



VTNE Masterclass

Medical Math

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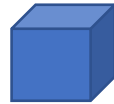
lb

2.2

Kg

Lots of Little Things

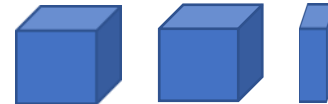
SMALL



2.2

LARGE

2.2



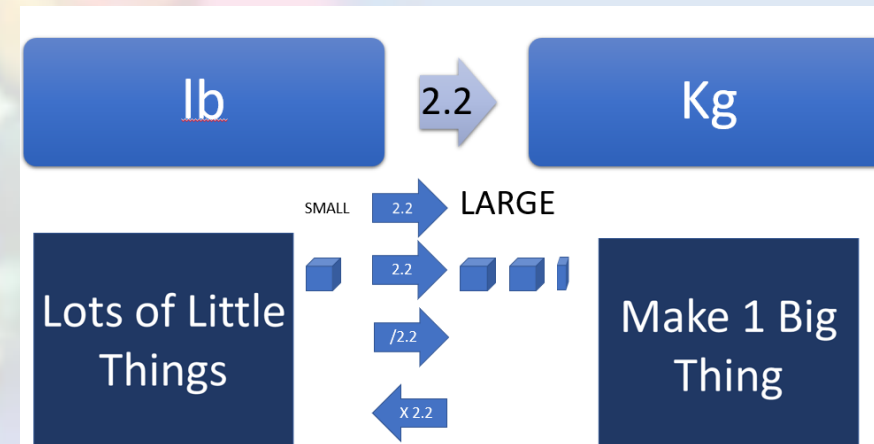
/2.2

X 2.2

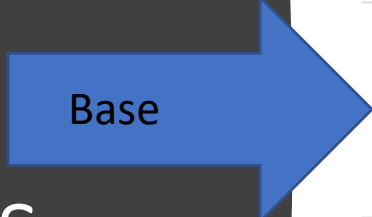
Make 1 Big Thing












#1. Convert 22 lb to kg $\frac{22\text{lb}}{2.2} = 10\text{kg}$

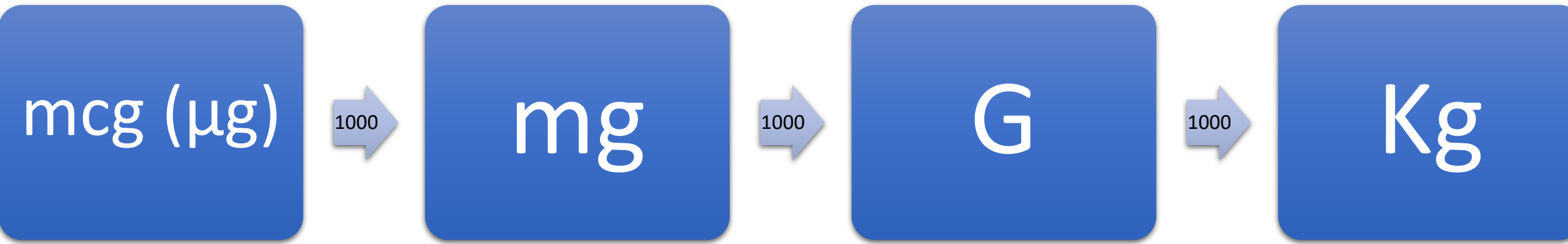
#2. Convert 22 kg to lb $22\text{kg} \times 2.2 = 48.4\text{lb}$



