Chapter 8 – Chemical Reactions

Chapter 8: 1 – 7, 9 – 18, 20, 21, 24 – 26, 29 – 31, 46, 55, 69

Practice Problems

1. Write a skeleton equation for each chemical reaction. Include the appropriate symbols from Table 8.1 on page 206.

a. Sulfur burns in oxygen to form sulfur dioxide.

b. Heating potassium chlorate in the presence of the catalyst manganese dioxide produces oxygen gas. Potassium chloride is left as a solid.

2. Write a sentence that describes each chemical reaction.

a. $KOH(aq) + H_2SO_4(aq) \rightarrow H_2O(l) + K_2SO_4(aq)$

b. $Na(s) + H_2O(l) \rightarrow NaOH(aq) + H_2(g)$

3. Balance each equation, using the rules for balancing equations provided on pages 208, 209.

a. $\_\_ AgNO_3 + \_\_ H_2S \rightarrow \_\_ Ag_2S + \_\_HNO_3$

b. $\_\_ MnO_2 + \_\_ HCl \rightarrow \_\_ MnCl_2 + \_\_ H_2O + \_\_ Cl_2$

c. $\_\_ Zn(OH)_2 + \_\_ H_3PO_4 \rightarrow \_\_ Zn_3(PO_4)_2 + \_\_ H_2O$

4. Rewrite these word equations as balanced chemical equations.

a. hydrogen + sulfur → hydrogen sulfide

b. iron(III) chloride + calcium hydroxide → iron(III) hydroxide + calcium chloride

5. Balance the equation. __ CO + __ Fe_2O_3 → __Fe + __ CO_2

6. Write the balanced chemical equation for the reaction of carbon with oxygen to form carbon monoxide.

7. Balance each equation.

a. __ $FeCl_3$ + __ $NaOH$ → __ $Fe(OH)_3$ + __ $NaCl$

b. __ CS_2 + __ Cl_2 → __ CCl_4 + __ S_2Cl_2

c. __ CH_4 + __ Br_2 → CH_3Br + __ HBr

Section Review 8.1

9. Write out chemical equations for the following chemical reactions.

a. Pure copper can be produced by heating copper(II) sulfide in the presence of diatomic oxygen from the air. Sulfur dioxide gas is also produced in this reaction.

b. Water is formed by the explosive reaction between hydrogen gas and oxygen gas.

c. When baking soda (sodium hydrogen carbonate) is heated, it decomposes, forming the products sodium carbonate, carbon dioxide, and water.

10. Balance the following equations.

a. __ SO_2 + __ O_2 → __ SO_3

b. __ Fe_2O_3 + __ H_2 → __ Fe + __ H_2O

c. __ P + __ O_2 → __ P_4O_{10}

d. __ Al + __ N_2 → __ AlN

11. Write formulas and other symbols for these substances.

a. sulfur trioxide gas

b. potassium nitrate dissolved in water

c. heat supplied to a chemical reaction

d. metallic copper

e. liquid mercury

f. zinc chloride as a catalyst

12. How is the law of conservation of mass related to the balancing of a chemical equation?

Practice Problems

13. Complete and balance these combination reactions.

a. __ Be + __ O_2 →

b. __ SO_2 + __ H_2O →

14. Write and balance an equation for the formation of each compound from its elements.

a. strontium iodide (SrI_2)

b. magnesium nitride (Mg_3N_2)

15. Complete and balance these decomposition reactions.

a. __ HI →

b. __ $Mg(ClO_3)_2$ → __ $MgCl_2$ +

16. Write the formula for the binary compound that decomposes to each set of products.

a. → __ H_2 + __ Br_2

b. → __ Na + __ Cl_2

17. Complete the equations for these single-replacement reactions that take place in aqueous solution. If a reaction does not occur (use the activity series on Table 8.2, p. 217), write "no reaction."

a. __ $Fe(s)$ + __ $Pb(NO_3)_2$ (aq) →

b. __ $Cl_2(g)$ + __ $NaI(aq)$ →

c. __ $Ca(s)$ + __ $H_2O(l)$ →

18. Write the products for these double-replacement reactions. Then balance each equation.

a. __ $NaOH$ + __ $Fe(NO_3)_3$ →

(Iron hydroxide is a precipitate)

b. __ $Ba(NO_3)_2$ + __ H_3PO_4 →

(Barium phosphate is a precipitate.)

