تـذكـر . .

{ وَأَن لَّيْسَ لِلْإِنسَانِ إِلَّا مَا سَعَىٰ }

Percentage, ratio strength, and other concentration expressions

Parts per Million (PPM) and Parts per Billion (PPB)

The strengths of very dilute solutions are commonly expressed in terms of *parts per million (ppm)* or *parts per billion (ppb)*, i.e., the number of parts of the agent per 1 million or 1 billion parts of the whole.

Y parts per million= Y x 10^-6 g / ml (W/V)

Y parts per billion= Y x10^-9 g/ml (W/V)

Example

Express 5 ppm of iron in water in percentage strength and ratio strength.

→ 5 ppm = 5 parts in 1,000,000 parts = 1:200,000, ratio

→ strength = 0.0005% percentage strength,

$5\text{ppm} \rightarrow \frac{5 \text{ parts of iron}}{10^6 \text{ (mixture)}} \rightarrow \frac{5 * 10^{-4}}{100} \rightarrow 0.0005\%$

Percentage, ratio strength, and other concentration expressions

- **Molarity** (M) is the expression of the number of moles of solute dissolved per liter of solution. It is calculated by dividing the moles of solute by the volume of solution in liters.

$$M_A = \frac{n_A}{\text{solution (L)}}$$

$$n_A = \frac{\text{mass}_A}{\text{molar mass}_A}$$

- **Molality** (m) is the moles of solute dissolved per kilogram of solvent. Molality is calculated by dividing the number of moles of solute by the number of kilograms of solvent.

$$m_A = \frac{n_A}{\text{mass}_{\text{solvent (kg)}}}$$

We can express about Concentration in many way :

بقدر اعبر عن التركيز بطرق عدة :

1 . Molarity (M)

2. Molality (m)
3. Normality (N)
4. %
5. Ppm
6. PPb
7. 1 in x
8. 1: x

Percentage, ratio strength, and other concentration expressions

- **Normality**. A common way of dealing with acids, bases, and electrolytes involves the use of equivalents.

➢ One equivalent of an acid is the quantity of that acid that supplies or donates 1 mole of H+ ions.

➢ One equivalent of a base is the quantity that furnishes 1 mole of OH- ions.

➢ One equivalent of acid reacts with 1 equivalent of base.

- Equivalent weight can be calculated for atoms or molecules.

0.1 mole of H2SO4

عشانها حمض فلما بدي اعبر عنه بالـ Normality

بعبر عنها بعدد مولات الهيدروجين

1 H_2SO_4 –> 2 H^+ + SO_4^-

H_2SO_4 → H

0.1 → x

1 → 2

x = 0.2 N

Dilution and concentration

- If the amount of drug remains constant in a dilution or concentration, then any change in the mass or volume of a mixture is inversely عكسي proportional to the concentration.

Dilution and concentration problems can be solved by:

1. Inverse proportion
2. The equation: quantity1 × concentration1 = quantity2 × concentration2 → ($V_1 * C_1 = V_2 * C_2$) اهم قانون
3. Determining the amount of active ingredient present in the initial mixture and, with the assumption that the initial quantity does not change, calculating the final concentration of the new total mass or volume
4. Alligation medial
5. Alligation alternate

