MATH REVIEW

MEASUREMENTS AND CONVERSIONS RATIO AND PROPORTIONS PERCENTAGES DILUTIONS

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DISCLOSURES

I have no relevant financial relationships to disclose.

"I HATE MATH"

The best answer for pharmacy technicians is to.....

- "KEEP IT SIMPLE"
- Learn the basic "MEASUREMENTS"
- Use "RATIO and PROPORTION"
- DOUBLE CHECK your answers
- ASK if you aren't sure

MEASUREMENTS AND CONVERSIONS

As a pharmacy technician it is important to know basic measurements and conversions.

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Examples:

- 1 teaspoonful (tsp)
- 1 tablespoonful (tbsp)
- 1 fluid ounce (oz)
- 1 kilogram (kg)
- 1 tablespoon (tbsp)

- 5 milliliters (mL)
- 15 milliliters (mL)
- 30 milliliters (mL)
- 2.2 pounds (lb)
- 3 teaspoons (tsps)

CONVERSION CHART

MOVE THE DECIMAL 3 PLACES FOLLOWING THE DIRECTION OF THE ARROWS

1 L 1000 mL 1 Kg 1000 g 1000000 mg 100000000 mcg

CONVERSIONEXAMPLESPROBLEMSANSWERS

4255 mL = ____ liters (L) 2.6 liters (L) = ____ mL 0.0375 g = ____ mg 8570 mcg = ____ grams 45 kg = ____ mg 0.00965 g = ____ mcg 50000 mg = ____ grams

4.255 liters (L) 2600 mL 37.5 mg 0.00857 grams 4500000 mg 9650 mcg 50 grams

When solving ratio and proportion problems:

- Always start with what you have or what you know.
- The units across from each other in the equation must always be the same.

Cross multiply and divide.

1. How many 120-mL bottles can be filled from 3.84 L of a cough syrup?

Answer: $\frac{120 \text{ mL}}{1 \text{ bottle}} = \frac{3840 \text{ mL}}{2 \text{ bottles}}$

 $3840 \times 1 = 3840 \div 120 = 32$

(32 bottles)

2. How many 30 mg codeine capsules can be prepared from 0.0009 kg of codeine?

You must change kilograms to milligrams because both sides must have the same units of measure. Answer:

<u>30 mg</u>	=	<u>900 mg</u>
1 capsule		? capsules

 $900 \times 1 = 900 \div 30 = 30$

(30 capsules)

3. If a vial contains 40 mg of tobramycin sulfate per milliliter, how many micrograms would be in 0.1 mL ?

Answer:

<u>40 mg</u>	=	<u>? mg</u>
1 mL		0.1 mL

 $40 \times 0.1 = 4 \div 1 = 4$

4 mg must be changed to micrograms.

4 mg = 4000 mcg (4000 mcg)

4. 4.5 tsps = _____ mL

You use what you know. You know that 1 teaspoon is equal to 5 milliliters.

Answer:

<u>1 tsp</u>	=	<u>4.5 tsp</u>
5 mL		? mL

 $4.5 \times 5 = 22.5 \div 1 = 22.5$ (22.5 mL)

5. 330 lb = _____ kg

You know that 1 kg is equal to 2.2 pounds.

Answer:

$$\frac{1 \text{ kg}}{2.2 \text{ lb}} = \frac{? \text{ Kg}}{330 \text{ lb}}$$

 $330 \times 1 = 330 \div 2.2 = 150$

(150 kg)

6. 35 tbsp = _____ tsp

You know that 1 tablespoon is equal to 3 teaspoons.

Answer:

<u>1 tbsp</u>	=	<u>35 tbsp</u>
3 tsps		? tsps

 $35 \times 3 = 105 \div 1 = 105$

(105 teaspoons)

7. An IV fluid containing NS is running at 80 mL/hr. How much fluid is the patient receiving per day?

Answer:

<u>80 mL</u>	=	<u>? mL</u>
1 hour		24 hours

 $80 \times 24 = 1920 \div 1 = 1920$

(1920 mL)

8. 350 tsps = _____ liters

Answer:

1	tsp	—	<u>350 tsps</u>	
5	mL		? mL	

 $350 \times 5 = 1750 \div 1 = 1750$

(1750 mL = 1.75 liters)

(1.75 liters)

Many pharmaceutical products from IV solutions to topicals are labeled in percents.

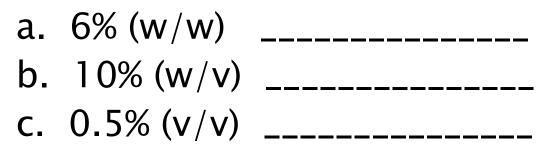
Examples:

- 5% Dextrose Injection
- 20% Zinc Oxide Ointment
- 1% Hydrocortisone Cream

In Pharmacy Practice you will find three types of percentage preparations:

- Percent weight-in-weight (w/w) or (wt/wt) is the grams of a drug in 100 grams of the product.
- Percent volume-in-volume (v/v) or (vol/vol) is the milliliters of drug in 100 mL of the product.
- Percent weight-in-volume (w/v) or (wt/vol) is the grams of a drug in 100 mL of the product.

How do you write the following in drug form?



Answer:

a. 6 g / 100 g
b. 10 g / 100 mL
c. 0.5 mL / 100 mL

Percent Weight-in-Weight (w/w) or (wt/wt)

This type of percent is used for measuring the weight of a solid or semisolid in the total weight of a product.

Examples of these products are powders, ointments, and creams.

Percent Weight-in-Weight (w/w) or (wt/wt)

Example:

1% Hydrocortisone cream means 1 gram of Hydrocortisone in 100 grams of cream.

