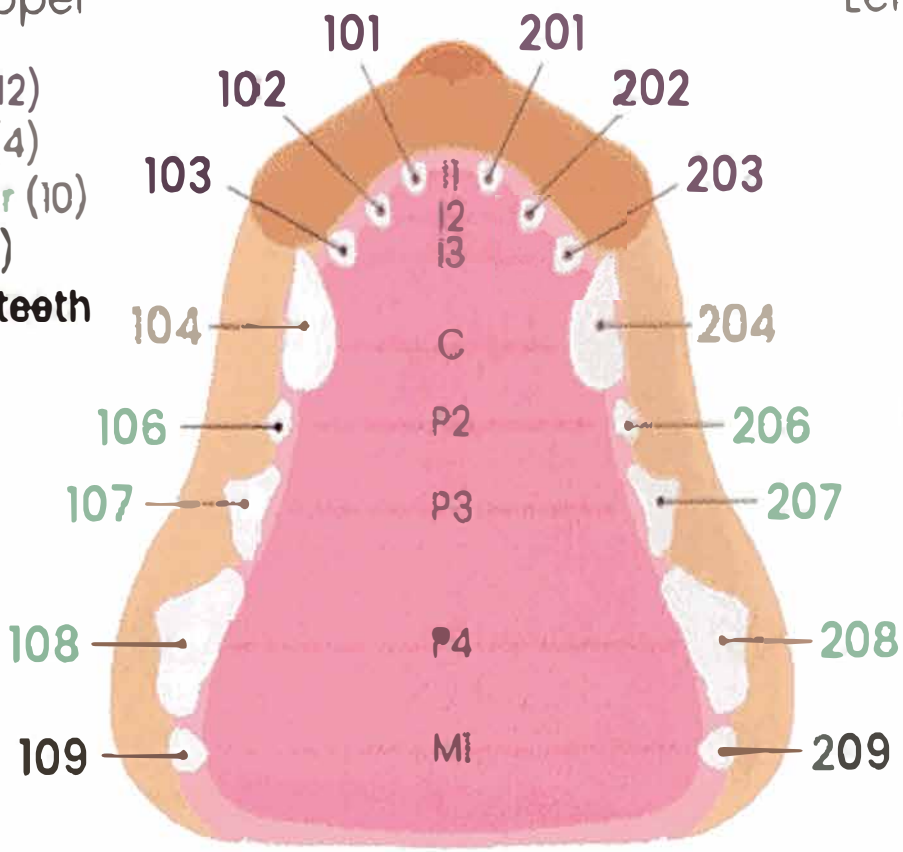
Teeth eruption times are estimates and vary considerably based on factors such as breed and nutrition. Check values and use at own risk. This card is to be used for educational purposes and as guidelines only.

Dental Chart for Cats (Triadan System)

