

Pharmaceutical Calculations

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- 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

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Numbers and Numerals

- Number: a total quantity or amount ١ ٢ ٣
- 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, X
 - XXX:? $10 + 10 + 10 = 30$
 - LX:? $50 + 10 = 60$
 - XL = $50 - 10 = 40$

The roman translation of number 1510 :

$$1000 + 500 + 10$$

$$MDX$$

نقط سوٓ ال٥

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
 - 0.237, 2.37, ...

Decimals كسور عشرية

تعريف

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

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Using **ratios**, **proportions**, and **percentages** in dosage calculations:

- * نسبة متناسب
easy level
- **Example:** ^{عقار} a vial of ^{Antibiotic} Rociphen contains 100 milligrams per milliliter. How many milliliters should be given to a patient to obtain 650 milligrams?
- Amount volume
 - 100 mg → 1 ml
 - 650mg → X ml
 - X = 6.5 ml

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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, size: volume or strength
- Given any two of the above, you can solve for the third
- General Formula:

احفظه و تعرفه فيه

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

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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?

bronchodilators

three times a day
number of doses ✓

مطلوب

total amount of dose ?

- X total amount = 3 X 300mg

size of dose ✓
300 mg

X = 900 mg total beta blocker

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

X dose = 160 mg / 4 doses total amount

24 ÷ 6 = 4 times
number of doses

X = 40 mg

مطلوب

size of dose

Note: every 6 hours means 4 times daily

Every 8 hours means 3 times daily $24 \div 8 = 3$

Every 12 hrs means twice daily $24 \div 12 = 2$

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Using ratios, proportions, and percentages in dosage calculations:

Solve by your self:

Total amount → for allergies

- How many doses are in 120ml of Benadryl Elixir, if one dose is 5ml? (Answer 24 doses)

size of dose number of doses : $\frac{\text{Total amount}}{\text{size of dose}}$

$$\text{number of dose} = \frac{\text{Total}}{\text{size}} = \frac{120 \text{ mL}}{5 \text{ mL}} = 24 \text{ doses}$$



IV antibiotic

- 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

$$50 \times 10^{-3} \text{ g} \rightarrow 1 \text{ mL}$$

$$0.9 \text{ g} \rightarrow X \text{ mL}$$

50mg.....1ml
0.9 gm(.....mg).....???

$$X = 18 \text{ mL}$$

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) X (40/100) = 0.5 X 0.4 = 0.2 = 20/100 = 20%

$$\frac{50}{100} \times \frac{40}{100} = 0.2 \times 100\% = 20\%$$

Phenol Glycerin IP (indian pharmacopoeia)

- **Method** Phenol and glycerin are mixed in a beaker. The beaker is warmed gently until it becomes a solution.
- **Use** مخدر Local anesthetic and مطهر local antiseptic. Phenol glycerin is used to prepare Phenol Gargle and Phenol Glycerin Ear Drop. عزّة
- **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. مادة كاوية



Examples:

Prepare 500 ml of sugar (solid) solution

Sugar 100 gm

Water 900 gm

Weight per ml of water = 1 gm.....(water density)

Sugar : water

100..... 900

???.....500

$100 \times 500 / 900 =$

The quantity of water required ? (500g)

The quantity of sugar required ? (55 g)

$$500 \text{ ml} \left(\frac{1 \text{ gm}}{\text{ml}} \right) = 500 \text{ gm}$$

$$100 \text{ sugar} \times \left(\frac{500}{900} \right) \approx 55 \text{ g}$$

value
total

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

$$40\% \text{ w/v} = \frac{40 \text{ gm solute}}{100 \text{ ml solution}}$$



Mass-volume percentage:

• Example:

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

2g NaCl 100 ml solution $\frac{2 \text{ gm}}{100 \text{ ml}}$

X 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 ^{dilute} 1 in 10000 solution from 1 in 5000 ^{concentrate} solution (stock solution)? حوالنامہ percentage

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

$$C_1V_1 = C_2V_2$$

$$0.02\% \times V_1 = 0.01\% \times 500 \text{ ml}, \quad V_1 = 250 \text{ ml}$$

معنی ترکیبیت و حجم

$$C_1V_1 = C_2V_2$$

$$0.02\% \times V_1 = 0.01\% \times 500 \text{ ml}$$

$$V_1 = 250 \text{ ml}$$



Mass-volume percentage:

