AP Chemistry
Ms. Ye

Name _____
Date _____Block _____

Solubility Equilibrium

- Initially, when a solid is placed in water, it dissociates into ions: **$XY(s) \rightarrow X^+(aq) + Y^-(aq)$**
- As time continues, more of the solid dissolves and the [ions] begins to increase.
- When the concentration of ions increases, eventually there is a greater the chance that they will collide and reform the solid: **$XY(s) \leftarrow X^+(aq) + Y^-(aq)$**
- When it _____

$$XY(s) \rightleftharpoons X^+(aq) + Y^-(aq)$$

- Equilibrium Constant for Solubility-K_{sp}

$$K_{sp} = [X^+]^x [Y^-]^y$$

- The _____

  _____ of the substance.

- The value of Ksp tells you _____

  (how much it will dissolve and dissociate into ions).

  - A _____ means the substance is relatively

    _____ (not much will dissolve and dissociate into ions)

- We can still use ICE tables to solve Ksp problems.

Examples:

1) Consider the solubility equilibrium: **$AgI(s) \leftrightarrow Ag^+(aq) + I^-(aq)$** ($K_{sp} = 8.52 \times 10^{-17}$).
   a. Write the Ksp expression for this solubility equilibrium.

b. Calculate the solubility of AgI in pure water.

Common Ion Effect

- Instead of adding your solute to water, you're adding it to a solution that contains a common ion as your solute
- This means the **starting concentration of one of your ions will NOT be 0.**

c. Then calculate the new solubility of AgI in a solution containing 1.00×10^{-3} M NaI.

Ksp Problems

1. Write the corresponding solubility product expressions for each of the following solids:
   a. $Al(OH)_3$ b. $Ca_3(PO_4)_2$

2. The molar solubility of Ag_2SO_4 is 1.44×10^{-2} mol/L. Calculate the K_{sp} of this compound.

3. Calculate the molar solubility of $Co(OH)_3$ ($K_{sp} = 2.51 \times 10^{-43}$) in moles per Liter

4. Barium sulfate is a contrast agent for X-ray scans that are most often associated with the gastrointestinal tract. Calculate the mass of $BaSO_4$ that can dissolve in 100.0 mL of solution. The K_{sp} value for $BaSO_4$ is 1.5×10^{-9}.

5. Determine the solubility of lead(II) fluoride, PbF_2, $K_{sp} = 4.0 \times 10^{-8}$ in:
   a. 0.10 M $Pb(NO_3)_2$

   b. 0.010 M NaF

6. A 200.0 mL solution of 4.00×10^{-3} M $BaCl_2$ is added to a 600.0 mL solution of 8.00×10^{-3} M K_2SO_4. Assuming that the volumes are additive, will $BaSO_4$ ($K_{sp} = 1.08 \times 10^{-10}$) precipitate from this solution?

7. Will a precipitate of $Ca(OH)_2$ ($K_{sp} = 5.02 \times 10^{-6}$) form if 2.00 mL of 0.200 M NaOH is added to 1.00×10^3 mL of 0.100 M $CaCl_2$?