20% Zinc Oxide Ointment means 20 grams of Zinc Oxide in 100 grams of ointment.

1. To prepare a 3% hydrocortisone topical cream, how many grams of hydrocortisone would be required to prepare 180 grams of the topical cream?

Answer: $\frac{3 \ g}{100 \ g} = \frac{? \ g}{180 \ g}$ $180 \ x \ 3 = 540 \div 100 = 5.4$ (5.4 grams hydrocortisone)

Percent Volume–in–Volume (v/v) or (vol/vol)

The percent volume-in-volume compounds are solution or liquid preparations, and the active constituents are also solutions or liquids.

In most cases you will measure the volumes of the final product and the constituents in milliliters.

1. What would be the percent strength (v/v) of a pint (480 mL) of a solution that contains 1 fluid ounce of liquefied phenol?

Answer:

 $\frac{30 \text{ mL liquefied phenol}}{480 \text{ mL}} = \frac{? \text{ mL}}{100 \text{ mL}}$

 $100 \times 30 = 3000 \div 480 = 6.25$

(6.25 mL of liquefied phenol)

Percent Weight-in-Volume (w/v) or wt/vol)

The percent weight-in-volume is a percent you will frequently work with in most practice settings. The final product is a solution or liquid preparation.

With percent (w/v), the numerator or constituent is measured in grams <u>ONLY</u>, and the denominator or final solution is measured in milliliters <u>ONLY</u>.

1. What would be the percent (w/v) of a solution of KCl that contains 24 grams of potassium chloride in 4 fluid ounces? (4 fl. oz. = 120 mL)

Answer:

<u>24 g KCl</u>	=	<u>? g KCl</u>
120 mL		100 mL

 $100 \times 24 = 2400 \div 120 = 20$

(20 g KCI)

2. How many grams of potassium chloride would be in a pint (480 mL) of 10% KCl?

Answer:

<u>10 g KCl</u>	=	<u>? g KCl</u>
100 mL		480 mL

 $480 \times 10 = 4800 \div 100 = 48$

(48 g KCl)

3. You have a liter bag of normal saline (NS) that is 0.9% sodium chloride.

How many grams of sodium chloride are contained in the bag?

Answer:

<u>0.9 g NaCl</u>	=	<u>? g NaCl</u>
100 mL		1000 mL

 $1000 \times 0.9 = 900 \div 100 = 9$

(9 g NaCl)

4. How many milligrams of neomycin are in 200 mL of a 1% neomycin solution?

- a. 2 mg
- b. 20 mg
- c. 200 mg
- d. 2000 mg

Answer: d. $1 \text{ gram} = \frac{2 \text{ grams}}{200 \text{ mL}}$

 $200 \times 1 = 200 \div 100 = 2$ (2 grams = 2000 mg)

A dilution is taking a higher percent and adding a diluent like water to "dilute" it down to a lower percent or "weaker" solution.

The formula for solving dilutions is:

(OV) (O%) = (NV) (N%)

OV stands for Old Volume (This is the volume you are starting with.)

0% stands for Old% (This is the percent concentration of the Old Volume.)

NV stands for New Volume (This is the "new" volume you are making.)

N% stands for New% (This is the "new" percent of the NV after the dilution.)

Stock solutions are "concentrated" or "potent" solutions of medicinal substances that are frequently used to compound "weaker" solutions.

These stock solutions are very convenient because a pharmacy technician can prepare larger volumes of a product from small quantities of the stock solution.

- These products are in small bottles of concentrate that require dilution.
- Using the stock solution without dilution would be dangerous.
- The advantage of using stock solutions is they save space.

The percent of a concentrated stock solution will always be larger than the percent of the dilution made from that stock solution?

> a. True b. False

Answer: a. True

1. How many milliliters of a 40% stock solution drug would you need to prepare 500 mL of a 6% solution using that drug?

$$(?)(40\%) = (500 \text{ mL})(6\%)$$

40X = 3000

Divide both sides by the number with X to figure out what the (?) number is.

$$\frac{40X}{40} = \frac{3000}{40} \qquad 3000 \div 40 = 75 \quad (75 \text{ mL})$$

(75mL)(40%) = (500 mL)(6%)

By plugging this number into the equation where the (?) is, you solve the problem.

The 75 mL answer means you would measure 75 mL of the 40% stock solution, and add enough water to it to make 500 mL of a 6 % solution.

How much water will you add to the 75 mL of the 40 % stock solution to make the dilution of 500 mL of 6 % ?

The final volume is 500 mL and you are going to use 75 mL of the 40 % stock solution, then 500 mL - 75 mL = 425 mL.

Answer:

425 mL of water must be added

2. You have 4 fluid ounces of 10 % aluminum acetate solution as a stock solution. How many milliliters of a 2 % solution of aluminum acetate can be prepared from the volume you have on hand?

$$(120 \text{ mL})(10\%) = (?)(2\%)$$

$$\frac{1200}{2} = \frac{2X}{2}$$

X = 600 (NV) = 600 mL

How much water would you add to the stock solution to prepare the dilution in the last problem?

600 mL - 120 mL = 480 mL

3. You have on hand 100 mL of concentrated dextrose injection 50 %. What is the resulting percent of dextrose if you mixed the dextrose injection with 400 mL of water for injection?

(100 mL)(50 %) = (500 mL)(N %)

 $\frac{5000}{500} = \frac{500X}{500} \qquad X = 10 \qquad N \% = 10 \%$

4. Using 100 mL of concentrated dextrose injection 50 %, how much 5 % dextrose could be prepared from the dextrose injection?

(100 mL)(50%) = (NV)(5%)

 $\frac{5000}{5} = \frac{5X}{5}$

X = 1000 (NV) = 1000 mL