Chemical Reactions
Worksheets

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CHAPTER 1

Chemical Reactions

Worksheets

CHAPTER OUTLINE

1.1 Introduction to Chemical Reactions
1.2 Chemical Equations
1.3 Types of Chemical Reactions
1.4 Lesson 8.4: Chemical Reactions and Energy
Lesson 8.1: True or False

Determine if the following statements are true or false.

_____ 1. Most chemical reactions take place in labs.
_____ 2. All changes in matter involve chemical reactions.
_____ 3. Evaporation is an example of a chemical change.
_____ 4. Reactants and products can be elements or compounds.
_____ 5. Chemical reactions may occur quickly or slowly.
_____ 6. Some chemical reactions can proceed in just one direction.
_____ 7. An example of a chemical change is water boiling.
_____ 8. Freezing involves a chemical reaction.
_____ 9. A banana turning brown is a chemical change.
_____ 10. Wax melting is an example of a chemical reaction.

Lesson 8.1: Critical Reading

Read this passage from the text and answer the questions that follow.

What Is a Chemical Reaction?

A chemical reaction is a process in which some substances change into different substances. Substances that start a chemical reaction are called reactants. Substances that are produced in the reaction are called products. Reactants and products can be elements or compounds. Bonds break in the reactants and new bonds form in the products. The reactants and products contain the same atoms, but they are rearranged during the reaction. As a result, the atoms are in different combinations in the products than they were in the reactants.

Questions

1. What is a chemical reaction?
2. Compare and contrast reactants and products of a chemical reaction.

Lesson 8.1: Multiple Choice

What is a chemical reaction?

1. What is a chemical reaction?
2. Compare and contrast reactants and products of a chemical reaction.
Circle the letter of the correct choice.

1. What do the formation of rust and the formation of cottage cheese have in common?
   a. Both occur very quickly.
   b. Both involve chemical reactions.
   c. Both are changes of state.
   d. Both are physical processes.

2. Which of the following changes does not involve chemical reactions?
   a. clouds forming
   b. candles burning
   c. leaves turning color
   d. fire extinguishers foaming

3. During chemical reactions, atoms are
   a. rearranged.
   b. created or destroyed.
   c. changed to new elements.
   d. two of the above

4. There is no overall change in reactants and products whenever a chemical reaction
   a. goes in just one direction.
   b. goes in two directions.
   c. reaches equilibrium.
   d. proceeds slowly.

5. Evidence of chemical reactions include changes in
   a. state.
   b. color.
   c. temperature.
   d. two of the above

6. What does the following equation represent? Reactants ↔ Products
   (a) any chemical reaction
   (b) a reversible chemical reaction
   (c) a chemical reaction in equilibrium
   (d) all of the above

Lesson 8.1: Matching

Name___________________ Class______________ Date________

Match each definition with the correct term.

Definitions
   _____ 1. substance produced in a chemical reaction
   _____ 2. force of attraction that breaks and reforms in a chemical reaction
   _____ 3. substance that starts a chemical reaction
   _____ 4. example of chemical change
1.1. Introduction to Chemical Reactions

____ 5. balance between opposing changes
____ 6. process in which some substances become different substances
____ 7. example of a physical change

Terms
a. chemical reaction
b. melting
c. equilibrium
d. chemical bond
e. product
f. rusting
g. reactant

Lesson 8.1: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. In chemical reactions, bonds __________ in reactants.
2. The point at which forward and reverse reactions occur at the same rate is called __________.
3. A change in color may be evidence that a(n) __________ has occurred.
4. New bonds form in __________ of chemical reactions.
5. The direction in which a chemical reaction occurs is represented by a(n) __________.
6. Products and reactants contain the same __________ but in different combinations.
7. A(n) __________ is a solid that settles out of a liquid solution in a chemical reaction.

Lesson 8.1: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Describe chemical reactions and explain how they change matter.
1.2 Chemical Equations

Lesson 8.2: True or False

Determine if the following statements are true or false.

_____ 1. The general form of a chemical equation is Reactants = Products.
_____ 2. The symbol CO$_2$ represents two molecules of carbon monoxide.
_____ 3. The symbol 2H$_2$ represents two atoms of hydrogen.
_____ 4. Coefficients are used to balance chemical equations.
_____ 5. In balancing chemical equations, you should use the smallest subscripts possible.
_____ 6. The number of each type of molecule must be the same on both sides of a chemical equation.
_____ 7. Changing coefficients changes the substances involved in a chemical reaction.
_____ 8. Chemists use a standard method to represent chemical reactions.
_____ 9. The chemical equation H$_2$CO$_3$ $\rightarrow$ H$_2$O + CO$_2$ is balanced.
_____ 10. Water is the reactant in the chemical equation H$_2$O $\rightarrow$ H$_2$ + O$_2$.

Lesson 8.2: Critical Reading

Read this passage from the text and answer the questions that follow.

Conserving Mass

Matter cannot be created or destroyed in chemical reactions. This is the law of conservation of mass. In every chemical reaction, the same mass of matter must end up in the products as started in the reactants. Balanced chemical equations show that mass is conserved in chemical reactions.

