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Seg II. Chem. Subsidiary (Physical)

Topic :- Phase Rule

The Phase rule by Willard Gibbs may be expressed in the simple form —

$$P + F = C + 2$$

P = The number of Phases

F = The number of degree of freedom

C = The number of Components in a System at equilibrium.

The above equation does not involve the mass of Phase as it has no effect on the state of equilibrium.

In words, the above equation can be stated as —

"In a heterogeneous system in equilibrium the number of degrees of freedom plus the number of Phases are equal to the number of Components plus 2.

Phase :- A phase is defined as any homogeneous and physically distinct part of a system which is bounded by a surface and is mechanically separable from other part of the system.

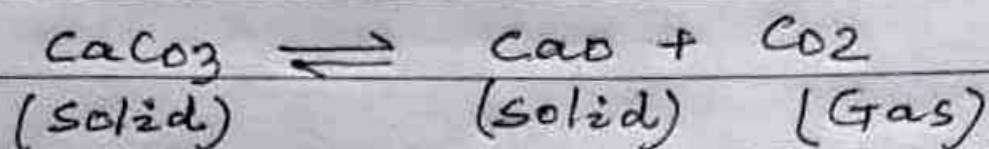
A Phase may be gaseous, liquid or solid. It is perfectly homogeneous and distinct from every other Phase that may be present in the system. There must be a definite boundary between any two Phases which is known as Interface.

Examples: - ① All gases are completely miscible. Therefore, a gaseous mixture irrespective of the number of gases present consists of one Phase only. There can be no boundary i.e. interface between one gas and another gas.

② In a system consisting of Ice, water and vapour there are three Phases - Ice (solid Phase), water (liquid Phase) and vapour (gas Phase). Each Phase is homogeneous in itself and can be separated from other Phase by mechanical process.

③ A solid mixture constitutes

as many Phases as are solids Present, Every solid constitutes a separate Phase. Thus a heterogeneous equilibrium —



involves three Phases, two solids and one gas.

Degree of freedom : —

The degree of freedom of a system may be defined as the number of variable factors such as Pressure, temperature and Composition which must be arbitrarily fixed in order to define the system completely.

Examples : —

System consisting of Ice, water and vapour has no degree of freedom because three Phases can coexist in equilibrium only at one particular temperature and under one Pressure. Thus the system is "non-variant"