Estimation of molarity, molality, osmolarity, osmolality and equivalent

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Molarity:

Number of grams molecular weight (moles) of solute per liter of solution.

$$M = \frac{number\ of\ moles(n)}{V(L)}$$

$$n = \frac{Wt}{M.Wt}$$

$$M = \frac{Wt}{M.Wt} \times \frac{1000}{Vml}$$

Ex: How many grams of 0.125 M AgNO3 used to prepare 500ml of its solution.

M.Wt= 169.9 g/mol

$$M = \frac{Wt}{M.Wt} \times \frac{1000}{Vml}$$

$$0.125 = \frac{Wt}{169.9} \times \frac{1000}{500}$$

$$Wt = \frac{0.125x169.9x500}{1000}$$

Wt= 10.619 g

Molality:

Number of Moles of solute per Kilogram (1000g) of solvent

$$m = \frac{number\ of\ moles(n)}{Wt.solvent(kg)}$$

$$m = \frac{Wt}{M.Wt} \times \frac{1000}{Wt.solvent(g)}$$

Ex: Calculate the molality (m) of solution result from dissolving 5 g of Sodium hydroxide in 250 g of distilled water. (M.Wt=40g/mole)

$$n = \frac{Wt}{M.Wt}$$

$$n = \frac{5}{40} = 0.125 \text{ mol}$$

$$m = \frac{Wt}{M.Wt} \times \frac{1000}{Wt.solvent(g)}$$

$$m = 0.125 \times \frac{1000}{250} = 0.5 \text{ m}$$

Calculation of Equivalent weight:

1-Acids

$$\text{eq.wt(acid)} = \frac{M.Wt}{\text{no. of hydrogen atoms ionized (H+)}}$$

Ex. Calculate the Equivalent weight for hydrochloric and Sulfuric acid

HCl M.Wt=1+35.5=36.5 g/mol

$$\text{eq.wt} = \frac{36.5}{1} = 36.5$$

H2SO4 M.Wt=(2x1)+(1x32)+(4x16)=98 g//mol

$$\text{eq.wt} = \frac{98}{2} = 49$$

2-Bases :

$$\text{eq.wt(base)} = \frac{M.Wt}{\text{no. of hydroxide atoms ionized}(OH^-)}$$

Ex: Calculate the Equivalent weight for Sodium hydroxide

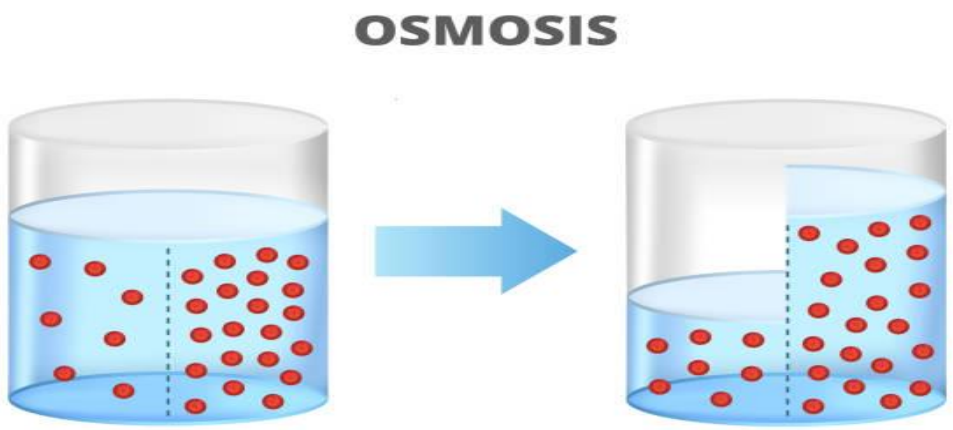
NaOH M.Wt=23+1+16=40 g/mol

eq.wt= $\frac{40}{1}$=40

Al(OH)3 M.Wt=27+(3x1)+(3x16)=78 g/mol

eq.wt= $\frac{78}{3}$= 26

Osmosis : the tendency of a fluid ,usually water,to pass through a semipermeable into a solution where the solute concentration is higher.



Osmolarity(or osmotic concentration): is the concentration of osmolatically active particles in solution.

It is defined as the number of osmoles(Osm) of solute per liter(L) of solution(Osm/L) .

Osmolality is a measure of the osmoles of solute per kilogram of solvent(Osm/kg).

A high osmolarity indicates a highly concentrated solution and the converse applies.

