2.10. CAUSE OF ABNORMAL MOLECULAR MASSES OF SOLUTES IN SOLUTIONS

In certain situations, we find that the value of colligative property measured is greater or smaller than the value expected. Also since molecular mass is inversely related to the observed colligative property, the molecular mass calculated from the observed value of colligative property by applying the relevant relation, comes out to be different from the calculated molecular mass. We express it by saying that the solute is showing abnormal molecular mass.

Abnormal molecular mass of solute in solution is due to *association* or *dissociation* of molecules in the solution. These are explained as below.

(a) **Association**: If the molecules of a solute undergo association in solution, there will be decrease in the number of species. As a result there will be proportionate decrease in the value of each colligative property. The experimental value of molecular mass of the solute will be higher in such a case. This is because molecular mass is inversely proportional to the value of any colligative property.

For example acetic acid and benzoic acid both associate in benzene. Similarly, chloroacetic acid associates in naphthalene. The molecular mass of solute in such cases is higher than the molecular mass obtained from their molecular formulae. Thus the molecular mass of acetic acid (CH_3COOH) in benzene, as determined from freezing point depression is 118 instead of 60.

(*b*) **Dissociation:** Inorganic acids, bases and salts dissociate or ionise in solution. As a result of this, number of effective particles increases and therefore, the value of colligative property is also increased. Therefore, the experimental value of molecular mass of the solute will be lower in such a case. This is because molecular mass is inversely proportional to the value of any colligative property as already discussed.

Evidently the observed molecular mass will be higher in case of association and lower in case of dissociation.