CHAPTER 8 REVIEW

Chemical Equations and Reactions

SECTION 1

SHORT ANSWER Answer the following questions in the space provided..

1. Match the symbol on the left with its appropriate description on the right.

_____ $\xrightarrow{\Delta}$ **(a)** A precipitate forms.

_____ $\downarrow$ **(b)** A gas forms.

_____ $\uparrow$ **(c)** A reversible reaction occurs.

_____ (l) **(d)** Heat is applied to the reactants.

_____ (aq) **(e)** A chemical is dissolved in water.

_____ $\rightleftarrows$ **(f)** A chemical is in the liquid state.

2. Finish balancing the following equation:

$3Fe_3O_4 +$ _____ $Al \rightarrow$ _____ $Al_2O_3 +$ _____ Fe

3. In each of the following formulas, write the total number of atoms present.

_____ **a.** $4SO_2$

_____ **b.** $8O_2$

_____ **c.** $3Al_2(SO_4)_3$

_____ **d.** $6 \times 10^{23} HNO_3$

4. Convert the following word equation into a balanced chemical equation:
aluminum metal + copper(II) fluoride → aluminum fluoride + copper metal

_____

5. One way to test the salinity of a water sample is to add a few drops of silver nitrate solution with a known concentration. As the solutions of sodium chloride and silver nitrate mix, a precipitate of silver chloride forms, and sodium nitrate is left in solution. Translate these sentences into a balanced chemical equation.

_____

6. a. Balance the following equation: $NaHCO_3(s) \xrightarrow{\Delta} Na_2CO_3(s) + H_2O(g) + CO_2(g)$

_____

SECTION 1 continued

    b. Translate the chemical equation in part **a** into a sentence.

_____

_____

_____

_____

7. The poisonous gas hydrogen sulfide, H_2S, can be neutralized with a base such as sodium hydroxide, NaOH. The unbalanced equation for this reaction follows:

$$NaOH(aq) + H_2S(g) \rightarrow Na_2S(aq) + H_2O(l)$$
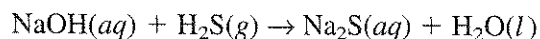
A student who was asked to balance this equation wrote the following:

$$Na_2OH(aq) + H_2S(g) \rightarrow Na_2S(aq) + H_3O(l)$$
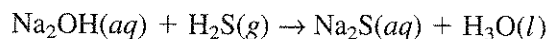
Is this equation balanced? Is it correct? Explain why or why not, and supply the correct balanced equation if necessary.

_____

_____

_____

_____

PROBLEM Write the answer on the line to the left. Show all your work in the space provided.

8. Recall that coefficients in a balanced chemical equation give relative amounts of moles as well as numbers of molecules.

_____ **a.** Calculate the number of moles of CO_2 that form if 10 mol of C_3H_4 react according to the following balanced equation:

$$C_3H_4 + 4O_2 \rightarrow 3CO_2 + 2H_2O$$
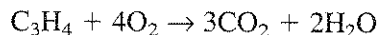
_____ **b.** Calculate the number of moles of O_2 that are consumed.

          MODERN CHEMISTRY

CHAPTER 8 REVIEW
Chemical Equations and Reactions

SECTION 2

SHORT ANSWER Answer the following questions in the space provided.

1. Match the equation type on the left to its representation on the right.

_____ synthesis

(a) $AX + BY \rightarrow AY + BX$

_____ decomposition

(b) $A + BX \rightarrow AX + B$

_____ single-displacement

(c) $A + B \rightarrow AX$

_____ double-displacement

(d) $AX \rightarrow A + X$

2. _____ In the reaction described by the equation $2Al(s) + 3Fe(NO_3)_2(aq) \rightarrow 3Fe(s) + 2Al(NO_3)_3(aq)$, iron has been replaced by

(a) nitrate.   **(c)** aluminum.
(b) water.   **(d)** nitrogen.

3. _____ Of the following chemical equations, the only reaction that is both synthesis and combustion is

(a) $C(s) + O_2(g) \rightarrow CO_2(g)$.
(b) $2C_4H_{10}(l) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(l)$.
(c) $6CO_2(g) + 6H_2O(g) \rightarrow C_6H_{12}O_6(aq) + 6O_2(g)$.
(d) $C_6H_{12}O_6(aq) + 6O_2(g) \rightarrow 6CO_2(aq) + 6H_2O(l)$.

4. _____ Of the following chemical equations, the only reaction that is both combustion and decomposition is

(a) $S(s) + O_2(g) \rightarrow SO_2(g)$.
(b) $2C_4H_{10}(l) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(l)$.
(c) $2H_2O_2(l) \rightarrow 2H_2O(l) + O_2(g)$.
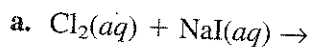**(d)** $2HgO(s) \xrightarrow{\Delta} 2Hg(l) + O_2(g)$.

