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Page No. Date

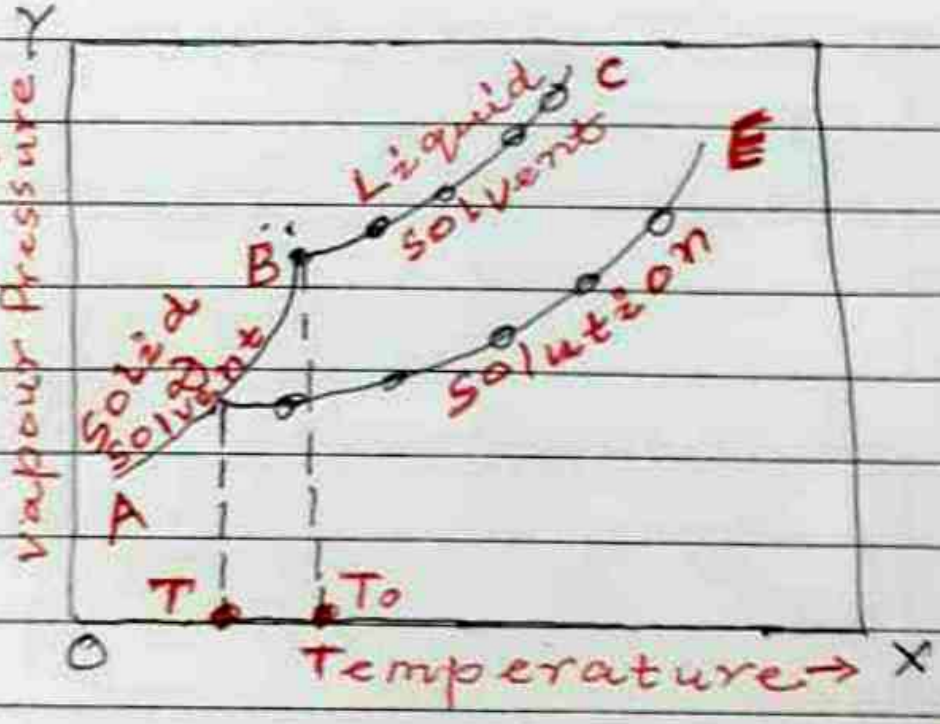
Deg I. Chem. Hons. Paper – II

Topic :- Colligative Properties

Depression of freezing Point :-

The freezing point depression is also one of the Colligative Properties.

The freezing point of a liquid is that temperature at which the solid and liquid states of a substance have the same vapour Pressure



Curve AB :- Vapour pressure curve of solid solvent (S)

Curve BC :- Vapour pressure curve of liquid solvent (L)

The two curve AB and BC meet at

Point B. Thus we see that at this temperature both states of the solvent have the same vapour pressure. Hence T_0 is the freezing point of the solvent. As the vapour pressure of solution is always less than that of the solvent Hence the vapour pressure curve of solution always lies below that of the solvent as shown in figure

The vapour pressure curve of solution is seen to meet that of solid solvent at the Point D ie at a lower temperature T. Hence T' is the freezing point of solution.

T_0 = Freezing Point of solvent

T = Freezing Point of solution

From graph $T_0 > T$

∴ Depression of freezing Point

$$\Delta T_f = T_0 - T$$

Raoult's Law of depression of freezing Point

1st Law :- The depression of freezing Point of a solvent is directly Proportional to the molal Concentration of the dissolved solute.

$$\Delta T_f \propto C_m$$

Where ΔT_f = Depression of freezing Point

C_m = Molal Concentration

$$\therefore \boxed{\Delta T_f = K_f \times C_m} \quad \text{——(1)}$$

Where K_f is a Constant known as molal depression Constant.

If $C_m = 1$ Then $\Delta T_f = K_f$

The depression of freezing Point Produced by dissolving 1 mole of a solute in 1000 gram of solvent is known as molal depression Constant

$$K_f = \frac{0.002\ T_0^2}{L_f}$$

Where T_0 = Freezing Point of Solvent in absolute temp.

L_f = Latent heat of fusion of Solvent per gram for Water

$L_f = 80$ Cal/gram