

$$\text{or, } \frac{p^{\circ} - p}{p^{\circ}} = \frac{n_2}{n_1 + n_2} = \Delta \rho$$

This is the Raoult's Law.

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Freezing Point of liquid (Depression of Freezing Point) :-

Freezing Point :- The F.P of a liquid is the temp. at which liquid and solid forms of a substance have the same V.P.

Thus, at the F.P the solid and liquid forms co-exist in Equilibrium.



Since upon dissolution of a solid in a solvent there is a decrease in V.P, it follows therefore, ~~is a decrease in~~ at when solid is dissolved in a solvent there will be a decrease in F.P. This is called the depression of F.P.

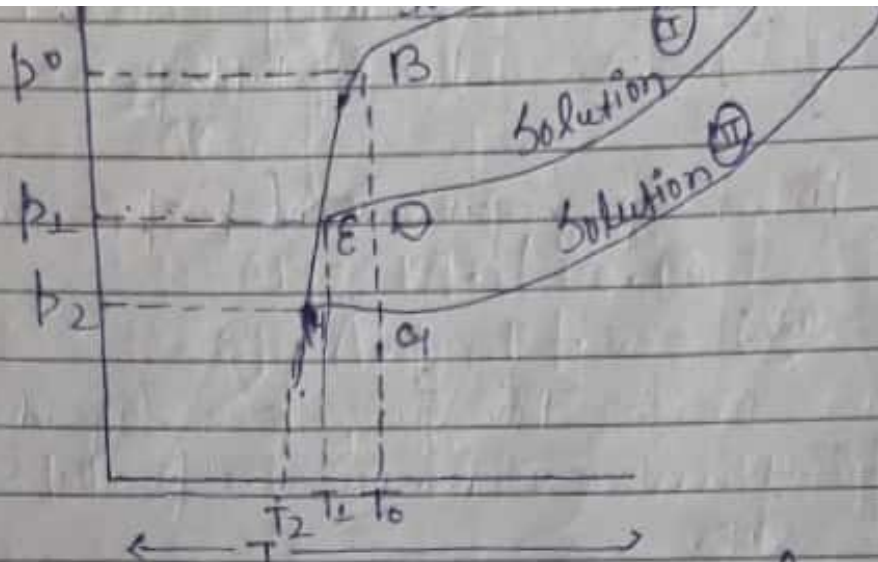
$$p^{\circ} - p = \Delta P = \Delta \rho \text{ of V.P.}$$

Similarly,

$p^{\circ} - p = \Delta T_f$ is called depression of F.P.

$$\text{i.e., } \Delta P \propto \Delta T_f \quad \text{--- (I)}$$

ΔP is directly proportional to (ΔT_f) the freezing point depression.



p° and T_0 and v.P and F.P for solvent.

p_1 " T_1 " " " " " " Solution (I).

p_2 " T_2 " " " " " " " " (II).

Since the solutions are fairly dilute, the Curve ED and HG are considered as parallel straight lines.

Hence the triangles BHG and BED are

similar.

$$\begin{aligned} \text{So, } \frac{BG}{BE} &= \frac{GH}{ED} \\ \frac{p_0 - p_2}{p_0 - p_1} &= \frac{T_0 - T_2}{T_0 - T_1} \\ \frac{\Delta P_2}{\Delta P_1} &= \frac{\Delta T_2}{\Delta T_1} \\ \text{or } \Delta P &\propto \Delta T \quad \text{--- (I)} \end{aligned}$$

Henry's law (1805) \rightarrow The mass of gas dissolved in given volume of liquid is directly proportional to pressure of the gas at constant temperature in equilibrium with solution.

$$\text{mass of gas} \propto P_{\text{gas}}$$

Suppose m be the mass of gas dissolved per unit volume of a solvent and P is the pressure of the gas in equilibrium with the solution, then

$$m \propto P_{\text{gas}} \Rightarrow \boxed{m = K_H \cdot P_g}, \text{ where } K_H \text{ is known as}$$

Henry's law constant. K_H -value depends upon the nature of the gas, solvent, Temp (T) and pressure (P)

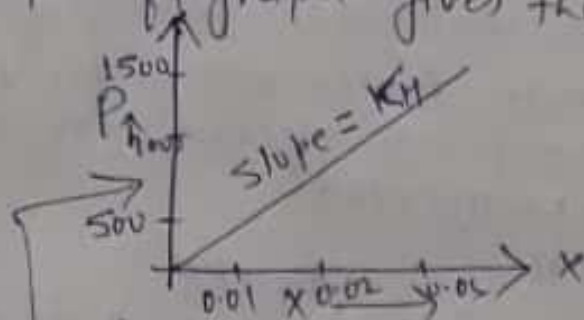
Solubility of gas $\propto \frac{1}{K_H}$. It means

$$K_H \propto \text{Temp} \propto \frac{1}{\text{solubility}} \text{ i.e. solubility} \propto \text{pressure} \propto \frac{1}{K_H}$$

$$\boxed{\text{Solubility} \propto P \propto \frac{1}{K_H} \propto \frac{1}{T}} \quad \text{unit of } K_H = \text{Pressure unit}$$

i.e. unit of $K_H = \text{Torr, atm, K, bar}$

Graphical representation of Henry's law \rightarrow When a graph is plotted b/w Pressure and mole fraction then a straight line is obtained, the slope of graph gives the value of K_H .



Henry's law in terms of Dalton's law of partial pressure

At a given Temp. mole fraction of a gas is directly proportional to pressure of the gas i.e. pressure of gas is directly proportional to mole fraction of the gas.

$$P_{\text{gas}} \propto X_{\text{gas}} \Rightarrow \boxed{P_g = K_H \cdot X_g}$$