• Solve by yourself:

How much of a 5% will be required to prepare 1000 ml of a 1 in 500 ^{$\frac{1}{500}$} solution? $\frac{1}{500} \times 100\%$

Strength of concentrate = 5%

Strength of dilute solution = 0.2% (1 in 500)

Degree of dilution = $(5/0.2)$ 25 times

Volume to be prepared = 1000 ml

$1000/25 = 40$ ml of 5%

$$C_1V_1 = C_2V_2$$

Therefore dilute solution is obtained by diluting 40 ml of 5% solution to 1000 ml

$$C_1V_1 = C_2V_2$$

$$5\% \times V_1 = 0.2\% \times 1000 \text{ ml} = 40 \text{ ml}$$



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 100 ml of 50% alcohol

X ml 500 ml of 50% alcohol

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

$$C1V1 = C2V2$$

$$5\% \times 100 \text{ ml} = V_2 \times 500 \text{ ml}$$

$$V_2 = 25 \text{ ml}$$

5% → 5 ml chloroform → 100 ml solution
 X → 500 ml (je = 500)
 X = 25 ml chloroform



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 solidtotal: 201gm
 - 1 ml liquid to 200 ml liquid.....?? total 201 ml
 - 1 gm solid to 200 ml liquid.....?? Check the density

Example

- ∴ for inflammation (corticosteroids)
If 2000 gm of ointment contain 75 gm of hydrocortisone, what is the percentage strength (w/w) of the ointment?

2000 gm ointment75 gm hydrocortisone

100 gm ointment X

$$100 \times 75 / 2000 =$$

$$X = 3.75\%$$

$$w/w \% = \frac{\text{mass}}{\text{total}} \times 100\%$$

$$= \frac{75 \text{ g}}{2000} \times 100\%$$

$$= 3.75\%$$



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Ratio strength

- If 8 ml of phenol were used in 480 ml of lotion what is the percentage of phenol in the lotion?
- 8 ml.....480 ml
- ??? 100 ml
- X=1.6% of phenol
- 100 ml of lotion contain 1.6 ml of phenol

$$\frac{V}{V} \% = \frac{8 \text{ ml}}{480 \text{ ml}} \times 100\%$$

$$= 1.6 \%$$



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?

Answer= **0.25% of menthol** $\frac{w}{v} \% = \frac{1.2 \text{ g}}{480 \text{ ml}} \times 100\% = 0.25\%$

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

Answer: **1000ml**

$$0.1\% \text{ w/v} = \frac{0.1 \text{ g}}{100 \text{ ml}} = \frac{1 \text{ g}}{X}$$

$$X = 1000 \text{ mL}$$

Handwritten calculation on a piece of paper:

0.1 % means 0.1 g atropine in 100 ml

for 1 g atropine → ??

$\frac{1 \text{ g} \times 100 \text{ ml}}{0.1 \text{ g}} = 1000 \text{ ml}$

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: **C1V1 = C2V2**
- V1= the quantity or the amount (**volume??**) of the original preparation
- C1= the % strength of the original preparation expressed as a decimal or percent
- V2= the quantity or amount of the wanted preparation
- C2= the % strength of the wanted preparation expressed as a decimal or percent
- C=S

Concentration and Dilution

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

$$500 \text{ ml (V}_1\text{)} \times 15\% \text{ (C}_1\text{)} = 1500 \text{ ml (V}_2\text{)} \times \text{C}_2$$

$$\text{C}_2 = 5\%$$

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

$$1000 \text{ ml (V}_1\text{)} \times 20\% \text{ (C}_1\text{)} = 5000 \text{ ml (V}_2\text{)} \times \text{C}_2$$

$$\text{C}_2 = 4\%$$

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Concentration and Dilution

• Solve:

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

$$\text{C}_1 \text{V}_1 = \text{C}_2 \text{V}_2 \dots \text{Answer: } 1950 \text{ ml}$$

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

$$\text{C}_1 \text{V}_1 = \text{C}_2 \text{V}_2 \dots \text{Answer: } 45 \text{ gm}$$

- (1:X) 3. If 20 ml of a $1:200$ solution of a chemical is diluted to 500 ml , what is the ratio strength?

$$\text{C}_1 \text{V}_1 = \text{C}_2 \text{V}_2 \dots$$

$$0.5\% \times 20 \text{ ml} = \text{C}_2 \times 500 \text{ ml} \dots \text{C}_2 = 0.02\% \Rightarrow 0.02 \text{ g in } 100 \text{ ml} \quad (1:X)$$

Ratio strength of the diluted solution??

