

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
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Application of Raoult's law:-

① In Elevation of boiling point.

We have from Raoult's law

$$\frac{\Delta P}{P^0} = \frac{wM}{mW}$$

$$\text{or } \Delta P = \frac{wM}{mW} \times P^0 \rightarrow \textcircled{1}$$

Since at constant temperature the v.p of pure solvent ( $P^0$ ) is constant and the molecular weight  $M$  of the solvent is constant

$$\Delta P \propto \frac{w}{mW}$$

But  $\Delta P \propto \Delta T_b$ .

$$\Delta T_b \propto \frac{w}{mW}$$

$$\Delta T_b = K_b \frac{w}{mW} \rightarrow \textcircled{2}$$

where  $K_b$  is a constant called elevation constant. If  $\frac{w}{m} = 1$  mole solute

$W = 1$  g solvent-

Then  $\Delta T_b = K$

it is

But ~~it~~ practically not possible as one mole cannot be dissolved in 1 gm solvent.

Hence  $K$  must be corrected into some other constants  ~~$k_m$~~  which is convenient form,

$$K = 1000 k_b$$

where  $k_b$  is called molal elevation constants

Then

$$\Delta T_b = \frac{1000 k_b \times W}{m \times W} \rightarrow (3)$$

If  $\frac{W}{m} = 1$  mole non volatile solute.

$W = 1000 \text{ gm}$  or  $1 \text{ kg}$  solvent.

$$\text{Then } \Delta T_b = \cancel{1000} k_b$$

Wednesday

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Besides experimental determination of  $k_b$  from these relations it can be theoretically calculated by the formula (Thermodynamically)

$$k_b = \frac{R T_b^2}{1000 L} \text{ or } \frac{R T_b^2 \times M}{1000 \times \Delta H_b}$$

$R$  = molar gas constant (in caloric)

Where  $T_b$  = Normal boiling Point of the solvent.

$L$  = Latent heat of vaporisation per gm of solvent.

$\Delta H_b$  = Enthalpy of vaporisation per mole of the solvent.

$M$  = Mole.

2nd Sem (Honours) Thursday

Raoult's law and its applications.Raoult's law:

For dilute solutions containing non volatile solute, the relative lowering of vapour pressure  $\Delta P/P^0$  is equal to the mole fraction of the solute  $X_2$ .

$$\frac{P^0 - P_s}{P^0} = \frac{n}{n + N}$$

Where  $P^0$  is the vapour pressure of pure solvent.  
 $P_s$  is the vapour pressure of the solution.  
 $n$  is the number of molecules of solute.  $N$  represents the number of solvent molecules.

Friday

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If in a determination  $w =$  wt of solute

$W =$  weight of pure solvent,  $m =$  molecular wt of solute.  $M =$  molecular weight of solvent.

$$\frac{P^0 - P_s}{P^0} = \frac{n}{n + N} = \frac{\frac{w}{m}}{\frac{w}{m} + \frac{W}{M}}$$

Since for dilute solution  $\frac{w}{m}$  is small it can be neglected in the denominator. Thus

$$\frac{P^0 - P_s}{P^0} = \frac{WM}{mW}$$

This relation enable us to calculate the molecular weight of dissolved substance, when relative lowering of vapour pressure, wt of the solute, wt of the solvent are known.