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Deg I. Chem. Hons, Paper - II

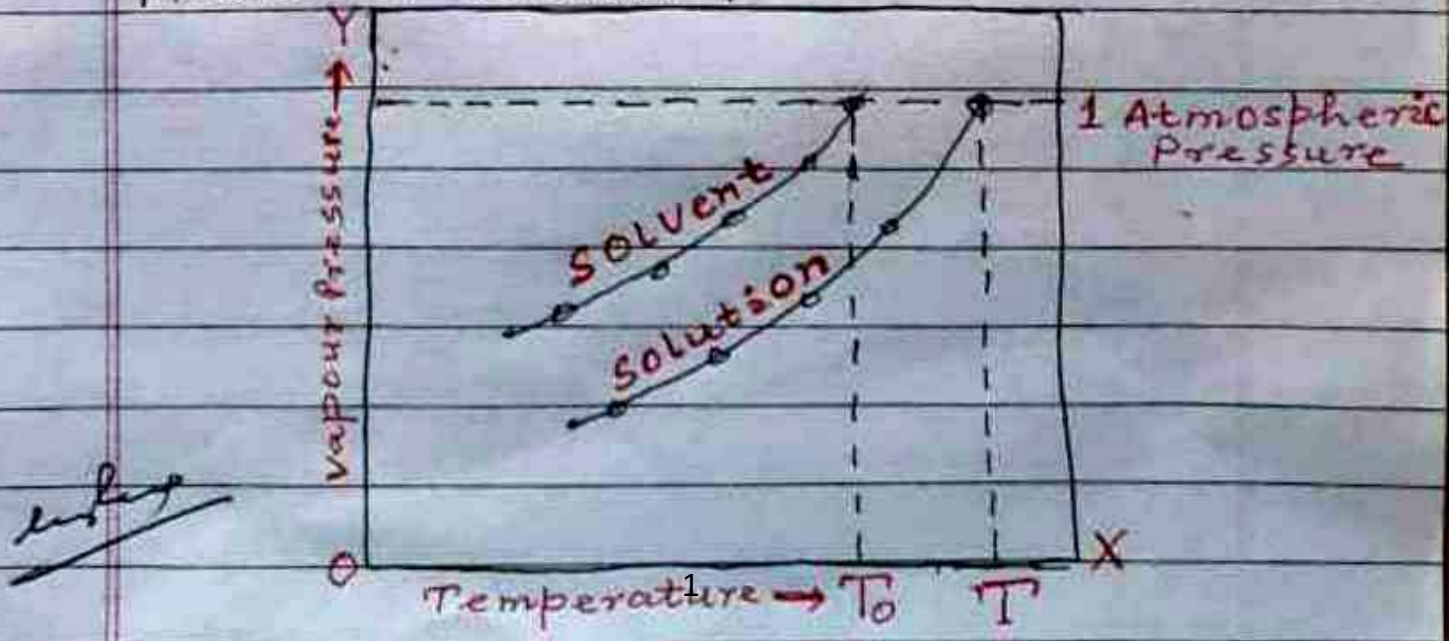
Topic :- Colligative Properties

Elevation of boiling Point :-

The boiling Point of a liquid is that temperature at which its vapour pressure becomes equal to one atmosphere.

As we know that vapour pressure of solution is always less than that of the solvent hence the boiling Point of the solution will always be higher than that of the solvent

This fact is clear in the vapour pressure – Temperature curve plotted below :–



The upper curve is the vapour pressure curve of the solvent while the lower curve is the vapour pressure curve of solution. As we see that vapour pressure of solution at every temperature is lower than that of the solvent. The boiling Point of solvent is T_0 and the boiling Point of solution is T. It is clear from the curve that

$$T > T_0$$

∴ Elevation of boiling Point

$$\boxed{\Delta T_b = T - T_0}$$ ✓

Raoult's law of elevation of boiling Point :-

1st Law :- The elevation of boiling Point of a solvent is proportional to the molal Concentration (molality) of the dissolved solute

$$\Delta T_b \propto C_m$$

where ΔT_b = Elevation of boiling Point

C_m = molal Concentration,

$$\therefore \Delta T_b = K_b \times C_m \quad \text{——(1)}$$

where K_b is a constant known as molal elevation constant.

If $C_m = 1$ Then $\Delta T_b = K_b$

"The elevation of boiling Point Produced by dissolving 1 mole of a solute in 1000 gm of solvent is known as molal elevation Constant"

$$K_b = \frac{R T_o^2}{L_V \times 1000}$$

$R = 1.987$ Calories ≈ 2 calories

$$K_b = \frac{2 T_o^2}{L_V \times 1000} = \frac{0.002 T_o^2}{L_V}$$

Where T_o = boiling Point of solvent in absolute temperature

L_V = Latent heat of Vaporisation of solvent per gram

L_V for water = 537 Calories/gram

(2) Raoult's 2nd Law :-

Equimolecular amount of different solutes dissolved in the same quantity of a Particular solvent raise the boiling Point to the same extent.