Q1
Right Upper

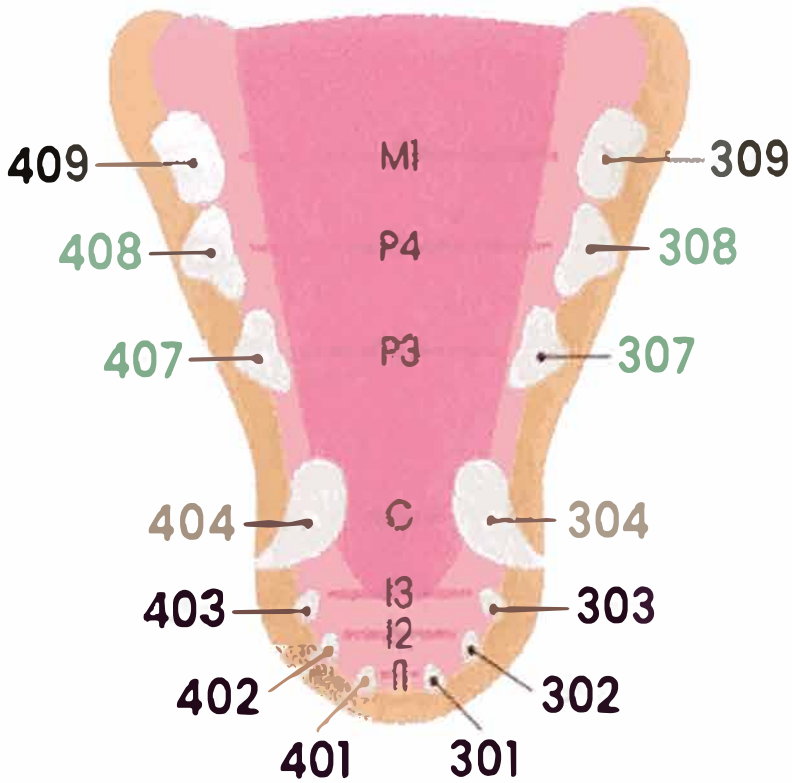
Q2
Left Upper

Incisor (12)
Canine (4)
Premolar (10)
Molar (4)
30 total teeth



Maxilla

Right — Left



Mandible

Q4
Right Lower

Q3
Left Lower

Route & Frequency Abbreviations

PO	orally (by mouth)
NPO	nothing by mouth
SC or SQ	subcutaneous(ly)
IM	intramuscular(ly)
IV	intravenous(ly)
IP	intraperitoneal(ly)
IO	intraosseous(ly)
IN	intranasal(ly)
OD	right eye
OS	left eye
OU	both eyes
AD	right ear
AS	left ear
AU	both ears
EOD	every other day (typically every 48 hours)
SID	once per day (typically every 24 hours)
BID	twice per day (typically every 12 hours)
TID	three times per day (typically every 8 hours)
QID	four times per day (typically every 6 hours)
PRN	as needed
ad lib	freely as wanted
q6h	every 6 hours
q8h	every 8 hours
q12h	every 12 hours
q24h	every 24 hours
q48h	every 48 hours

Unit Conversion Factors

Conversion Factors for Weight and Mass

1 kilogram (kg) = 1,000 grams (g)
1 gram (g) = 1,000 milligrams (mg)
1 milligram (mg) = 1,000 micrograms (mcg or µg)
1 kilogram (kg) = 2.2 pounds (lb)
1 pound (lb) = 16 ounces (oz)
1 ounce (oz) = 28.35 grams (g)
1 gram (g) = 15.43 grains (gr)
1 grain (gr) = 64.8 milligrams (mg)

Conversion Factors for Volume

1 liter (L) = 1,000 milliliters (mL)
1 milliliter (mL) = 1 cubic centimeter (cc)
1 milliliter (mL) = 1,000 microliters (µL)
1 metric teaspoon (tsp) = 5 milliliters (mL)
1 metric tablespoon (tbsp) = 15 milliliters (mL)
1 fluid ounce (fl oz)* = 29.57 milliliters (mL)
1 pint (pt)* = 473.18 milliliters (mL)
1 quart (qt)* = 0.946 liter (L)
1 gallon (gal)* = 3.785 liters (L)

Conversion Factors for Water

1 kilogram (kg) = 1 liter (L)
1 gram (g) = 1 milliliter (mL)

Conversion Factor for Equivalent

1 equivalent (Eq) = 1,000 milliequivalents (mEq)

Some units have different conversion factors depending on the system of measurement. The values marked with "" are using the U.S. customary system. Compare this to the imperial system: 1 fl oz = 28.41 mL, 1 pt = 568.26 mL, 1 qt = 1.137 L and 1 gal = 4.546 L.

Blood Work for Dogs and Cats

Estimated Reference Interval

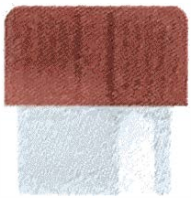
CHEM	Adult Dog	Adult Cat
TP	5.5 to 7.5 g/dL	6.3 to 8.8 g/dL
ALB	2.3 to 4.4 g/dL	2.4 to 4 g/dL
GLOB	1.6 to 4.5 g/dL	2.3 to 5.1 g/dL
AST	5 to 66 IU/L	0 to 65 IU/L
ALT	10 to 125 IU/L	10 to 150 IU/L
ALP or ALKP	5 to 200 IU/L	5 to 100 IU/L
GGT	0 to 12 IU/L	0 to 6 IU/L
TBIL	0 to 0.3 mg/dL	0 to 0.4 mg/dL
CK	50 to 300 IU/L	60 to 400 IU/L
SDMA	0 to 14 µg/dL	0 to 14 µg/dL
BUN	6 to 30 mg/dL	16 to 36 mg/dL
CREA	0.5 to 1.8 mg/dL	0.8 to 2.3 mg/dL
PHOS	2.5 to 6.5 mg/dL	2.6 to 7.5 mg/dL
GLU	70 to 125 mg/dL	70 to 150 mg/dL
CA^{2+}	7.9 to 12 mg/dL	7.8 to 11.4 mg/dL
MG^{2+}	1.4 to 2.5 mg/dL	1.5 to 3 mg/dL
NA^{+}	144 to 162 mEq/L	145 to 165 mEq/L
K^{+}	3.5 to 5.5 mEq/L	3.4 to 5.5 mEq/L
$NA^{+}:K^{+}$	27 to 46	27 to 48
CL^{-}	102 to 122 mEq/L	110 to 126 mEq/L
CHOL	92 to 320 mg/dL	75 to 225 mg/dL
TRIG	10 to 291 mg/dL	25 to 135 mg/dL
AMYL	450 to 1,500 IU/L	450 to 1,500 IU/L
LIPA	200 to 1,800 IU/L	100 to 1,400 IU/L