Metric Conversions

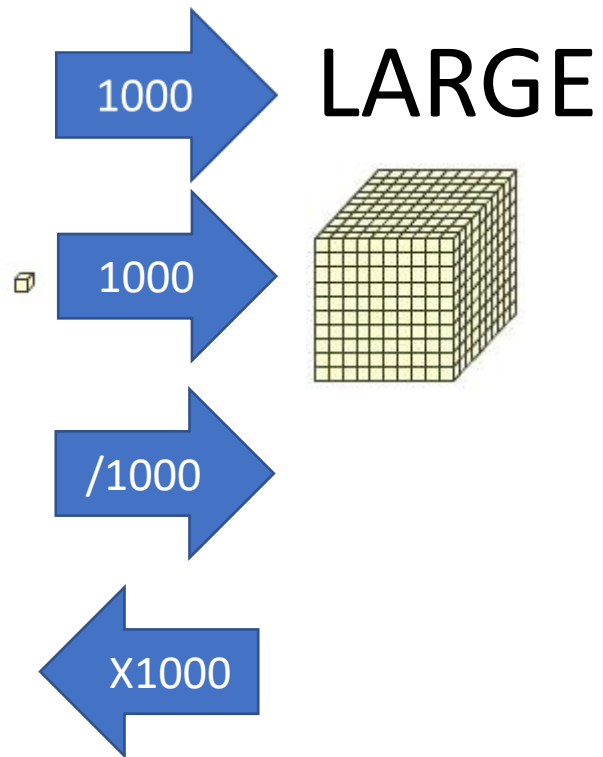


giga		G	1 000 000 000	10^9
mega		M	1 000 000	10^6
kilo		k	1000	10^3
hecto		h	100	10^2
deka		da	10	10^1
deci		d	0.1	10^{-1}
centi		c	0.01	10^{-2}
milli		m	0.001	10^{-3}
micro		μ	0.000 001	10^{-6}
nano		n	0.000 000 001	10^{-9}
pico		p		10^{-12}



Lots of Little Things

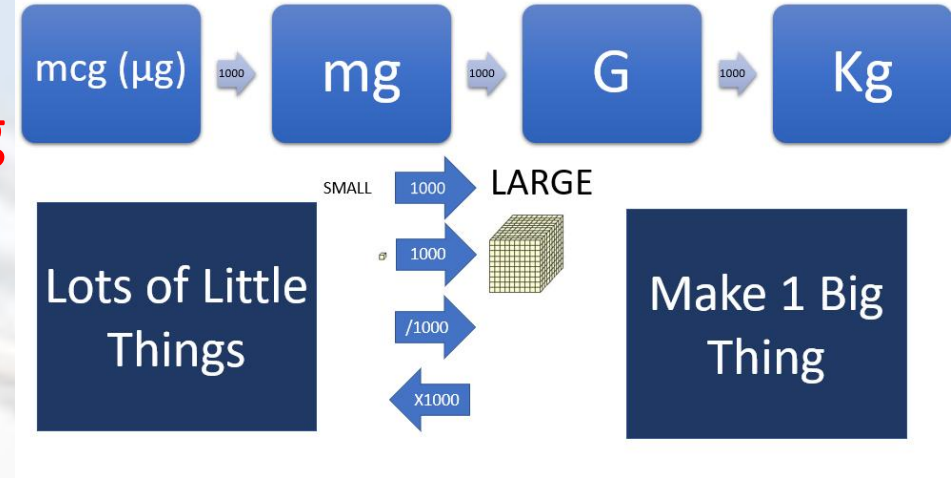
SMALL



Make 1 Big Thing

#3. 50 mcg to mg

$$50 \text{ mcg} / 1000 = 0.05 \text{ mg}$$



#4. 5 kg to G

$$5 \text{ kg} \times 1000 = 5000 \text{ G}$$

#5. 0.4 G to mcg



$$0.4 \text{ G} \times 1000 = 400 \text{ mg}$$

$$400 \text{ mg} \times 1000 = 400,000 \text{ mcg}$$

Percent Solution to mg/ml

$$2\% = 0.02 \quad \left| \quad \frac{100 \text{ G}}{100 \text{ ml}} \quad \left| \quad \frac{2\text{G}}{100\text{ml}} \quad \left| \quad \frac{1000 \text{ mg}}{1\text{G}} \quad \left| \quad \frac{2000\text{mg}}{100\text{ml}} \quad \left| \quad = 20 \text{ mg/ml} \right. \right. \right. \right.$$

OR

2% erase the percent sign = 2 multiply by 10 = 20 write mg/ml = 20mg/ml

• #6 50% solution to mg/ml

$$50 \times 10 = 500 \text{ mg/ml}$$

#7 0.4% solution to mg /ml

$$0.4 \times 10 = 4 \text{ mg/ml}$$



THE FORMULA THAT THEY DON'T TEACH YOU

- Weight
 - lb
 - kg
 - G
- Dose
 - mg/kg
 - mg/lb
 - mcg/kg
- Concentration
 - mg/ml
 - mcg/ml
 - G/ml
 - %
 - XXX mg / XXX ml

