**Complex Ion Formation Constants**

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| **Halo Ligands** | *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 |
|  |  |
| **Ammine Ligands** | *K f* |
| 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 |
|  |  |
| **Cyanide Ligands** | *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* |
| 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 |
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| **Acetate**  **CH3COO–** | **log *K*1** | | **log *K*2** | **log *K*3** | | | **log *K*4** | | | **log *K*5** | | **log *K*6** | |
| Mg2+ | 1.27 | |  |  | | |  | | |  | |  | |
| Ca2+ | 1.18 | |  |  | | |  | | |  | |  | |
| Ba2+ | 1.07 | |  |  | | |  | | |  | |  | |
| Mn2+ | 1.40 | |  |  | | |  | | |  | |  | |
| Fe2+ | 1.40 | |  |  | | |  | | |  | |  | |
| Co2+ | 1.46 | |  |  | | |  | | |  | |  | |
| Ni2+ | 1.43 | |  |  | | |  | | |  | |  | |
| Cu2+ | 2.22 | | 1.41 |  | | |  | | |  | |  | |
| Ag2+ | 0.73 | | –0.09 |  | | |  | | |  | |  | |
| Zn2+ | 1.57 | |  |  | | |  | | |  | |  | |
| Cd2+ | 1.93 | | 1.22 | –0.89 | | |  | | |  | |  | |
| Pb2+ | 2.68 | | 1.40 |  | | |  | | |  | |  | |
| **Ammonia NH3** | **log *K*1** | | **log *K*2** | **log *K*3** | | | **log *K*4** | | | **log *K*5** | | **log *K*6** | |
| Ag+ | 3.31 | | 3.91 |  | | |  | | |  | |  | |
| Co2+ (*T* = 20 oC) | 1.99 | | 1.51 | 0.93 | | | 0.64 | | | 0.06 | | –0.73 | |
| Ni2+ | 2.72 | | 2.17 | 1.66 | | | 1.12 | | | 0.67 | | –0.03 | |
| Cu2+ | 4.04 | | 3.43 | 2.80 | | | 1.48 | | |  | |  | |
| Zn2+ | 2.21 | | 2.29 | 2.36 | | | 2.03 | | |  | |  | |
| Cd2+ | 2.55 | | 2.01 | 1.34 | | | 0.84 | | |  | |  | |
| **Chloride Cl–** | **log *K*1** | | **log *K*2** | **log *K*3** | | | **log *K*4** | | | **log *K*5** | | **log *K*6** | |
| Cu2+ | 0.40 | |  |  | | |  | | |  | |  | |
| Fe3+ | 1.48 | | 0.65 |  | | |  | | |  | |  | |
| Ag+ (μ = 5.0 M) | 3.70 | | 1.92 | 0.78 | | | –0.3 | | |  | |  | |
| Zn2+ | 0.43 | | 0.18 | –0.11 | | | –0.3 | | |  | |  | |
| Cd2+ | 1.98 | | 1.62 | –0.2 | | | –0.7 | | |  | |  | |
| Pb2+ | 1.59 | | 0.21 | –0.1 | | | –0.3 | | |  | |  | |
| **Cyanide CN–** | **log *K*1** | | **log *K*2** | **log *K*3** | | | **log *K*4** | | | **log *K*5** | | **log *K*6** | |
| Fe2+ |  | |  |  | | |  | | |  | | 35.4 | |
| Fe3+ |  | |  |  | | |  | | |  | | 43.6 | |
| Ag+ |  | | 20.48 | 0.92 | | |  | | |  | |  | |
| Zn2+ |  | | 11.07 | 4.98 | | | 3.57 | | |  | |  | |
| Cd2+ | 6.01 | | 5.11 | 4.53 | | | 2.27 | | |  | |  | |
