CHM152 Quiz 7 25 Pts Fall 2010 Name: Key

SHOW ALL WORK TO RECEIVE CREDIT.

1. Barium carbonate has a measured solubility of 4.04×10^{-5} *M* at 25°C. Determine K_{sp}.

$BaCO_3(s) \rightleftharpoons Ba^{2+} + CO_3^{2-}$

$K_{sp} = [Ba^{2+}][CO_3^{2-}]$

$K_{sp} = [4.04 \times 10^{-5}]^2 = 1.63 \times 10^{-9}$

2. It is found that the concentration of Pb^{2+} in a saturated solution of lead(II) chloride is 1.6×10^{-2} *M*. What is K_{sp} for $PbCl_2$?

$PbCl_2(s) \rightleftharpoons Pb^{2+} + 2Cl^-$

$K_{sp} = [Pb^{2+}][Cl^-]^2$

$K_{sp} = [1.6 \times 10^{-2}][2(1.6 \times 10^{-2})]^2 = 1.6 \times 10^{-5}$

3. The hydroxide-ion concentration of a saturated solution of $Cu(OH)_2$ is 8.0×10^{-7} *M*. What is the solubility product constant for $Cu(OH)_2$?

$Cu(OH)_2(s) \rightleftharpoons Cu^{2+} + 2OH^-$

$K_{sp} = [Cu^{2+}][OH^-]^2$

$K_{sp} = \left[\frac{8.0 \times 10^{-7}}{2}\right][8.0 \times 10^{-7}]^2 = 2.6 \times 10^{-19}$

4. Rank the following salts in order of increasing molar solubility.

	Salt	K_{sp}
2	$BaSO_4$	1.1×10^{-10}
3	AgCl	1.8×10^{-10}
4	$BaCO_3$	9.1×10^{-9}
Least → 1	CdS	8×10^{-27}
5	$PbSO_4$	1.8×10^{-8}

A) $CdS < AgCl < BaCO_3 < BaSO_4 < PbSO_4$

B) $PbSO_4 < BaCO_3 < AgCl < BaSO_4 < CdS$

C) $CdS < AgCl < BaSO_4 < BaCO_3 < PbSO_4$

D) $PbSO_4 < BaCO_3 < BaSO_4 < AgCl < CdS$

(E) $CdS < BaSO_4 < AgCl < BaCO_3 < PbSO_4$

************There are more problems on the back**************

Key

5. What is the hydroxide-ion concentration of a saturated solution of $Zn(OH)_2$? For $Zn(OH)_2$, $K_{sp} = 2.1 \times 10^{-16}$.

$Zn(OH)_2(s) \rightleftharpoons Zn^{2+} + 2OH^-$ $\quad K_{sp} = [Zn^{2+}][OH^-]^2$

	Zn^{2+}	OH^-
I.	0	0
C.	x	2x
E	x	2x

$K_{sp} = [x][2x]^2$

$2.1 \times 10^{-16} = 4x^3$

$x = [Zn^{2+}] = 3.7 \times 10^{-6}$

$2x = [OH^-] = 7.5 \times 10^{-6}$

6. What is the pH of a saturated solution of $Mg(OH)_2$? For $Mg(OH)_2$, $K_{sp} = 1.8 \times 10^{-11}$.

$Mg(OH)_2(s) \rightleftharpoons Mg^{2+} + 2OH^-$ $\quad K_{sp} = [Mg^{2+}][OH^-]^2$

Mg^{2+}	OH^-
0	0
x	2x

$1.8 \times 10^{-11} = (x)[2x]^2 = 4x^3$

$x = [Mg^{2+}] = 1.65 \times 10^{-4}$

$2x = [OH^-] = 3.3 \times 10^{-4}$

$pOH = -\log(3.3 \times 10^{-4}) = 3.48$ $\quad pH = 10.52$

7. What is the concentration of silver(I) ion in a saturated solution of silver(I) carbonate containing 0.0052 M Na_2CO_3? For Ag_2CO_3, $K_{sp} = 8.6 \times 10^{-12}$.

$Ag_2CO_3(s) \rightleftharpoons 2Ag^+ + CO_3^{2-}$ $\quad K_{sp} = [Ag^+]^2[CO_3^{2-}]$

	Ag^+	CO_3^{2-}
	0	0.0052
	2x	x
	2x	0.0052 + x

$8.6 \times 10^{-12} = [2x]^2[0.0052 + x]$

$x = 2.03 \times 10^{-5}$ $\quad 4.06 \times 10^{-5}$

$2x = [Ag^+] = 4.1 \times 10^{-5}$

8. Suppose 50.00 mL of 2.0×10^{-4} M $Fe(NO_3)_3$ is added to 50.00 mL of 2.0×10^{-4} M KIO_3. Which of the following statements is true? For $Fe(IO_3)_3$, $K_{sp} = 1.0 \times 10^{-14}$.

A) A precipitate forms because $Q_c > K_{sp}$.
B) A precipitate forms because $Q_c < K_{sp}$.
C) No precipitate forms because $Q_c > K_{sp}$.
(D) No precipitate forms because $Q_c < K_{sp}$.
E) Nothing happens.

$Fe(IO_3)_3(s) \rightleftharpoons Fe^{3+} + 3IO_3^-$

$Q_{sp} = [Fe^{3+}][IO_3^-]^3$

$Q_{sp} = [1.0 \times 10^{-4}][1.0 \times 10^{-4}]^3$

$Q_{sp} = 1.0 \times 10^{-16}$

TAKE dilution into account. $\longrightarrow$

$M_1V_1 = M_2V_2$

$(2.0 \times 10^{-4})(50.00\,mL) = M_2(100.00\,mL)$

$Q_{sp} < K_{sp}$