

Chemical Reactions

Section 9.1 Reactions and Equations

In your textbook, read about evidence of chemical reactions.

For each statement, write *yes* if evidence of a chemical reaction is present. Write *no* if there is no evidence of a chemical reaction.

- _____ 1. A tomato smells rotten.
- _____ 2. A drinking glass breaks into smaller pieces.
- _____ 3. A piece of ice melts.
- _____ 4. Drain cleaner is mixed with water and the solution becomes warm.
- _____ 5. Candle wax burns.
- _____ 6. Molten candle wax solidifies.
- _____ 7. Green leaves turn yellow and red as the seasons change.
- _____ 8. Baking powder produces a gas that makes a cake rise.

In your textbook, read about how to represent chemical reactions and how to balance chemical equations.

Use the terms below to complete the passage. Each term may be used once, more than once, or not at all.

arrow	plus sign	(s)	(l)
reactant	product	(g)	(aq)

The fuel for the space shuttle is hydrogen, which burns in oxygen to produce water vapor and energy. In this chemical reaction, hydrogen is a(n) **(9)** _____, oxygen is a(n) **(10)** _____, and water vapor is a(n) **(11)** _____. In a chemical equation for this reaction, a(n) **(12)** _____ is used to separate hydrogen and oxygen from water vapor and energy. A(n) **(13)** _____ is used to separate the symbols for hydrogen and oxygen. A(n) **(14)** _____ symbol is used to tell the state of hydrogen in the reaction, a(n) **(15)** _____ symbol is used for the state of oxygen, and a(n) **(16)** _____ symbol is used for the state of water vapor.

Section 9.1 *continued*

For each of the following chemical reactions, write a word equation, a skeleton equation, and a balanced chemical equation. Be sure to show the state of each reactant and product. If you need more help writing formulas or determining the state of a substance, refer to Chapters 7 and 8 and the periodic table on pages 178–179.

17. Solid mercury(II) oxide breaks down when heated, forming the elements mercury and oxygen.

18. Sodium metal reacts with water vapor in air to form solid sodium hydroxide and hydrogen.

19. In the first step of refining zinc metal from its zinc sulfide ore, the ore is heated in the presence of oxygen. The products are solid zinc oxide and sulfur dioxide gas.

20. The next step of refining zinc involves heating the zinc oxide in the presence of carbon. This reaction produces zinc vapor and carbon monoxide gas.

21. Certain pollutants in the air react with water vapor to form acids. For example, sulfur trioxide reacts with water vapor to form sulfuric acid.

22. Solid calcium carbonate is commonly used in antacids because it reacts with the hydrochloric acid found in the stomach. The products of this reaction are aqueous calcium chloride, carbon dioxide, and water.

Section 9.2 Classifying Chemical Reactions

In your textbook, read about synthesis, combustion, decomposition, and replacement reactions.

Assume that Q, T, X, and Z are symbols for elements. Match each equation in Column A with the reaction type it represents in Column B.

Column A

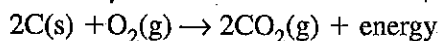
- _____ 1. $Q + XZ \rightarrow X + QZ$
 _____ 2. $Q + Z \rightarrow QZ$
 _____ 3. $QT \rightarrow Q + T$
 _____ 4. $QT + XZ \rightarrow QZ + XT$

Column B

- a. decomposition
 b. double-replacement
 c. single-replacement
 d. synthesis

Answer the following questions.

5. Does the following equation represent a combustion reaction, a synthesis reaction, or both? Explain your answer.



6. Why is it sometimes incorrect to state that a compound is broken down into its component elements in a decomposition reaction?

7. When soap is added to hard water, solid soap scum forms. When water is added to baking powder, carbon dioxide bubbles form. When lemon juice is added to household ammonia solution, water is one of the products. Tell how you know a double-replacement reaction has occurred in each case.

8. Explain how you can use an activity series to determine whether a single-replacement reaction will occur.

Section 9.2 *continued*

In your textbook, read about the activity series for metals and halogens.

Examine each of the following pairs of potential reactants. Use Figure 9.13 in your textbook to help you decide whether or not a reaction would occur. If a reaction occurs, write the balanced equation. If no reaction occurs, write *NR*.

9. calcium and water _____
10. magnesium and water _____
11. rubidium and lithium chloride _____
12. potassium and aluminum oxide _____
13. silver and calcium nitrate _____
14. fluorine and potassium iodide _____
15. magnesium bromide and chlorine _____
16. copper and iron(III) sulfate _____

Match each example of a chemical reaction in Column A to the type(s) listed in Column B. List all types from Column B that apply.

