AP Chem Chapter 16 Quiz **Name:** CALVIN **Date:** **Hour:**

1) Write solubility product expressions for the following salts:

a. $PbSO_4$ $K_{sp} = [Pb^{2+}][SO_4^{2-}]$

b. $Ca_3(PO_4)_2$ $K_{sp} = [Ca^{2+}]^3[PO_4^{3-}]^2$

c. CuS $K_{sp} = [Cu^{2+}][S^{2-}]$

d. CaF_2 $K_{sp} = [Ca^{2+}][F^-]^2$

2) The molar solubility of PbI_2 is 1.52×10^{-3} *M*. Calculate the value of K_{sp} for PbI_2.

A) 3.51×10^{-9}
B) 4.62×10^{-6}
C) 1.40×10^{-8}
D) 1.52×10^{-3}
E) none of these

$PbI_{2(s)} \rightleftharpoons Pb^{2+}_{(aq)} + 2I^-_{(aq)}$

I	S	0	0
C	-S	+S	+2S
E	0	1.52×10^{-3}	3.04×10^{-3}

$K_{sp} = (1.52 \times 10^{-3})(3.04 \times 10^{-3})^2 = \boxed{1.40 \times 10^{-8}}$

3) The concentration of OH^- in a saturated solution of $Mg(OH)_2$ is 3.63×10^{-4} *M*. The K_{sp} of $Mg(OH)_2$ is

A) 6.6×10^{-8}
B) 4.8×10^{-11}
C) 1.3×10^{-7}
D) 3.6×10^{-4}
E) 2.4×10^{-11}

$Mg(OH)_{2(s)} \rightleftharpoons Mg^{2+}_{(aq)} + 2OH^-_{(aq)}$

I	S	0	0
C	-S	+S	+2S
E	0	1.82×10^{-4}	3.63×10^{-4}

$K_{sp} = (1.82 \times 10^{-4})(3.63 \times 10^{-4})^2 = \boxed{2.4 \times 10^{-11}}$

4) Calculate the concentration of the silver ion in a saturated solution of silver chloride, AgCl ($K_{sp} = 1.57 \times 10^{-10}$).

A) 1.57×10^{-10}
B) 1.25×10^{-5}
C) 2.46×10^{-20}
D) 3.14×10^{-10}
E) none of these

$AgCl_{(s)} \rightleftharpoons Ag^+_{(aq)} + Cl^-_{(aq)}$

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$K_{sp} = s^2 = 1.57 \times 10^{-10}$

$s = \boxed{1.25 \times 10^{-5}}$

5) Calculate the concentration of Al^{3+} in a saturated aqueous solution of $Al(OH)_3$ ($K_{sp} = 2.2 \times 10^{-32}$).

A) 7.0×10^{-9}
B) 2.0×10^{-34}
C) 1.2×10^{-8}
D) 8.1×10^{-34}
E) 5.3×10^{-9}

$Al(OH)_{3(s)} \rightleftharpoons Al^{3+}_{(aq)} + 3OH^-_{(aq)}$

I	S	0	0
C	-S	+S	+3S
E	0	S	3S

$K_{sp} = (S)(3S)^3 = 2.2 \times 10^{-32}$ $\quad S = 5.3 \times 10^{-9}$

(For #6) Solubility Products (K_{sp})

$BaSO_4$	1.5×10^{-9}
CoS	5.0×10^{-22}
$PbSO_4$	1.3×10^{-8}
AgBr	5.0×10^{-13}
$BaCO_3$	1.6×10^{-9}

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6) Which of the following compounds is the most soluble (in moles/liter)?

A) $BaSO_4$
B) CoS
C) $PbSO_4$
D) AgBr
E) $BaCO_3$

7) What is the relationship for Al_2S_3? $K_{sp} = [Al^{3+}]^2[S^{2-}]^3 = (2S)^2(3S)^3 = 108\,S^5$

8) What is the relationship for Ag_3PO_4? $K_{sp} = [Ag^+]^3[PO_4^{3-}] = (3S)^3(S) = 27\,S^4$

9) The $[F^-]$ in a saturated solution of BaF_2 is 1.5×10^{-2} M. What is the K_{sp} of BaF_2?

$BaF_{2(s)} \rightleftharpoons Ba^{2+}_{(aq)} + 2F^-_{(aq)}$

I	S	0	0
C	-S	+S	+2S
E	0	7.5×10^{-3} M	1.5×10^{-2} M

$K_{sp} = (7.5 \times 10^{-3})(1.5 \times 10^{-2})^2 = 1.69 \times 10^{-6}$

10) The K_{sp} of ZnS is 2.0×10^{-25}. What is the molar solubility of ZnS in 0.10 M K_2S?

$ZnS_{(s)} \rightleftharpoons Zn^{2+}_{(aq)} + S^{2-}_{(aq)}$ $\quad K_{sp} = (s)(0.10) = 2.0\times10^{-25}$

I	s	0	0.10
C	-s	+s	+s
E	0	s	0.10 + ~~s~~

$s = 2.0\times10^{-24}$

11) If the molar solubility of silver iodide is 1.22×10^{-8} M, what is the solubility product for AgI?

$AgI_{(s)} \rightleftharpoons Ag^{+}_{(aq)} + I^{-}_{(aq)}$ $\quad K_{sp} = (1.22\times10^{-8})^2$

I	~~s~~	0	0
C	~~-s~~	+s	+s
E	~~0~~	1.22×10^{-8}	1.22×10^{-8}

$K_{sp} = 1.49\times10^{-16}$ M

12) What is the concentration of CrO_4^{2-} in a saturated solution of $PbCrO_4$? $K_{sp} = 1.8 \times 10^{-14}$?

$PbCrO_{4(s)} \rightleftharpoons Pb^{2+}_{(aq)} + CrO_4^{2-}_{(aq)}$ $\quad K_{sp} = s^2 = 1.8\times10^{-14}$

I	~~s~~	0	0
C	~~-s~~	+s	+s
E	~~0~~	s	s

$s = 1.34\times10^{-7}$ M

13) What is the $[Mg^{2+}]$ in a saturated solution of magnesium fluoride, MgF_2 if its solubility product constant is 6.4×10^{-9}? The solution also contains 0.30 M sodium fluoride?

$MgF_{2(s)} \rightleftharpoons Mg^{2+}_{(aq)} + 2F^{-}_{(aq)}$ $\quad K_{sp} = (s)(0.30)^2 = 6.4\times10^{-9}$

I	~~s~~	0	0.30
C	~~-s~~	+s	+2s
E	~~0~~	s	0.30 + ~~2s~~

$s = 7.1\times10^{-8}$ M

Go Vikings!!