Therefore, $\frac{p^\circ - p}{p^\circ} = \frac{n_2}{n_1}$

or, $\frac{\Delta P}{p^\circ} = \frac{n_2}{n_1}$

or, $\Delta P = \frac{p^\circ \times n_2}{n_1}$ —— (III)

Also here $n_1 = \frac{W_1}{M_1}$, $n_2 = \frac{W_2}{M_2}$

So, we can write, $\Delta P = p^\circ \times \frac{W_2}{M_2} \times \frac{M_1}{W_1}$ —— (IV)

For a particular solvent at a given temp.

We write, p° and M_1 is a constant quantities.

Hence, $\Delta P \propto \frac{W_2}{M_2 \cdot W_1}$ —— (V)

or, Also from, $\Delta T_f \propto \frac{W_2}{W_1 \cdot M_2}$

or, $\Delta T_f = K \cdot \frac{W_2}{M_2 \cdot W_1}$ —— (VI)

Where K is a ~~Partic~~ Propotinally Constant Known as F.P. Constant.

if $\frac{W_2}{M_2} = 1$ mol, $W_1 = 1$ g.

So, $\Delta T_f = K$ —— (VIa)

Thus, the F.P. Constant is depression in F.P. observed by dissolving 1 mol of a solute in 1 g of a solvent.

Generally, the mass of solvent is taken as 1 g or 1 Kg.

Thus, when, $\frac{W_2}{M_2} = 1$ mole, $W_1 = 1000$.

$\Delta T_f = K \cdot \frac{1}{1000} = K_f$ —— (VIb).

So, that $K = 1000 K_f$

Hence, from the Eq. $\Delta T_f = \frac{1000 K_f \times W_2}{M_2 \cdot W_1}$ —— (VII)

Hence the Constant K_f is called molal freezing point depression Constant or Cryoscopic Constant

when $\frac{W_2}{M_2} = 1$ mol and $W_1 = 1000$ g

from Eq (VII),

(i) Nature of Solute and Solvent :→ Like dissolve like is the general rules for the solubility.

Polar solutes are Highly soluble in Polar solvent (H_2O) and non polar solutes are insoluble in water.

eg glucose, and sugar, are soluble in water, while I_2 is insoluble

(ii) Temperature (T) → Solubility of solid solute ∝ Temp

with increasing Temperature solubility of solid solute increases

(iii) Pressure (P) :→ No effect, because solid is Incompressible.

Factors affecting the solubility of a gas in a liquid :→

(i) Nature of Solute and Solvent → non polar gases like H_2, O_2 & N_2 dissolve in H_2O in small amount while CO_2, HCl, NH_3 are highly soluble in water because they are Polar in nature. O_2, CO_2, N_2 are more soluble in C_2H_5OH than H_2O.

(ii) Effect of Temp →

gas + liquid ⇌ solution + Heat

For Exothermic rxn solubility of gas in liquid decreases with increasing Temp

For Endothermic rxn

gas + solvent + Heat ⇌ Solution

solubility increases with increasing Temp

(iii) Effect of Pressure :→ with increasing Pressure solubility of gas in liquid increases i.e P ∝ solubility

This fact can be explained on the basis of Henry's law —

V.V.I Henry's law → The solubility of a gas dissolved in given volume of liquid at constant Temp(T) is directly proportional to pressure of the solution in equilibrium. i.e $m \propto P_g \Rightarrow$ $m = K_H P_g$

where K_H is a constant, which is called Henry's constant

K_H - value depends upon the nature of the gas.

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