



لجان الرفعات

DISPENSING



MORPHINE ACADEMY

MORPHINE
ACADEMY

Pharmaceutical Calculations

- One of the greatest potentials for error in prescription compounding is in the area of pharmacy math or pharmacy calculations
- A misplaced decimal or “estimated” value for a medication can have serious consequences including death
- There is no excuse for ignorance in this area and an individual unprepared to do the necessary calculations should not be involved in pharmaceutical compounding

Numbers and Numerals

- Number: a total quantity or amount
- Numeral: a word, sign, or group of words and signs representing a number:
 - **Roman Numerals:**
 - A numeral system of ancient Rome based on letters of the Alphabet
 - I: one, V: five, X: ten, L:50, C:100, D: 500, M:1000
 - The first ten Roman numerals are: I, II, III, IV, V, VI, VII, VIII, IX,
10 X
 - XXX:? 30
 - LX:? 60

Numbers and Numerals

Arabic Numerals:

- Most common symbols used to represent numbers
- The basic symbols called digits are: 0,1,2,3,4,5,6,7,8,9
- The position of a digit determines its value
- 237

Decimals

يعني هذه الأشياء الأساسية الي المفروض الكل عارفهم

- A decimal is a fraction whose denominator is 10 or a multiple of 10
- e.g.:
 - $0.7 = 7/10$
 - $0.06 = 6/100$
 - $0.006 = 6/1000$
- $0.3 = 0.30 = 0.300$
- $0.3 = 3/10$
- $0.03 = 3/100$
- $0.003 = 3/1000$

Using ratios, proportions, and percentages in dosage calculations:

- Example: a vial of Rociphen contains 100 milligrams per milliliter. How many milliliters should be given to a patient to obtain 650 milligrams?
- $100 \text{ mg} \rightarrow 1 \text{ ml}$ \swarrow *نعمل نسبة وتناسب وبنضرب وبنطلع الناتج*
- $650 \text{ mg} \rightarrow X \text{ ml}$
- $X = 6.5 \text{ ml}$

Using ratios, proportions, and percentages in dosage calculations:

- Always look for what is being asked:
 - Number of doses
 - Total amount of drug
 - Size of dose
- Given any two of the above, you can solve for the third
- General Formula: *ممکن تحفظ القانون أول تفهم السؤال وتحل نسبة وتناسب*

Number of doses = Total amount / Size of dose

Total amount = number of doses X size of dose

Size of dose = Total amount / number of doses

Using ratios, proportions, and percentages in dosage calculations:

- Example: how many milligrams of theophylline does a patient receive per day, if the prescription indicates 300mg

tid?

يعني اذا باليوم كامل ثلاث مرات بدو يأخذ الدواء ، كم الجرعة الكاملة باليوم؟
بنضرب الجرعة الواحدة بثلاث

$$X \text{ total amount} = 3 \times 300\text{mg}$$

$$X = 900 \text{ mg total}$$

يعني أربع مرات باليوم

- How much propranolol will a patient receive every 6 hours if he is to receive 160 mg per day?

$$X \text{ dose} = 160 \text{ mg} / 4 \text{ doses}$$

$$X = 40 \text{ mg}$$

Using ratios, proportions, and percentages in dosage calculations:

Solve by your self:

- How many doses are in 120ml of Benadryl Elixir, if one dose is 5ml? (Answer 24 doses) الجرعة كاملة 120/5 = 24 عدد الجرعات
- When erythromycin lactobionate is reconstituted, it yields a concentration of 50 mg/ml. How many milliliters are required to give a 0.9 gm dose? (Answer: 18 ml)... be careful for the unit أول شيء لازم ننتبه على الوحدات ونوحدهم

جاري الاستيعاب!

$$0.9 \cancel{\text{g}} \times \frac{1000 \text{ mg}}{\cancel{\text{g}}} = 900 \text{ mg}$$

بعدين بنكمل وبنحل نسبة وتناسب

$$\begin{array}{l}
 50 \text{ mg} \longrightarrow 1 \text{ ml} \\
 \quad \quad \quad \times \\
 900 \text{ mg} \longrightarrow ?? \\
 \qquad \qquad \qquad = 18 \text{ ml}
 \end{array}$$

Percentage

- $45\% = 45/100 = 0.45$
- It is not correct to divide by 100 and use the percent sign at the same time:

e.g. $25\% = 25/100$ and not $25\%/100$ ✗

- To calculate a percentage of a percentage:

50% of 40% is:

$$(50/100) \times (40/100) = 0.5 \times 0.4 = 0.2 = 20/100 = 20\%$$

زي لما نحكي
بدنا نص
الاربعين

Mass percentage (fraction)

- **Wt%:** Percent weight-in-weight (w/w) expresses the number of grams of a drug or active ingredient in 100 grams of a mixture (g/g)
- If a bottle contains 40 gm of ethanol and 60 gm of water then it contains 40% ethanol by mass or 0.4 mass fraction ethanol

