1a. Define the terms *precipitation* and *solubility*.

b. Write a chemical equation and a net ionic equation for a reaction that forms a precipitate.

c. Write the solubility equation for the precipitate formed above.

2a. Using the solubility table below predict whether the following compounds are soluble or insoluble in water.

Solubility Table

Ion	Solubility	Exceptions
NO_3^-	soluble	none
ClO_4^-	soluble	none
Cl^-	soluble	except Ag^+, Hg_2^{2+}, $*Pb^{2+}$
I^-	soluble	except Ag^+, Hg_2^{2+}, Pb^{2+}
SO_4^{2-}	soluble	except Ca^{2+}, Ba^{2+}, Sr^{2+}, Hg^{2+}, Pb^{2+}, Ag^+
CO_3^{2-}	insoluble	except Group IA and NH_4^+
PO_4^{3-}	insoluble	except Group IA and NH_4^+
^-OH	insoluble	except Group IA, $*Ca^{2+}$, Ba^{2+}, Sr^{2+}
S^{2-}	insoluble	except Group IA, IIA and NH_4^+
Na^+	soluble	none
NH_4^+	soluble	none
K^+	soluble	none

*slightly soluble

Soluble/Insoluble

a) AgI
b) $(NH_4)_2SO_4$
c) $Cu(OH)_2$

3. Complete and balance the following reactions. Identify all products phases as either (g)as, (l)iquid, (s)olid or (aq)ueous. If no reaction occurs, write NR.

   a) $Na_2SO_{4(aq)} + Ba(NO_3)_{2(aq)} \rightarrow$

   b) $AgNO_{3(aq)} + KCl_{(aq)} \rightarrow$

   c) $Fe(NO_3)_{3(aq)} + HCl_{(aq)} \rightarrow$

   d) $\mathbf{2}NH_4I_{(aq)} + Pb(NO_3)_{2(aq)} \rightarrow$

4. Write the equilibrium expression for the reaction described by the general solubility equation below,

$$M_nX_{m(s)} \rightarrow nM^{m+}{}_{(aq)} + mX^{n-}{}_{(aq)}$$

5. Define the term *solubility product constant*.

6. Complete the following problem:

a. Calculate the K_{sp} for $Bi(OH)_3$ if 1.1×10^{-8} moles of $Bi(OH)_3$ dissolve in 1.0 liter of water to form a saturated solution.

Ans: $K_{sp} = 4.0 \times 10^{-31}$

7. Complete the following problem:

a. Calculate the solubility of $BaSO_4$ in H_2O. $K_{sp} = 1.1 \times 10^{-10}$.

Solubility = 1×10^{-5} M

8. Complete the following problem:

a. Calculate the solubility of $BaSO_4$ in 0.100 M Na_2SO_4.

Solubility = 1.1 x 10^{-9} M

9. Complete the following problem;

a. A 50.0 mL sample of 0.0152 M Na_2SO_4 is added to 50.0 mL of 0.0125 M $Ca(NO_3)_2$.

i) Should precipitation of $CaSO_4$ occur?

ii) What % of the Ca^{2+} will precipitate?

% Ca^{2+} remaining = 38 %

10a. Under what circumstances will the solubility of an ionic compound be dependent on the pH of the solution?

b. Give two examples of ionic compounds that are more soluble in acidic solutions than basic solutions.

c. Give two examples of ionic compounds that are more soluble in basic solutions than acidic solutions.

PS.1. Complete and balance the following reactions. Identify all products phases as either (g)as, (l)iquid, (s)olid or (aq)ueous. If no reaction occurs, write NR.

a) $Na_2CO_{3(aq)} + Ca(NO_3)_{2(aq)} \rightarrow$

b) $AgNO_{3(aq)} + KBr_{(aq)} \rightarrow$

c) $\mathbf{3}NaOH_{(aq)} + Al(NO_3)_{3(aq)} \rightarrow$

d) $(NH_4)_2S_{(aq)} + Pb(NO_3)_{2(aq)} \rightarrow$

PS.2. Calculate K_{sp} for the following salts using the information provided.

a) The concentration of $CrO_4^{2-}{}_{(aq)}$ in a saturated solution of Ag_2CrO_4 is 6.50×10^{-5} M.

$K_{sp} = 1.10 \times 10^{-12}$

b) The solubility of $AgBrO_3$ in water is 7.2×10^{-2} g/L.

$K_{sp} = 9.32 \times 10^{-8}$

c) A sample of a saturated solution of $PbSO_4$ contains .0262 g/L of Pb^{2+}.

$K_{sp} = 1.61 \times 10^{-8}$

PS.3. Calculate the solubility of the following compounds in water. (Use a table of solubility product constants in your text or some other reference book.)

a) $BaCO_3$

Solubility = 7.1×10^{-5} M

b) AuCl

c) $AuCl_3$

solubility = 3.3 x 10^{-7} M

d) $Cu_3(PO_4)_2$

solubility = 1.6 x 10^{-8} M

PS.4. Calculate the solubility of;

a) $BaCO_3$ in 0.500 M $Ba(NO_3)_2$

solubility= 1.02 x 10^{-8} M

b) $PbCl_2$ in 0.0250 M $CaCl_2$

solubility = 6.4 x 10^{-3} M

c) $Cu_3(PO_4)_2$ in 0.200 M $Cu(NO_3)_2$

solubility = 2.01 x 10^{-18} M

PS29.10. A 45 mL sample of 0.015 M calcium chloride is added to 55 mL of 0.010 M sodium sulfate. Is a precipitate expected? Explain. (Your answer must include a calculation!)

A precipitate of $CaSO_4$ will form.