1. What is the definition of an Arrhenius acid and base? What is the definition of a Brønstedt-Lowry acid and base? Give an example of a Brønstedt-Lowry base that is not an Arrhenius acid.

2. Write balanced complete ionic and net ionic equations for each acid/base reaction:

   a. $HI(aq) + Ca(OH)_2 \rightarrow$

   b. $H_2SO_4(aq) + NaOH(aq) \rightarrow$

   c. $Al(OH)_3(s) + HNO_3(aq) \rightarrow$

   d. $KOH(aq) + HCHO_2(aq) \rightarrow$

   e. $NaHSO_4(aq) + NaOH(aq) \rightarrow$

   f. $Na_2HPO_4(aq) + NaOH(aq) \rightarrow$

   g. $Na_2HPO_4(aq) + HCl(aq) \rightarrow$

   h. $H_3AsO_4(aq) + NH_3(aq) \rightarrow$

3. Write balanced complete ionic and net ionic equations for each acid/base reaction:

   a. Reaction of aqueous phosphorous acid and aqueous sodium hydroxide

   b. Reaction of aqueous hydrocyanic acid and aqueous barium hydroxide

   c. Reaction of aqueous nitrous acid and solid chromium(III)hydroxide

   d. Reaction of solid magnesium carbonate with aqueous perchloric acid

4. A 25.00 mL sample of an unknown perchloric acid solution requires titration with 22.62 mL of 0.2000M NaOH to reach the equivalence point. Provide the balanced molecular equation and calculate the concentration of the unknown perchloric acid solution.

5. A 30.00 mL sample of an unknown phosphoric acid solution is titrated with a 0.100 M sodium hydroxide solution. The equivalence point is reached when

26.38mL sodium hydroxide solution is added. Provide the balanced molecular equation and calculate the concentration of the unknown phosphoric acid solution.

6. An acid solution is 0.100 M in HCl and 0.200 M in H_2SO_4. What volume of a 0.150 M KOH solution would completely neutralize all the acid in 500.0 mL of this solution?

7. A solid sample of $Zn(OH)_2$ is added to 0.350 L of 0.500 M aqueous HBr. The solution that remains is still acidic. It is then titrated with 0.500 M NaOH solution and it takes 88.5 mL of the NaOH solution to reach the equivalence point. What mass of $Zn(OH)_2$ was added to the HBr solution?

8. By titration, 15.0 mL of 0.1008M sodium hydroxide is needed to neutralize a 0.2053 g sample of a weak acid. The weak acid is monoprotic.

   a. What is the molar mass of the sample?

   b. An elemental analysis of the acid indicates that it is composed of 5.89% H, 70.6% C and 23.5% O by mass. What is its molecular formula?

9. A sample of 7.75 g of $Mg(OH)_2$ is added to 25.0 mL of 0.200 M HNO_3.
   a. Write the chemical equation for the reaction that occurs
   b. Which is the limiting reactant in the reaction?
   c. How many moles of $Mg(OH)_2$, HNO_3 and $Mg(NO_3)_2$ are present after the reaction is complete?