Colligative Properties
↳ (Go together)

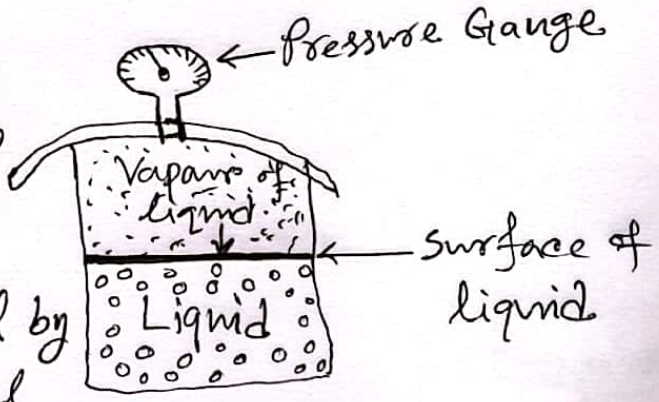
- no. of solute particles (not size or chemical nature of particles) in solution.

0.01 mole sugar
0.01 mole urea
} → Same

- Conditions: (1) non-electrolyte solute (solid)
(2) non-volatile solid
(3) Dilute solution.

- Vapour pressure:

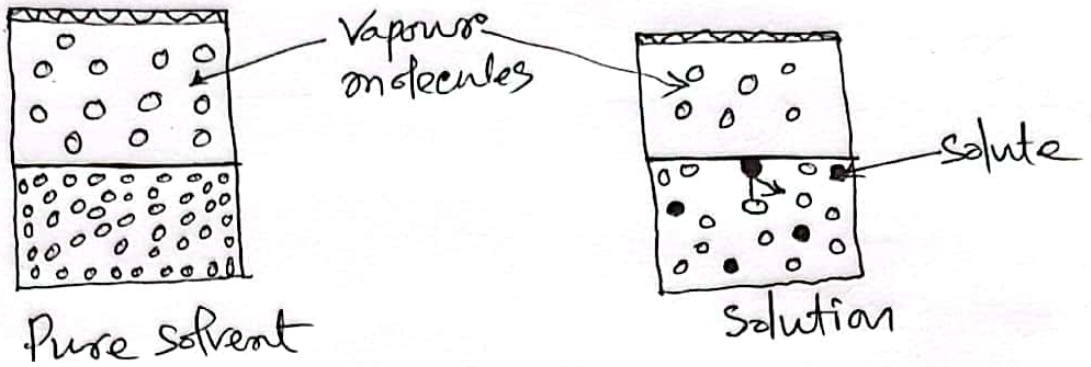
rate evaporation ⇌ condensation
liquid ⇌ vapour



The pressure exerted by the vapour on liquid surface in equilibrium at particular temperature, is known as vapour pressure of a liquid.

- colligative properties are—
(1) Lowering of vap. pressure
(2) Elevation of boiling point
(3) Depression of freezing point
(4) Osmotic pressure.

- Vapour pressure(solvent) > Vapour Pressure(solution)



If, P_0 is vapour pressure of pure solvent and P_s is vapour pressure of solution.

So lowering of vap. pressure $= P_0 - P_s$

Now, Relative lowering of vap. pressure

$$= \frac{P_0 - P_s}{P_0}$$

$\therefore$ Raoult's law, $\frac{P_0 - P_s}{P_0} = x_2$ $\quad \begin{cases} 1 \rightarrow \text{solvent} \\ 2 \rightarrow \text{solute} \end{cases}$

Derivation of Raoult's law:

Consider a solution which contains n_1 moles of solvent and n_2 moles of solute.

$\therefore$ Total mole in solution $= n_1 + n_2$

Thus, mole-fraction of solute in solution $= \frac{n_2}{n_1 + n_2}$

and mole-fraction of solvent in solution $= \frac{n_1}{n_1 + n_2}$