Chapter 4 Study Questions

1. Classify each of the following substances as: 1) acid, base, or neutral, and 2) strong or weak. Then 3) write a balanced equation for the *ionization* of the substance in water:
   a) HNO_3 b) $HClO$ c) NH_3 d) $NaNO_3$ e) $Ba(OH)_2$

2. A common method of preparing solutions is to make up a concentrated solution and then dilute it to the desired concentration.
   a) What is the molarity of a solution prepared by dissolving 29.2 g NaCl in enough water to make 0.250 liters of solution?
   b) What volume of the above solution is needed to make 125 ml of a 0.350 M NaCl solution?

3. What mass of glucose $(C_6H_{12}O_6)$ is needed to prepare 200.0 ml of a 2.50 M glucose solution?

4. Solid magnesium is added to 125 ml of 2.00 M hydrochloric acid to produce dissolved magnesium chloride and hydrogen gas.
   a) Write a balanced equation for this reaction.
   b) If excess magnesium is added, how many moles of hydrogen gas are produced?

5. Indicate whether a precipitate will form when the following solutions are mixed. If a precipitate forms, write a *net ionic* equation for the reaction.
   a) iron(III) nitrate and potassium hydroxide
   b) ammonium chloride and lithium carbonate
   c) sodium sulfide and nickel(II) sulfate

6. Name two solutions which could be mixed to form strontium sulfate.

7. Write a balanced *net ionic* equation for the acid-base reaction between HNO_3 with KOH.

8. How many ml of 2.00 M NaOH would be required to neutralize 12.5 ml of 0.0800 M HBr?

9. When solutions of lead(II) nitrate and aluminum chloride are mixed, a precipitate forms.
   a) Write a balanced *formula* equation for the reaction.
   b) What volume of a 0.200 M lead(II) nitrate solution is needed to completely form a precipitate when added to 2.48 mL of 0.300 M aluminum chloride?
   c) What is the mass of precipitate formed in (b)?

10. What mass of precipitate is formed when 71.3 mL of 0.500 M iron(III) nitrate are mixed with 112 mL of 0.800 M sodium carbonate?

11. How many ml of 2.50 M HNO_3 contain enough nitric acid to dissolve an old copper penny with a mass of 3.94 grams?
    $$3\ Cu(s)\ +\ 8\ HNO_3(aq)\ \rightarrow\ 3\ Cu(NO_3)_2(aq)\ +\ 2\ NO(g)\ +\ 4\ H_2O$$

Summary of Chapter 4: Chemical Reactions in Water Solutions

solute, solvent, solubility
electrolytes & nonelectrolytes
strong vs. weak electrolytes
ionization equations
molarity
calculations involving molarity
    finding the molarity of a solution
    using molarity as a conversion factor
    solution preparation
    dilution: $\mathbf{V_1 \times M_1 \;=\; V_2 \times M_2}$
precipitation reactions
    reading a solubility table
formula equations
complete ionic equations
net ionic equations
stoichiometry of precipitation reactions
acid-base reactions