40

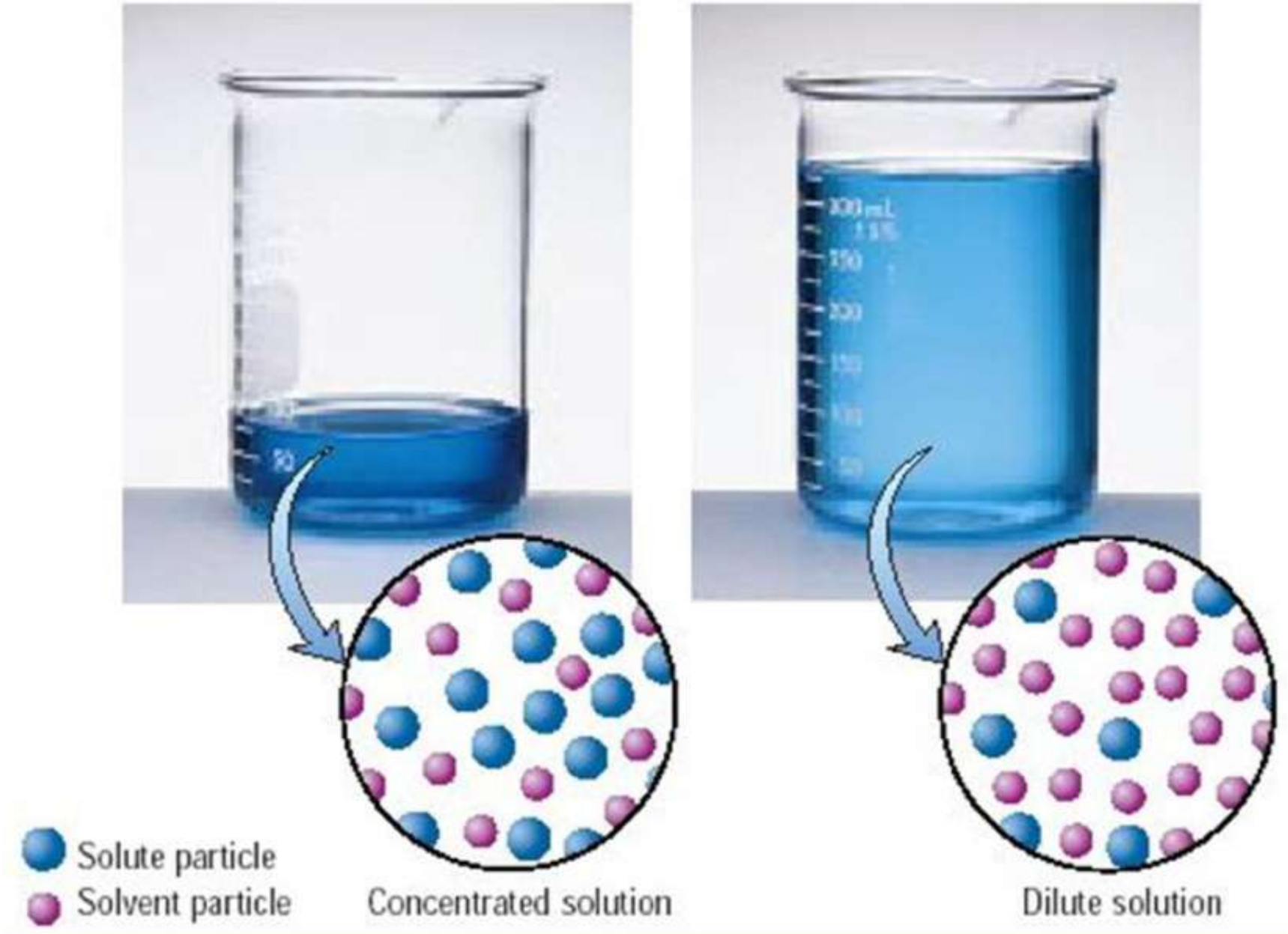
0.1 M in 1 liter

طيب لو مسكت الـ 0.1M وحطيتهم بـ 10 L فالتركيز راح يقل لـ 0.01M ولو حطيت نفس التركيز بـ 0.5L فالتركيز راح يزيد ويصير 0.2M يعني صار مركز

*** (inversely -علاقة عكسية)

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 X S1 = V2 X S2
- V1= the quantity or the amount of the original preparation كمية المحلول من التحضرية الأصلية الي بدي اخدها وأضيفها لتحضيرة ثانية إما لتخفيف تركيزها أم لجعلها مركزة أكثر
- 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


Solute particle
Solvent particle
Concentrated solution
Dilute solution

Concentration and Dilution

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

500 ml (V1) X 15% (S1)= 1500 ml (V2) X S2

S2=5%

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

1000 ml(V1)X 20% (S1) = 5000 ml (V2) X S2

S2= 4%

Dilution and concentration

- **Example**
- **How many milliliters of a 1:50 stock solution of ephedrine sulfate should be used in compounding the following prescription?**

R_x	ephedrine sulfate	0.25%
	rose water, ad	30 mL

$$\frac{0.25\ \text{g}}{100\ \text{mL}} \times 30\ \text{mL} = 0.075\ \text{g drug required}$$

$$\frac{50\ \text{mL}}{1\ \text{g}} = \frac{x\ \text{mL}}{0.075\ \text{g}}$$

$$x = 3.75\ \text{mL of stock solution required}$$

Way1

0.25 ⟶ 100 mL

x ⟶ 30 mL

x = 0.075 g of sulfat powder

معي stock فيها 1:50 من مادة الpowder

⇒

1g ⟶ 50 mL

0.075 g ⟶ y

y = 3.75 mL of stock solution

Concentration and Dilution

- Solve:

