Chapters 7 Study Questions

1. Describe <u>three</u> observations that frequently accompany chemical reactions and explain why they might indicate that a chemical reaction is occuring.

2. Balance the following equations:
   a) the reaction between iron and oxygen to form iron(III) oxide,
      $Fe(s) + O_2(g) \rightarrow Fe_2O_3(s)$
   b) the combustion of the rocket fuel diborane,
      $B_2H_6(l) + O_2(g) \rightarrow B_2O_3(s) + H_2O(l)$
   c) the combustion of the poisonous gas, PH_3,
      $PH_3(g) + O_2(g) \rightarrow H_2O(l) + P_4O_{10}(s)$

3. In the balanced equation for *2c* above
   a) What are the reactants? b) What are the products? c) What is the coefficient for water?

4. Write a balanced equation for each of the following reactions:
   a) the reaction of lithium with nitrogen gas to form lithium nitride.
   b) the reaction of propane (C_3H_8) gas with oxygen to form carbon dioxide and water.

5. Sodium carbonate and iron(III) chloride react to form a precipitate.
   a) Write a balanced molecular equation for this reaction.
   b) Write a balanced net ionic equation for this reaction.

6. Decide 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

7. For each of the following equations
   i. indicate whether it is a combustion (C), synthesis (S), decomposition (D), single displacement (SD), or double displacement (DD)
   ii. indicate which reactions are oxidation-reductions (OR), precipitations (P) or acid-base (AB) reactions.
   iii. predict the products and record their formulas. If no reaction occurs, write "NR." (Use Tables as needed to help you decide if a reaction occurs.)
   iv. balance the equation.

   a) $Li(s) + Cl_2(g) \rightarrow$
   b) $Sr(NO_3)_2(aq) + K_2SO_4(aq) \rightarrow$
   c) $C_3H_6(g) + O_2(g) \rightarrow$
   d) $CaCl_2(aq) + NaNO_3(aq) \rightarrow$
   e) $Fe(s) + MgSO_4(aq) \rightarrow$
   f) $KI(l) \rightarrow$
   g) $Al(s) + HCl(aq) \rightarrow$
   h) $HNO_3(aq) + KOH(aq) \rightarrow$

8. Write a chemical equation for the ionization of iron(III) nitrate when it dissolves in water.

Summary of Chapter 7: Chemical Reactions

chemical reactions
chemical equations
reactants, products
coefficients
writing and balancing chemical equations
predicting whether a reaction will occur
precipitation reactions
using a solubility table
predicting whether a precipitate occurs
writing equations for precipitation reactions
molecular equations
net ionic equations
acid-base reactions
double displacement reactions
    precipitation reactions
    acid-base reactions
oxidation-reduction reactions
    synthesis (combination)
    decomposition
    combustion reactions
    single displacement reactions

Answers to Chapters 7 Study Questions

1. Chemical reactions are frequently accompanied by:
   a) bubbles which show that a gas is one of the products of the reaction.
   b) heat changes; heat is evolved in exothermic reactions; heat is used up in endothermic reactions. Exothermic reactions also often result in the production of light and sound.
   c) color changes which often signify a change in chemical composition.
   d) the formation of a precipitate which represents the formation of an insoluble ionic compound from soluble ionic compounds.

2. a) **4** $Fe(s)$ + **3** $O_2(g)$ → **2** $Fe_2O_3(s)$

   b) $B_2H_6(l)$ + **3** $O_2(g)$ → $B_2O_3(s)$ + **3** $H_2O(l)$

   c) **4** $PH_3(g)$ + **8** $O_2(g)$ → **6** $H_2O(l)$ + $P_4O_{10}(s)$

3. a) $PH_3(g)$ and $O_2(g)$ b) $H_2O(l)$ and $P_4O_{10}(s)$ c) 6

4. a) 6 $Li(s)$ + $N_2(g)$ → 2 $Li_3N(s)$

   b) $C_3H_8(g)$ + 5 $O_2(g)$ → 3 $CO_2(g)$ + 4 $H_2O(l)$

5. a) 3 $Na_2CO_3(aq)$ + 2 $FeCl_3(aq)$ → 6 $NaCl(aq)$ + $Fe_2(CO_3)_3(s)$

   b) 2 $Fe^{3+}(aq)$ + 3 $CO_3^{2-}(aq)$ → $Fe_2(CO_3)_3(s)$

6. a) $Fe^{3+}(aq)$ + 3 $OH^-(aq)$ → $Fe(OH)_3(s)$

   b) No Reaction ($(NH_4)_2CO_3$ and LiCl are both soluble)

   c) $Ni^{2+}(aq)$ + $S^{2-}(aq)$ → $NiS(s)$

7. a) S, OR; 2 $Li(s)$ + $Cl_2(g)$ → 2 $LiCl(s)$
   b) DD, P; $Sr(NO_3)_2(aq)$ + $K_2SO_4(aq)$ → 2 $KNO_3(aq)$ + $SrSO_4(s)$
   c) C, OR; 2 $C_3H_6(g)$ + 9 $O_2(g)$ → 6 $CO_2(g)$ + 6 $H_2O(l)$
   d) DD; $CaCl_2(aq)$ + 2 $NaNO_3(aq)$ → No reaction (all products are soluble)
   e) SD, OR; $Fe(s)$ + $MgSO_4(aq)$ → No reaction (Mg is more active than Fe)
   f) D, OR; 2 $KI(l)$ → 2 $K(s)$ + $I_2(s)$
   g) SD, OR; 2 $Al(s)$ + 6 $HCl(aq)$ → 3 $H_2(g)$ + 2 $AlCl_3(aq)$
   h) DD, AB; $HNO_3(aq)$ + $KOH(aq)$ → $H_2O(l)$ + $KNO_3(aq)$

8. $Fe(NO_3)_3(s)$ → $Fe^{3+}(aq)$ + 3 $NO_3^-(aq)$