Name: Key Date: _____ Hour: 1 2 3 4 5 6

Chapter 10 Conceptual Understanding
Chemical Reactions

Section 10.1 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.

Yes **1.** A tomato smells rotten.

No **2.** A drinking glass breaks into smaller pieces.

No **3.** A piece of ice melts.

Yes **4.** Drain cleaner is mixed with water and the solution becomes warm.

Yes **5.** Candle wax burns.

No **6.** Molten candle wax solidifies.

Yes **7.** Green leaves turn yellow and red as the seasons change.

Yes **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)** reactant, oxygen is a(n) **(10)** reactant, and water vapor is a(n) **(11)** product. In a chemical equation for this reaction, a(n) **(12)** arrow is used to separate hydrogen and oxygen from water vapor and energy. A(n) **(13)** plus sign is used to separate the symbols for hydrogen and oxygen. A(n) **(14)** (g) symbol is used to tell the state of hydrogen in the reaction, a(n) **(15)** (g) symbol is used for the state of oxygen, and a(n) **(16)** (g) symbol is used for the state of water vapor.

For each of the following chemical reactions write 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 8 and 9 and the periodic table on pages 156–157.

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

$2\,HgO_{(s)} \rightarrow 2\,Hg_{(s)} + O_{2(g)}$

Name: _____ Date: _____ Hour: 1 2 3 4 5 6

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

$2Na(s) + 2H_2O(g) \rightarrow 2NaOH(s) + H_2(g)$

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.

$2ZnS_{(s)} + 3O_{2(g)} \rightarrow 2ZnO_{(s)} + 2SO_{2(g)}$

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.

$ZnO_{(s)} + C_{(s)} \rightarrow Zn_{(g)} + CO_{(g)}$

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.

$SO_{3(g)} + H_2O_{(g)} \rightarrow H_2SO_{4(g)}$

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.

$CaCO_{3(s)} + 2HCl_{(l)} \rightarrow CaCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$

Section 10.2 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

C 21. $Q + XZ \rightarrow X + QZ$

D 22. $Q + Z \rightarrow QZ$

A 23. $QT \rightarrow Q + T$

B 24. $QT + XZ \rightarrow QZ + XT$

Column B

a. Decomposition

b. Double-replacement

c. Single-replacement

d. Synthesis

Answer the following questions.

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

$2C(s) + O_2(g) \rightarrow 2CO_2(g) + \text{energy}$

Synthesis, no water produced

Name: _____ Date: _____ Hour: 1 2 3 4 5 6

26. Describe what is meant by each the following: Word Equation, Skeleton Equation, Balanced Equations, ~~Complete Ionic Equation, and Net Ionic Equation.~~ (Be specific regarding what each should show) word equations: using the names to describe the reaction
skeleton equation: using formulas
balanced equation: using coefficients to show equal reactants + product

27. Why is it sometimes incorrect to state that a compound is broken down into its component elements in a decomposition reaction?
sometimes they can break down to smaller molecules that contain more than one element.

28. 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.
two different products are formed that were not present as a reactant.

Section 10.3 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.

29. 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

30. In an aqueous solution, water is the
a. homogeneous part. **b.** precipitate. **c.** solute. **d.** solvent.

31. Compounds that produce hydrogen ions in aqueous solutions are
a. acids. **b.** aqueous. **c.** bases. **d.** ionic compounds.

32. What type of reaction occurs between ions present in aqueous solution?
a. decomposition **b.** double-replacement **c.** single-replacement **d.** synthesis

33. 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

34. 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

35. 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

36. $H^+(aq) + Br^-(aq) + K^+(aq) + OH^-(aq) \rightarrow H_2O(l) + Br^-(aq) + K^+(aq)$ is an example of what type of chemical equation?
a. complete ionic **b.** net ionic **c.** precipitation **d.** spectator

Name: _____ Date: _____ Hour: 1 2 3 4 5 6

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; H2S and CO2 are gases.)

Column A

Column B
- **A. Gas**
- **B. Precipitate**
- **C. Water**

C **37.** $HBr(aq) + KOH(aq) \rightarrow$ $H_2O + KBr$

38. $HNO_3(aq) + Na_2CO_3(aq) \rightarrow$ $H_2CO_3 + NaNO_3$

B **39.** $NaI(aq) + Pb(C_2H_3O_2)_2(aq) \rightarrow$ $NaC_2H_3O_2 + PbI_{2(s)}$

C,B **40.** $CsOH(aq) + H_2SO_4(aq) \rightarrow$ $CsSO_{4(s)} + H_2O$

A **41.** $K_2S(aq) + HCl(aq) \rightarrow$ $KCl + H_2S_{(g)}$

For each of the following reactions, write the chemical equations.

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

Chemical equation: $H_3PO_4 + LiOH \rightarrow Li_3PO_{4(s)} + H_2O$

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

Chemical equation: $MgSO_4 + CaCl_2 \rightarrow CaSO_{4(s)} + MgCl$

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

Chemical equation: $HNO_3 + K_2(CO_3) \rightarrow H_2CO_3 + KNO_{3(g)}$

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

Chemical equation: $HBr + (NH_4)_2S \rightarrow NH_4Br + H_2S$

Balance the following chemical equations.

46. ___ $SnS_2(s)$ + 3 $O_2(g) \rightarrow$ ___ $SnO_2(s)$ + 2 $SO_2(g)$

47. 2 $C_2H_6(g)$ + 7 $O_2(g) \rightarrow$ 4 $CO_2(g)$ + 6 $H_2O(g)$

48. 2 $Al(s)$ + 6 $HCl(aq) \rightarrow$ 2 $AlCl_3(aq)$ + 3 $H_2(g)$

49. ___ $CoCO_3(s) \rightarrow$ ___ $CoO(s)$ + ___ $CO_2(g)$ Balanced