WEIGHT X DOSE
CONCENTRATION

BE SURE YOUR UNITS MATCH

9. The patient requires a 150 mg dose of doxycycline IV. The concentration is 250mg/5ml. How many ml of doxycycline would you give the patient?

$$\frac{250\text{mg}}{5\text{ml}} = 50\text{mg/ml}$$

$$\frac{150\text{mg}}{50\text{mg/ml}} = 3\text{ml}$$

10. A 36.6 pound patient requires 3mcg/kg of Fentanyl. The concentration of Fentanyl is 50 mcg/ml. How many ml of Fentanyl would you give the patient?

$$\underline{36.6 \text{ lb}} = 16.4 \text{ kg}$$

2.2

$$\underline{16.6 \text{ kg} \times 3 \text{ mcg/kg}} = 1 \text{ ml}$$

50 mcg/ml

12 &13. A 12kg patient requires 5 mcg/kg of dexdomitor. The concentration of Dexdomitor is 0.5mg/ml. What volume of dexdomitor would you give the patient. #12 solve by converting dose for 13 solve by converting concentration)

12 CONVERT DOSE TO MG/KG

$$\frac{5 \text{ mcg/kg}}{1000} = 0.005 \text{ mg/kg}$$

1000

$$\frac{12 \text{ kg} \times 0.005 \text{ mg/kg}}{0.5 \text{ mg/ml}} = 0.12 \text{ ml}$$

0.5 mg/ml

13.CONVERT CONCENTRATION TO MCG/ML

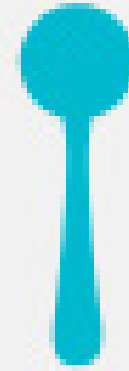
$$0.5 \text{ mg/ml} \times 1000 = 500 \text{ mcg / ml}$$

$$\frac{12 \text{ kg} \times 5 \text{ mcg/kg}}{500 \text{ mcg/ml}} = 0.12 \text{ ml}$$

500 mcg/ml



=



3 TEASPOONS

1 TABLESPOON

Lots of Little
Things

/3

X 3

Make 1 Big
Thing



tsp = 5ml

Tbs = 15ml

14. Convert 2 Tbs to Tsp (also how many ml?)

$$2 \text{ Tbs} \times 3 = 6 \text{ tsp} \times 5 = 30 \text{ ml}$$

15. Convert 9 tsp to Tbs (also how many ml?)

$$\frac{9 \text{ tsp}}{3} = 3 \text{ Tbs} \times 15 = 45 \text{ ml}$$

16. You have a 15 ml bottle of medication. The patient gets 0.5 ml per dose. How many doses are in the bottle?

$$\frac{15 \text{ ml}}{0.5 \text{ ml/dose}} = 30 \text{ doses}$$



CLAVAMOX[®]
*(amoxicillin trihydrate/
clavulanate potassium)*

Drops

*For veterinary oral suspension
For use in dogs and cats*

When reconstituted each mL contains 50 mg of amoxicillin as the trihydrate and 12.5 mg of clavulanic acid as the potassium salt.

Do Not Use if Product is Discolored

Caution: Federal law restricts this drug to use by or on the order of a licensed veterinarian.

15 mL

NADA #55-101, Approved by FDA



17. Panacur is dosed at 1cc per 10 lb of body weight.
How much would you administer to a 22.7kg animal?

$$22.7 \text{ lb} \times 2.2 = 50 \text{ lb}$$

$$\underline{50 \text{ lb}} = 5 \text{ ml.}$$

10



- 18 A dose of a chemotherapy drug is 100 mg / m². How many ml of a 50 mg/ml drug would you give to a patient that weighs 57kg

*Body Surface Area
Metre Squared conversion chart
DOGS*

VETERINARY ONCOLOGY CONSULTANTS
Helping veterinarians treat your pet's cancer

Body weight in kg	Body surface area in m ²				
2	0.16	15	0.61	38	1.14
3	0.21	16	0.64	39	1.16
4	0.25	17	0.67	40	1.18
5	0.30	18	0.69	41	1.20
5.5	0.31	19	0.72	42	1.22
6	0.33	20	0.74	43	1.24
6.5	0.35	21	0.77	44	1.26
7	0.37	22	0.79	45	1.28
7.5	0.39	23	0.82	46	1.30
8	0.40	24	0.84	47	1.32
8.5	0.42	25	0.86	48	1.33
9	0.44	26	0.89	49	1.35
9.5	0.45	27	0.91	50	1.37
10	0.47	28	0.93	51	1.39
11	0.50	29	0.95	52	1.41
12	0.53	30	0.98	53	1.43
13	0.56	31	1.00	54	1.44
14	0.59	32	1.02	55	1.46
		33	1.04	56	1.48
		34	1.06	57	1.50
		35	1.08	58	1.51
		36	1.10	59	1.53
		37	1.12	60	1.55