Column A	Column B
_____ 17. Aluminum lawn furniture becomes coated with a layer of aluminum oxide when it sits out in the air.	a. combustion
_____ 18. Chlorine gas is bubbled through a calcium bromide solution. The solution turns brown, the color of bromine.	b. decomposition
_____ 19. Lime is added to acid water in a lake. Water and a salt form.	c. double-replacement
_____ 20. Propane is a common household fuel. When burned, water and carbon dioxide are produced.	d. single-replacement
_____ 21. Steel wool burns, forming an iron oxide.	e. synthesis
_____ 22. When an electric current is passed through molten potassium bromide, potassium and bromine form.	
_____ 23. When solutions of sodium iodide and lead nitrate are combined, a yellow solid forms.	

Section 9.3 Reactions in Aqueous Solutions

In your textbook, read about aqueous solutions, reactions that form precipitates, reactions that form water, and reactions that form gases.

Circle the letter of the choice that best completes the statement or answers the question.

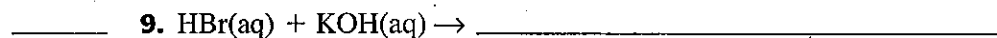
1. A spoonful of sodium chloride is dissolved in a liter of water. What is sodium chloride in this solution?
a. molecule b. precipitate c. solute d. solvent
2. In an aqueous solution, water is the
a. homogeneous part. b. precipitate. c. solute. d. solvent.
3. Compounds that produce hydrogen ions in aqueous solutions are
a. acids. b. aqueous. c. bases. d. ionic compounds.
4. What type of reaction occurs between ions present in aqueous solution?
a. decomposition b. double-replacement c. single-replacement d. synthesis
5. What type of ions are present in solution but are not actually involved in a chemical reaction?
a. complete b. net c. precipitate d. spectator
6. If hydrochloric acid and potassium hydroxide react, what is the product of the net ionic equation for the reaction?
a. hydrochloric acid b. hydrogen ions c. potassium chloride d. water
7. Which of the following gases is not commonly produced in a double-replacement reaction?
a. carbon dioxide b. hydrogen cyanide c. hydrogen sulfide d. sulfur dioxide
8. $\text{H}^+(\text{aq}) + \text{Br}^-(\text{aq}) + \text{K}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{Br}^-(\text{aq}) + \text{K}^+(\text{aq})$ is an example of what type of chemical equation?
a. complete ionic b. net ionic c. precipitation d. spectator

Section 9.3 *continued*

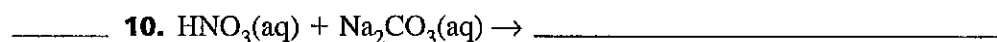
Predict the products for each reaction in Column A. Write the formulas for these products on the product side of each equation. In the space at the left, write the letter of the choice from Column B that indicates what type of product is produced during the reaction shown in Column A. Write as many choices as apply. (Hints: Compounds of group 1 metals are never precipitates; H_2S and CO_2 are gases.)

Column A

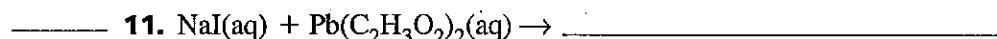
Column B



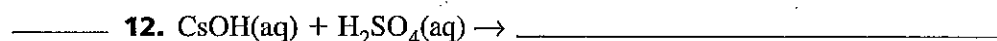
a. gas



b. precipitate



c. water



For each of the following reactions, write chemical, complete ionic, and net ionic equations.

14. Phosphoric acid (H_3PO_4) and lithium hydroxide react to form a salt and water.

15. When solutions of magnesium sulfate and calcium chloride are mixed, calcium sulfate precipitates.

16. Bubbles are released when nitric acid (HNO_3) is added to a potassium carbonate solution.

17. Bubbles are released when hydrobromic acid (HBr) is added to a solution of ammonium sulfide. Aqueous ammonium bromide also forms.

Chapter 11 WS

Skeleton Equations

Name: _____

Period: _____ **Date:** _____

Using the word equations given, create the skeleton equation for each reaction and balance it.

- 1) Zinc and lead (II) nitrate react to form zinc nitrate and lead
- 2) Aluminum bromide and chlorine gas produce aluminum chloride and bromine gas
- 3) Sodium phosphate and calcium chloride yield calcium phosphate and sodium chloride
- 4) Potassium metal mixed with chlorine gas to make potassium chloride
- 5) Aluminum and hydrochloric acid react to form aluminum chloride and hydrogen gas
- 6) Calcium hydroxide and phosphoric acid neutralize to calcium phosphate and water
- 7) Copper and sulfuric acid react to form copper (II) sulfate and water and sulfur dioxide

- 8) Hydrogen gas and nitrogen monoxide react to form water and nitrogen gas

- 9) Lithium bromide reacts with cobalt (IV) sulfite to produce lithium sulfite and cobalt (IV) bromide

