The solubility product constant K_{sp} is a useful parameter for calculating the aqueous solubility of sparingly soluble compounds under various conditions. It may be determined by direct measurement or calculated from the standard Gibbs energies of formation $\Delta_f G^\ominus$ of the species involved at their standard states. Thus if $K_{sp} = [M^+]^m[A^-]^n$ is the equilibrium constant for the reaction

$$M_mA_n(s) \rightleftharpoons mM^+(aq) + nA^-(aq)$$

where M_mA_n is the slightly soluble substance and M^+ and A^- are the ions produced in solution by the dissociation of MmAn, then the Gibbs energy change is

$$\Delta G^\ominus = m\Delta_f G^\ominus(M^+(aq)) + n\Delta_f G^\ominus(A^-(aq)) - \Delta_f G^\ominus(M_mA_n(s))$$

The solubility product constant is calculated from the equation

$$\ln K_{sp} = \frac{-\Delta G^\ominus}{RT}$$

The table gives selected values of K_{sp} at 25 °C. The above formulation is not convenient for treating sulfides because the S^{-2} ion is usually not present in significant concentrations. This is due to the hydrolysis reaction $S^{-2} + H_2O \rightleftharpoons HS^- + OH^-$ which is strongly shifted to the right except in very basic solutions. Furthermore, the equilibrium constant for this reaction, which depends on the second ionization constant of H_2S, is poorly known. Therefore it is more useful in the case of sulfides to define a different solubility product K_{spa} based on the reaction

$$M_mS_n(s) + 2H^+(aq) \rightleftharpoons mM^+(aq) + nH_2S(aq)$$

Reference: Rumble, J. *CRC Handbook of Chemistry and Physics*, 98th Edition, CRC Press LLC, 2017.

Formula	K_{sp}	K_{spa}
$Ag_2C_2O_4$	5.40×10^{-12}	
Ag_2CO_3	8.46×10^{-12}	
Ag_2CrO_4	1.12×10^{-12}	
Ag_2SO_3	1.50×10^{-14}	
Ag_2SO_4	1.20×10^{-5}	
Ag_2S		6×10^{-30}
Ag_3AsO_4	1.03×10^{-22}	
Ag_3PO_4	8.89×10^{-17}	
$AgBrO_3$	5.38×10^{-5}	
$AgBr$	5.35×10^{-13}	
$AgC_2H_3O_2$	1.94×10^{-3}	
$AgCN$	5.97×10^{-17}	
$AgCl$	1.77×10^{-10}	
$AgIO_3$	3.17×10^{-8}	
AgI	8.52×10^{-17}	
$AgSCN$	1.03×10^{-12}	
$AlPO_4$	9.84×10^{-21}	
$Ba(BrO_3)_2$	2.43×10^{-4}	
$Ba(IO_3)_2 \cdot H_2O$	1.67×10^{-9}	
$Ba(IO_3)_2$	4.01×10^{-9}	
$Ba(OH)_2 \cdot 8H_2O$	2.55×10^{-4}	
$BaCO_3$	2.58×10^{-9}	
$BaCrO_4$	1.17×10^{-10}	
BaF_2	1.84×10^{-7}	
$BaMoO_4$	3.54×10^{-8}	
$BaSO_3$	5.0×10^{-10}	
$BaSO_4$	1.08×10^{-10}	
$BaSeO_4$	3.40×10^{-8}	
$Be(OH)_2$ (α)	6.92×10^{-22}	
$BiAsO_4$	4.43×10^{-10}	
BiI_3	7.71×10^{-19}	
$Ca(IO_3)_2 \cdot 6H_2O$	7.10×10^{-7}	
$Ca(IO_3)_2$	6.47×10^{-6}	
$Ca(OH)_2$	5.02×10^{-6}	
$Ca_3(PO_4)_2$	2.07×10^{-33}	
$CaC_2O_4 \cdot H_2O$	2.32×10^{-9}	
$CaCO_3$ (calcite)	3.36×10^{-9}	
CaF_2	3.45×10^{-11}	
$CaMoO_4$	1.46×10^{-8}	
$CaSO_3 \cdot 0.5H_2O$	3.1×10^{-7}	
$CaSO_4 \cdot 2H_2O$	3.14×10^{-5}	
$CaSO_4$	4.93×10^{-5}	
$Cd(IO_3)_2$	2.5×10^{-8}	
$Cd(OH)_2$	7.2×10^{-15}	
$Cd_3(AsO_4)_2$	2.2×10^{-33}	
$Cd_3(PO_4)_2$	2.53×10^{-33}	
$CdC_2O_4 \cdot 3H_2O$	1.42×10^{-8}	
$CdCO_3$	1.0×10^{-12}	
CdF_2	6.44×10^{-3}	
CdS		8×10^{-7}
$Co(IO_3)_2 \cdot 2H_2O$	1.21×10^{-2}	
$Co(OH)_2$	5.92×10^{-15}	
$Co_3(AsO_4)_2$	6.80×10^{-29}	
$Co_3(PO_4)_2$	2.05×10^{-35}	
$CsClO_4$	3.95×10^{-3}	
$CsIO_4$	5.16×10^{-6}	
$Cu(IO_3)_2 \cdot H_2O$	6.94×10^{-8}	
$Cu_3(AsO_4)_2$	7.95×10^{-36}	
$Cu_3(PO_4)_2$	1.40×10^{-37}	
$CuBr$	6.27×10^{-9}	
CuC_2O_4	4.43×10^{-10}	
$CuCN$	3.47×10^{-20}	
$CuCl$	1.72×10^{-7}	
CuI	1.27×10^{-12}	
$CuSCN$	1.77×10^{-13}	
CuS		6×10^{-16}
$Eu(OH)_3$	9.38×10^{-27}	
$Fe(OH)_2$	4.87×10^{-17}	
$Fe(OH)_3$	2.79×10^{-39}	
$FeCO_3$	3.13×10^{-11}	
FeF_2	2.36×10^{-6}	
$FePO_4 \cdot 2H_2O$	9.91×10^{-16}	
FeS		6×10^{2}
$Ga(OH)_3$	7.28×10^{-36}	
$Hg_2(SCN)_2$	3.2×10^{-20}	
Hg_2Br_2	6.40×10^{-23}	
$Hg_2C_2O_4$	1.75×10^{-13}	
Hg_2CO_3	3.6×10^{-17}	

