## 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.

Examples:
1 teaspoonful (tsp) = 5 milliliters (mL)
1 tablespoonful (tbsp) = 15 milliliters (mL)
1 fluid ounce (oz)
1 kilogram (kg)
1 tablespoon (tbsp)
$=2.2$ pounds ( lb )
$=3$ teaspoons (tsps)

## CONVERSION CHART

MOVE THE DECIMAL 3 PLACES FOLLOWING THE DIRECTION OF THE ARROWS

1 Kg<br>1000 g<br>1000000 mg<br>1000000000 mcg

## CONVERSION EXAMPLES

## PROBLEMS

$4255 \mathrm{~mL}=$
2.6 liters (L) = liters (L)
$0.0375 \mathrm{~g}=\ldots \mathrm{mg}$ $8570 \mathrm{mcg}=\ldots \quad$ grams $45 \mathrm{~kg}=\ldots \mathrm{mg}$
$0.00965 \mathrm{~g} \mathrm{=} \quad \mathrm{mcg}$
$50000 \mathrm{mg}=\ldots$ grams

ANSWERS
4.255 liters (L)

2600 mL
37.5 mg
0.00857 grams

45000000 mg
9650 mcg
50 grams

## RATIOS AND PROPORTIONS

## 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.


## RATIOS AND PROPORTIONS

1. How many $120-\mathrm{mL}$ bottles can be filled from 3.84 L of a cough syrup?

Answer:

$$
\begin{aligned}
\frac{120 \mathrm{~mL}}{1 \text { bottle }} & =\frac{3840 \mathrm{~mL}}{? \text { bottles }} \\
3840 \times 1=3840 & \div 120=32
\end{aligned}
$$

## RATIOS AND PROPORTIONS

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:

$$
\frac{30 \mathrm{mg}}{1 \text { capsule }}=\frac{900 \mathrm{mg}}{\text { ?capsules }}
$$

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

$$
\text { ( } 30 \text { capsules ) }
$$

## RATIOS AND PROPORTIONS

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

Answer:

$$
\frac{40 \mathrm{mg}}{1 \mathrm{~mL}}=\frac{? \mathrm{mg}}{0.1 \mathrm{~mL}}
$$

$40 \times 0.1=4 \div 1=4$
4 mg must be changed to micrograms.
$4 \mathrm{mg}=4000 \mathrm{mcg} \quad(4000 \mathrm{mcg})$

## RATIOS AND PROPORTIONS

4. $4.5 \mathrm{tsps}=\ldots \mathrm{mL}$

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

Answer:

$$
\frac{1 \mathrm{tsp}}{5 \mathrm{~mL}}=\frac{4.5 \mathrm{tsp}}{? \mathrm{~mL}}
$$

$4.5 \times 5=22.5 \div 1=22.5 \quad(22.5 \mathrm{~mL})$

## RATIOS AND PROPORTIONS

5. $330 \mathrm{lb}=\ldots \mathrm{kg}$

You know that 1 kg is equal to 2.2 pounds.
Answer:

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

$330 \times 1=330 \div 2.2=150$
( 150 kg )

## RATIOS AND PROPORTIONS

6. $35 \mathrm{tbsp}=\ldots \mathrm{tsp}$

You know that 1 tablespoon is equal to 3 teaspoons.

Answer:

$$
\frac{1 \mathrm{tbsp}}{3 \mathrm{tsps}}=\frac{35 \mathrm{tbsp}}{? \mathrm{tsps}}
$$

$35 \times 3=105 \div 1=105$
( 105 teaspoons )

## RATIOS AND PROPORTIONS

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

Answer:

$$
\frac{80 \mathrm{~mL}}{1 \text { hour }}=\frac{? \mathrm{~mL}}{24 \text { hours }}
$$

$80 \times 24=1920 \div 1=1920$
( 1920 mL )

## RATIOS AND PROPORTIONS

8. $350 \mathrm{tsps}=\ldots$ liters

Answer:

$$
\frac{1 \mathrm{tsp}}{5 \mathrm{~mL}}=\frac{350 \mathrm{tsps}}{? \mathrm{~mL}}
$$

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

( $1750 \mathrm{~mL}=1.75$ liters )

## ( 1.75 liters)

## PERCENTAGES

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

Examples:

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

## PERCENTAGES

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.


