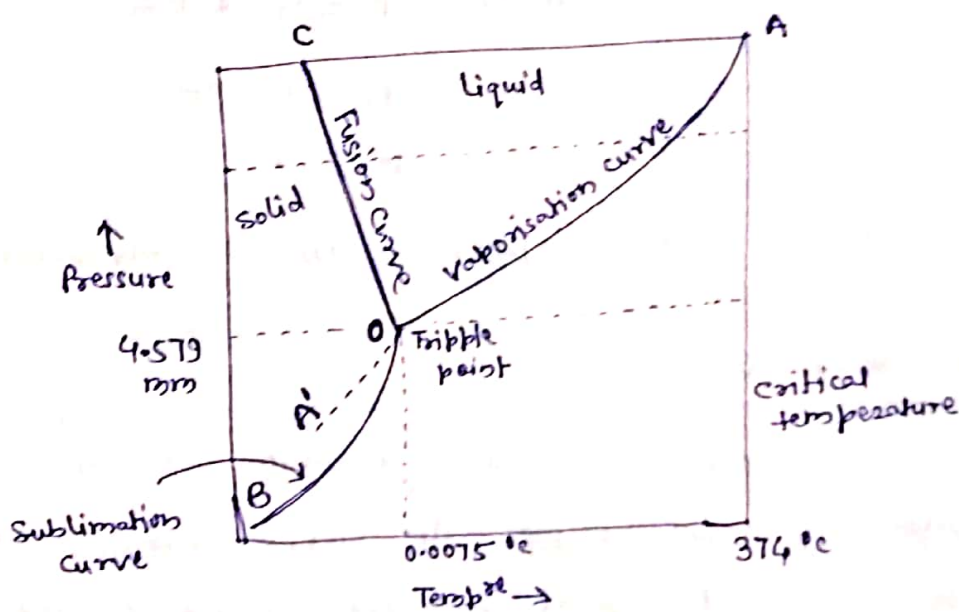## Phase diagram :-

A phase diagram is the sum total of the discription of the behaviour of phases under equilibrium.

The no. of phases that exists in equilibrium depends upon its conditions of temperature and pressure, or temperature and compositions. These conditions are determined experimently and inter depency of the variables can be shown grafically using appropriate conditions.

* One Component System

(1). Water System :-

Water system is three phase but one component system. It has no degree of freedom i.e. it is invariant system. This system exists in three phases as: —

Figure with axes Pressure (↑) vs Temp → showing points C, A, O (Tripple point), A', B; regions labeled Solid, Liquid; curves labeled Fusion curve, Vaporisation curve, Sublimation curve; values 4.579 mm, 0.0075 °c, 374 °c, critical temperature.

solid ⇌ liquid

liquid ⇌ vapour

vapour ⇌ solid

solid ⇌ liquid ⇌ vapour.

The phase diagram of water system consists of —

(i) three stable curves OA, OB, OC.

(ii) One metastable curve OA'.

(iii) three areas AOB, COB, AOC.

(iv) triple point O.

* Curve OA :–

This represents the liquid ⇌ vapour at different temperature. It is called the vapour pressure of water. The rate of increase of vapour pressure with temperature is relatively higher at higher temp^{re} and therefore the curve OA. Above critical temp^{re}, only vapour phase exist whatever may be the pressure.

Since, $F = C - P + 2$

$F = 1 - 2 + 2$

$F = 1$.

So, the water-vapour system is univariant.

*. Curve OB :–

It represents the equilibrium between ice & vapour. It falls off more steeply. The curve OB existance as the temp^{re} decreases and vapour pressure of ice become insignificant. It is also a univalent system.

*. Curve OC :-

This represents the equilibrium between ice & water. This indicates that the melting point of ice is slightly lower by increase of pressure. This is also uni-valent system.

* Curve OA' :-

Along this curve liquid-water co-exists with vapour and vapour-pressure are different. This is called meta stable equilibrium as slight disturbance brings it is to the stable region OB of the phase diagram.

*. Tripple point O :-

The point 'O' at which the three curves AO, BO & CO meet, is called the tripple point. At this point all the three phases are in equilibrium and the system is non-variant. This show that there is only one set of variables P,T at which the three phases exists togather.

The tripple point 'O' is a self defined point corresponding to a definite temperature & definit pressure. It differs from the ordinary freezing point because freezing temperature is lower than tripple point temperature due to effect of high pressure and dissolved more.

* Areas :- The areas gives the conditions of tempre & pressure under which single phase — ice, water & vapour can exists. These areas are bivariant.

—x—