$V_2 = \frac{V_1 C_1}{C_2}$

$V_2 = ?$ C_2

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

V_1 C_1

Answer: 1950 ml

W_1 C_1

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

C_2

$W_2 = \frac{W_1 C_1}{C_2}$

Answer: 45 gm

V_1 C_1

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

V_2

Answer: 1:5000

$C_2 = \frac{20 * \frac{1}{200}}{500} \rightarrow \frac{20}{100000} \rightarrow \frac{1}{5000} \rightarrow 1:5000$ #

Reducing and enlarging formulas

الهدف من الحسابات التي قمنا بها تحت

- The pharmacist is often required to reduce or enlarge a recipe.
- Problems of this type are solved through proportion, or by multiplication or division by the appropriate factor to obtain the required amount of each ingredient that will give the desired total mass or volume of the formula.

التناسب

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

$$F = \frac{\text{الكمية بدي احضرها}}{\text{الكمية المعيارية}}$$ ،

وبضرب الجواب اللي طلع معي بكل القيم الموجودة في الجدول

Reducing and Enlarging formulas

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

Sodium salicylate	10 g * 0.05 = 0.5g
Sodium metabisulfate	1 g * 0.05 = 0.05g
D.S. chloroform water	525 ml * 005 = 26.25mL
Water q.s.	1000 ml

Answer:

Sodium salicylate 0.5gm

Sodium metabisulfate 0.05g

D.S. chloroform water 26.25 ml

Water 50 ml → محطى

الكمية الي بدي احضرها / الكمية المعيارية = Factor

Factor = 50/1000 = 0.05

Reducing and Enlarging formulas

- Calculate the amounts needed for 100 ml peppermint water?

Peppermint water:

$F = \frac{100}{1000} = 0.1$

Peppermint oil	2 ml * 0.1 = 0.2 ml
Talc	15 g * 0.1 = 1.5 g
Purified Water q.s.	1000 ml

Answer:

Peppermint 0.2 ml

Talc 1.5 gm

Purified water q.s. 100 ml → نخطي

(V/V)

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

(ROH_1) Alcohol 2% 5ml (0.1 ml)

(ROH_2) Alcohol 4% 10 ml (0.4 ml)

Answer:

X= 3.33%

→ 2 → 100, x → 5, x = 0.1 ml ; 4 → 100, y → 10, y = 0.4 ml

Total V of mixture = 15ml

Total amount of ROH = 0.5

0.5 → 15 ml, z → 100 ml or $\frac{0.5}{15} * 100\%$

= 3.33 %

Reducing and enlarging formulas

Formulas that indicate quantities

Example 1 pound = 454 g

- The following prescript ion for cold cream provides a 100 g quantity.
- What mass of each ingredient is required to provide 1 pound (AV) of cream?

454g

$F = \frac{454\,g}{100\,g} = 4.54$

R_x	white wax	12.5 g
	mineral oil	60.0 g
	lanolin 4.54 *	2.5 g
	sodium borate	1.0 g
	rose water	24.0 g
		100 g

Reducing and enlarging formulas

Formulas that indicate quantities

Example (solution)

1 pound (AV) = 454 g

454/100 = 4.54 (factor used in calculating quantities for each ingredient)

12.5 g × 4.54	=	56.8 g of white wax
60.0 g × 4.54	=	272 g of mineral oil
2.5 g × 4.54	=	11.4 g of lanolin
1.0 g × 4.54	=	4.54 of sodium borate
24.0 g × 4.54	=	109 g of rose water

Reducing and enlarging formulas

Formulas that indicate parts

- When dealing with formulas that specify parts, parts by weight will require the determination of weights of ingredients, whereas parts by volume warrant the calculation of volumes of ingredients.
- Always find the total number of parts indicated in the formula and equate that total with the total mass or volume of the desired formula in order to set up a proportion.

حسب السؤال بحدده : Part

يعني لو كنت بتعامل مع Grams فبتكون بالـ g

و لو كنت بتعامل مع ml فبتكون بالـ ml

Reducing and enlarging formulas

Formulas that indicate parts

Example

- What quantities should be used to prepare 100 g of camphorated parachlorophenol?

