Principles of pharmacy practice

Lec 4

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Percent and ratio strength calculations

Percentage

- The term *percent* and its corresponding sign (%) mean "by the hundred" or "in a hundred," and *percentage* means "rate per hundred" , so *50 percent* (or 50%) and *a percentage of 50* are equivalent expressions.
- A percent may also be expressed as a *ratio*, represented as a common or decimal fraction. For example, *50%* means *50 parts in 100* of the same kind, and may be expressed as 50⁄100 or 0.50
- For the purposes of computation, percents are usually changed to equivalent decimal fractions. This change is made by dropping the percent sign (%) and dividing the expressed numerator by 100. Thus,

12.5% = 12.5/100 = 0.125

- The percentage concentrations of active and inactive constituents in various types of pharmaceutical preparations are defined as follows by the *United States Pharmacopeia*1
- ***Percent weight-in-volume*** (w/v) expresses the number of *grams* of a constituent in *100 mL* of solution or liquid preparation and is used regardless of whether water or another liquid is the solvent or vehicle. Expressed as:

***50% w/v*.**

- ***Percent volume-in-volume*** (v/v) expresses the number of *milliliters* of a constituent in *100 mL* of solution or liquid preparation. Expressed as:

***50% v/v*.**

- ***Percent weight-in-weight*** (w/w) expresses the number of *grams* of a constituent in *100 g* of solution or preparation. Expressed as:

50% *w/w*.

- The term *percent*, or the symbol %, when used *without qualification (ex: 6%)* means:

1. • for solutions or suspensions of solids in liquids, *percent weight-in-volume*;
2. • for solutions of liquids in liquids, *percent volume-in-volume*;
3. • for mixtures of solids or semisolids, *percent weight-in-weight*

Percentage weight in volume (W/V)

- weight-in-volume expressions, the “correct” strength of a 1% (w/v) solution or other liquid preparation is defined as containing 1 g of constituent in 100 mL of product
- Multiply the required number of milliliters by the percentage strength, expressed as a decimal, to obtain the number of grams of solute or constituent in the solution or liquid preparation.
- *The volume, in milliliters, represents the weight in grams of the solution or liquid preparation as if it were pure water.*

Volume (mL, representing grams) x % (expressed as a decimal) = grams (g) of solute or constituent

- *How many grams of dextrose are required to prepare 4000 mL of a 5% solution?*

4000 mL represents 4000 g of solution

5% = 0.05

4000 g x 0.05 = 200 g, *answer*.

- *How many grams of potassium permanganate should be used in compounding the following prescription?*

Potassium Permanganate		0.02%
Purified Water	ad	250 mL

Sig. as directed.

250 mL represents 250 g of solution

0.02% = 0.0002

250 g x 0.0002 = 0.05 g, *answer*

- *How many grams of aminobenzoic acid should be used in preparing 8 fluidounces of a 5% solution in 70% alcohol?*

8 fl. oz. = 8 x 29.57 mL = 236.56 mL

236.56 mL represents 236.56 g of solution

5% = 0.05

236.56 g x 0.05 = 11.83 g, *answer.*

What is the percentage strength (w/v) of a solution of urea, if 80 mL contains 12 g?

80 mL of water weighs 80 g

$$\frac{80\ (g)}{12\ (g)} = \frac{100\ (\%)}{x\ (\%)}$$

$$x = 15\%, \textit{ answer.}$$

How many milliliters of a 3% solution can be made from 27 g of ephedrine sulfate?

$$\frac{3\ (\%)}{100\ (\%)} = \frac{27\ (g)}{x\ (g)}$$

$$x = 900\ g, \text{ weight of the solution if it were water}$$

$$\text{Volume (in mL)} = 900\ mL, \textit{ answer.}$$

Percentage volume in volume

Examples of Volume-in-Volume Calculations

How many milliliters of liquefied phenol should be used in compounding the following prescription?

℞	Liquefied Phenol	2.5%
	Calamine Lotion ad	240 mL
	Sig. For external use.	

Volume (mL) × % (expressed as a decimal) = milliliters of active ingredient

240 mL × 0.025 = 6 mL, *answer.*

In preparing 250 mL of a certain lotion, a pharmacist used 4 mL of liquefied phenol. What was the percentage (v/v) of liquefied phenol in the lotion?

$$\frac{250\ (\text{mL})}{4\ (\text{mL})} = \frac{100\ (\%)}{x\ (\%)}$$

$$x = 1.6\%, \textit{ answer.}$$

What is the percentage strength v/v of a solution of 800 g of a liquid with a specific gravity of 0.800 in enough water to make 4000 mL?

800 g of water measures 800 mL
800 mL ÷ 0.800 = 1000 mL of active ingredient

$$\frac{4000\ (\text{mL})}{1000\ (\text{mL})} = \frac{100\ (\%)}{x\ (\%)}$$

$$x = 25\%, \textit{ answer.}$$

Peppermint spirit contains 10% v/v of peppermint oil. What volume of the spirit will contain 75 mL of peppermint oil?

$$\frac{10\ (\%)}{100\ (\%)} = \frac{75\ (\text{mL})}{x\ (\text{mL})}$$

$$x = 750\ \text{mL}, \textit{ answer.}$$

If a veterinary liniment contains 30% v/v of dimethyl sulfoxide, how many milliliters of the liniment can be prepared from 1 lb of dimethyl sulfoxide (sp gr 1.10)?

1 lb = 454 g

454 g of water measures 454 mL

454 mL ÷ 1.10 = 412.7 mL of dimethyl sulfoxide

$$\frac{30\ (\%)}{100\ (\%)} = \frac{412.7\ (\text{mL})}{x\ (\text{mL})}$$

$$x = 1375.7 \text{ or } 1376 \text{ mL, } \textit{answer.}$$

1. ℞ Antipyrine 5%
Glycerin ad 60
Sig: Five drops in right ear.

How many grams of antipyrine should be used in preparing the prescription?

3.[4] ℞ Dexamethasone Sodium Phosphate 100 mg
Sterile Water for Injection ad 100 mL
Sig: 2 drops into eyes q 4 hours × 2 days; then 2 drops q 6 hours × 4 days.

Calculate the percent strength of dexamethasone sodium phosphate in the prescription.

7. If a pharmacist dissolved the contents of eight capsules, each containing 300 mg of clindamycin phosphate, into a sufficient amount of an astringent liquid base to prepare 60 mL of topical solution, what would be the percentage strength (w/v) of clindamycin phosphate in the prescription?

25. ATROVENT Nasal Spray contains 0.03% of ipratropium bromide in a 30-mL metered dose container. If the container is calibrated to deliver 345 sprays, calculate the volume of each spray, in microliters, and the medication content of each spray, in micrograms.

34. A dermatologic lotion contains 1.25 mL of liquefied phenol in 500 mL. Calculate the percentage (v/v) of liquefied phenol in the lotion.

31. How many liters of a mouthwash can be prepared from 100 mL of cinnamon flavor if its concentration is to be 0.5% (v/v)?