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Seg II Chem. subsidiary (Physical)

Topic :- Phase Rule continued

One Component Water system (Rest)

The curve OB represents the equilibrium between Ice and Vapour. It is called the Vapour Pressure curve of Ice or sublimation curve of ice. Its lower end B extends to absolute zero.

We see that for each temperature there can be only one pressure. In other words, the degree of freedom is 1.

Now along the curve OA two phases are liquid and Vapour and along OB the two phases are solid and Vapour at the point O where the two curves meet three phases solid, liquid and Vapour will coexist. Such a point is known as the "triple point". Thus according to phase rule O is an invariant point, the degree of freedom is zero.  $F = C - P + 2 = 1 - 3 + 2 = 0$



The curve OC represents the equilibrium between ice and water. It is called the Fusion curve of ice as it indicates the temperature and pressure at which the solid (Ice) and liquid (water) can coexist in equilibrium.

In other words, this curve shows the effect of pressure on the melting point of ice. Line OC is inclined towards the pressure axis which indicates the melting point of ice is lowered by increase of pressure.

Along the curve OC, there are two phases namely ice and water. Thus according to phase rule the degree of freedom is 1.

Metastable equilibrium :-

Some times it is possible with due care to cool water or any liquid below its <sup>normal</sup> freezing temperature without the separation of ice.



The water is then said to be super cooled and can be kept as such almost indefinitely, if the presence of any other solid phase is carefully avoided.

The vapour pressure curve of water AC can, therefore, continue below the point O as shown by the dotted curve OA'. The liquid vapour system along the curve OA' is said to be in metastable equilibrium because as soon as a small particle of ice is brought in contact with the super cooled liquid, the entire liquid solidifies.

It should be remembered that the metastable system has a higher vapour pressure than a stable system at the same temperature.