R_x	parachlorophenol	5 * 7 g parts
	camphor	5 * 13 g parts
	7 parts + 13 parts = 20 g parts total	

$F = \frac{100}{20} = 5$

$$\frac{7 \text{ parts}}{20 \text{ parts}} = \frac{x \text{ g}}{100 \text{ g}}; \; x = 35 \text{ g of parachlorophenol}$$

$$\frac{13 \text{ parts}}{20 \text{ parts}} = \frac{x \text{ g}}{100 \text{ g}}; \; x = 65 \text{ g of camphor}$$

Iso-osmoticity and Isotonicity

ظاهرة

- Osmosis is a phenomenon that occur when a semipermeable membrane (permeable only to solvent molecules) is used to separate solutions of different solute concentrations

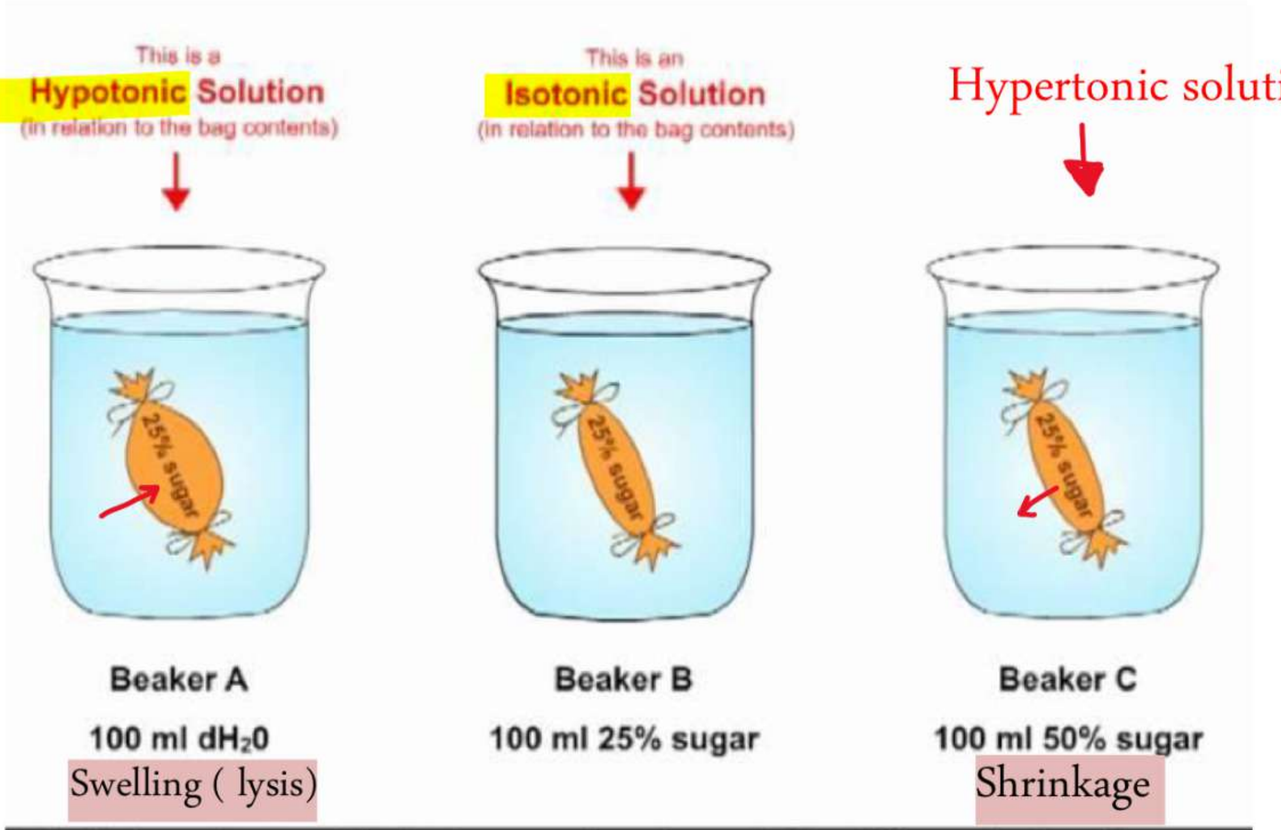
شبه نفّاذ ← semipermeable membrane

يكون الغشاء نفّاذ فقط لجزيئات الماء

- The solvent molecules cross the membrane from lower to higher concentration to establish a concentration equilibrium