1: 200 is 0.5%,

Answer: 1:5000

1 g in X

$$X = 5000 \quad (1:5000)$$

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Concentration and Dilution

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

$C1V1 = C2V2$

$0.5\% \times 20\text{ml} = C2 \times 500\text{ml} \dots C2 = 0.02\%$

Ratio strength of the diluted solution??

One part of solute in certain volume (weight)

the diluted solution = 0.02 %

0.02 gm 100 ml

1gm ???

Answer: 1:5000

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★ 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
- Example: Calculate the amount needed for 50 ml strong sodium salicylate mixture (scaling down)

Sodium salicylate	10g / 20 = 0.5
Anti oxidant Sodium metabisulfate	1 g / 20 = 0.05
double strength D.S chloroform water	525 ml / 20 = 26.25
Water q.s. <i>add enough water to complete 1000ml</i>	1000 ml (total)

quantity sufficient ←

Answer:

Sodium salicylate	0.5g
Sodium metabisulfate	0.05g
D.S. chloroform water	26.25 ml
Water	qs 50 ml

بدنا نحضر 50ml من 1000ml
فيبدأ نجد العامل إلى راج نقصه عليه

$$\frac{50}{1000} = \frac{1}{20} \text{ Factor}$$

إلى باقي الإه
Total

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Reducing and Enlarging formulas

- ✓ • Calculate the amounts needed for 100 ml peppermint water?

Peppermint water: **scaling down**

Peppermint 2 ml / 10 = 0.2 ml

Talc 15 gm / 10 = 1.5 ml

Purified water q.s. 1000 ml total

$$\left. \begin{array}{l} 2 \text{ ml} / 10 = 0.2 \text{ ml} \\ 15 \text{ gm} / 10 = 1.5 \text{ ml} \end{array} \right\} \frac{100}{1000} = \frac{1}{10} \text{ Factor}$$

Answer:

Peppermint 0.2 ml

Talc 1.5 gm

Purified water q.s. 100 ml

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مساوية

Alligation is an arithmetical technique for solving problems that require mixing two solutions to make a third solution. Words fail to describe the technique. It is much easier to demonstrate and work problems than to explain.



تحالف Alligation method

- How many parts of an **20% w/v solution** and **8% w/v solution** are needed to produce **500 ml of 10% w/v solution**?

