*AP Chemistry*

*Ksp Problems, Level 1*

The **solubility product** is just the equilibrium constant for the dissolving of a slightly soluble solid. Here are some examples:

 AgCl(s) ⇌ Ag+(aq) + Cl- (aq) Ksp = [Ag+][Cl-]

 MgF2(s) ⇌ Mg2+(aq) + 2 F-(aq) Ksp = [Mg2+][F-]2

Since the reactant is always a solid, there is no denominator on solubility equilibrium expressions. Assume that the denominator is always “1”.

There are two basic types of Ksp problems:

1. Give the solubility (also known as the concentration of a saturated solution), find the Ksp.
2. Given the Ksp, find the molarity or the concentration of a saturated solution (also known as the solubility) of the solid in question.

*Watch out—these problems all use different ways of*

General Problem-Solving Strategy

**List what you know.**

Write out the balanced ionization expression.

List known values. Identify the unknown(s).

**Set up the problem.**

Write the Ksp expression.

Write out the ICE table

**Estimate and calculate.**

Substitute and evaluate. Use sig figs.

*saying the same thing*!

1. The solubility of Agl is 1.34 x 10-5 M. Find the Ksp of AgI.

Model Calculation:

AgI(s) ⇌ Ag+(aq) + I-(aq)

I -- 0 0

C -- +x +x

E -- 1.34 x 10-5 1.34 x 10-5

Ksp = [Ag+][I-] = (1.34 x 10-5)2 = 1.80 x 10-10

1. The concentration of a saturated solution of barium chromate, BaCrO4, is 1.08 x 10-5 M. Calculate the Ksp of barium chromate.
2. Find the Ksp of iron(II) fluoride, FeF2, if a saturated solution is 8.39 x 10-3 M.

1. What is the Ksp of lead (II) hydroxide, Pb(OH)2, if a saturated solution has a concentration of 1.5 x 10-7 mol/L?
2. The Ksp of strontium oxalate, SrC2O4, is 1.58 x 10-7. Find the concentration of a saturated solution of strontium oxalate.

Model Calculation: SrC2O4(s) ⇌ Sr2+(aq) + C2O42-(aq)

 I -- 0 0

 C -- +x +x

 E -- x x

Ksp = [Sr2+][C2O42-]

1.58 x 10-7 = x2

X = 3.97 x 10-4 ∴ [Sr2+] = [C2O42-] = 3.97 x 10-4 M

1. If the Ksp of manganese(II) carbonate is 2.24 x 10-11, what is the solubility of MnCO3?
2. What will be the concentration of lead ions in a saturated solution of lead(II) sulfate, PbSO4? (The Ksp of lead(II) sulfate is 2.5 x 10-8).
3. What is the molarity of a saturated solution of cadmium hydroxide, Cd(OH)2? The Ksp of cadmium hydroxide is 7.2 x 10-15. (Note: Be careful! Write the balanced equation first, then set up your ICE table to correctly show the relative changes)

Answers

2. 1.17 x 10-10

3. 2.36 x 10-6

4. 1.4 x 10-20

6. 4.73 x 10-6 M

7. 1.6 x 10-4 M

8. 1.2 x 10-5 M