$$\frac{1.5 \text{ m}^2 \times 100 \text{ mg/m}^2}{50 \text{ mg/ml}} = 3 \text{ ml}$$

IV Fluid Calculation Formulas

- Maintenance Fluids: 60ml/kg/day
- Surgical Fluids: 10ml/kg/hr
- Shock Fluids (Canine): 90ml/kg
- Shock Fluids (Feline): 60ml/kg
- Fluid deficit (ml) = patient's weight in kg x % dehydration x1000
- Fluid rate (ml/hr) to correct for dehydration:
- Maintenance fluids per day + fluid deficit + ongoing losses = ml/hr for fluids

25 kg

German
Shepard

A small brown dog is lying on a patterned blanket on a tiled floor. The dog is looking towards the camera. A clear plastic IV line is connected to the dog's neck. The dog is wearing a dark collar. The background is a tiled floor and a grey blanket.

Maintenance Fluids

60 ml/kg/day

132 x body weight in $\text{kg}^{0.75}$

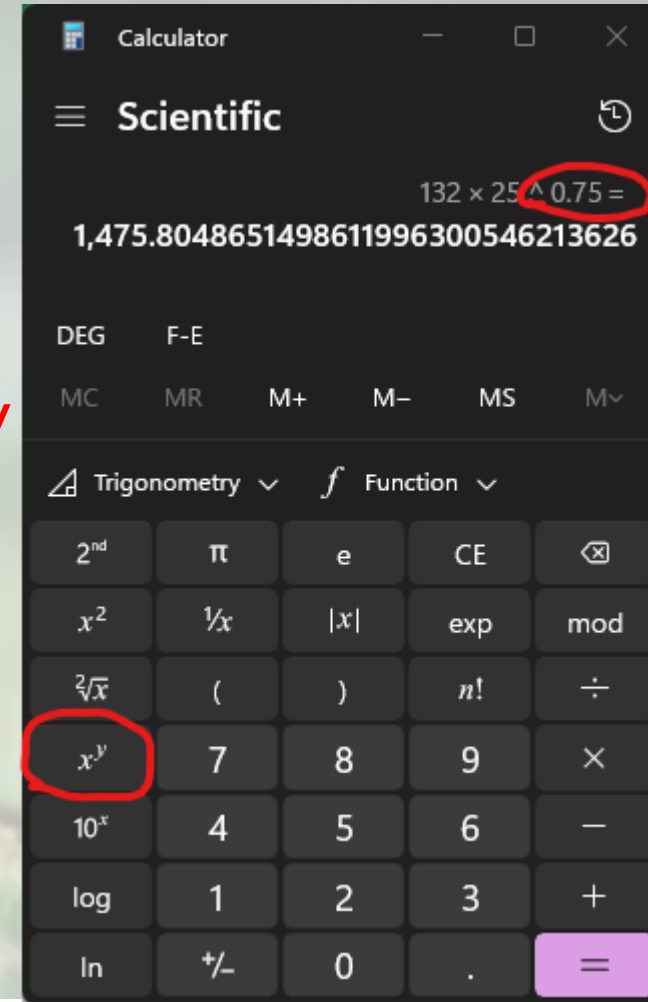
Maintenance Fluids

- #19 Calculate the daily maintenance fluids for a 25 kg dog

$$25 \text{ kg} \times 60 \text{ ml/kg/day} = 1500 \text{ ml/day}$$

or

$$132 \times \text{body weight in kg}^{0.75} = 132 \times 25^{0.75} = 1475 \text{ ml/day}$$



