K_{sp}

To begin:

- Solubility (S)
- K_{sp} (Solubility product constant)

In a reaction: $(Cation)_n (Anion)_m(s) \Leftrightarrow n\ Cation(aq) + m\ Anion(aq)$:

K_{sp} or $Q = [Cation]^n [Anion]^m$

At a certain temperature: All salts have a given constant K_{sp}

If:

$Q = K_{sp}$: Solution is saturated

$Q > K_{sp}$: A solid precipitate is formed in the reaction

$Q < K_{sp}$: Solution is considered unsaturated

Solubility – Measure of how to make saturated solution

Either gram solubility (how many grams in a given volume) or MOLAR solubility (S, how many moles per liter of saturated solution)

Relationships between S and K_{sp}

1. Write an equation where the salt is dissolved and dissociated (review ions from previous chapters)
2. Write an expression to help solve for K_{sp}
3. Write out concentration in terms of S (you can get that by using stoichiometry)
4. Substitute the concentrations into the K_{sp} expression

Example:

Say you are given AgCl (K_{sp} value = $1.8*10^{-10}$) Determine the molar solubility

1) $AgCl(s) \Leftrightarrow Ag^+(aq) + Cl^-(aq)$
2) $Ksp = [Ag^+][Cl^-]$
3) $[Ag^+] = S, [Cl^-] = S$
4) $Ksp = S^2$

$1.8*10\text{^}(-10) = S^2$ so, $S=1.3*10^{-5}$

Solubility can also be expressed in g/L, but is mainly expressed in mol/L (M)

K_{sp} can also be used to predict whether or not a precipitate will form, but Q has to be greater than K_{sp}