Blood Work for Dogs and Cats

Estimated Reference Interval

CBC	Adult Dog	Adult Cat
WBC	4 to 15.5 × 10^3/µL	3.5 to 16 × 10^3/µL
RBC	5 to 8.5 × 10^6/µL	6 to 11.5 × 10^6/µL
HGB	13 to 20.5 g/dL	9.5 to 16 g/dL
HCT	37 to 60 %	29 to 52 %
MCV	60 to 74 fL	39 to 58 fL
MCH	20 to 27 pg	12 to 20 pg
MCHC	31 to 38 g/dL	28 to 38 g/dL
PLT	150 to 400 × 10^3/µL	200 to 600 × 10^3/µL
NEU	2.5 to 11 × 10^3/µL	2.5 to 13 × 10^3/µL
LYM	0.9 to 4.8 × 10^3/µL	0.9 to 6.9 × 10^3/µL
MONO	0 to 1.1 × 10^3/µL	0 to 0.6 × 10^3/µL
EOS	0 to 1.5 × 10^3/µL	0 to 1.8 × 10^3/µL
BASO	0 to 0.15 × 10^3/µL	0 to 0.2 × 10^3/µL

Common Blood Collection Tubes



Red Top Tube

Common tests run: biochemistry (CHEM), endocrinology, serology **Additive:** no anticoagulant, with clot activator **Sample handling:** centrifuge after clotting for serum sample

Lavender Top Tube

Common tests run: complete cell count (CBC) with or without differential, PCR, heartworm, ACTH stimulation, endogenous ACTH **Additive:** EDTA anticoagulant **Sample handling:** do not centrifuge for EDTA whole blood sample, centrifuge immediately for EDTA plasma sample

Reference interval varies and is specific to each lab (machine, reagent, sample population, etc.). Refer to each lab report's reference interval whenever available. Refer to the specific lab request form's instructions. Check information and use at own risk. This card is to be used for educational purposes and as guidelines only.

Blood Work for Dogs and Cats

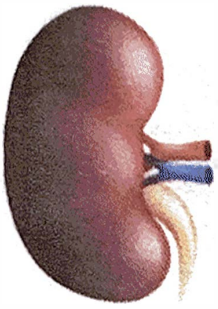
Organ Systems Highlights

Hepatic/Liver

ALT	**AST**	**ALP/ALKP**
GGT	**TBIL**	

BUN	ALB	GLOB	GLU	NA^+
CHOL	TRIG	LIPA	RBC	HGB
HCT	PLT	NEU	LYM	

ALT is the more liver specific enzyme.



Renal/Kidney

BUN	**CREA**	**SDMA**
PHOS	**K^+**	

ALB	GLU	NA^+	CL^-	CA^{2+}
MG^{2+}	AMYL	CHOL	TRIG	LIPA
RBC	HGB	HCT		

Pancreas — nonspecific

AMYL	**LIPA**	**CHOL**
TRIG	**GLU**	

ALT	AST	ALP/ALKP	GGT	TBIL
BUN	CREA	ALB	NA^+	CL^-
CA^{2+}	K^+	RBC	HGB	HCT
PLT	NEU	LYM		

Muscle

AST	**CK**	**K^+**
ALT	CREA	MG^{2+}

Bone

CA^{2+}	**PHOS**	**ALP/ALKP**

Blood Work for Dogs and Cats

Leukogram Patterns Highlights

Physiologic Leukogram

"Fight or flight" response due to epinephrine or norepinephrine.

↑NEUT
No left shift.

↑LYM

May see ↑EOS and ↑BAS in cats.

Stress Leukogram

Increase in endogenous (ill patient, hyperadrenocorticism) or exogenous (dexamethasone, prednisone or prednisolone administration) corticosteroids.