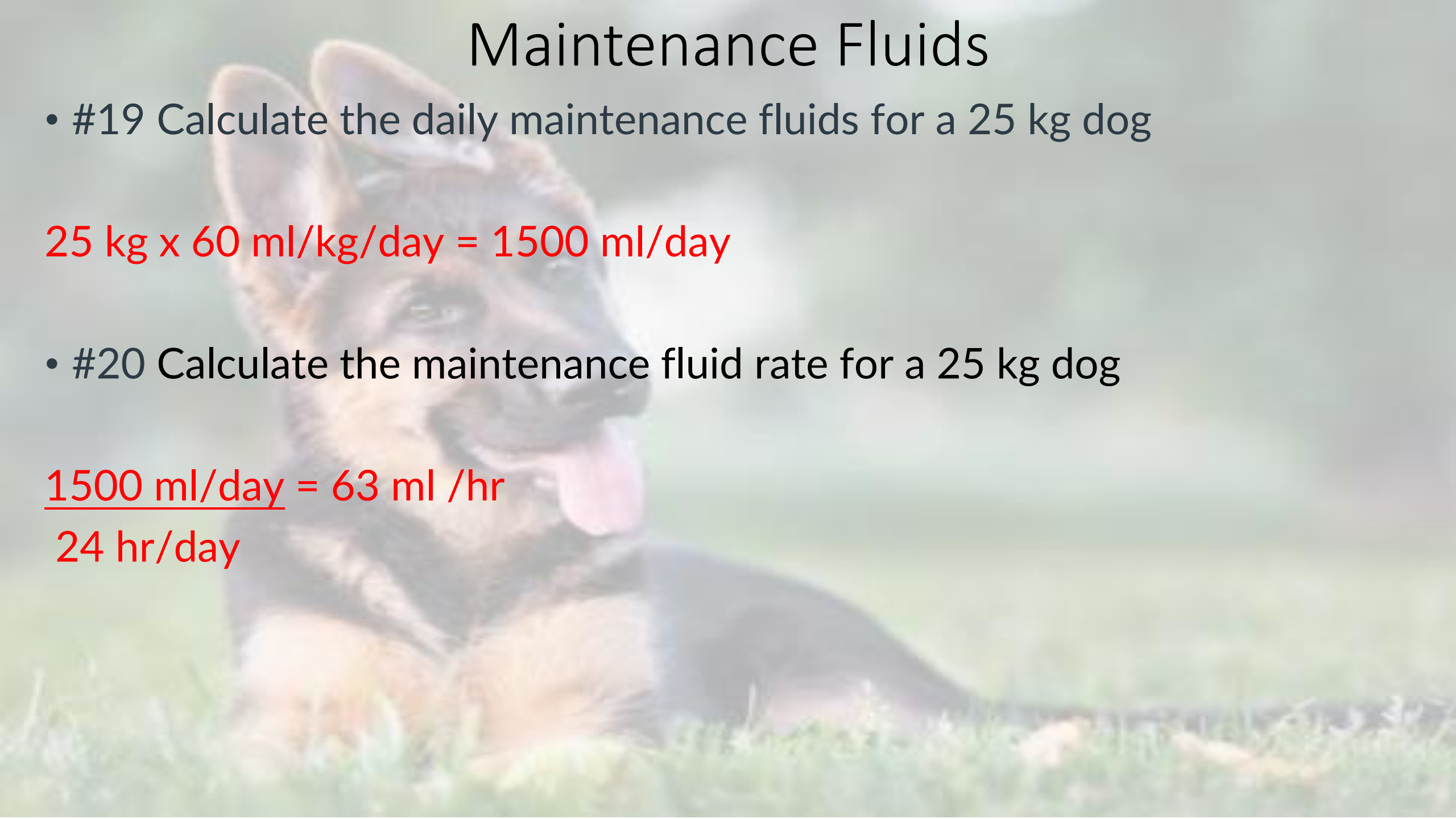
Maintenance Fluids

- #19 Calculate the daily maintenance fluids for a 25 kg dog

$$25 \text{ kg} \times 60 \text{ ml/kg/day} = 1500 \text{ ml/day}$$

- #20 Calculate the maintenance fluid rate for a 25 kg dog

$$\frac{1500 \text{ ml/day}}{24 \text{ hr/day}} = 63 \text{ ml/hr}$$





Calculating
Fluid Deficit

Patient weight in kg x %
dehydration x 1000

Calculating fluid deficit for a dehydrated animal

- #21 Calculate the fluid deficit for a 25 kg dog that is 5% dehydrated.