20. Write a balanced equation for the complete combustion of each compound.

a. formic acid ($HCOOH$)

b. heptane (C_7H_{16})

21. Write a balanced equation for the complete combustion of glucose ($C_6H_{12}O_6$).

24. What three types of products drive double-replacement reactions?

25. Write balanced net ionic equations for each reaction.

a. $Pb(ClO_4)_2(aq) + NaI(aq) \rightarrow PbI_2(s) + NaClO_4(aq)$

b. $Zn(s) + HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$

c. $Ca(OH)_2(aq) + H_3PO_4(aq) \rightarrow Ca_3(PO_4)_2(aq) + H_2O(l)$

26. Identify the precipitate formed when solutions of these ionic compounds are mixed. Write a net ionic equation.

$NH_4Cl(aq) + Pb(NO_3)_2(aq) \rightarrow$

Section Review 8.3

29. Write a net ionic equation for each reaction.

a. $HCl(aq) + AgNO_3(aq) \rightarrow$

b. $Pb(C_2H_3O_2)_2(aq) + LiCl(aq) \rightarrow$

c. $Na_3PO_4(aq) + CrCl_3(aq) \rightarrow$

30. Identify the spectator ions in each reaction in Problem 29.

a.

b.

c.

31. Identify the precipitate formed when solutions of these ionic compounds are mixed.

a. $H_2SO_4 + BaCl_2 \rightarrow$

b. $Al_2(SO_4)_3 + NH_4OH \rightarrow$

c. $AgNO_3 + H_2S \rightarrow$

d. $CaCl_2 + Pb(NO_3)_2 \rightarrow$

e. $Ca(NO_3)_2 + NaCO_3 \rightarrow$

Chapter 8 Review

46. For each of the following pairs, predict which element as an atom would displace the other element as an ion from a compound in aqueous solution.

a. iron and sodium

b. silver and copper

c. zinc and hydrogen (in HCl)

55. Write a balanced chemical equation for each reaction. Use the necessary symbols from Table 8.1 to describe the reaction completely.

a. Bubbling chlorine gas through a solution of potassium iodide gives elemental iodine and a solution of potassium chloride.

b. Bubbles of hydrogen gas and aqueous iron(III) chloride are produced when metallic iron is dropped into hydrochloric acid.

c. Solid tetraphosphorus decoxide reacts with water to produce phosphoric acid.

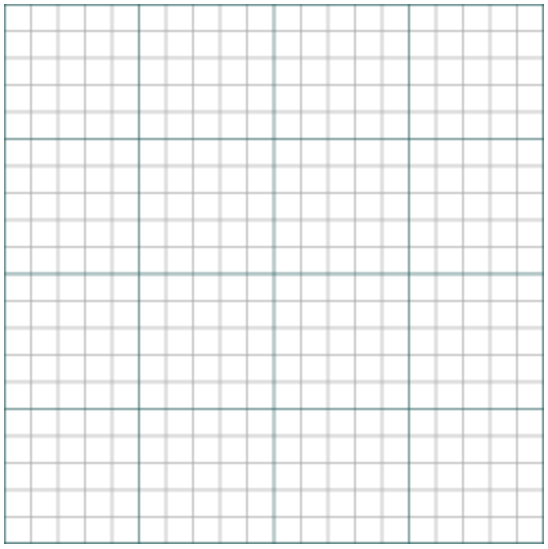
d. Solid silver oxide can be heated to give silver and oxygen gas.

e. Iodine crystals react with chlorine gas to form solid iodine trichloride.

f. Mercury metal is produced by heating a mixture of mercury(II) sulfide and calcium oxide. Additional products are calcium sulfide and calcium sulfate.

69. The white solid calcium chloride ($CaCl_2$) is used as a drying agent. The maximum amount of water absorbed by different quantities of $CaCl_2$ is given in the table below.

$CaCl_2$ (g)	$CaCl_2$ (mol)	H_2O (g)	H_2O (mol)
17.3		5.62	
48.8		15.8	
124		40.3	
337		109	



a. Complete the table.

b. Plot the moles of water absorbed (y-axis) versus the moles of $CaCl_2$.

c. Based on your graph, how many molecules of water does each formula unit of $CaCl_2$ absorb?