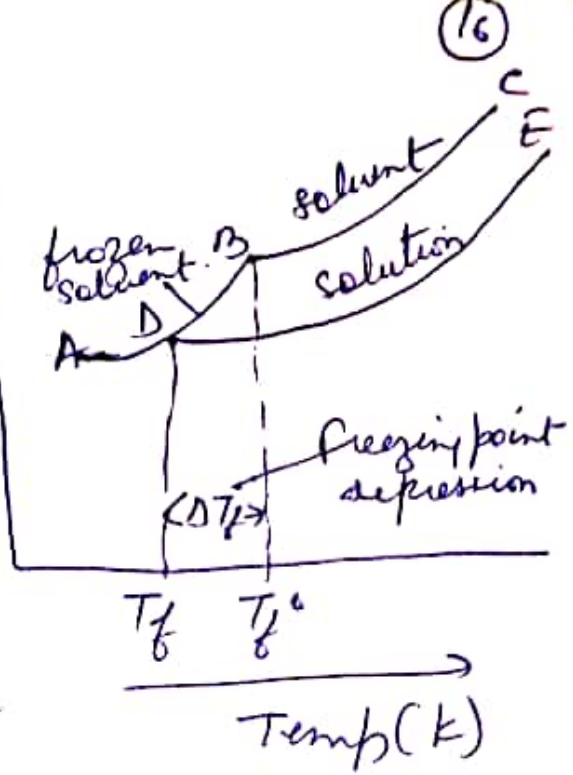


3) Depression in freezing point:

Freezing point of a solvent, the solid & liquid are in equilibrium. The solⁿ freeze when its vapour pressure become equal to the vapour pressure of pure solid solvent.



F.P is the temp at which the solid and liquid states of the substances have the same vapour pressure.

BC is vap pressure of pure solvent

DE - V.P of solⁿ.

AB - V.P of solid at diff. temp

T_f is less than T_f^0 then $\Delta T_f = T_f^0 - T_f$.

$$\Delta T_f \propto m = k_f m.$$

ΔT_f is prop to molal concⁿ of solⁿ.

k_f is molal freezing point depression constant or metal cryoscopic constant

k_f molal freezing point depression const is defined as the depression in freezing point for 1 molal solⁿ i.e solⁿ containing 1 gm mole of solute dissolved in 1000 gm of solvent.

$$k_f = \frac{M R T_f^2}{\Delta_{fus} H \times 100}$$

Determination of Molar mass of solute from depression in freezing point temp. To calculate molar mass of an unknown non volatile compd.

let wt of solute = w_B , weight of solvent = w_A g.
 molar mass of solute = M_B molality of solⁿ = $\frac{w_B \times 1000}{M_B \times w_A}$

$$\Delta T_f = K_f m$$

$$\Delta T_f = \frac{K_f \times W_B \times 1000}{W_A \times M_B}$$

$$M_B = \frac{K_f \times W_B \times 1000}{W_A \times \Delta T_f}$$



4) Osmosis and Osmotic pressure:

Osmosis - The phenomenon of the flow of solvent through a semipermeable membrane from pure solvent to the solⁿ is osmosis. movement ~~was~~ of solvent molecules from low solute conc to higher higher solute concⁿ.

Osmotic pressure: The excess pressure which must be applied to a solution to prevent the passage of solvent into it through a semipermeable membrane.

$$\pi = CRT \quad c = \text{molarity of sol}^n$$

$$T = \text{temp}, \quad R = \text{gas const.}$$

Experimental determination of Molar mass from osmotic pressure!

$$\pi = \frac{n}{V} RT$$

$$c = \frac{n}{V} \quad n = \text{no of moles of solute}$$

$$V = \text{Vol in litre}$$

$$\pi = \frac{W_B RT}{V M_B}$$

$$M_B = \frac{W_B RT}{V \pi}$$

Isotonic solⁿ: The isotonic solⁿ are those solⁿ which have same osmotic pressure, or equimolar concⁿ at some temp.

Reverse osmosis and desalination of sea water: (18)

The process of movement of solvent through a semi-permeable membrane from the solⁿ to the pure solvent by applying excess pressure on solⁿ side is called reverse osmosis.

Hypertonic and hypotonic solⁿ: If a solⁿ has more osmotic pressure than some other solⁿ it is called hypertonic. A solⁿ having less osmotic pressure than the other solⁿ is called hypotonic.

Abnormal molar masses: The molar masses found out by colligative properties method do not give accurate result. The accurate values of molar masses can be obtained only if the two conditions are fulfilled.

- 1) The solution should be dilute: when solⁿ is conc. the particles interact with each other as well as with solvent. The solⁿ becomes non ideal.
- 2) The solute must not dissociate or associate. The eq for colligative property is for non-electrolyte solutes which do not undergo any association and dissociation. The no. of solute changes & colligative property depends upon no. This give abnormal molar mass.

- 1) Association of solute particles: The solute molecules undergo association or two, three or more molecules exist as combination & no. of solute decreases. The colligative property will be lower. Colligative property is inversely proportional to molar mass of the solute molar mass will be greater.
eg. benzene & ethanoic acid exist as dimer.
∴ ΔT is half of normal value, molar mass will twice

Dissociation of solute molecules: molecules dissociate ⁽¹⁹⁾ to give two or more particles. The colligative properties of solⁿ will be large and molar mass will be less.

Van't Hoff factor: (i) $i = \frac{\text{normal molar mass}}{\text{observed molar mass}}$

For association, observed molar mass is more than normal the factor i has value less than 1

For dissociation the value of i is more than 1

The solute which neither associate or dissociate the value of $i = 1$

Degree of dissociation: The fraction of total substance that undergoes dissociation into ions

Degree of dissociation = $\frac{\text{no. of moles of subst dissociated}}{\text{Total no. of moles of subst. taken}}$

$$\alpha = \frac{i-1}{m-1}$$

$m =$ molecules of electrolyte after dissociation

eg For AB $\alpha = 1, m = 2, \alpha = i - 1$

Degree of association: The fraction of total no of molecules which combine to form associated molecules

Degree of association = $\frac{\text{no. of moles of the subst associated}}{\text{Total no of moles of subst taken.}}$

$$\alpha = \frac{i-1}{\frac{1}{n} - 1}$$

$n =$ no of simple molecules which combine to give associated molecules