↑NEUT
Usually no left shift.

↓LYM

↓EOS

↑MON common in dogs, but uncommon in cats.

Inflammatory Leukogram

Due to inflammatory mediators. Infection, immune-mediated, necrosis, neoplasia, etc.

↑NEUT
With or without left shift.

May see toxic NEUT, ↓LYM (chronic inflammation may lead to ↑LYM), ↓EOS, ↑MON.

Severe or overhwelming inflammation may lead to leukopenia, ↓NEUT with left shift or degenerative left shift, toxic NEUT, ↓LYM, ↓EOS.

CPR Emergency Drugs for Dogs and Cats

BLS: Basic Life Support (1 BLS cycle = 2 minute duration), **CPA:** Cardiopulmonary Arrest, **CPR:** Cardiopulmonary Resuscitation, **IC:** Intracardiac, **IO:** Intraosseous, **IT:** Intratracheal, **IV:** Intravenous, **PEA:** Pulseless Electrical Activity, **ROSC:** Return of Spontaneous Circulation, **VF:** Ventricular Fibrillation, **VT:** Ventricular Tachycardia

Atropine: Anticholinergic parasympatholytic. Increases HR. Uses include bradycardia, consider for asystole or PEA associated with increased vagal tone. Give with epinephrine based on HR. Dog/cat dosage (extra-label): 0.04 mg/kg IV, IO q 3 to 5 min (~every other BLS cycle) prn, but due to longer half life should only repeat once. Consider IT *.

Epinephrine (Epi): Alpha- and beta- adrenergic agonist. Catecholamine vasopressor. Peripheral vasoconstriction (also increases HR and cardiac contractility, bronchodilation). Uses include asystole, PEA, consider low-dose for refractory or prolonged (>10 min) VF/pulseless VT. Side effects include adverse cardiac effects. High-dose may lead to increased ROSC, but also to decreased survival to discharge. Dog/cat dosage (extra-label): Start with low-dose, consider high-dose if prolonged (at least >10 min) CPR and as last ditch effort. Should not use high-dose for shockable rhythm. Low-dose 0.01 mg/kg IV, IO q 3 to 5 min (~every other BLS cycle) prn. High-dose 0.1 mg/kg IV, IO. Consider IT *.

Vasopressin: Non-catecholamine vasopressor. Peripheral vasoconstriction. Uses include asystole, PEA, consider for refractory or prolonged (>10 min) VF/pulseless VT. Substitute for, or in combination with, epinephrine. Dog/cat dosage (extra-label): 0.8 U/kg IV, IO q 3 to 5 min (~every other BLS cycle) prn. Consider IT *.

Defibrillation: Biphasic defibrillator recommended. Uses include VF, pulseless VT. CPA <4 min, immediate defibrillation recommended. CPA >4 min, recommended to perform 1 BLS cycle, then defibrillate. **Biphasic:** External 2 to 4 J/kg, internal 0.2 to 0.4 J/kg. **Monophasic:** External 4 to 6 J/kg, internal 0.5 to 1 J/kg. Provide 1 shock, immediately resume 1 BLS cycle, repeat prn with a 50% dose increase each time to a maximum of 10 J/kg. If defibrillator not available, provide precordial thump.

CPR Emergency Drugs for Dogs and Cats

Amiodarone: K^+ channel blocker. Antiarrhythmic. Consider for refractory or prolonged (>10 min) VF/pulseless VT. Side effects include anaphylaxis, hypotension. Dog dosage (extra-label): 5 mg/kg slow IV, IO. Can repeat once 2.5 mg/kg slow IV, IO in 3 to 5 min. Information not available on use in cats.

Lidocaine: Na^+ channel blocker. Antiarrhythmic. Consider for refractory or prolonged (>10 min) VF/pulseless VT. Side effects include vomiting, hypotension, seizures if given too fast. Cats are significantly more sensitive to the cardiac and CNS side effects. May make monophasic defibrillation harder. Dog dosage (extra-label): 2 mg/kg slow IV, IO. Can repeat q 2 min to a cumulative of 8 mg/kg. Cat dosage (extra-label): 0.25 to 0.5 mg/kg slow IV, IO. Can repeat once 0.15 to 0.25 mg/kg slow IV, IO in 5 to 20 min. Consider IT *.