HC • Solution of **Highest** Concentration: 20% w/v

LC • Solution of **Lowest** Concentration : 8% w/v

DC • Solution of **Desired** Concentration: 10% w/v

① عدد التلات تراجين

② نظرح لخب ratios

$$10 - 8 = 2$$

$$20 - 10 = 10$$

$$2 : 10$$

desired - low = high ratio value

high - desired = Low ratio values

L : H



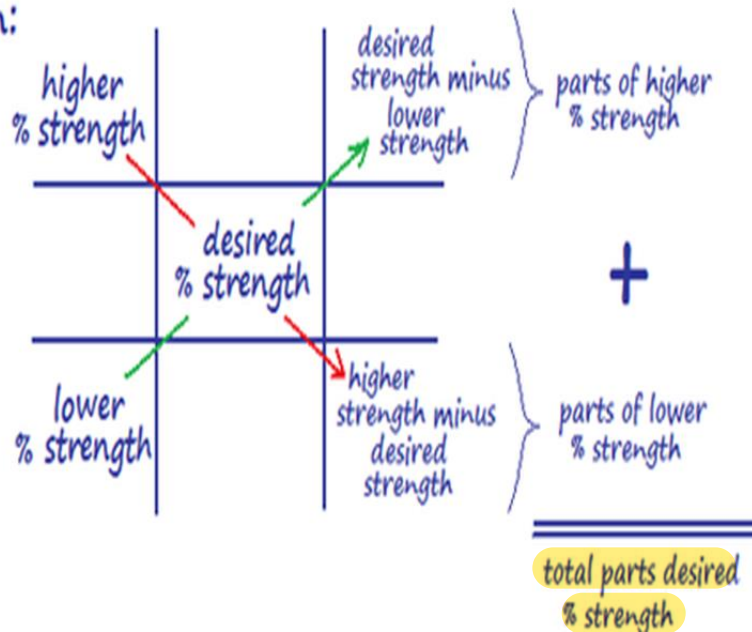
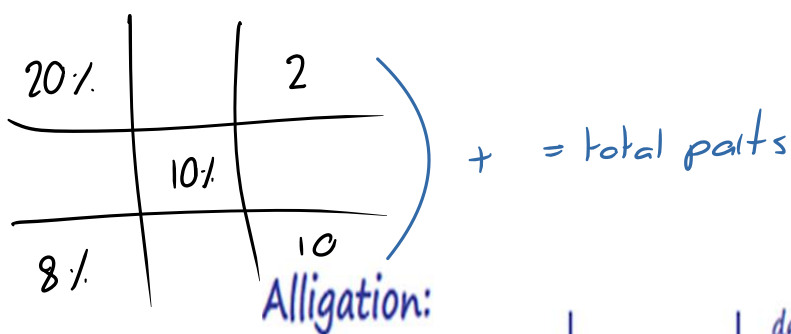
Highest Concentration Desired Concentration Lowest Concentration

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total = 12 parts of desired concentration

$$HC = \frac{2}{12} \times 500 \text{ ml} = 83.3 \text{ ml of } 20\%$$

$$LC = \frac{10}{12} \times 500 \text{ ml} = 416.7 \text{ ml of } 8\%$$



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Alligation method

• Subtracting the lower concentration (8 w/v) from the desired concentration (10% w/v) = **2** (*higher concentration ratio value*)

• Subtract the desired concentration (10 w/v) from the higher concentration (20% w/v) = **10** (*lower concentration ratio value*)

This gives us a ratio of **2:10** (*higher concentration : lower concentration*)

In this case, we know the ratio – **2:10**.....

Total parts= 12 parts

In other words, **2 parts higher concentration to 10 parts lower concentration.**

In other words, there are 12 parts (2 parts + 10 parts):

• (**higher conc**) $2/12 \times 500\text{mL} = \mathbf{83.33 \text{ mL}}$ of **20%** (**lower conc**) $10/12 \times 500\text{mL} = \mathbf{416.66 \text{ mL}}$ of **8%**

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نصف الجولومز

skip subtract

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

Alcohol 2% 5ml (will take 0.1 ml) (lowest concentration)

Alcohol 4% 10 ml (will take 0.4 ml) (highest concentration)

Total volume (parts)= 5 + 10= 15 ml Alcohol volume Total alcohol = 0.5

(can be solved by the alligation method)

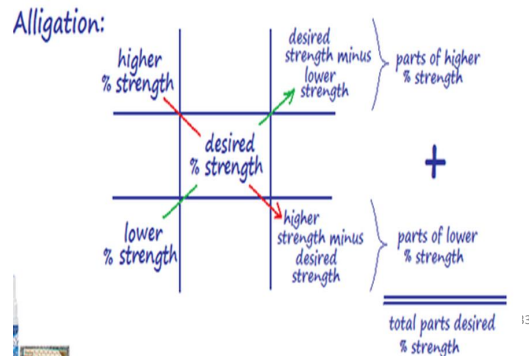
Answer:

$0.1+0.4=0.5$ = no. of parts of the desired concentration

Total volume (parts)= 5 + 10= 15 ml

$0.5/(5+10)=0.0333$Multiply by 100 to get % desired concentration

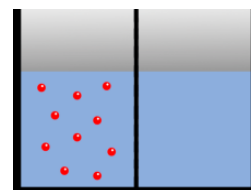
X= 3.33%

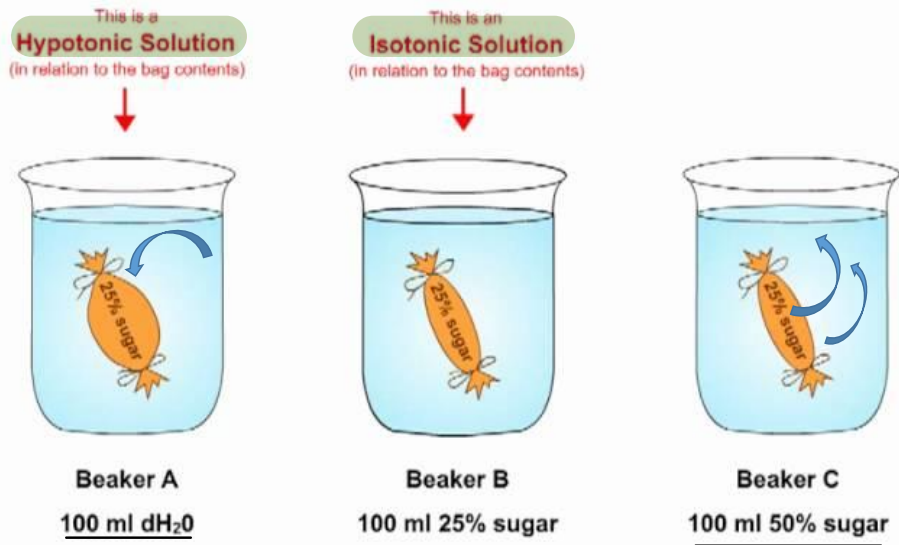


Iso-osmoticity and Isotonicity

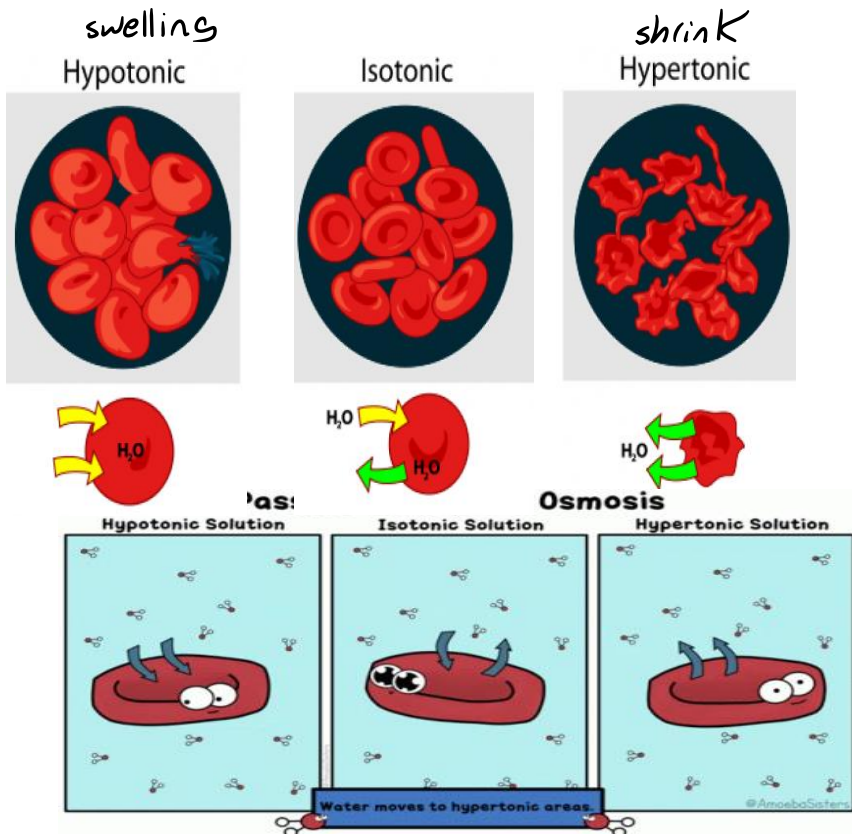
- **Osmosis** is a phenomenon that occur when a semipermeable membrane (permeable only to solvent molecules) is used to separate solutions of different solute concentrations
- The solvent molecules cross the membrane from lower to higher concentration to establish a concentration equilibrium
- The pressure driving this movement called osmotic pressure
- Osmotic pressure is governed by the number of **particles** of solute in solution
- Iso-osmotic solutions: solutions containing the same concentration of particles and thus exert equal osmotic pressure

solvent





In the final experiment, watch what happens when a bag containing 25% sugar is placed in a beaker containing 50% sugar. In this case, the solute concentration of the beaker is higher than that of the bag.



