

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 $\log_{10} K$ and some typical values are shown below:-