Atipamezole: Alpha-2 adrenergic (eg dexmedetomidine) antagonist. Side effects include hypotension, particularly if given too fast. Dog/cat dosage (extra-label): 100 µg/kg (adjust prn based on dexmedetomidine dose) slow IV, IO as part of CPR, but note that labelled and non-CPR route is IM.

Flumazenil: Benzodiazepine (eg diazepam, midazolam) antagonist. Dog/cat dosage (extra-label): 0.01 mg/kg IV, IO repeat prn.

Naloxone: Opioid (eg fentanyl, morphine, hydromorphone, buprenorphine) antagonist. Dog/cat dosage (extra-label): 0.04 mg/kg IV, IO q 2 to 3 min prn. Consider IT *.

Routes: IV (recommended to follow drug administration with non-heparinized isotonic crystalloid solution flush ~3 to 5 mL cat, ~5 to 10 mL small/medium dog, ~10 to 15 mL large/giant breed dog) > IO > IT. Prioritize location closest to the heart for IV, IO. IC not recommended.

* IT route: **NAVEL** -> **N**aloxone, **A**tropine, **V**asopressin, **E**pinephrine, **L**idocaine. Increase IT dose ~2 to 10 x (~10 x for epinephrine) IV, IO dose. Dilute drug in ~5 to 10 mL sterile saline or sterile water, give via red rubber catheter past end of ET tube, flush with ~5 to 10 mL of air, remove catheter, give 2 breaths.

Ranges and values vary slightly among sources. See drug resource for side effects, etc. Check information and use at own risk. This card is to be used for educational purposes and as guidelines only.

CPR Emergency Drugs for Dogs and Cats

KG	LB	Cardiopulmonary Arrest			
		Atropine 0.54 mg/mL 0.04 mg/kg IV	Epi Low 1 mg/mL 0.01 mg/kg IV	Epi High 1 mg/mL 0.1 mg/kg IV	Vasopressin 20 U/mL 0.8 U/kg IV
1	2.2	0.07 mL	0.01 mL	0.1 mL	0.04 mL
2	4.4	0.15 mL	0.02 mL	0.2 mL	0.08 mL
3	6.6	0.22 mL	0.03 mL	0.3 mL	0.12 mL
4	8.8	0.3 mL	0.04 mL	0.4 mL	0.16 mL
5	11	0.37 mL	0.05 mL	0.5 mL	0.2 mL
6	13.2	0.44 mL	0.06 mL	0.6 mL	0.24 mL
8	17.6	0.59 mL	0.08 mL	0.8 mL	0.32 mL
10	22	0.74 mL	0.1 mL	1 mL	0.4 mL
12	26.4	0.89 mL	0.12 mL	1.2 mL	0.48 mL
14	30.8	1.04 mL	0.14 mL	1.4 mL	0.56 mL
16	35.2	1.19 mL	0.16 mL	1.6 mL	0.64 mL
18	39.6	1.33 mL	0.18 mL	1.8 mL	0.72 mL
20	44	1.48 mL	0.2 mL	2 mL	0.8 mL
25	55	1.85 mL	0.25 mL	2.5 mL	1 mL
30	66	2.22 mL	0.3 mL	3 mL	1.2 mL
35	77	2.59 mL	0.35 mL	3.5 mL	1.4 mL
40	88	2.96 mL	0.4 mL	4 mL	1.6 mL
45	99	3.33 mL	0.45 mL	4.5 mL	1.8 mL
50	110	3.7 mL	0.5 mL	5 mL	2 mL

Note: Start with Epi Low, consider Epi High if prolonged (at least >10 min) CPR. 1 : 1,000 = 1 mg/mL. 1 : 10,000 = 0.1 mg/mL.