- 10) Lithium nitrate added to silver metal forms lithium and silver nitrate

- 11) Carbon tetrafluoride and oxygen combust to form carbon dioxide and fluorine gas

- 12) Potassium dichromate decomposes into solid potassium chromate, chromium (III) oxide, and oxygen gas

- 13) Octane (octacarbon octodecahydride) burns with oxygen to produce carbon dioxide and water

- 14) Sodium hydroxide and phosphoric acid react to produce sodium phosphate and water

- 15) Sulfer, oxygen gas, and water react to form sulfuric acid

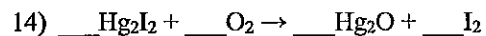
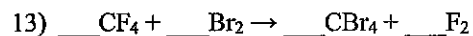
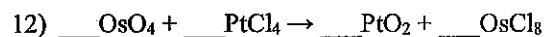
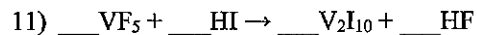
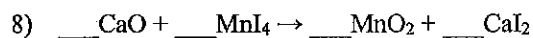
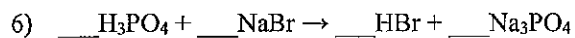
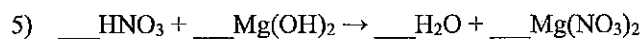
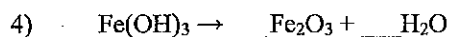
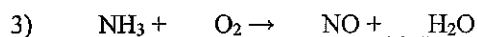
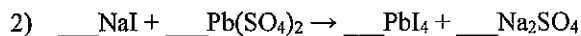
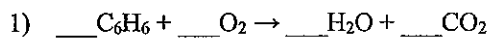
Chapter 11 WS

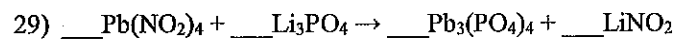
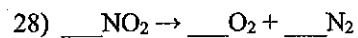
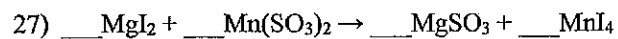
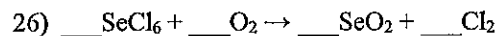
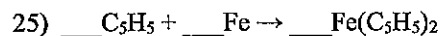
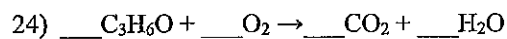
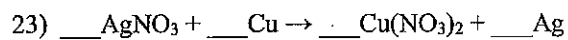
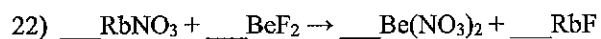
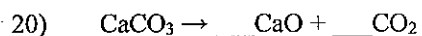
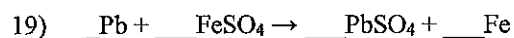
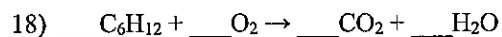
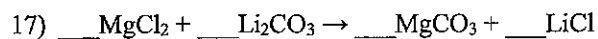
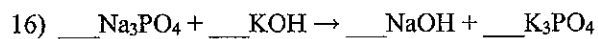
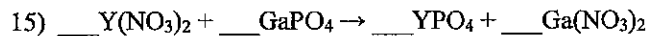
Balancing Equations

Name: _____

Period: _____ Date: _____

Balance the following skeleton equations.





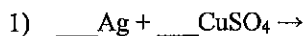
Chapter 11 WS

Products and Reaction Types

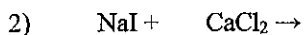
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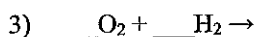
State the type of reaction, predict the products of the reaction to complete the skeleton equation, and balance it to determine the complete chemical reaction:



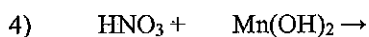
Type of Reaction: _____



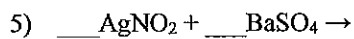
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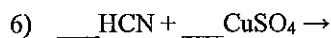
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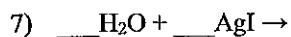
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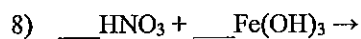
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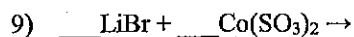
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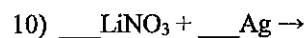
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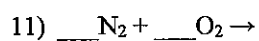
Type of Reaction: _____



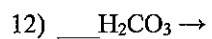
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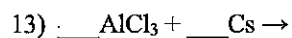
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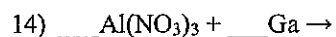
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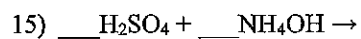
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Type of Reaction: _____



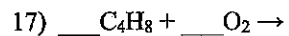
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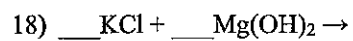
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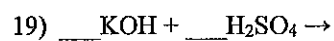
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Type of Reaction: _____



Type of Reaction: _____



Type of Reaction: _____