Mass percentage (fraction)

- Examples: Prepare 500 ml of Phenol glycerin

$$\begin{array}{l} \text{Phenol: } 150 \text{ gm} \xrightarrow{\quad} ?? \\ \text{Glycerin } 850 \text{ gm} \xrightarrow{\quad} 500 * 1.25 \text{ g} \end{array}$$

هسا هو معطينا الكمية الي بدو اياها بال ml بس
احنا بدنا اياهم بال g فبنضرب بالكثافة عشان
بتختلف الكمية حسب كثافة كل مادة

Weight per ml of glycerin: 1.25g density الكثافة (g / ml)

So for preparing 500 ml of phenol glycerin the quantity of glycerin required = $500 \cancel{\text{ml}} \times \frac{1.25 \text{ g}}{\cancel{\text{ml}}} = 625 \text{ gm}$

- Quantity of phenol required = $150 * 625 / 850 = 110 \text{ gm}$
- So for preparing 500 ml of phenol glycerin the formula becomes:
 - Phenol 110 g
 - Glycerin 625 g

Phenol Glycerin IP

- Method: Phenol and glycerin are mixed in a beaker. The beaker is warmed gently until it becomes a solution.
- Use: Local anesthetic and local antiseptic. Phenol glycerin is used to prepare Phenol Gargle and Phenol Glycerin Ear Drop.
- Cautions: Phenol Glycerin when diluted with water becomes caustic so it is diluted with glycerin.
- Label: FOR EXTERNAL USE ONLY should be displayed in the label.

• Examples:

نفس السؤال الي قبل باختلاف المادة

Prepare 500 ml of sugar solution

Sugar 100 gm \longrightarrow ?? = 55 g

Water 900 gm \longrightarrow ~~500 ml~~ * $\frac{1 \text{ g}}{\text{ml}}$ = 500g

Weight per ml of water = 1 gm/ml

The quantity of water required ? (500g)

The quantity of sugar required ? (55 g)

Mass-volume percentage:

- Weight-in-volume (w/v) percentage: expresses the number of grams of a drug or active ingredient in 100 milliliters of a mixture
- Often used for solutions made from a solid solute dissolved in a liquid
- For example a 40% w/v sugar solution contains 40 gm of sugar per 100 ml of resulting solution

Mass-volume percentage:

- Example:

Calculate the quantity of sodium chloride required to prepare 400 ml of 2 (w/v)% solution

2g NaCl \rightarrow 100 ml solution

X \rightarrow 400 ml

X = 8 g of sodium chloride is dissolved in water to produce 400 ml makes 2% w/v solution

Mass-volume percentage:

- Example:

Prepare 500 ml of a 1 in 10000 solution from 1 in 5000 solution?

Strength of concentrate 1 in 5000 = $100/5000 = 0.02\%$

Strength of dilute solution = 1 in 10000 = $100/10000 = 0.01\%$

Degree of dilution = strength of concentrate / strength of dilute solution = $0.02/0.01 = 2$ times

Volume of solution to be prepared = 500 ml

Therefore, dilute solution is obtained by diluting $500/2 = 250$ ml of 1 in 5000 solution to 500 ml

او طريقة ثانية على قانون

$$V * M_{\text{diluted}} = V * M_{\text{concentrated}}$$

$$500 * 0.01 = V * 0.02$$

$$V = 250 \text{ml}$$

Mass-volume percentage:

- Solve by yourself:

How much of a 5% will be required to prepare 1000 ml of a 1 in 500 solution?

Strength of concentrate = 5%

Strength of dilute solution = $\frac{1}{500}$ = 0.2%

Degree of dilution = 25 times $\frac{5\%}{0.2\%}$

Volume to be prepared = 1000 ml

Therefore dilute solution is obtained by diluting $\frac{1000}{25} = 40$ ml of 5% solution to 1000 ml

Volume-volume percentage:

- (v/v) percentage expresses the number of milliliters of a drug or active ingredient in 100 milliliters of a mixture
- Most useful when a liquid-liquid solution is being prepared
- For example, a 40% v/v ethanol solution contains 40ml ethanol per 100ml total volume
- Example:

Prepare 500 ml of 5% solution of chloroform in 50% alcohol

5 ml chloroform \rightarrow 100 ml of 50% alcohol

X ml \rightarrow 500 ml of 50% alcohol

X = 25 ml of chloroform dissolved in sufficient quantity of 50% alcohol to make 500 ml of solution

Ratio strength

- Ratio strength (1:N) is one part by weight or volume in N parts by weight or volume
- 1:200 ratio strength can be
 - 1gm solid to 200 gm solid
 - 1 ml liquid to 200 ml liquid
 - 1 gm solid to 200 ml liquid

- Example:

If 2000 gm of ointment contain 75 gm of hydrocortisone, what is the percentage strength (w/w) of the ointment?