$$5\% / 100 = 0.05$$

$$25 \text{ kg} \times 0.05 \times 1000 = 1250 \text{ ml}$$

- #22 What fluid rate would you put the patient on to replace its fluid deficit over 24 hours?

$$\frac{\text{Maintenance Fluids} + \text{Fluid Deficit}}{24}$$

$$\frac{1500 \text{ ml} + 1250 \text{ ml}}{24} = 115 \text{ ml/hr}$$

Calculating fluid rate
with ongoing losses



Maintenance Fluids+ Fluid Deficit +Ongoing loses

Calculating fluid deficit for a dehydrated animal with ongoing fluid losses

- #23 Calculate the fluid deficit for a 25 kg dog that is 5% dehydrated and is vomiting 1000 ml of fluid a day.

Maintenance Fluids + Fluid Deficit + Ongoing Losses

24

1500 ml + 1250 ml + 1000 ml = 156 ml/hr

24

A close-up photograph of a dog's mouth, showing the tongue and the inner lining of the mouth. The mucous membranes appear pale and moist, which is a clinical sign of shock. The dog's teeth are visible, and a person's finger is seen holding the lower lip down to inspect the gums. In the top left corner, there is a small orange horizontal bar.

Shock Fluids

Dogs 90 ml/kg

Cats 60 ml/kg

Calculating Shock Doses of Fluids

- #24 Calculate a shock dose of fluids for a 25 kg dog.

$$25 \text{ kg} \times 90 \text{ ml/kg} = 2250 \text{ ml}$$

- #25 Calculate a $\frac{1}{2}$ shock dose of fluids for a 25 kg dog.

$$2250 \text{ ml} / 2 = 1125 \text{ ml}$$

- #26 Calculate a $\frac{1}{4}$ shock dose of fluids for a 25 kg dog.

$$2250 \text{ ml} / 4 = 563 \text{ ml}$$



Surgical Fluid Rate

10 ml/kg/hr



Calculating Surgical Fluid Rate

- #28 Calculate a surgical fluid rate for a 25 kg dog.

$$25 \text{ kg} \times 10 \text{ ml/kg/hr} = 250 \text{ ml/hr}$$





Calculating Drip Rate

$$\frac{\text{Fluid Rate} \times \text{Drip Factor}}{60}$$



Calculating a drip rate

- #28 Calculate a drip rate for a fluid rate of 240 ml/hr with a 15 drop /ml drip set

$$240 \text{ ml/hr} \times 15 \text{ drops/ml} = 3600 \text{ drops/hr}$$

$$\frac{3600 \text{ drops/hr}}{60} = 60 \text{ drops per minute}$$

60

$$V_1 C_1 = V_2 C_2$$

- V_1 : Volume 1
- C_1 : Concentration 1
- V_2 : Volume 2
- C_2 : Concentration 2

$$V_1 C_1 = V_2 C_2$$

#29 You want to make a 1000 ml bag of 0.9% NaCl with 2.5% dextrose. You have 50% dextrose in a bottle. How much 50% dextrose would you add to the bag to make it?

$$\frac{(X \text{ ml})(50\%)}{50\%} = \frac{(1000 \text{ ml})(2.5\%)}{50\%} = (X \text{ ml}) = \frac{(1000 \text{ ml})(2.5\%)}{50\%} = 50 \text{mls}$$