| Hg2+ | 17.00 | | 15.75 | 3.56 | | | 2.66 | | |  | |  | |
| Ni2+ |  | |  |  | | | 30.22 | | |  | |  | |
| **Ethylenediamine** | **log *K*1** | | **Log*K*2** | **log *K*3** | | | **log *K*4** | | | **log *K*5** | | **log *K*6** | |
| Ni2+ | 7.38 | | 6.18 | 4.11 | | |  | | |  | |  | |
| Cu2+ | 10.48 | | 9.07 |  | | |  | | |  | |  | |
| Ag+ (*T* = 20oC, μ = 0.1 M) | 4.700 | | 3.00 |  | | |  | | |  | |  | |
| Zn2+ | 5.66 | | 4.98 | 3.25 | | |  | | |  | |  | |
| Cd2+ | 5.41 | | 4.50 | 2.78 | | |  | | |  | |  | |
| **EDTA\***(*T*=20oC,μ= 0.1 M) | **log *K*2** |  | | |  | | |  |  | |  | |
| Mg2+ | 8.79 | |  | | |  |  | | |  | |  | |
| Ca2+ | 10.69 | |  | | |  |  | | |  | |  | |
| Ba2+ | 7.86 | |  | | |  |  | | |  | |  | |
| Bi3+ | 27.8 | |  | | |  |  | | |  | |  | |
| Co2+ | 16.31 | |  | | |  |  | | |  | |  | |
| Ni2+ | 18.62 | |  | | |  |  | | |  | |  | |
| Cu2+ | 18.80 | |  | | |  |  | | |  | |  | |
| Cr3+ | [23.4] | |  | | |  |  | | |  | |  | |
| Fe3+ | 25.1 | |  | | |  |  | | |  | |  | |
| Ag+ | 7.32 | |  | | |  |  | | |  | |  | |
| Zn2 | 16.50 | |  | | |  |  | | |  | |  | |
| Cd2+ | 16.46 | |  | | |  |  | | |  | |  | |
| Hg2+ | 21.7 | |  | | |  |  | | |  | |  | |
| Pb2+ | 18.04 | |  | | |  |  | | |  | |  | |
| Al3+ | 16.3 | |  | | |  |  | | |  | |  | |
| **Fluoride F–** | **log *K*1** | | **Log*K*2** | | | **log *K*3** | **log *K*4** | | | **log *K*5** | | **log *K*6** | |
| Al3+ (μ = 0.5 M) | 6.11 | | 5.01 | | | 3.88 | 3.0 | | | 1.4 | | 0.4 | |
| **Hydroxide OH–** | **log *K*1** | | **log *K*2** | | | **log *K*3** | **log *K*4** | | | **log *K*5** | | **log *K*6** | |
| Al3+ | 9.01 | | [9.69] | | | [8.3] | 6.0 | | |  | |  | |
| Co2+ | 4.3 | | 4.1 | | | 1.3 | 0.5 | | |  | |  | |
| Fe2+ | 4.5 | | [2.9] | | | 2.6 | –0.4 | | |  | |  | |
| Fe3+ | 11.81 | | 10.5 | | | 12.1 |  | | |  | |  | |
| Ni2+ | 4.1 | | 3.9 | | | 3. |  | | |  | |  | |
| Pb2+ | 6.3 | | 4.6 | | | 3.0 |  | | |  | |  | |
| Zn2+ | 5.0 | | [6.1] | | | 2.5 | [1.2] | | |  | |  | |
| **Iodide I–** | **log *K*1** | | **log *K*2** | | | **log *K*3** | **log *K*4** | | | **log *K*5** | | **log *K*6** | |
| Ag+ (*T* = 18 oC) | 6.58 | | [5.12] | | | [1.4] |  | | |  | |  | |
| Cd2+ | 2.28 | | 1.64 | | | 1.08 | 1.0 | | |  | |  | |
| Pb2+ | 1.92 | | 1.28 | | | 0.7 | 0.6 | | |  | |  | |
| **Nitriloacetate** | **log *K*1** | | **log *K*2** | | | **log *K*3** | **log *K*4** | | | **log *K*5** | | **log *K*6** | |
| Mg2+ (*T*=20oC, μ = 0.1 M) | 5.41 | |  | | |  |  | | |  | |  | |
| Ca2+ (*T*=20oC, μ = 0.1 M) | 6.41 | |  | | |  |  | | |  | |  | |