2000 gm ointment \rightarrow 75 gm hydrocortisone

100 gm ointment \rightarrow X

X=3.75%

Ratio strength

- If 8 ml of phenol were added to 480 ml of lotion what is the percentage of phenol in the lotion?
- $X=1.6\%$ of phenol
- 100 ml of lotion contain 1.6% of phenol

$$\begin{array}{l} 8 \text{ ml} \longrightarrow 480 \text{ ml} \\ ?? \longrightarrow 100 \text{ ml} \end{array} = 1.6 \%$$

Ratio strength

- Solve:

1. If 1.2gm of menthol is added to 480 ml of lotion, what is the percentage of menthol in the lotion?

1.2 g \longrightarrow 480 ml

Answer = 0.25% of menthol

?? \longrightarrow 100 ml

2. How many milliliters of a 0.1% solution can be made from one gram of atropine sulfate?

0.1 g \longrightarrow 100 ml

Answer: 1000ml

1 g \longrightarrow ??

Concentration and Dilution

- Stock solutions are concentrated bulk solutions from which more dilute solutions can be quickly prepared
- These solutions can be used with a ratio strength or percentage strengths
- General formula for solving: $V1 \times S1 = V2 \times S2$
- $V1$ = the quantity or the amount of the original preparation
- $S1$ = the % strength of the original preparation expressed as a decimal or percent
- $V2$ = the quantity or amount of the wanted preparation
- $S2$ = the % strength of the wanted preparation expressed as a decimal or percent

Concentration and Dilution

- Example: if 500 ml of a 15% solution are diluted to 1500 ml, what will be the percent strength ?

$$500 \text{ ml (V1)} \times 15\% \text{ (S1)} = 1500 \text{ ml (V2)} \times S2$$

$$S2 = 5\%$$

- If 1000 ml of a 20% solution are diluted to 5000 ml what will be the percent strength?

$$1000 \text{ ml (V1)} \times 20\% \text{ (S1)} = 5000 \text{ ml (V2)} \times S2$$

$$S2 = 4\%$$

Concentration and Dilution

- Solve:

1. **How many milliliters of a 25% solution can be prepared from 750ml of a 65% solution?**

Answer: 1950 ml $750 * 65\% = V * 25\%$

2. **If 30 gm of a 45% powder was diluted to make a 30% powder, how many grams will the new preparation weigh?**

Answer: 45 gm

$$30 * 45\% = \text{mass} * 30\%$$

3. **If 20 ml of a 1:200 solution of a chemical is diluted to 500 ml, what is the ratio strength?**

Answer: 1:5000

$$20 * 1/200 = 500 * \text{ratio}$$

Reducing and Enlarging formulas

- Determine the total weight or volume of ingredients and convert to the required quantity. The quantity in the original and new formulas will have the same ratio

Reducing and Enlarging formulas

- Calculate the amount needed for 50 ml strong sodium salicylate mixture

في طريقتين ممكن بنحل نسبة وتناسب زي قبل كل وحدة لحال او حل اسرع بنطلع نسبة التخفيف وبنقسمها على الكل

Sodium salicylate $\frac{10g}{20}$

Sodium metabisulfate $\frac{1}{20}$ gm

D.S. chloroform water $\frac{525}{20}$ ml

Water 1000 ml $\longrightarrow \frac{1000}{50} = 20$

Answer:

Sodium salicylate 0.5gm

Sodium metabisulfate 0.05g

D.S. chloroform water 26.25 ml

Water 50 ml

Reducing and Enlarging formulas

- Calculate the amounts needed for 100 ml peppermint water?

Peppermint water:

يمكن انحل هذه بطريقة النسبة والتناسب

Peppermint 2 ml
Talc 15gm
Purified water q.s. 1000 ml

$$\begin{aligned} 1000 \text{ ml} &\longrightarrow 2 \text{ ml} \\ 100 \text{ ml} &\longrightarrow ?? = 0.2 \text{ ml} \end{aligned}$$

Answer:

$$\begin{aligned} 1000 \text{ ml} &\longrightarrow 15 \text{ ml} \\ 100 \text{ ml} &\longrightarrow ?? = 1.5 \text{ ml} \end{aligned}$$

Peppermint 0.2 ml
Talc 1.5 gm
Purified water q.s. 100 ml

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بأول بنطلع كم ml من الكحول في كل وحدة

- What is the percentage of alcohol in the following mixture ?

Alcohol 2% 5ml

2 ml alcohol → 100 ml mixture

Alcohol 4% 10 ml

?? → 5 ml mixture

0.1 ml alcohol

(can be solved by the alligation method)

Answer:

4 ml alcohol → 100 ml mixture

X = 3.33%

?? → 10 ml mixture

0.4 ml alcohol

وطبعًا هذه كمية الخليط كاملة
هذه كمية الكحول في الخليط
(0.4 + 0.1) ml alcohol → 15 ml mixture

?? → 100 ml mixture

هسا بنلاقيها نسبة الكحول بالمية

3.33%