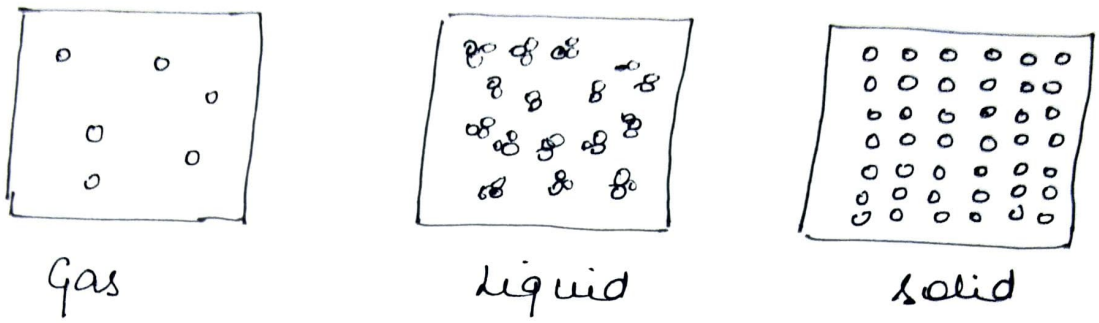
The Liquid State

Gaseous, liquid and solid:-



Gas Liquid Solid

→ Solid in crystalline form exhibit complete ordered arrangement of molecules, atoms or ions and gases and liquid exhibit complete disorder

→ In solid there is close packing of molecules, atoms or ions. This arrangement exists to some extent in the liquid state. In gases there are no such arrangement of close packing of molecules or atoms considered as spheres.

→ The definite and ordered arrangement of the constituents of a solid extends over a large distance. This is termed as long range order. The liquid exhibits only a short range order while gases shows no order at all.

→ A liquid may be regarded as a condensed gas or molten solid.

→ In a gas on other side, molecules have random motion and neither have definite shapes nor a definite volume.

→ solid, molecules are rigidly fixed and it has a definite shape and definite volume.

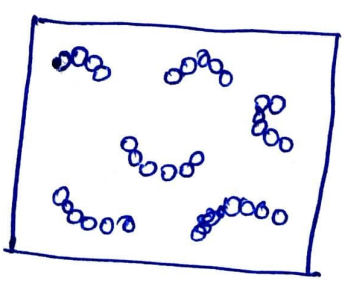
→ In liquids, molecules are not rigidly fixed as in solids. They have some freedom of motion which is more restricted than in gases. A liquid has definite volume but indefinite shape. It is less compressible and denser than gases.

→ Intermolecular forces in liquid > solid but < gases.

⇒ Vacancy Theory of liquids:-

→ 1961, Ering and Ree proposed a simple theory that the intermolecular space of liquid is not randomly distributed but contains molecule sized holes or vacancies.

The liquid is also considered as random congregation of molecular sized holes or vacancies



It is assumed that the molecules surrounding a given hole can easily jump into it and are thus "gas-like" whereas those in the ~~inter-mediate contact~~ immediate contact with the holes are "solid-like".

Hence

$$\frac{\text{Number of holes}}{\text{number of molecules}} = \frac{V_l - V_s}{V_s}$$

The probability that a hole confers gas-like properties on its neighbouring molecules is proportional to the fraction of the neighbouring positions occupied by the molecules.

For a random distribution of holes, this ratio is given by V_s/V_l. Hence

$$x_g = \left(\frac{V_l - V_s}{V_s}\right)\left(\frac{V_s}{V_l}\right) = \frac{V_l - V_s}{V_l}$$

and $$x_s = V_s/V_l$$

and x_g and x_s are the mole fractions of the gas-like and solid-like molecules, respectively.

Based on these ideas, Ering and Ree calculated the melting point, boiling point, critical point and thermodynamic properties of Argon.