Formula	K_{sp}	K_{spa}
Hg_2Cl_2	1.43×10^{-18}	
Hg_2F_2	3.10×10^{-6}	
Hg_2I_2	5.2×10^{-29}	
Hg_2SO_4	6.5×10^{-7}	
$HgBr_2$	6.2×10^{-20}	
HgI_2 (red)	2.9×10^{-29}	
HgS (black)		2×10^{-32}
HgS (red)		4×10^{-33}
K_2PtCl_6	7.48×10^{-6}	
$KClO_4$	1.05×10^{-2}	
KIO_4	3.71×10^{-4}	
$La(IO_3)_3$	7.50×10^{-12}	
Li_2CO_3	8.15×10^{-4}	
Li_3PO_4	2.37×10^{-11}	
LiF	1.84×10^{-3}	
$Mg(OH)_2$	5.61×10^{-12}	
$Mg_3(PO_4)_2$	1.04×10^{-24}	
$MgC_2O_4 \cdot 2\,H_2O$	4.83×10^{-6}	
$MgCO_3 \cdot 3\,H_2O$	2.38×10^{-6}	
$MgCO_3 \cdot 5\,H_2O$	3.79×10^{-6}	
$MgCO_3$	6.82×10^{-6}	
MgF_2	5.16×10^{-11}	
$Mn(IO_3)_2$	4.37×10^{-7}	
$MnC_2O_4 \cdot 2\,H_2O$	1.70×10^{-7}	
$MnCO_3$	2.24×10^{-11}	
MnS (α)		3×10^{7}
$Nd_2(CO_3)_3$	1.08×10^{-33}	
$Ni(IO_3)_2$	4.71×10^{-5}	
$Ni(OH)_2$	5.48×10^{-16}	
$Ni_3(PO_4)_2$	4.74×10^{-32}	
$NiCO_3$	1.42×10^{-7}	
$Pb(IO_3)_2$	3.69×10^{-13}	
$Pb(OH)_2$	1.43×10^{-20}	
$PbBr_2$	6.60×10^{-6}	
$PbCO_3$	7.40×10^{-14}	
$PbCl_2$	1.70×10^{-5}	
PbF_2	3.3×10^{-8}	
PbI_2	9.8×10^{-9}	
$PbSO_4$	2.53×10^{-8}	
$PbSeO_4$	1.37×10^{-7}	
PbS		3×10^{-7}
$Pd(SCN)_2$	4.39×10^{-23}	
$Pr(OH)_3$	3.39×10^{-24}	
$Ra(IO_3)_2$	1.16×10^{-9}	
$RaSO_4$	3.66×10^{-11}	
$RbClO_4$	3.00×10^{-3}	
$Sc(OH)_3$	2.22×10^{-31}	
ScF_3	5.81×10^{-24}	
$Sn(OH)_2$	5.45×10^{-27}	
SnS		1×10^{-5}
$Sr(IO_3)_2 \cdot 6\,H_2O$	4.55×10^{-7}	
$Sr(IO_3)_2 \cdot H_2O$	3.77×10^{-7}	
$Sr(IO_3)_2$	1.14×10^{-7}	
$Sr_3(AsO_4)_2$	4.29×10^{-19}	
$SrCO_3$	5.60×10^{-10}	
SrF_2	4.33×10^{-9}	
$SrSO_4$	3.44×10^{-7}	
$Tl(OH)_3$	1.68×10^{-44}	
Tl_2CrO_4	8.67×10^{-13}	
$TlBrO_3$	1.10×10^{-4}	
TlBr	3.71×10^{-6}	
TlCl	1.86×10^{-4}	
$TlIO_3$	3.12×10^{-6}	
TlI	5.54×10^{-8}	
TlSCN	1.57×10^{-4}	
$Y(IO_3)_3$	1.12×10^{-10}	
$Y(OH)_3$	1.00×10^{-22}	
$Y_2(CO_3)_3$	1.03×10^{-31}	
YF_3	8.62×10^{-21}	
$Zn(IO_3)_2 \cdot 2\,H_2O$	4.1×10^{-6}	
$Zn(OH)_2$	3×10^{-17}	
$Zn_3(AsO_4)_2$	2.8×10^{-28}	
$ZnC_2O_4 \cdot 2\,H_2O$	1.38×10^{-9}	
$ZnCO_3 \cdot H_2O$	5.42×10^{-11}	
$ZnCO_3$	1.46×10^{-10}	
ZnF_2	3.04×10^{-2}	
$ZnSeO_3 \cdot H_2O$	1.59×10^{-7}	
ZnSe	3.6×10^{-26}	
ZnS (spharelite)		2×10^{-4}
ZnS (wurtzite)		3×10^{-2}