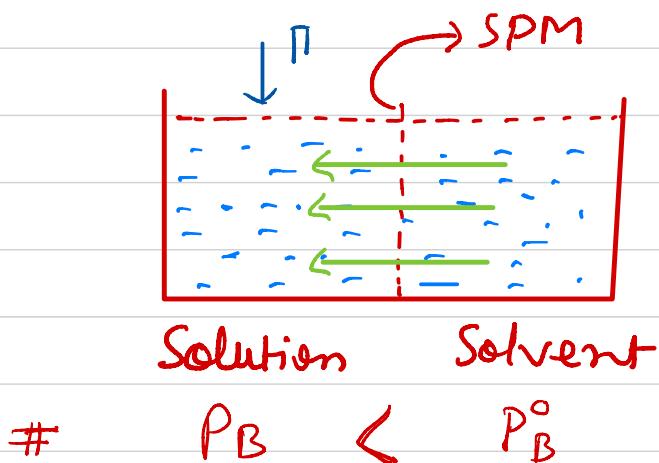


Osmotic Pressure (Π):



- ① When pure solvent is separated from soln using SPM then transfer of Solvent particle take place from pure solvent to Soln, this is called as Osmosis.
- ② Min pressure applied on soln side to prevent osmosis is called as Osmotic Pressure.
- ③ If more than osmotic pressure is applied on solution side then transfer of solvent particle take place in reverse direction, which is called as reverse osmosis (RO).
- ④ SPM (Semi permeable membrane) allow transfer of only solvent particle through it.

⑤ Law of Osmosis:

$$\Pi \propto C \quad \text{--- (I)}$$

$$\Pi \propto T \quad \text{--- (II)}$$

$$\Pi \propto C \cdot T$$

Where

C = Molarity of Soln

R = Const for soln (Similar to)

T = Temp (K) gas cont

$$R = 0.0821 \text{ lit-atm / k-mol}$$

or

$$8.314 \text{ J/mol-K}$$

or

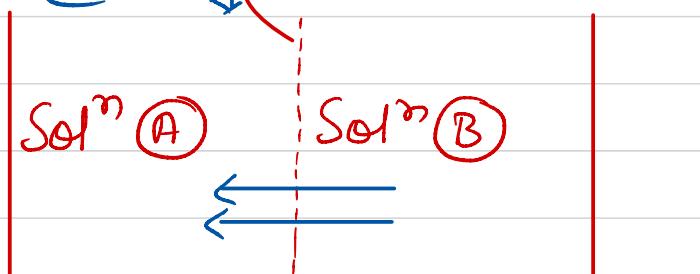
$$2 \text{ Cal / mol-K}$$

$$\Pi = CRT$$

If solute is dissociating/associating

$$\Pi = i \cdot C RT$$

(6) $(\Pi_A - \Pi_B) \downarrow$ SPM



$$C_A > C_B \text{ given}$$
$$P_A < P_B$$

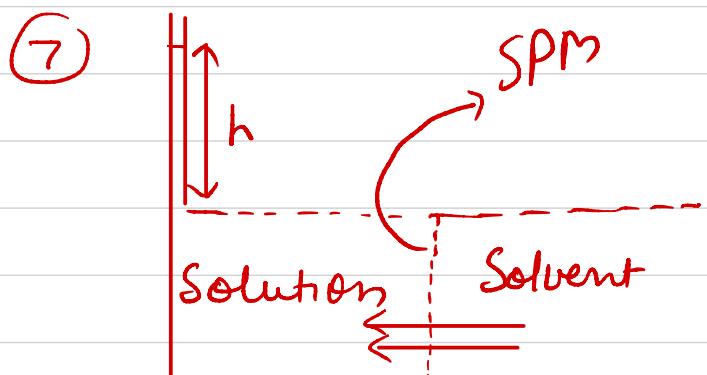
Solⁿ(A) $\Rightarrow \Pi_A$
Solⁿ(B) $\Rightarrow \Pi_B$

If $\Pi_A > \Pi_B$

Solⁿ(A) = hyper tonic
Solⁿ(B) = hypotonic

If $\Pi_A = \Pi_B$

Solⁿ(A) and Solⁿ(B) are isotonic



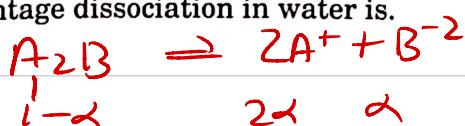
$$\Pi = \rho g h$$

The freezing point of aqueous solution that contains 3% urea, 7.45% KCl and 9% of glucose is (given K_f of water = 1.86 and assume molality = molarity).