5. Identify the products when the following substances decompose:
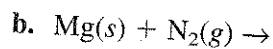
_____ **a.** a binary compound

_____ **b.** most metal hydroxides

_____ **c.** a metal carbonate

_____ **d.** the acid H_2SO_3

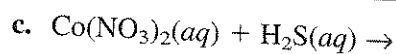**6.** The complete combustion of a hydrocarbon in excess oxygen yields the products _____ and _____.
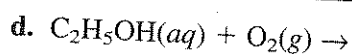
7. For the following four reactions, identify the type, predict the products (make sure formulas are correct), and balance the equations:

   a. $Cl_2(aq) + NaI(aq) \rightarrow$

   b. $Mg(s) + N_2(g) \rightarrow$

   c. $Co(NO_3)_2(aq) + H_2S(aq) \rightarrow$

   d. $C_2H_5OH(aq) + O_2(g) \rightarrow$

8. Acetylene gas, C_2H_2, is burned to provide the high temperature needed in welding.

   a. Write the balanced chemical equation for the combustion of C_2H_2 in oxygen.

   b. If 1.0 mol of C_2H_2 is burned, how many moles of CO_2 are formed?

   c. If 1.0 mol of C_2H_2 is burned how many moles of oxygen gas are consumed?

9. a. Write the balanced chemical equation for the reaction that occurs when solutions of barium chloride and sodium carbonate are mixed. Refer to Table 1 on page 437 in Chapter 13 for solubility.

   b. To which of the five basic types of reactions does this reaction belong?

10. For the commercial preparation of aluminum metal, the metal is extracted by electrolysis from alumina, Al_2O_3. Write the balanced chemical equation for the electrolysis of molten Al_2O_3.

CHAPTER 8 REVIEW

Chemical Equations and Reactions

SECTION 3

SHORT ANSWER Answer the following questions in the space provided.

1. List four metals that will *not* replace hydrogen in an acid.

_____

2. Consider the metals iron and silver, both listed in **Table 3** on page 286 of the text. Which one readily forms an oxide in nature, and which one does not?

_____

3. In each of the following pairs, identify the more active element.

_____ **a.** F_2 and I_2

_____ **b.** Mn and K

_____ **c.** Cu and H

4. Use the information in **Table 3** on page 286 of the text to predict whether each of the following reactions will occur. For each reaction that will occur, complete the chemical equation by writing in the products formed and balancing the final equation.

a. $Al(s) + CH_3COOH(aq) \xrightarrow{50°C}$

_____

_____

b. $Al(s) + H_2O(l) \xrightarrow{50°C}$

_____

_____

c. $Cr(s) + CdCl_2(aq) \rightarrow$

_____

_____

d. $Br_2(l) + KCl(aq) \rightarrow$

_____

_____

CHEMICAL EQUATIONS AND REACTIONS
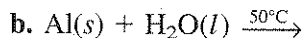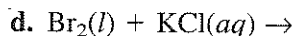
SECTION 3 continued

5. Very active metals will react with water to release hydrogen gas and form hydroxides.

   a. Complete, and then balance, the equation for the reaction of Ca(s) with water.

   _____

   b. The reaction of rubidium, Rb, with water is faster and more violent than the reaction of Na with water. Use the atomic structure and radius of each metal to account for this difference.

   _____

   _____

   _____

   _____

6. Gold, Au, is often used in jewelry. How does the relative activity of Au relate to its use in jewelry?

   _____

   _____

   _____

7. Explain how to use an activity series to predict the outcome of a single-displacement reaction.

   _____

   _____

   _____

   _____

8. Aluminum is above copper in the activity series. Will aluminum metal react with copper(II) nitrate, $Cu(NO_3)_2$, to form aluminum nitrate, $Al(NO_3)_3$? If so, write the balanced chemical equation for the reaction.

   _____

   _____

   _____

   _____

MODERN CHEMISTRY

CHAPTER 8 REVIEW

Chemical Equations and Reactions

MIXED REVIEW

SHORT ANSWER Answer the following questions in the space provided.

1. _____ A balanced chemical equation represents all the following *except*

   (a) experimentally established facts.
   (b) the mechanism by which reactants combine to form products.
   (c) identities of reactants and products in a chemical reaction.
   (d) relative quantities of reactants and products in a chemical reaction.

2. _____ According to the law of conservation of mass, the total mass of the reacting substances is

   (a) always more than the total mass of the products.
   (b) always less than the total mass of the products.
   (c) sometimes more and sometimes less than the total mass of the products.
   (d) always equal to the total mass of the products.

3. Predict whether each of the following chemical reactions will occur. For each reaction that will occur, identify the reaction type and complete the chemical equation by writing in the products formed and balancing the final equation. General solubility rules are in **Table 1** on page 437 of the text.

   a. $Ba(NO_3)_2(aq) + Na_3PO_4(aq) \rightarrow$

   _____

   _____

   b. $Al(s) + O_2(g) \rightarrow$

   _____

   _____

   c. $I_2(s) + NaBr(aq) \rightarrow$

   _____

   _____

   d. $C_3H_4(g) + O_2(g) \rightarrow$

   _____

   _____

MIXED REVIEW continued

e. electrolysis of molten potassium chloride

_____

_____

4. Some small rockets are powered by the reaction represented by the following unbalanced equation:

$$(CH_3)_2N_2H_2(l) + N_2O_4(g) \rightarrow N_2(g) + H_2O(g) + CO_2(g) + heat$$

a. Translate this chemical equation into a sentence. (Hint: The name for $(CH_3)_2N_2H_2$ is dimethylhydrazine.)

_____

_____

_____

b. Balance the formula equation.

_____

_____

5. In the laboratory, you are given two small chips of each of the unknown metals X, Y, and Z, along with dropper bottles containing solutions of $XCl_2(aq)$ and $ZCl_2(aq)$. Describe an experimental strategy you could use to determine the relative activities of X, Y, and Z.

_____

_____

_____

_____

_____

_____

_____

_____

_____

6. List the observations that would indicate that a reaction had occurred.

_____

_____