AP Worksheet 7d (Solubility and K_{sp})

1. Write balanced net ionic equations for the reactions that occur when the following solutions are mixed. If no precipitation occurs, write "no reaction." (Hint – you may need to refresh your memory of solubility rules from unit 4.)
    a. Lead (II) nitrate and hydrochloric acid

    b. Silver nitrate and lithium hydroxide

    c. Copper (II) sulfate and potassium carbonate

2. $Ca_3(PO_4)_2$ has a solubility of 7.1×10^{-7} M in pure water.
    a. Write the equation for the dissolution of calcium phosphate in water.

    b. Write the solubility product expression.

    c. Calculate the K_{sp} value for calcium phosphate. *1.8×10^{-29}*

3. The K_{sp} of BaF_2 is 1.7×10^{-6}.
    a. What is its solubility in moles per liter? *0.0075 M*

    b. Grams per liter? *1.3 g/L*

4. Silver chloride has a larger K_{sp} than silver carbonate ($K_{sp} = 1.8 \times 10^{-10}$ and 8.1×10^{-12} respectively). Does this mean that AgCl has a larger molar solubility than Ag_2CO_3? Explain.

5. **Optional challenge** A volume of 75 mL of 0.060 M NaF is mixed with 25 mL of 0.15 M $Sr(NO_3)_2$. Calculate the concentrations in the final solution of NO_3^-, Na^+, Sr^{2+}, and F^-. (K_{sp} for $SrF_2 = 2.0 \times 10^{-10}$) (Ignore any common ion effect) *0.076 M, 0.045 M, 0.015 M, 7.4×10^{-4} M*

6. The K_{sp} of calcium carbonate is 4.9×10^{-9}. Calculate the solubility of calcium carbonate in 0.010 M sodium carbonate solution. *4.9×10^{-7} M*

7. CrO_4^{2-} is added to a solution in which the original concentration of Sr^{2+} is 1.0×10^{-3} M. Assuming the concentration of Sr^{2+} stays constant, will a precipitate of $SrCrO_4$ ($K_{sp} = 3.6 \times 10^{-5}$) form when $[CrO_4^{2-}] = 3.0 \times 10^{-5}$ M?

8. A solution contains 1.0×10^{-4} M Pb^{2+} and 2.0×10^{-3} M Sr^{2+}. If a source of SO_4^{2-} is added to this solution, will $PbSO_4$ ($K_{sp} = 6.3 \times 10^{-7}$) or $SrSO_4$ ($K_{sp} = 3.4 \times 10^{-7}$) precipitate first? Specify the concentration of SO_4^{2-} necessary to begin precipitation of each salt.

    $[SO_4^{2-}] = 6.3 \times 10^{-3}$ M for $PbSO_4$; $[SO_4^{2-}] = 1.7 \times 10^{-4}$ M for $SrSO_4$