SOLUTION

TYPES

GASEOUS SOLUTION

LIQID SLUTION , SOLID SOLUTION

EXPRESSING THE CONCENTRATION OF SOLUTION

MASS PERCENTAGE

VOLUME PERCENTAGE

PART PER MILLION

MOLARITY

- Calculation of molar mass of the solute
- Find no of moles of solute (amount of solute /molar mass)
- Calculate the volume of solution in litre
- Molarity = no. of moles of solute /volume of solution in litre
- It is expressed by 'M'.

MOLALITY

- Finding the no. of moles of solute
- Calculate the amount of solvent (mass of solution – mass of solute) in kilogram
- Molality = no. of moles of solute/mass of solvent in kg
- It is expressed by ‘m’.

Mole fraction

- Mole fraction of a component =
- No. of moles of a component / Total no. of moles of all the components
- In a binary solution if the no. of moles of A and B are n_A and n_B , then mole fraction of A ,

$$n_A/n_A + n_B$$

- The sum of mole fraction of all the components in a solution is unity .

Numericals

- Calculate the molarity of a solution containing 5g of NaOH in 450 mL of solution.
- Calculate molality of 2.5 g of ethanoic acid in 75 g of benzene .
- Concentrated nitric acid used in laboratory work is 68% nitric acid by mass in aqueous solution. What should be the molarity of such a sample of the acid if the density of the solution is 1.504 gram per mililitre.

Henry’s law

The solubility of a gas at a given temperature is directly proportional to the pressure at which it is dissolved .

$p = K_H x$ where K_H is Henry’s constant and x is mole fraction of the gas .

The unit of Henry’s constant is torr.

This helps in calculation of solubility at a certain temperature .

Factors afecting solubilty of solids

Nature of solute:-Like Dissolves like . Eg polar solutes dissolves in polar solvents and non-polar solutes dissolve in in non- polar solvents .

Temperature:- The solubility may increase or dicrease with the rise in temperature depending upon the value of enthalpy of solution .

Factors affecting the solubility of gas

- The nature of gas and the nature of solvent

Non- polar gases like Oxygen , Nitrogen etc are very less soluble in water , Whereas HCl, Carbon dioxide are highly soluble in water.

- Effect of temperature
- Effect of pressure

Raoult’s law

- The vapor pressure of a a solution containing non- volatile solute is directly proportional to the mole – fraction of the solvent .
- For a solution containing non- volatile solute , at a given temperature , the relative lowering of vapour pressure is equal to the mole fraction of the solute .

Ideal and Non- ideal solution

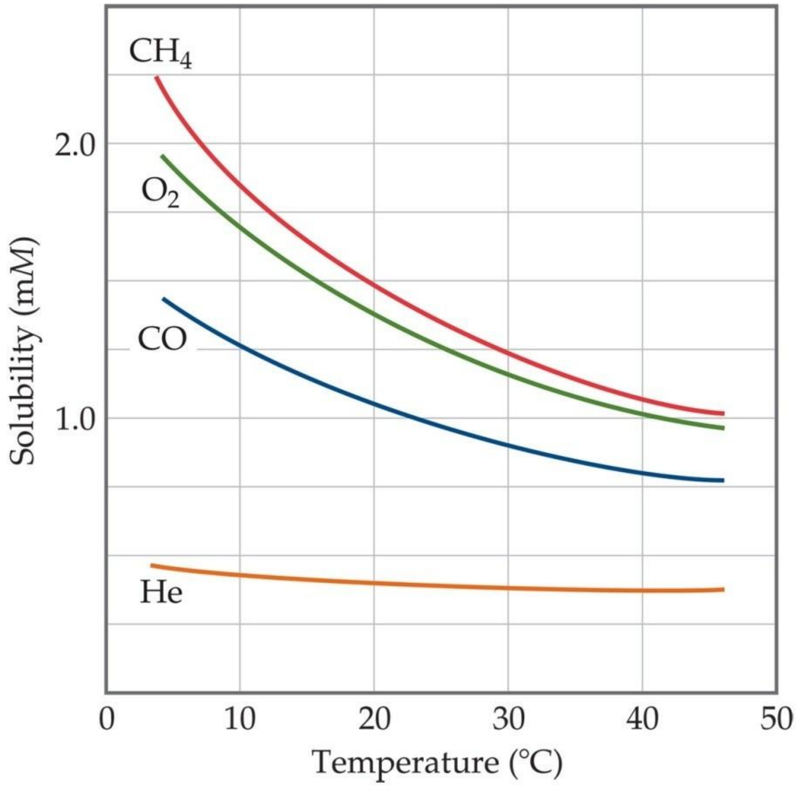
- The solution which obeys Raoult's law over the entire range of concentration and temperature is known as ideal solution and reverse is true for a non- ideal solution .
- For ideal solution
- (I) it should obey Raoult law, i.e,

  (ii) $\Delta H_{mixing} = 0$

  (iii) $\Delta V_{mixing} = 0$

Solubility of Gases

- This graph shows how gases decrease in solubility as temperature increases.