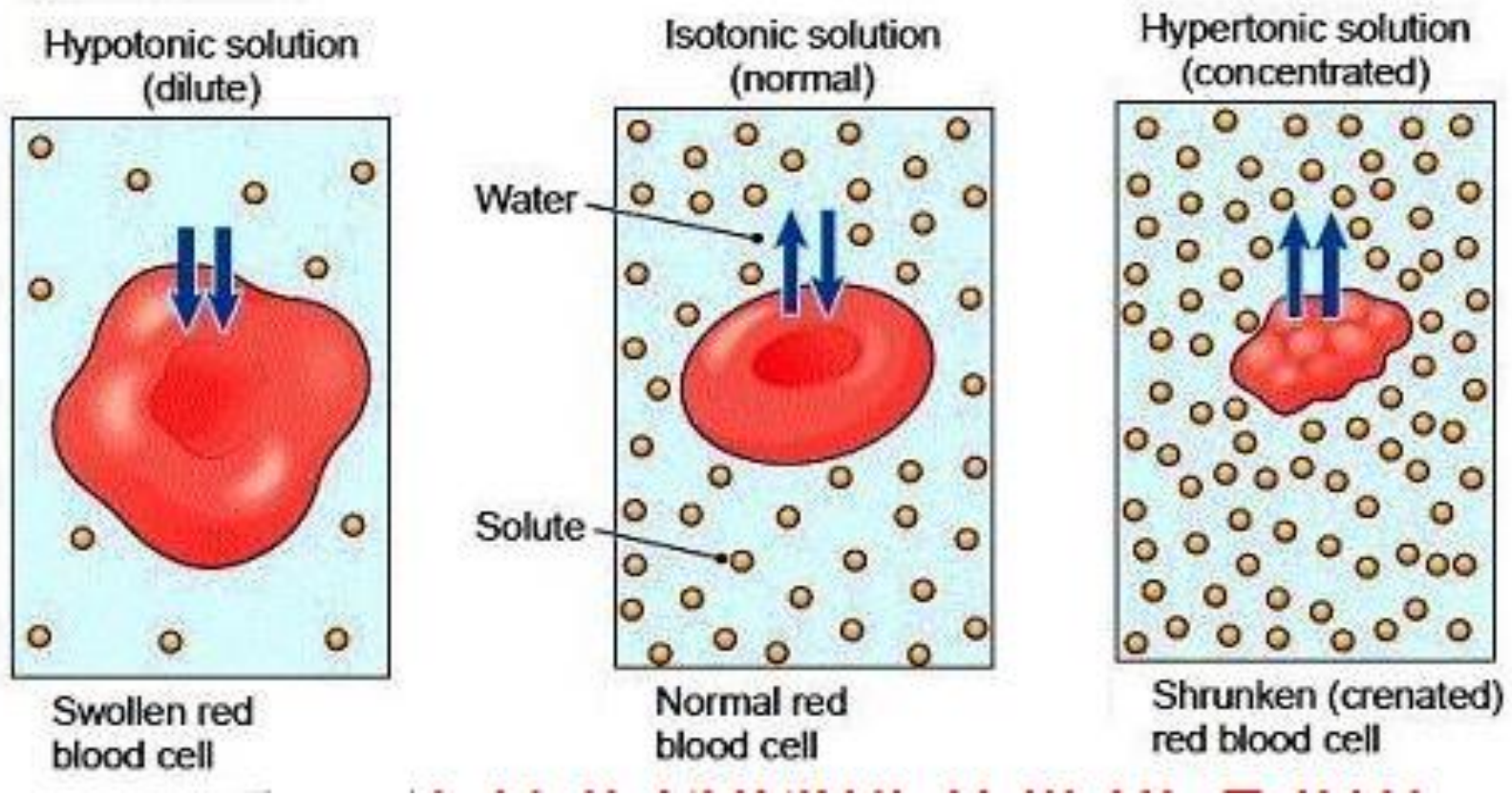
had an So, if two solutions were separated only by a semi-permeable membrane, one osmolarity of 300 Osm/L and the other 270 Osm/L .Water would flow from the solution with the lower osmolarity (270 Osm/L) into the solution with the higher osmolarity (300 Osm/L) because, the solution with the lower osmolarity is less concentrated and so has more water particles.

Osmolality is more of a clinical concept used in Medicine. For example when injected fluids into a patient's veins (intravenous/IV fluids) it is important to know the osmolarity of the solution. If the solution has an osmolarity much lower than the blood cells.

The water always moves from low to high osmolarity. This means water would move from the solution into the blood cells. This can cause the blood cells to swell and burst under the pressure of the influx of water. This type of solution is called 'hypotonic' solution.

A hypertonic solution would have an osmolarity higher than the blood cell's so, water will move from the blood cells into the solution and this will cause the cell to shrink.

Isotonic solutions would have the same osmolarity as the blood cells meaning there would be no net flow of water in either direction.



Thank you for listening