$$\Delta T_f = 1.86 \times \left[\frac{3}{60} \times 1 + \frac{7.45}{74.5} \times 2 + \frac{9}{180} \times 1 \right] \underline{\underline{80.55 / 1000}}$$

$$T_f' = 266 \text{ K}$$

A current of dry air was passed through a solution containing 2.0 g of a solute A_2B in 98 g of water and then through pure water. The loss in weight of the solution was 0.98 g and the loss in weight of pure water is 0.01 g. If the molar mass of A_2B is 90 g/mol and it dissociates into A^+ and B^{2-} ions, then its percentage dissociation in water is.



$$0.98 \propto P_B - 0$$

$$0.01 \propto P_B^o - P_B \quad \text{---(11)}$$

$$\frac{P_B^o - P_B}{P_B} = \frac{i n_A}{n_B} = \frac{0.01}{0.98}$$

$$0.744 = 1.86 \times m$$

$$m = \frac{0.744}{1.86} = M$$

$$\begin{aligned} \Pi &= \frac{0.744}{1.86} \times 0.0821 \times 300 \\ &= 9.852 \text{ atm} \end{aligned}$$

63. 'x' moles of KCl and 'y' mole of BaCl₂ are dissolved in 1 kg of water. If $(x + y) = 0.1$, then the observed range of ΔT_f is (K_f of water = 1.86 K·kg mol⁻¹)

- (a) 0.372°C to 0.558°C
 (b) 0.186°C to 0.93°C
 (c) 0.558°C to 0.93°C
 (d) 0.372°C to 0.93°C

$$\begin{cases} \Delta T_F = 2 \times 1.86 \times 0.1 = 0.372 \\ \Delta T_F = 3 \times 1.86 \times 0.1 = 0.558 \end{cases}$$

• If vapour pressure of pure liquids 'A' and 'B' are 300 and 800 torr respectively at 25° C. When these two liquids are mixed at this temperature to form a solution in which mole percentage of 'B' is 92, then the total vapour pressure is observed to be 0.95 atm. Which of the following is true for this solution?

- (a) $\Delta V_{\text{mix}} > 0$ (b) $\Delta H_{\text{mix}} < 0$
 (c) $\Delta V_{\text{mix}} = 0$ (d) $\Delta H_{\text{mix}} = 0$

Brom:

Calculate Osmotic Press. of a soln formed by mixing 200 ml, 60% $\frac{w}{v}$ of $C_6H_{12}O_6$ and 300 ml, 5.85% $\frac{w}{v}$ of NaCl at 300 K. (given $R = 0.08 \frac{\text{lit atm}}{\text{K-mole}}$)

$$\# C_6H_{12}O_6 = 200 \times \frac{60}{100} \times \frac{1}{180} \times 1 = \frac{2}{3} \text{ mole}$$

$$NaCl = 300 \times \frac{5.85}{100} \times \frac{1}{58.5} \times 2 = \frac{3}{5} \text{ mole}$$

$$V_{soln} = 200 + 300 = 500 \text{ ml} = 0.5 \text{ lit}$$

$$\Pi = \frac{\left(\frac{2}{3} + \frac{3}{5}\right)}{0.5} \times 0.08 \times 300 = 60.8 \text{ atm}$$

Ideal and Non-Ideal Soln:

Ideal Solution:-

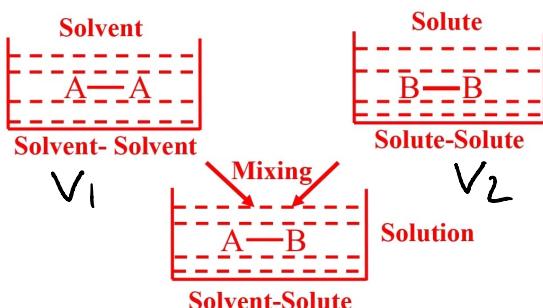
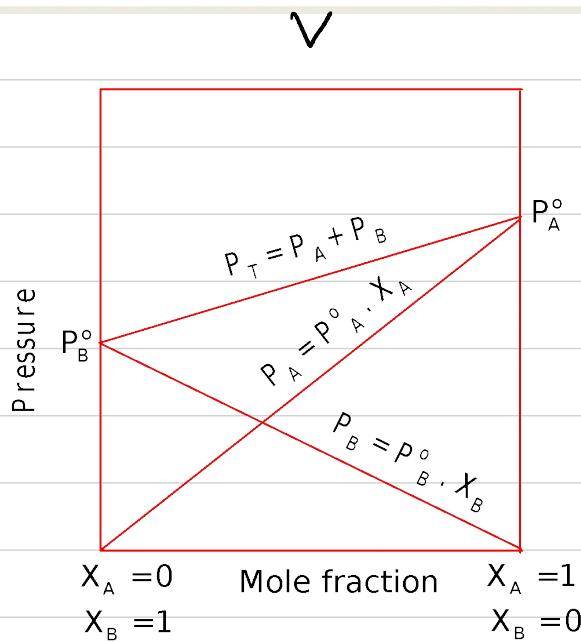


