Solubility Key

1. Write the reaction and K_{sp} expression for barium sulfate.

   $BaSO_4(s) \leftrightarrows Ba^{2+}(aq) + SO_4^{2-}(aq)$ $\quad\quad$ $Ksp = [Ba^{2+}][SO_4^{2-}]$

2. The K_{sp} for calcium fluoride is 3.9×10^{-11}. Calculate its solubility. Write the reaction for full credit.

   $CaF_2(s) \leftrightarrows Ca^{2+}(aq) + 2\ F^-(aq)$

   $Ksp = (x)(2x)^2 = 4x^3 = 3.9 \times 10^{-11}$ $\quad$ solve $x = 2.1363 \times 10^{-4}$ mol/L
   Now turn molar solubility into solubility $\quad 2.1363 \times 10^{-4}$ mol/L (78.078 g/mol) = 0.017 g/mol

3. Calculate the molar solubility of calcium fluoride in a solution containing 0.010M calcium nitrate. Write the reaction for full credit.

   $CaF_2(s) \leftrightarrows Ca^{2+}(aq) + 2\ F^-(aq)$ $\quad\quad$ $Kxp = 3.9 \times 10^{-11} = (.010)(2x)^2 = 0.04x^2$

I	**-**	**0.010**	**0**
C	**-**	**x**	**2x**
E	**-**	**(.010+x)**	**(2x)**

   $x = 3.1 \times 10^{-5}$ mol/L

4. Will a precipitate form if 0.10 L of 8.0×10^{-3}M lead(II) nitrate is added to 0.40 L of 5.0×10^{-3}M sodium sulfate? Write all balanced reactions for full credit.

   $Pb(NO_3)_2(aq) + Na_2SO_4(aq) \rightarrow 2\ NaNO_3(aq) + PbSO_4(s)$

   The precipitate ion molarities are needed to see if they exceed Ksp or not
   $[Pb^{2+}] = .10L\ (8.0 \times 10^{-3}mol/L) = .00080$ moles / .50L = .0016M
   $[SO_4^{2-}] = .40L\ (5.0 \times 10^{-3}mol/L) = .0020$ moles / .50L = .0040M

   $PbSO_4(s) \leftrightarrows Pb^{2+}(aq) + SO_4^{2-}(aq)$

   $Q = (.0016)(.0040) = 6.4 \times 10^{-6}$ $\quad$ but $\quad Ksp = 1.8 \times 10^{-8}$ $\quad$ so Q > Ksp so solid ppt forms