CPR Emergency Drugs for Dogs and Cats

KG	LB	Biphasic Defibrillation		Monophasic Defibrillation	
		External 2 to 4 J/kg	Internal 0.2 to 0.4 J/kg	External 4 to 6 J/kg	Internal 0.5 to 1 J/kg
1	2.2	2 to 4 J	0.2 to 0.4 J	4 to 6 J	0.5 to 1 J
2	4.4	4 to 8 J	0.4 to 0.8 J	8 to 12 J	1 to 2 J
3	6.6	6 to 12 J	0.6 to 1.2 J	12 to 18 J	1.5 to 3 J
4	8.8	8 to 16 J	0.8 to 1.6 J	16 to 24 J	2 to 4 J
5	11	10 to 20 J	1 to 2 J	20 to 30 J	2.5 to 5 J
6	13.2	12 to 24 J	1.2 to 2.4 J	24 to 36 J	3 to 6 J
8	17.6	16 to 32 J	1.6 to 3.2 J	32 to 48 J	4 to 8 J
10	22	20 to 40 J	2 to 4 J	40 to 60 J	5 to 10 J
12	26.4	24 to 48 J	2.4 to 4.8 J	48 to 72 J	6 to 12 J
14	30.8	28 to 56 J	2.8 to 5.6 J	56 to 84 J	7 to 14 J
16	35.2	32 to 64 J	3.2 to 6.4 J	64 to 96 J	8 to 16 J
18	39.6	36 to 72 J	3.6 to 7.2 J	72 to 108 J	9 to 18 J
20	44	40 to 80 J	4 to 8 J	80 to 120 J	10 to 20 J
25	55	50 to 100 J	5 to 10 J	100 to 150 J	12.5 to 25 J
30	66	60 to 120 J	6 to 12 J	120 to 180 J	15 to 30 J
35	77	70 to 140 J	7 to 14 J	140 to 210 J	17.5 to 35 J
40	88	80 to 160 J	8 to 16 J	160 to 240 J	20 to 40 J
45	99	90 to 180 J	9 to 18 J	180 to 270 J	22.5 to 45 J
50	110	100 to 200 J	10 to 20 J	200 to 300 J	25 to 50 J

Shockable: VF, pulseless VT. Non-shockable: asystole, PEA.

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CPR Emergency Drugs for Dogs and Cats

KG	LB	Antiarrhythmic		
		Amiodarone 50 mg/mL 5 mg/kg slow IV	**Lidocaine Dog** 20 mg/mL 2 mg/kg slow IV	**Lidocaine Cat** CAUTION 20 mg/mL 0.25 mg/kg slow IV
1	2.2	0.1 mL	0.1 mL	0.01 mL
2	4.4	0.2 mL	0.2 mL	0.03 mL
3	6.6	0.3 mL	0.3 mL	0.04 mL
4	8.8	0.4 mL	0.4 mL	0.05 mL
5	11	0.5 mL	0.5 mL	0.06 mL
6	13.2	0.6 mL	0.6 mL	0.08 mL
8	17.6	0.8 mL	0.8 mL	0.1 mL
10	22	1 mL	1 mL	0.13 mL
12	26.4	1.2 mL	1.2 mL	0.15 mL
14	30.8	1.4 mL	1.4 mL	0.18 mL
16	35.2	1.6 mL	1.6 mL	0.2 mL
18	39.6	1.8 mL	1.8 mL	**Caution**: Cats are significantly more sensitive to the cardiac and CNS side effects of lidocaine
20	44	2 mL	2 mL	
25	55	2.5 mL	2.5 mL	
30	66	3 mL	3 mL	
35	77	3.5 mL	3.5 mL	
40	88	4 mL	4 mL	
45	99	4.5 mL	4.5 mL	
50	110	5 mL	5 mL	

Note: Information not available on use in cats for amiodarone.
2% = 20 mg/mL (lidocaine).

CPR Emergency Drugs for Dogs and Cats

KG	LB	Reversal		
		Atipamezole 5 mg/mL 100 µg/kg slow IV	Flumazenil 0.1 mg/mL 0.01 mg/kg IV	Naloxone 0.4 mg/mL 0.04 mg/kg IV
1	2.2	0.02 mL	0.1 mL	0.1 mL
2	4.4	0.04 mL	0.2 mL	0.2 mL
3	6.6	0.06 mL	0.3 mL	0.3 mL
4	8.8	0.08 mL	0.4 mL	0.4 mL
5	11	0.1 mL	0.5 mL	0.5 mL
6	13.2	0.12 mL	0.6 mL	0.6 mL
8	17.6	0.16 mL	0.8 mL	0.8 mL
10	22	0.2 mL	1 mL	1 mL
12	26.4	0.24 mL	1.2 mL	1.2 mL
14	30.8	0.28 mL	1.4 mL	1.4 mL
16	35.2	0.32 mL	1.6 mL	1.6 mL
18	39.6	0.36 mL	1.8 mL	1.8 mL
20	44	0.4 mL	2 mL	2 mL
25	55	0.5 mL	2.5 mL	2.5 mL
30	66	0.6 mL	3 mL	3 mL
35	77	0.7 mL	3.5 mL	3.5 mL
40	88	0.8 mL	4 mL	4 mL
45	99	0.9 mL	4.5 mL	4.5 mL
50	110	1 mL	5 mL	5 mL

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