of solute

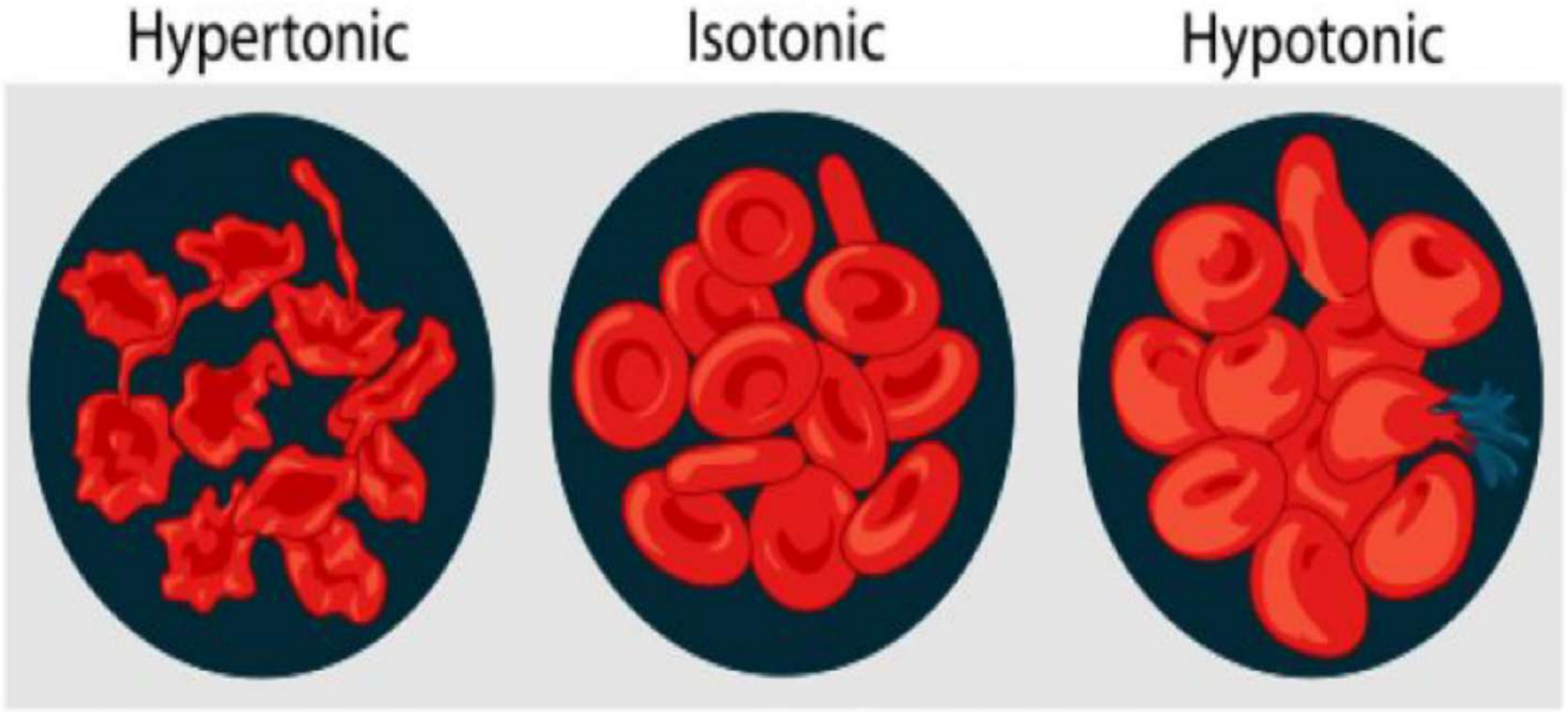
- The pressure driving this movement called osmotic pressure
- Osmotic pressure is governed by the number of particles of solute in solution
- Iso-osmotic solutions: solutions containing the same concentration of particles and thus exert equal osmotic pressure



بهمني مثلا لو عملنا قطرة عين فلازم يكون محلول

القطرة Iso لخلايا العين عشان ما يصير عندي سيولة أو جفاف**

انتقال جزيئات الماءبكون من التركيز العالي لجزيئات الماء (تركيز الSolute قليل) لمنطقة التركيز القليل لجزيئات الماء (تركيز ال Solute عالي)



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

لو صار خلل بال Isotonicity فكيف ممكن أصلحه

مطالبين بالأسماء فقط

Methods used to adjust the isotonicity of compounded solutions:

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. Cryscopic method
3. Isotonic solution **V** values

Methods of adjusting the tonicity

Class I: NaCl equivalent method

In NaCl equivalent method, NaCl or some other substance is added to the solution of the drug to make the concentration of the solution equivalent to 0.9% NaCl, and thus make it isotonic with body fluids.