## PERCENTAGES

How do you write the following in drug form?
a. $6 \%(w / w)$
b. $10 \%(\mathrm{w} / \mathrm{v})$
c. $0.5 \%(v / v)$

Answer:
a. $6 \mathrm{~g} / 100 \mathrm{~g}$
b. $10 \mathrm{~g} / 100 \mathrm{~mL}$
c. $0.5 \mathrm{~mL} / 100 \mathrm{~mL}$

## PERCENTAGES

## 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.

## PERCENTAGES

## 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.

## PERCENTAGES

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:

$$
\frac{3 \mathrm{~g}}{100 \mathrm{~g}}=\frac{? \mathrm{~g}}{180 \mathrm{~g}}
$$

$180 \times 3=540 \div 100=5.4$
( 5.4 grams hydrocortisone)

## PERCENTAGES

## 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.

## PERCENTAGES

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

Answer:

$100 \times 30=3000 \div 480=6.25$
( 6.25 mL of liquefied phenol )

## PERCENTAGES

## 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 ONLY, and the denominator or final solution is measured in milliliters ONLY.

## PERCENTAGES

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. $=120 \mathrm{~mL}$ )

Answer:

$$
\frac{24 \mathrm{~g} \mathrm{KCl}}{120 \mathrm{~mL}}=\frac{? \mathrm{~g} \mathrm{KCl}}{100 \mathrm{~mL}}
$$

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

## PERCENTAGES

2. How many grams of potassium chloride would be in a pint $(480 \mathrm{~mL})$ of $10 \% \mathrm{KCl}$ ?

Answer:

$$
\frac{10 \mathrm{~g} \mathrm{KCl}}{100 \mathrm{~mL}}=\frac{? \mathrm{~g} \mathrm{KCl}}{480 \mathrm{~mL}}
$$

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

## PERCENTAGES

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:

$$
\frac{0.9 \mathrm{~g} \mathrm{NaCl}}{100 \mathrm{~mL}}=\frac{? \mathrm{~g} \mathrm{NaCl}}{1000 \mathrm{~mL}}
$$

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

## PERCENTAGES

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.

$$
\frac{1 \text { gram }}{100 \mathrm{~mL}}=\frac{? \text { grams }}{200 \mathrm{~mL}}
$$

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

## DILUTIONS

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:

$$
(\mathrm{OV})(\mathrm{O} \%)=(\mathrm{NV})(\mathrm{N} \%)
$$

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

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

O\% 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.)

## DILUTIONS

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.

## DILUTIONS

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.

## DILUTIONS

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

## $(\mathrm{OV})(\mathrm{O} \%)=(\mathrm{NV})(\mathrm{N} \%)$

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\%) $=(500 \mathrm{~mL})(6 \%)$
$40 X=3000$
Divide both sides by the number with X to figure out what the (?) number is.

$$
\frac{40 X}{40}=\frac{3000}{40}
$$

$$
3000 \div 40=75 \quad(75 \mathrm{~mL})
$$

## $(O V)(O \%)=(N V)(N \%)$

$(75 \mathrm{~mL})(40 \%)=(500 \mathrm{~mL})(6 \%)$

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.

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

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 $500 \mathrm{~mL}-75 \mathrm{~mL}=425 \mathrm{~mL}$.

Answer:
425 mL of water must be added

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

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 mL$)(10 \%)=(?)(2 \%)$

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

$$
X=600
$$

$$
(N V)=600 \mathrm{~mL}
$$

## $(O V)(O \%)=(N V)(N \%)$

How much water would you add to the stock solution to prepare the dilution in the last problem?
$600 \mathrm{~mL}-120 \mathrm{~mL}=480 \mathrm{~mL}$

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

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?
$(100 \mathrm{~mL})(50 \%)=(500 \mathrm{~mL})(\mathrm{N} \%)$
$\underline{5000}=\underline{500 X}$
$500 \quad 500 \quad \mathrm{X}=10 \quad \mathrm{~N} \%=10 \%$

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

4. Using 100 mL of concentrated dextrose injection $50 \%$, how much $5 \%$ dextrose could be prepared from the dextrose injection?
$(100 \mathrm{~mL})(50 \%)=(\mathrm{NV})(5 \%)$
$\frac{5000}{5}=\frac{5 x}{5}$
$X=1000$
$(N V)=1000 \mathrm{~mL}$