Iso-osmoticity and Isotonicity



- A 0.9% solution of sodium chloride (normal saline) is iso-osmotic with blood
- Isotonic means equal tone and sometimes is used interchangeably with the term iso-osmotic
- The importance of using isotonic or iso-osmotic solutions is to assure that there is no tissue damage or pain when the formulation is administered
- **Hypotonic** solutions produce painful swelling of tissues
- **Hypertonic** solutions produce painful shrinking of tissues

بشکل متبادل

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Methods used to adjust the isotonicity of compounded solutions:

no shrinking
no swelling

E-value

1. Sodium chloride equivalent method:
 - the most widely used
 - The NaCl equivalent (E) is the amount of NaCl that has the same osmotic effect (based on the number of particles) as 1gm of drug
 - Tables of (E) for various drugs are available in standard references
2. Cryoscopic method
3. Isotonic solution V values

Table of Sodium Chloride Equivalents, Molecular Weights, Factors and Ions

Substance	Molecular weight	Ions	i	Sodium Chloride Equivalent
Antazoline phosphate	363	2	1.8	0.16
Atropine	186	1	1.0	0.17
Atropine sulfate H ₂ O	695	3	2.6	0.12
Benzoinate hydrochloride	345	2	1.8	0.17
Benzalkonium chloride	380	2	1.8	0.16
Benzyl alcohol	108	1	1.0	0.30
Boric acid	61.8	1	1.0	0.52
Chloramphenicol	323	1	1.0	0.10
Chlorambutol	177	1	1.0	0.18
Chlortetracycline hydrochloride	515	2	1.8	0.11
Cocaine hydrochloride	340	2	1.8	0.17
Cromolyn sodium	512	2	1.8	0.11
Cyclopentolate hydrochloride	328	2	1.8	0.18
Diamonium bromide	717	3	2.6	0.12
Dextrose (anhydrous)	180	1	1.0	0.18
Dextrose H ₂ O	198	1	1.0	0.16
Dipivefrin hydrochloride	388	2	1.8	0.15
Ephedrine hydrochloride	202	2	1.8	0.28
Ephedrine sulfate	429	3	2.6	0.20
Epinephrine bitartrate	333	2	1.8	0.18
Epinephrine borate	288	1	1.0	0.16
Eucatropine hydrochloride	328	2	1.8	0.22
Fluorescein sodium	376	3	2.6	0.22
Glycerin	92	1	1.0	0.36
Homatropine hydrochloride	356	2	1.8	0.16
Hydroxyamphetamine hydrobromide	232	2	1.8	0.25
Idoxurine	354	1	1.0	0.09
Lidocaine hydrochloride	289	2	1.8	0.22
Mannitol	182	1	1.0	0.18
Morphine sulfate 5H ₂ O	759	3	2.6	0.11
Naphazoline hydrochloride	247	2	1.8	0.27
Oxymetazoline hydrochloride	287	2	1.8	0.20
Oxytetracycline hydrochloride	497	2	1.8	0.12
Phenacaine hydrochloride	353	2	1.8	0.17
Phenobarbital sodium	254	2	1.8	0.23
Phenylephrine hydrochloride	254	2	1.8	0.23

E-value = amount of NaCl that has the same osmotic effect as 1 g of drug

Analogy (this makes it click instantly)

Imagine:

- You need 10 points to pass
- You already scored 3 points (drug)

Do you aim for 10 again? **X**

No, you only need 7 more (NaCl)

كم لازم أميني و
ليصلي NaCl
is isotonic
كنا بالدم
total
0.9%
يعني بالظلمة لما أميني
drug + NaCl the effect
must act like 0.9%

Sodium Chloride Equivalent Method:

• Example: Calculate the amount of NaCl required to make the following ophthalmic solution isotonic:

Atropine Sulfate 2% eye drops → 2g → 100 ml
 NaCl q.s. (quantity sufficient) X ? → 30 ml
 Aqua. Dist. q.s. ad. 30 ml

∴ amount L_v
of drug
X = 0.6g

* each gram of atropine sulfate can be replaced by 0.13 g of NaCl

$$\text{Drug amount} \times E\text{-value} =$$

$$0.6 \times 0.13 =$$

$$= 0.078 \text{ g of NaCl equivalent}$$

Amount of NaCl to add ?

