**Complex Ion Formation Constants**



A stability constant is an equilibrium constant for the formation of a complex in solution that measures the strength of the interaction between the ligands and metal that form the complex. The formation of complexes between a metal ion, M, and ligands, L, is really a [ligand exchange](https://chem.libretexts.org/Inorganic_Chemistry/Coordination_Chemistry/Complex_Ion_Chemistry/Ligand_Exchange_Reactions_%28Introduction%29) (i.e., substitution reaction) with metal ions in aqueous solutions present as aqua-ligated ions.

|  |  |
| --- | --- |
|   |   |
| **Ammine Ligands** | *K* *f*  Kf  |
| Ag+ + 2 NH3  ⇌ ⇌     [Ag(NH3)2]+ | 1.6 x 107 |
| Zn2+ + 4 NH3  ⇌ ⇌    [Zn(NH3)4]2+ | 7.8 x 108 |
| Cu2+ + 4 NH3  ⇌ ⇌   [Cu(NH3)4]2+ | 1.1 x 1013 |
| Hg2+ + 4 NH3  ⇌ ⇌   [Hg(NH3)4]2+ | 1.8 x 1019 |
| Co2+ + 6 NH3  ⇌ ⇌   [Co(NH3)6]2+ | 5.0 x 104 |
| Co3+ + 6 NH3  ⇌ ⇌   [Co(NH3)6]3+ | 4.6 x 1033 |
| Cd2+ + 6 NH3  ⇌ ⇌   [Cd(NH3)6]2+ | 2.6 x 105 |
| Ni2+ + 6 NH3  ⇌ ⇌    [Ni(NH3)6]2+ | 2.0 x 108 |

| **Halo Ligands** | ***K*** ***f***  Kf |
| --- | --- |
| Al3+ + 6 F- ⇌ ⇌ [AlF6]3- | 2.5 x 104 |
| Al3+ + 4 F- ⇌ ⇌   [AlF4]-1 | 2.0 x 108 |
|  Be2+ + 4 F-  ⇌ ⇌   [BeF4]2- | 1.3 x 1013 |
| Sn4+ + 6 F-  ⇌ ⇌   [SnF6]2- | 1.0 x 1025 |
| Cu+ + 2 Cl- ⇌ ⇌   [CuCl2]-1 | 3.0 x 105 |
| Ag+ + 2 Cl- ⇌ ⇌   [AgCl2]-1 | 1.8 x 105 |
| Pb2+ + 4 Cl- ⇌ ⇌   [PbCl4]2- | 2.5 x 1015 |
| Zn2+ + 4 Cl- ⇌ ⇌   [ZnCl4]2- | 1.6  |
| Hg2+ + 4 Cl-  ⇌ ⇌   [HgCl4]2- | 5.0 x 1015 |
| Cu+ + 2 Br-  ⇌ ⇌   [CuBr2]-1 | 8.0 x 105 |
| Ag+ + 2 Br-  ⇌ ⇌   [AgBr2]-1 | 1.0 x 1011 |
| Hg2+ + 4 Br-  ⇌ ⇌   [HgBr4]2- | 3.0 x 104 |
| Cu+ + 2 I-  ⇌ ⇌   [CuI2]-1 | 8.0 x 108 |
| Ag+ + 2 I-  ⇌ ⇌   [AgI2]-1 | 1.0 x 1011 |
| Pb2+ + 4 I-  ⇌ ⇌   [PbI4]2- | 3.0 x 104 |
| Hg2+ + 4 I-  ⇌ ⇌   [HgI4]2- | 1.9 x 1030 |
|  |  |
|  |  |

| **Cyanide Ligands** | *K* *f*  Kf |
| --- | --- |
| Fe2+ + 6 CN-  ⇌ ⇌   [Fe(CN)6]4- | 1.0 x 1024 |
| Fe3+ + 6 CN-  ⇌ ⇌   [Fe(CN)6]3- | 1.0 x 1031 |
| Ag+ + 2 CN-  ⇌ ⇌   [Ag(CN)2]-1 | 5.3 x 1018 |
| Cu+ + 2 CN-  ⇌ ⇌   [Cu(CN)2]-1 | 1.0 x 1016 |
| Cd2+ + 4 CN-  ⇌ ⇌   [Cd(CN)4]2- | 7.7 x 1016 |
| Au+ + 2 CN-  ⇌ ⇌   [Au(CN)2]-1 | 2.0 x 1038 |
|   |   |
| **Other monodentate ligands** | *K* *f*  Kf  |
| Ag+ + 2 CH3NH2  ⇌ ⇌   [Ag(CH3NH2)2]+1 | 7.8 x 106 |
| Cd2+ + 4 SCN-  ⇌ ⇌   [Cd(SCN)4]2- | 1.0 x 103 |
| Cu2+ 2 SCN-  ⇌ ⇌   [Cu(SCN)2]  | 5.6 x 103 |
| Fe3+ 3 SCN-  ⇌ ⇌   [Fe(SCN)3] | 2.0 x 106 |
| Hg2+ 4 SCN-  ⇌ ⇌   [Hg(SCN)4]2- | 5.0 x 1021 |
| Cu2+ 4 OH-  ⇌ ⇌   [Cu(OH)4]2- | 1.3 x 1016 |
| Zn2+ 4 OH-  ⇌ ⇌   [Zn(OH)4]2- | 2.0 x 1020 |
|   |   |
| **Bidentate ligands****(en = Ethylenediamine )** |            *K* *f*  Kf             |
| Mn2+ + 3 en  ⇌ ⇌    [Mn(en)3]2+ | 6.5 x 105 |
| Fe2+ + 3 en  ⇌ ⇌   [Fe(en)3]2+ | 5.2 x 109 |
| Co2+ + 3 en  ⇌ ⇌   [Co(en)3]2+ | 1.3 x 1014 |
| Co3+ + 3 en  ⇌ ⇌   [Co(en)3]3+ | 4.8 x 1048 |
| Ni2+ + 3 en  ⇌ ⇌   [Ni(en)3]2+ | 4.1 x 1017 |
| Cu2+ + 2 en  ⇌ ⇌   [Cu(en)2]2+ | 3.5 x 1019 |
| Co2+ + 3 C2O42-  ⇌ ⇌   [Co(C2O4)3]4- | 4.5 x 106 |
| Fe3+ + 3 C2O42-  ⇌ ⇌   [Fe(C2O4)3]3- | 3.3 x 1020 |