Chapter 17 – Practice Problems with Solubility and K_{sp} Name ___________________________

1. For each of the following solids,
   - write a balanced chemical equation for the equilibrium that would be established when the solid dissolves in water to form a saturated solution.
   - write the K_{sp} expression for each equilibrium

Solid	Balanced Equation	K_{sp}
barium carbonate	$BaCO_3(s) \leftrightarrows Ba^{2+}(aq) + CO_3^{2-}(aq)$	$K_{sp} = [Ba^{2+}][CO_3^{2-}]$
calcium chromate		$K_{sp} =$
silver sulfate		$K_{sp} =$
magnesium hydroxide		$K_{sp} =$

2. The following table contains some information about the solids from Question 1. Fill in the missing information in the table below.

Name	Molar Mass (g/mol)	Solubility of the Solid Compound (g/L)	Cation concentration in a saturated solution (*M*)	Anion concentration in a saturated solution (*M*)
barium carbonate	197.34	0.014	$[Ba^{2+}] = 7.1 \times 10^{-5}$	$[CO_3^{2-}] = 7.1 \times 10^{-5}$
calcium chromate	156.08	0.010	$[Ca^{2+}] =$	$[CrO_4^{2-}] =$
silver sulfate	311.80	4.8	$[Ag^{+}] =$	$[SO_4^{2-}] =$
magnesium hydroxide	58.32	0.0096	$[Mg^{2+}] =$	$[OH^{-}] =$

3. If you combine the K_{sp} information from Question 1 and the concentration of each ion (in units of *M*) from Question 2, you can calculate the value of K_{sp} for each solid. Show the set-up for your calculations in the space provided.

Name	Calculated value of K_{sp}
barium carbonate	$(7.1 \times 10^{-5})(7.1 \times 10^{-5}) = 5.0 \times 10^{-9}$
calcium chromate	
silver sulfate	
magnesium hydroxide	

4. Fill in the missing information in the table below.

Name	Formula	K_{sp}	Cation concentration in a saturated solution (M)	Anion concentration in a saturated solution (M)
barium carbonate	$BaCO_3$	5.0×10^{-9}	$[Ba^{2+}] = 7.1 \times 10^{-5}$	$[CO_3^{2-}] = 7.1 \times 10^{-5}$
calcium sulfate		2.4×10^{-5}	$[Ca^{2+}] =$	$[SO_4^{2-}] =$
silver carbonate		8.1×10^{-12}	$[Ag^{+}] =$	$[CO_3^{2-}] =$
zinc hydroxide		3.0×10^{-16}	$[Zn^{2+}] =$	$[OH^{-}] =$

5. Each of the following solids is more soluble in an acidic solution than it is in pure water. Write a balanced, net-ionic equation that shows why this occurs.

Formula	Equation that shows why the solid is more soluble in an acidic solution
PbF_2	$PbF_2 + 2\,H^+ \leftrightarrows Pb^{2+} + 2\,HF$
$Ni(OH)_2$	$Ni(OH)_2 + 2\,H^+ \leftrightarrows$
$CaCO_3$	$CaCO_3 + 2\,H^+ \leftrightarrows$
CuS	$CuS + 2\,H^+ \leftrightarrows$

6. In a certain experiment, 50.0 mL of 5.0×10^{-4} M $CaCl_2$ and 50.0 mL of 3.0×10^{-3} M KF are combined together in a beaker. (K_{sp} for $CaF_2 = 3.9 \times 10^{-11}$.)

(a) Calculate $[Ca^{2+}]$ and $[F^-]$ for the combined solution (100.0 mL total) in the beaker. Show your calculations below.

(b) Based on your answer to (a), calculate the value of Q. Show the set-up for your calculations below.

(c) A precipitate of CaF_2 (will won't) form in the beaker because the value of

Q is (less more) than the value of K_{sp}.