WANT

HAVE

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WANT

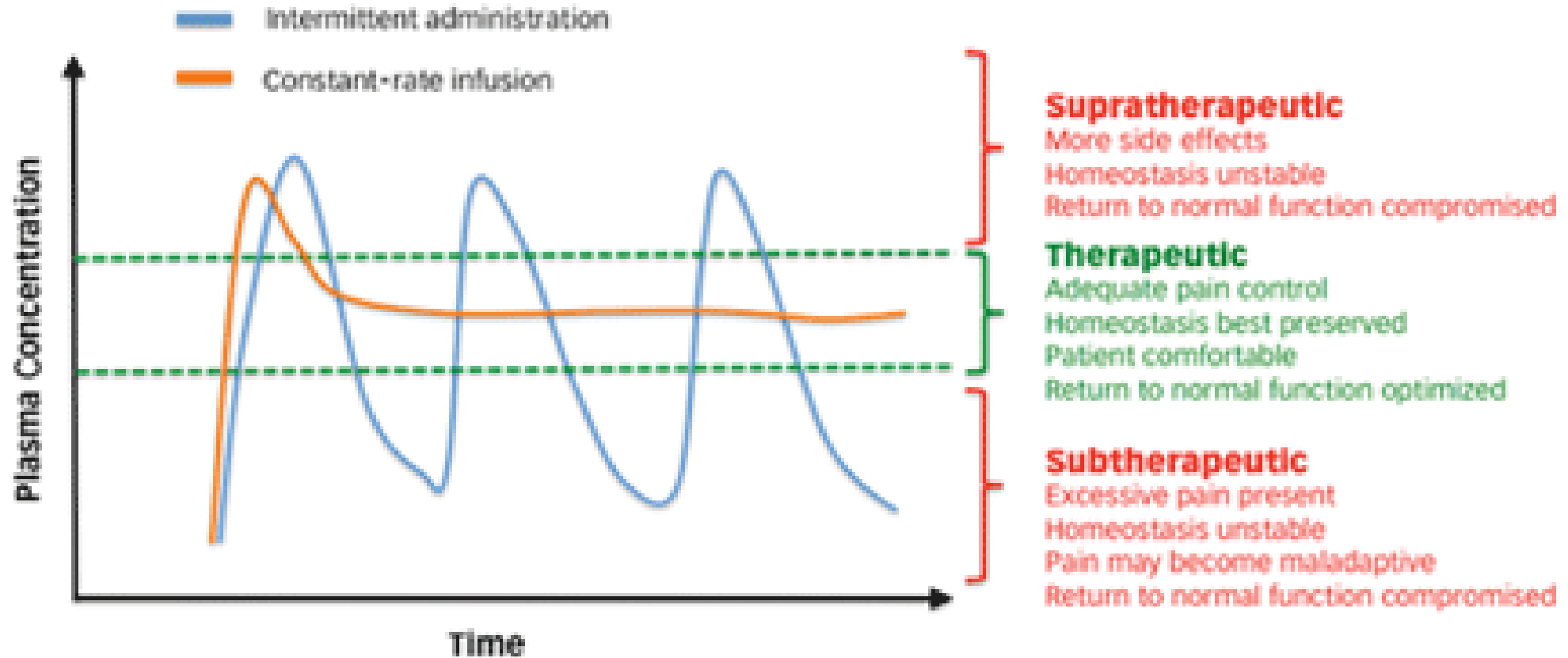
HAVE

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$$\frac{(1000 \text{ ml})(2.5\%)}{50\%} = 50 \text{mls}$$

**REMEMBER TO BE TECHNICALLY CORRECT YOU NEED TO REMOVE 50
MLS OF FLUID FROM THE BAG BEFORE YOU ADD THE DEXTROSE**

CONSTANT RATE INFUSIONS



CONSTANT RATE INFUSIONS

- 1. Weight x dose = amount in a given time (convert to mg/hr or mcg/hr)
- 2. Container Size / fluid rate = # of hours CRI will last
- 3. Multiply answer from 1 by the answer from 2 = amount in container (mg or mcg)
- 4. Divide amount of drug in container by concentration of drug. (be sure the units match)

#30 A 10 kg patient presents after being hit by a car and has a diaphragmatic hernia. You want to put the patient on a Fentanyl CRI at a dose of 3 mcg/kg/hr. You are going to make a 60 ml syringe of Fentanyl and you are going to make the rate 3 mls/hr. How much Fentanyl are you going to put in the syringe.

$$10 \text{ kg} \times 3 \text{ mcg/kg/hr} = 30 \text{ mcg/hr}$$

$$60 \text{ ml} / 3 \text{ ml/hr} = 20 \text{ hr}$$

$$30 \text{ mcg/hr} \times 20 \text{ hr} = 600 \text{ mcg in the syringe}$$

$$\underline{600 \text{ mcg}} = 12 \text{ ml Fentanyl} + 48 \text{ ml NaCl}$$

$$50 \text{ mcg/ml}$$

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$$50 \text{ mcg/ml}$$

You take the patient to surgery and the patient is still painful you want to increase the dose to 5 mcg/kg/hr. What do you change the fluid rate to?