Fig.-Formation of Ideal Solution



$$\textcircled{1} \quad \Delta V_{\text{mix}} = 0$$

$$V = V_1 + V_2$$

$$\textcircled{2} \quad \Delta H_{\text{mix}} = 0$$

\textcircled{3} follow Raoult's Law

$$P_A = P_A^o \times x_A$$

$$P_B = P_B^o \times x_B$$

$$P_T = P_A^o x_A + P_B^o x_B$$

\textcircled{4} Very dilute soln behave like ideal.

\textcircled{5} Mixing of similar components produce ideal soln.

$$\textcircled{6} \quad \Delta S_{\text{mix}} = +ve$$

$$\Delta G_{\text{mix}} = \Delta H_{\text{mix}} - T \cdot \Delta S_{\text{mix}}$$

$$= -ve$$

Examples;

dilute solutions:

benzene - toluene:

n-hexane + n-heptane.

chlorobenzene

bromobenzene;

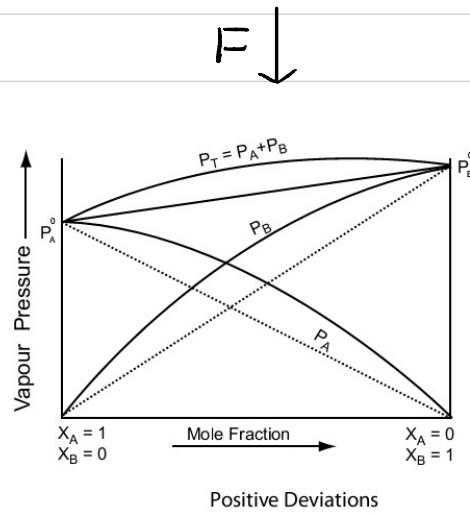
ethyl bromide + ethyl

iodide;

n-butyl chloride + n-butyl bromide.

Non-Ideal Solution:-

① Solution Showing +ve deviation :-



$$\textcircled{1} \quad \Delta V_{\text{mix}} = +\text{ve}$$

$$V > (V_1 + V_2)$$

$$\textcircled{2} \quad \Delta H_{\text{mix}} = +\text{ve}$$

$$\textcircled{3} \quad P_A > P_A^\circ X_A$$

$$P_B > P_B^\circ X_B$$

$$P_T > (P_A^\circ X_A + P_B^\circ X_B)$$

$\textcircled{4}$ Mix of diff. nature showing weak interaction, show +ve deviation

$\textcircled{5}$

$$\Delta S_{\text{mix}} > 0$$

$$\Delta G = \underbrace{\Delta H_{\text{mix}}}_{+\text{ve}} - T \cdot \underbrace{\Delta S_{\text{mix}}}_{-\text{ve}}$$

$$= -\text{ve}$$

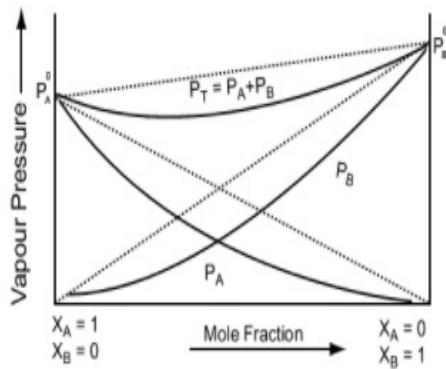
Examples:

acetone - ethanol
acetone - CS_2
water + methanol,
water + ethanol;
 CCl_4 , + toluene;
 CCl_4 + CHCl_3
acetone + benzene;
 CCl_4 + CH_3OH ;
cyclohexane - ethanol

② Solution Showing -ve deviation :-

$F \uparrow$

$$\textcircled{1} \quad \Delta V_{\text{mix}} < 0 \\ V < (V_1 + V_2)$$



$$\textcircled{2} \quad \Delta H_{\text{mix}} < 0$$

$$\textcircled{3} \quad P_A < P_A^o X_A \\ P_B < P_B^o X_B$$

$$P_T < (P_A^o X_A + P_B^o X_B)$$

④ Mixing of diff nature components showing st. interaction on chemical rxn for -ve deviation

Solⁿ

⑤ $\Delta S_{\text{mix}} > 0$

Examples:

acetone - aniline;
acetone - chloroform;
 CH_3OH - CH_3COOH
 $\text{H}_2\text{O} + \text{HNO}_3$
chloroform + diethyl ether,
water - HCl,
acetic acid + ~~pyridine~~ pyridine
chloroform - benzene.