total - equivalent

$$0.27 - 0.078 = 0.192 \text{ g}$$

total isotonic effect = drug + Added NaCl

$$0.27 = 0.078 + X$$

$$X = 0.192 \text{ g}$$

E-value

$$1 \text{ g drug} \rightarrow 0.13 \text{ g NaCl}$$

$$0.6 \text{ g drug} \rightarrow ? \times$$

$$\text{drug contribution } X = 0.078 \text{ g NaCl equivalent}$$

$$0.9 \text{ g} \rightarrow 100 \text{ ml standard isotonic}$$

$$? \text{ g} \rightarrow 30 \text{ ml}$$

$$X = 0.27 \text{ g total NaCl required}$$

Sodium Chloride Equivalent Method:

Step 1:

Determine the amount of NaCl to make 30 ml of an isotonic solution:

standard fact *

0.9g of sodium chloride in 100 ml of water will make an isotonic solution

0.9gm → 100 ml Rx

X → 30 ml

X = 0.27 gm total NaCl

- Atropine % convert to gm

- 2gm.....100ml

- ??30 ml

- 0.6gm

Atropine Sulfate	2%
NaCl	q.s.
Aqua. Dist. q.s. ad.	30 ml

Sodium Chloride Equivalent Method:

Step 2:

Calculate the contribution of atropine sulfate to the osmotic pressure of the solution (the sodium chloride equivalent for atropine $30 \text{ ml} \times 2\text{g}/100 \text{ ml} = 0.6 \text{ g}$ atropine sulfate will be present in the formulation

- sulfate (**E**)= **0.13**): from the table
- 1 gram drug.....**E** 0.13 gm NaCl
- 0.6gm.....????
- $0.6\text{g} \times 0.13 = 0.078 \text{ gm}$ will be the sodium chloride equivalent contribution of atropine sulfate in this preparation

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Sodium Chloride Equivalent Method:

Step 3 Determine the amount of NaCl to add to the formulation:

For 30 ml 0.27 NaCl is needed if no drug, but...

- The sodium chloride needed to make the final solution isotonic is calculated by:

$$0.27 \text{ gm} - 0.078\text{g} = 0.192 \text{ gm}$$

What if???

p200 Antiseptic boric acid is used to adjust isotonicity in ophthalmic solution because of its buffering and anti-infective properties:

- **E for boric acid= 0.5 from the table**
- 1 g boric acid..... 0.5 g NaCl
- X g boric acid..... 0.192g NaCl
- X= 0.38 g

Atropine Sulfate

0.6gm

NaCl

0.192gm

Aqua. Dist. q.s. ad. 30 ml

Atropine Sulfate

0.6gm

Boric acid	0.38gm
------------	--------

Aqua. Dist. q.s. ad. 30 ml

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Isotonic Solution V Values

- The V value of a drug is the volume of water to be added to a specified weight of drug to prepare an isotonic solution
- The V values are given in tables constructed for 0.3g and 1.0 g of drug**
- The basic principle is to **prepare an isotonic solution** of the prescribed drug and then **dilute this solution** to a final volume with a suitable isotonic vehicle
- Instead of changing the amount, change the volume of added water (drug amount is fixed)



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Extra practice

cough
(reliever)

- A physician asks a pharmacist to calculate the dose of a cough syrup so that it may be safely administered dropwise to a child. The cough syrup contains the active ingredient **dextromethorphan HBr**, 30mg/15ml, in a 120-ml bottle. Based on the child's weight and literature references, the pharmacist determines the dose of dextromethorphan HBr to be 1.5mg for the child.

size of dose

$$30 \text{ mg} \rightarrow 15 \text{ ml}$$

$$1.5 \text{ mg} \rightarrow ?$$

$$x = 0.75 \text{ ml}$$

The medicine dropper to be dispensed with the medication is calibrated by the pharmacist and shown to deliver **20 drops of the cough syrup per 1 ml**.

Calculate the dose, in drops, for the child? (answer 15 drops)

30mg15 ml

1.5 mg.....??? 0.75 ml

1ml.....20 drops

0.75 ml.....??? **15 drops**

$$1 \text{ ml} \rightarrow 20 \text{ drop}$$

$$0.75 \text{ ml} \rightarrow x ?$$

$$x = 15 \text{ drop}$$

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