| Ba2+(*T*=20oC, μ = 0.1 M) | 4.82 | |  | | |  |  | | |  | |  | |
| Mn2+ (*T*=20oC, μ = 0.1 M) | 7.44 | |  | | |  |  | | |  | |  | |
| Fe2+ (*T*=20oC, μ = 0.1 M) | 8.33 | |  | | |  |  | | |  | |  | |
| Co2+ (*T*=20oC, μ = 0.1 M) | 10.38 | |  | | |  |  | | |  | |  | |
| Ni2+ (*T*=20oC, μ = 0.1 M) | 11.53 | |  | | |  |  | | |  | |  | |
| Cu2+ (*T*=20oC, μ = 0.1 M) | 12.96 | |  | | |  |  | | |  | |  | |
| Fe3+ (*T*=20oC, μ = 0.1 M) | 15.9 | |  | | |  |  | | |  | |  | |
| Zn2+ (*T*=20oC, μ = 0.1 M | 10.67 | |  | | |  |  | | |  | |  | |
| Cd2+ (*T*=20oC, μ = 0.1 M) | 9.83 | |  | | |  |  | | |  | |  | |
| Pb2+ (*T*=20oC, μ = 0.1 M) | 11.39 | |  | | |  |  | | |  | |  | |
| **Oxalate C2O42–** | **log *K*1** | | **log *K*2** | | | **log *K*3** | **log *K*4** | | | **log *K*5** | | **log *K*6** | |
| Ca2+ (μ = 1 M) | 1.66 | | 1.03 | | |  |  | | |  | |  | |
| Fe2+ (μ = 1 M) | 3.05 | | 2.10 | | |  |  | | |  | |  | |
| Co2+ | 4.72 | | 2.28 | | |  |  | | |  | |  | |
| Ni2+ | 5.16 | |  | | |  |  | | |  | |  | |
| Cu2+ | 6.23 | | 4.04 | | |  |  | | |  | |  | |
| Fe3+ (μ = 0.5 M) | 7.53 | | 6.11 | | | 4.85 |  | | |  | |  | |
| Zn2+ | 4.87 | | 2.78 | | |  |  | | |  | |  | |
| **1,10Phenanthroline** | **log *K*1** | | **log *K*2** | | | **log *K*3** | **log *K*4** | | | **log *K*5** | | **log *K*6** | |
| Fe2+ |  | |  | | | 20.7 |  | | |  | |  | |
| Mn2+ (μ = 0.1 M) | 4.0 | | 3.3 | | | 3.0 |  | | |  | |  | |
| Co2+ (μ = 0.1 M) | 7.08 | | 6.64 | | | 6.08 |  | | |  | |  | |
| Ni2+ | 8.6 | | 8.1 | | | 7.6 |  | | |  | |  | |
| Fe3+ |  | |  | | | 13.8 |  | | |  | |  | |
| Ag+ (μ = 0.1 M) | 5.02 | | 7.04 | | |  |  | | |  | |  | |
| Zn2+ | 6.2 | | [5.9] | | | [5.2] |  | | |  | |  | |
| **Thiosulfate S2O32–** | **log *K*1** | | **log *K*2** | | | **log *K*3** | **log *K*4** | | | **log *K*5** | | **log *K*6** | |
| Ag+ (*T* = 20 oC) | 8.82 | | 4.85 | | | 0.53 |  | | |  | |  | |
| **Thiocyanate SCN–** | **log *K*1** | | **log *K*2** | | | **log *K*3** | **log *K*4** | | | **log *K*5** | | **log *K*6** | |
| Mn2+ | 1.23 | |  | | |  |  | | |  | |  | |
| Fe2+ | 1.31 | |  | | |  |  | | |  | |  | |
| Co2+ | 1.72 | |  | | |  |  | | |  | |  | |
| Ni2+ | 1.76 | |  | | |  |  | | |  | |  | |
| Cu2+ | 2.33 | |  | | |  |  | | |  | |  | |
| Fe3+ | 3.02 | |  | | |  |  | | |  | |  | |
| Ag+ | 4.8 | | 3.43 | | | 1.27 | 0.2 | | |  | |  | |
| Zn2+ | 1.33 | | 0.58 | | | 0.09 | –0.4 | | |  | |  | |
| Cd2+ | 1.89 | | 0.89 | | | 0.02 | –0.5 | | |  | |  | |
| Hg2+ |  | | 17.26 | | | 2.71 | 1.83 | | |  | |  | |