

Thermodynamics and Stability Constant

The standard free energy change ΔF° is related to Equilibrium Constant by the relation.

$$\Delta F^\circ = -RT \ln \beta_n \quad \text{--- (i)}$$

where R is gas constant and T is absolute Temperature.

And we know, $\Delta F^\circ = \Delta H^\circ - T \Delta S^\circ \quad \text{--- (ii)}$

from the above two relations we get

$$\begin{aligned} \Delta H^\circ - T \Delta S^\circ &= -RT \ln \beta_n \\ \text{or } -\Delta H^\circ + T \Delta S^\circ &= RT \ln \beta_n \end{aligned}$$

where ΔH° Enthalpy at standard state
 ΔS° Entropy at standard state
 β_n Stability Constant

From the above equation, it follows that

Complex formation is favoured by negative
Enthalpy and Positive Entropy change.

Determination of Stability Constant

By Spectro Photometric Method.

Most of the complexes absorb light differently than the metal ion from which they are made.

Now the relation between the absorbance or Optical density

(A) at a particular wavelength and concentration is expressed by Beer's Law as follows

$$A = \epsilon \cdot l \cdot C$$

Where ϵ = molar extinction coefficient

l = Length of the absorption cell

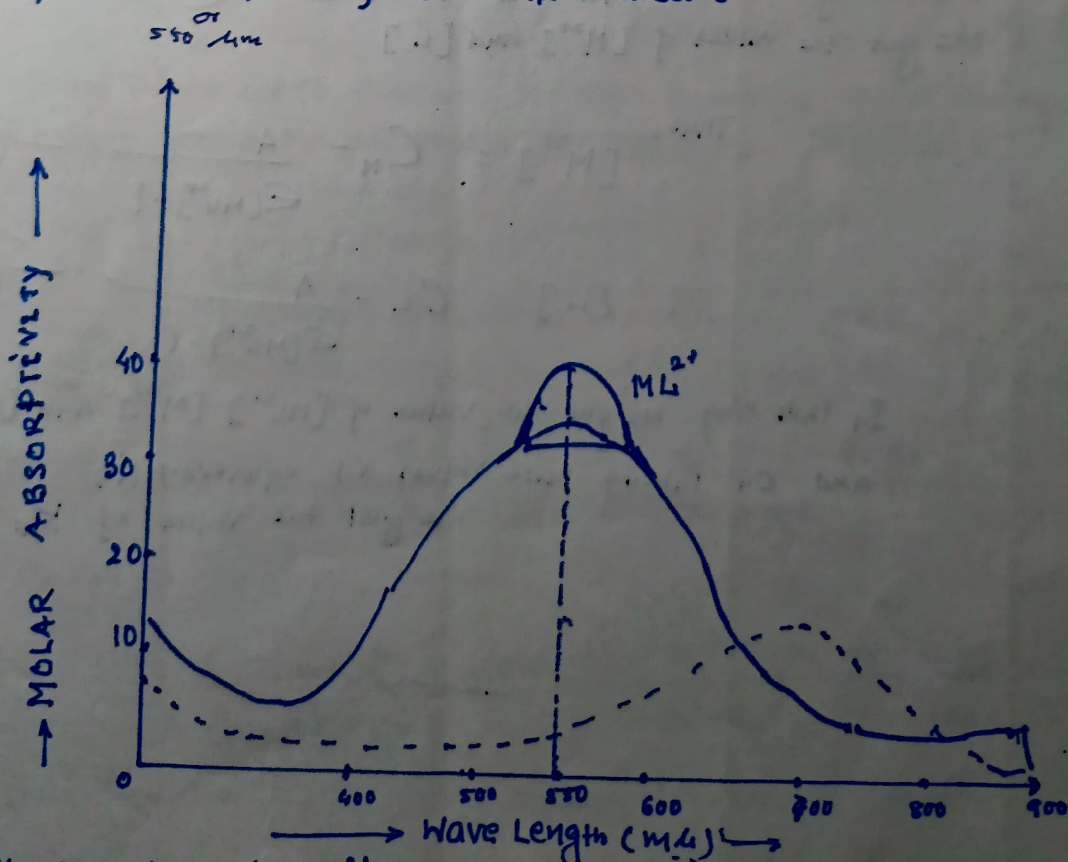
C = Concentration of Complex.

If we measure the absorption (A) with a Spectrophotometer and knowing the extinction coefficient (ϵ) at that wavelength and the cell length (l). Then the concentration C can be

calculated from Beer's Law.

It has been shown in fig that, How the spectrum of a metal ion M^{2+} changes on co-ordination with ligand L^- , which contains representative spectra of Metal ion M^{2+} (shown by broken lines) and its complex ion ML^{2+} (shown by unbroken lines)

It will be seen that the absorption by the complex takes place over the entire region of the metal ion absorption, while at 550 m μ only the complex absorbs.



Spectrum of Metal ion, M^{2+} and its Complex $[ML^{2+}]$