#31 You take the patient to surgery and the patient is still painful you want to increase the dose to 5 mcg/kg/hr. What do you change the fluid rate to?

$$\frac{3 \text{ mcg/kg/hr}}{3 \text{ ml/hr}} = \frac{5 \text{ mcg/kg/hr}}{X}$$

$$3 \text{ ml/hr} \quad X$$

$$3X = 15 \quad X = 5 \text{ ml/hr}$$

#32. A 5kg dog needs metoclopramide (5mg/ml) at a dose of 2mg/kg/day. How much metoclopramide must be added to a 500 ml bag of IV fluids at a rate of 20 ml/hr?

$$5\text{kg} \times 2\text{mg/kg/day} = 10\text{ mg/day}$$

$$\frac{10\text{ mg/day}}{24\text{ hr/day}} = 0.4\text{ mg/hr}$$

$$24\text{ hr/day}$$

$$\frac{500\text{ ml bag}}{20\text{ ml/hr}} = 25\text{ hours}$$

$$20\text{ ml/hr}$$

$$0.4\text{ mg} \times 25\text{ hours} = \underline{10\text{ mg}} = 2\text{ ml}$$

$$5\text{ mg/ml}$$

CONSTANT RATE INFUSIONS

- 1. Weight x dose = amount in a given time (convert to mg/hr or mcg/hr)
- 2. Container Size / fluid rate = # of hours CRI will last
- 3. Multiply answer from 1 by the answer from 2 = amount in container (mg or mcg)
- 4. Divide amount of drug in container by concentration of drug. (be sure the units match)

#33. A 10 kg patient has low blood pressure in surgery and you want to start a dopamine CRI at 7 mcg/kg/min. You are going to make a 250 ml bag of fluids and run the fluids at 10 mls an hour. The concentration of Dopamine is 40 mg/ml. How many ml of dopamine are you going to add to the bag.

$$10 \text{ kg} \times 7 \text{ mcg/kg/min} = 70 \text{ mcg/min}$$

$$250 \text{ ml} / 10 \text{ ml/hr} = 25 \text{ hr}$$

$$70 \text{ mcg/min} \times 60 \text{ min/hr} = 4,200 \text{ mcg/hr}$$

$$4,200 \text{ mcg/hr} \times 25 \text{ hr} = 105,000 \text{ mcg in the syringe}$$

$$\frac{105,000 \text{ mcg}}{1000} = \frac{105 \text{ mg}}{40 \text{ mg/ml}} = 2.6 \text{ ml}$$

CONSTANT RATE INFUSIONS

- 1. Weight x dose = amount in a given time (convert to mg/hr or mcg/hr)
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- 3. Multiply answer from 1 by the answer from 2 = amount in container (mg or mcg)
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34. You run a CBC on a patient, and the CBC machine reports a WBC count of 16,500 WBC/mcL. During your WBC differential, you count 76% neutrophils, 19% lymphocytes, 3% monocytes, and 2% eosinophils. Additionally, you see 25 nRBCs. Correct your WBC count for nRBCs and calculate the absolute value for each type of RBC.

$$\text{Corrected WBC count} = \frac{\text{WBC} \times 100}{100 + \text{nRBC}} = \frac{16,500 \times 100}{100 + 25} = \frac{1,650,000}{125} = 13,200 \text{ wbc/mcL}$$

Absolute Values

- Neutrophils (76%) = $0.76 \times 13,200 = 10,032$ neutrophils / mcL
- Lymphocytes (19%) = $0.19 \times 13,200 = 2,508$ lymphocytes / mcL
- Monocytes (3%) = $0.03 \times 13,200 = 396$ monocytes / mcL
- Eosinophils (2%) = $0.02 \times 13,200 = 264$ eosinophils / mcL

35. You have a dog that is anemic with a PCV of 22%, so the vet asks you to perform a reticulocyte count. You count 1000 total red blood cells, and 37 of them are reticulocytes. What is the reticulocyte percentage, and what is the corrected reticulocyte percentage (assuming normal PCV of 45% for dogs)?

$$\text{Reticulocyte \%} = \frac{\text{number of reticulocytes} \times 100}{1000 \text{ cells counted}} = \frac{37 \times 100}{1000} = 3.7\%$$

$$\text{Corrected reticulocyte \%} = \frac{\text{reticulocyte\%} \times \text{PCV of patient}}{\text{Normal PCV for species}} = \frac{3.7\% \times 22\%}{45\%} = 1.8\%$$