

Metal-Ligand Equilibrium in Solution.

When Ammonia is added to an aqueous solution of Nickel Sulphate (NiSO_4) then colour changed because some of the $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ ions are converted into $[\text{Ni}(\text{NH}_3)_6]^{2+}$ ions.

The reaction involved is ligands replacement reaction:-



Equilibrium Constant K for this reaction is as

$$K = \frac{[\text{Ni}(\text{NH}_3)_6]^{2+} [\text{H}_2\text{O}]^6}{[\text{Ni}(\text{H}_2\text{O})_6]^{2+} [\text{NH}_3]^6}$$

A High value of Equilibrium Constant means that the $[\text{Ni}(\text{NH}_3)_6]^{2+}$ is more stable.

In aqueous solution the concentration of water is constant, so the value of Equilibrium Constant K is given as

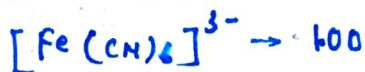
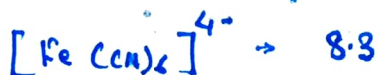
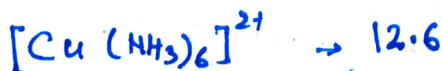
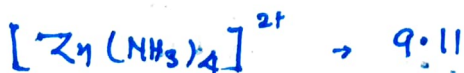
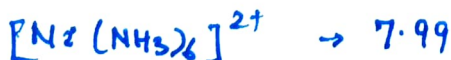
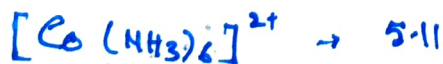
$$K = \frac{[\text{Ni}(\text{NH}_3)_6]^{2+}}{[\text{Ni}(\text{H}_2\text{O})_6]^{2+} [\text{NH}_3]^6}$$

Where K 's constant known as the "Stability Constant" for $[\text{Ni}(\text{NH}_3)_6]^{2+}$ ion.

Higher the value of Stability Constant for a complex ion, the greater is its stability.

And the value of $\frac{1}{K}$ is known as instability constant. High value of instability constant poses unstable complex ion.

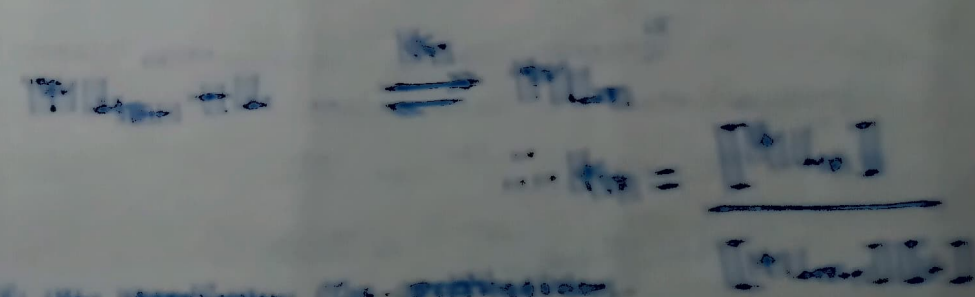
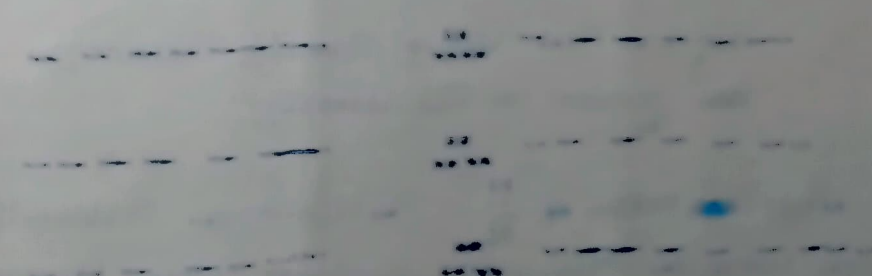
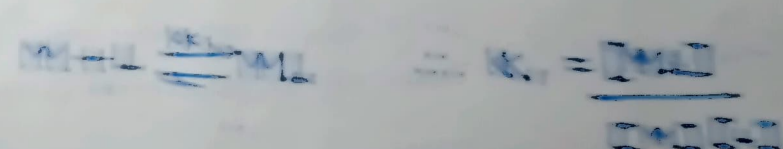
Generally stability constants are quoted as $\log K$ and some typical values are shown below:-



Ex 104] Suppose M and M' are formation of a double
 + double process with different velocities of reaction
 Equilibrium $\rightarrow$ then M and M'

Double Molecule $\rightarrow$ (double reaction, double)
 Hence M and M' must be same
 It is an equilibrium reaction
 If M and M' maximum concentration constant

Now Suppose And the formation of the double Molecule
 is affected by the following 71 conditions of
 and equilibrium constant



Hence If M the maximum concentration
 number of M is same for all the species
 The equilibrium constant $K_1, K_2, \dots, K_n$ are
 same for all formation constant
 of
 the same substance