Freezing Point Lowering

- When a solute is added to a solvent, the freezing point of the solution is lower than that of the pure solvent.
- Equation for freezing point depression:
  - $\Delta T_f = K_f \cdot m$
    - ΔT_f = change in freezing point
    - K_f = freezing point constant
    - m = molality of the solution

Boiling Point Elevation

- When a solute is added to a solvent, the boiling point of the solution is higher than that of the pure solvent
- Equation for boiling point elevation
  - $\Delta T_b = K_b \bullet m$
    - ΔT_b = change in boiling point
    - K_b = boiling point constant
    - M = molality of the solution

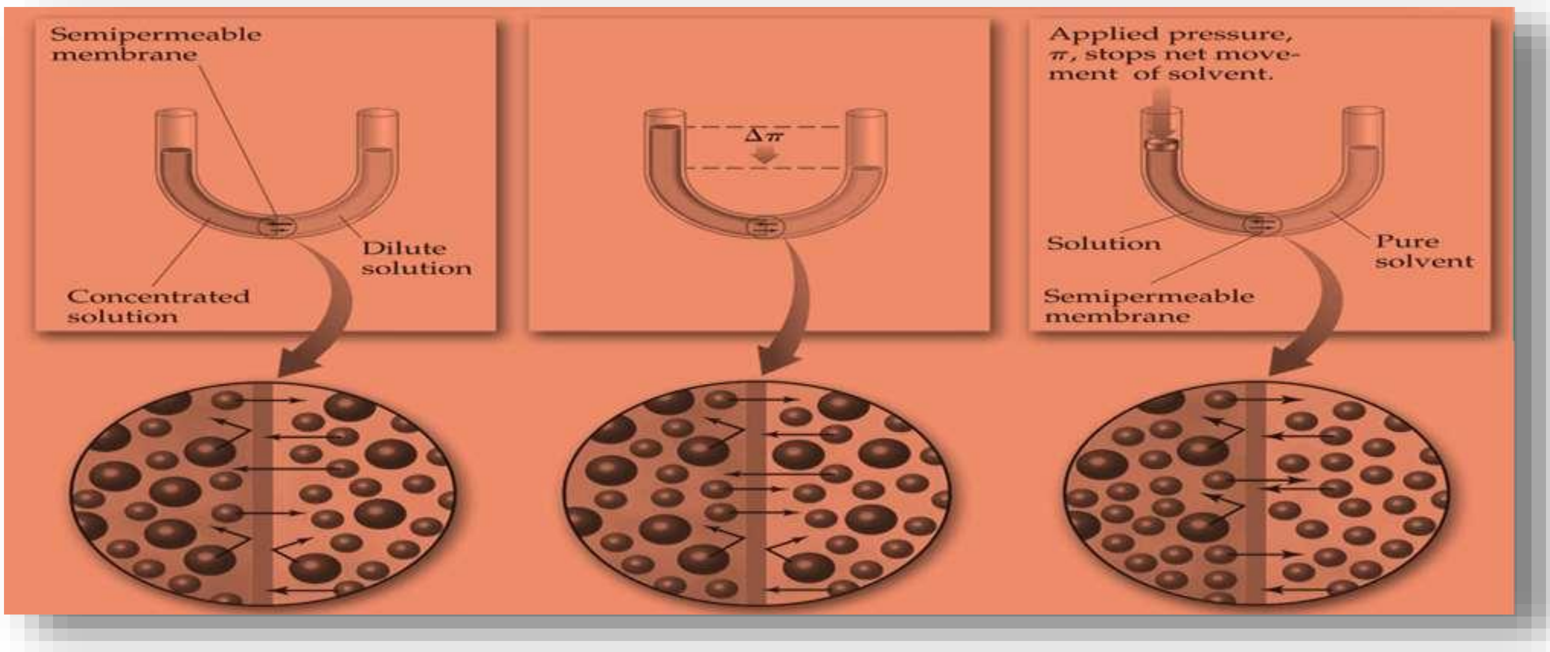
Osmosis

- **Semipermeable membranes allow some particles to pass through while blocking others. In biological systems, most semipermeable membranes (such as cell walls) allow water to pass through, but block solutes.**

- **In osmosis, there is net movement of solvent from the area of higher solvent concentration (*lower solute concentration*) to the are of lower solvent concentration (*higher solute concentration.***

- **Water tries to equalize the concentration on both sides until pressure is**
- **too high.**

Osmosis



Semipermeable membrane
Dilute solution
Concentrated solution
$\Delta\pi$
Applied pressure, π, stops net movement of solvent.
Solution
Pure solvent
Semipermeable membrane

VAN'T - HOFF FACTOR:

- **One mole of NaCl in water does not really give rise to two moles of ions.**
- **Some Na^{+} and Cl^{-} re associate as hydrated ion pairs, so the true concentration of particles is somewhat less than two times the concentration of NaCl. Some Na^{+} and Cl^{-} re associate as hydrated ion pairs, so the true concentration of particles is somewhat less than two times the concentration of NaCl.**