Solutions 9.7
The Solubility Product Constant, K_{sp}, and Predicting Precipitates
Worksheet

1) The solubility product constant, K_{sp}, for nickel (II) carbonate is 1.3×10^{-7} at 25°C.
   a. Write the balance chemical equation for this dissolving process.
   b. Write the equilibrium expression.
   c. Find the maximum molar concentration of all ions in solution and the molar solubility of the solution.

2) The solubility product constant, K_{sp}, for calcium hydroxide is 6.5×10^{-6} at 25°C.
   a. Write the balance chemical equation for this dissociation in water.
   b. Write the equilibrium expression.
   c. Find the molar concentration of all ions in this solution and the molar solubility of the solution.
   d. Calculate the maximum mass of calcium hydroxide that will dissolve in 100 mL of distilled water at 25°C.

3) A 250 mL saturated solution of silver chloride is prepared at 25°C. The solubility product constant, K_{sp}, for silver chloride is 1.8×10^{-10} at 25°C.
   a. Write the balance chemical equation for this dissolving process.
   b. Write the equilibrium expression.
   c. Find the molar concentrations of all ions in this solution and the molar solubility of the solution.
   d. What are the molar concentrations of all ions in a 500 mL saturated solution of silver chloride at 25°C?

4) At a certain temperature, 9.5×10^{-5} g of zinc carbonate will dissolve in 150 mL of water.
   a. Write the balanced chemical equation for the dissociation of zinc carbonate in water.
   b. Calculate the molar solubility of zinc carbonate in water at this temperature.
   c. Calculate the value of the solubility product constant, K_{sp}, for zinc carbonate at this temperature.

5) A 1.0 L saturated solution of zinc hydroxide is prepared, and the concentration of Zn^{2+} is measured to be 4.22×10^{-6} *M* at 25°C.
   a. Write the balanced chemical equation for the dissociation of zinc hydroxide in water.
   b. Calculate the molar concentration of OH^- in solution.
   c. Calculate the value of the solubility product constant, K_{sp}.
   d. Calculate the maximum mass of zinc hydroxide that will dissolve in 150 mL of distilled water at 25°C
   e. What is the molar concentration of Zn^{2+} if 200 mL of water evaporates from the solution?

6) The solubility product constant, K_{sp}, for barium sulfate is 1.1×10^{-10} at 25°C. Will a precipitate of $BaSO_4(s)$ form when 210 mL of 4.75×10^{-2} *M* $Ba(NO_3)_2$ is mixed with 315 mL of 0.450 *M* Li_2SO_4.

7) Find the solubility product constant for lead (II) iodide if the concentration of I^- is found to be 1.25×10^{-3} *M* when the solution is saturated.

8) Use the K_{sp} value obtained in question 7 to determine if a precipitate will form when 350 mL of 5.5×10^{-2} *M* lead (II) nitrate is mixed with 250 mL of 4.8×10^{-2} *M* sodium iodide.

9) Find the solubility product constant for copper (II) carbonate if the concentration of Cu^{2+} is found to be 1.5×10^{-6} *M* when the solution is saturated.

10) Use the K_{sp} value obtained in question 9 to determine if a precipitate will form when 325 mL of 0.50×10^{-6} *M* copper (II) nitrate is mixed with 325 mL of 0.50×10^{-6} *M* potassium carbonate.

11) If a 0.50 *M* solution of K_2SO_4 is slowly poured into a beaker containing 0.25 *M* barium nitrate and 0.30 *M* lead (II) nitrate at 25°C, what will be the first precipitate that forms? K_{sp} for barium sulfate is 1.1×10^{-10} and K_{sp} for lead (II) sulfate is 1.6×10^{-8}.

12) If a 0.50 *M* solution of KOH is slowly poured into a beaker containing 0.35 *M* magnesium nitrate and 0.032 *M* calcium nitrate at 25°C, what will be the first precipitate that forms? K_{sp} for calcium hydroxide is 6.5×10^{-6} and K_{sp} for magnesium hydroxide is 6.3×10^{-10}.