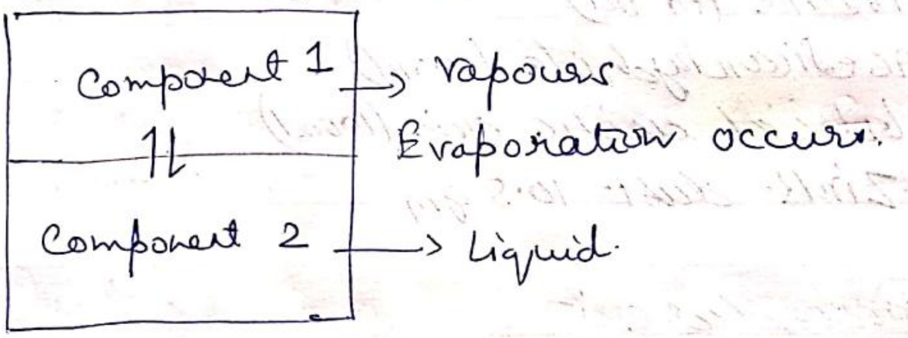
4. Vapour pressure of Liquid Solutions - Binary solution which includes two components-

a) liquid in liquids
b) solids in liquids.

4.1. Vapour pressure of liquid- liquid solutions.

Vapour pressure is defined as the pressure exerted by vapours of the liquid in equilibrium with liquid at a given temperature.



At particular temperature, vapour phase and liquid phase will approach equilibrium.

Let,

P_{total} = total vapour pressure

p_1 and p_2 = Partial vapour pressure of ~~two~~ 1 & 2 components.

x_1 and x_2 = Mole fraction of 1 & 2 components.

Raoult's law - It states that for a solution of volatile liquids, the partial vapour pressure of each component in the solution is directly proportional to its mole fraction.

For component 1,

$$p_1 \propto x_1 \Rightarrow p_1 = p_1^\circ x_1 \quad \text{--- (i)}$$

where, p_1° = vapour pressure of pure component 1 at same temperature.

For component 2,

$$p_2 = p_2^\circ x_2 \quad \text{--- (ii)}$$

p_2° = vapour pressure of pure component 2 at same temperature.

According to Dalton's law of partial pressure.

$$P_{total} = p_1 + p_2$$

From (i) & (ii)

$$p_{total} = x_1 p_1^\circ + x_2 P_2^\circ$$

$$= (1 - x_2) P_1^\circ + x_2 P_2^\circ \quad [x_2 + x_1 = 1] \text{ --- (iii)}$$

$$= p_1^\circ + (p_2^\circ - p_1^\circ) x_2$$

$$= p_1^\circ + p_2^\circ x_2 - p_1^\circ x_2 = p_1^\circ + x_2 (p_2^\circ \mp p_1^\circ) \text{ --- (iv)}$$

Scanned with CamScanner

Above equations (ii) concludes:

a) Total vapour pressure over the solution can be related to the mole fraction of any one component.

b) Total vapour pressure over the solution varies linearly with the mole fraction of component 2

c) Depending on the vapour pressures of the pure components 1 and 2, total vapour pressure over the solution decreases or increases with the increase of mole fraction of component 1.

Scanned with CamScanner