How do scientists know that mass is always conserved in chemical reactions? Careful experiments in the 1700s by a French chemist named Antoine Lavoisier led to this conclusion. Lavoisier measured the mass of reactants and products in many different chemical reactions. He carried out the reactions inside a sealed jar. As a result, any gases involved in the reactions were captured and could be measured. In every case, the total mass of the jar and its contents was the same after the reaction as it was before the reaction took place. This showed that matter was neither created nor destroyed in the reactions.

Questions

1. State the law of conservation of mass.
2. How did Lavoisier’s experiments demonstrate this law?
Lesson 8.2: Multiple Choice

Name___________________ Class________________ Date__________

Circle the letter of the correct choice.

1. A shorthand way of showing how atoms are rearranged in a chemical reaction is a chemical
   a. symbol.
   b. formula.
   c. equation.
   d. letter.

2. When there is more than one reactant in a chemical equation, they are separated by
   a. arrows.
   b. subscripts.
   c. plus signs.
   d. coefficients.

3. In the reaction represented by the chemical equation $2Cu + O_2 \rightarrow 2CuO$, new bonds are formed in
   a. $2Cu$.
   b. $O_2$.
   c. $CuO$.
   d. none of the above

4. Chemical equations must be balanced because matter cannot be
   a. created.
   b. destroyed.
   c. changed.
   d. two of the above

5. Which chemical equation is balanced?
   a. $2Na + Cl_2 \rightarrow 2NaCl$
   b. $Na + 2Cl_2 \rightarrow 2NaCl$
   c. $2Na + 2Cl_2 \rightarrow 2NaCl$
   d. $Na + Cl_2 \rightarrow NaCl$

6. What is the missing coefficient in the following chemical equation? $?NO + O_2 \rightarrow 2NO_2$?
   a. 0
   b. 1
   c. 2
   d. 4

Lesson 8.2: Matching

Name___________________ Class________________ Date__________

Match each definition with the correct term.

Definitions

_____ 1. symbolic representation of a chemical reaction
Lesson 8.2: Fill in the Blank

Name___________________ Class______________ Date________

Fill in the blank with the appropriate term.

1. In the chemical equation C + O₂ → CO₂, the product is __________.
2. To balance the chemical equation 2H₂ + O₂ → H₂O, water needs a coefficient of __________.
3. According to the law of __________, matter cannot be created or destroyed.
4. __________ did experiments that demonstrated the law in question 3.
5. When you balance a chemical equation, you should change only the __________.
6. Balanced equations show that __________ is conserved in chemical reactions.
7. The scientist called the father of modern chemistry is __________.

Lesson 8.2: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain how the law of conservation of mass relates to chemical equations.
Lesson 8.3: True or False

Determine if the following statements are true or false.

1. Water decomposes when an electric current passes through it.
2. A combustion reaction usually gives off heat and light.
3. The burning of glucose in cells is called cellular combustion.
4. Sodium chloride forms in a decomposition reaction.
5. Methane and oxygen combine in a synthesis reaction.
6. One product of the reaction in question 5 is carbon dioxide.
7. There are two types of decomposition reactions.
8. Carbon dioxide forms only in combustion reactions.
9. The general equation AB + CD \rightarrow AD + CB represents a replacement reaction.
10. The chemical reaction 2K + 2H\textsubscript{2} \rightarrow 2KOH + H\textsubscript{2} is a replacement reaction.

Lesson 8.3: Critical Reading

Read this passage from the text and answer the questions that follow.

Combustion Reactions

A combustion reaction occurs when a substance reacts quickly with oxygen (O\textsubscript{2}). Combustion is commonly called burning. The substance that burns is usually referred to as fuel. The products of a combustion reaction include carbon dioxide (CO\textsubscript{2}) and water (H\textsubscript{2}O). The reaction typically gives off heat and light as well. The general equation for a combustion reaction can be represented by:

Fuel + O\textsubscript{2} \rightarrow CO\textsubscript{2} + H\textsubscript{2}O

The fuel that burns in a combustion reaction is often a substance called a hydrocarbon. A hydrocarbon is a compound that contains only carbon (C) and hydrogen (H). Fossil fuels, such as natural gas, consist of hydrocarbons. Natural gas is a fuel that is commonly used in home furnaces and gas stoves. The main component of natural gas is the hydrocarbon called methane (CH\textsubscript{4}). The combustion of methane is represented by the equation:

CH\textsubscript{4} + 2O\textsubscript{2} \rightarrow CO\textsubscript{2} + 2H\textsubscript{2}O

Your own body cells burn fuel in combustion reactions. The fuel is glucose (C\textsubscript{6}H\textsubscript{12}O\textsubscript{6}), a simple sugar. The process
in which combustion of glucose occurs in body cells is called cellular respiration. This combustion reaction provides energy for life processes. Cellular respiration can be summed up by the equation:

\[ C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O \]

**Questions**

1. What is a combustion reaction?
2. Identify the reactants and products in any combustion reaction.
3. Compare and contrast methane and glucose as fuels.

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**Lesson 8.3: Multiple Choice**

**Circle the letter of the correct choice.**

1. Which of the following is an example of a synthesis reaction?
   a. \( 2NO + O_2 \rightarrow 2NO_2 \)
   b. \( 2Na + Cl_2 \rightarrow 2NaCl_2 \)
   c. \( H_2O \rightarrow H_2 + O_2 \)
   d. two of the above

2. A decomposition reaction is represented by the general equation
   a. \( A + B + C \rightarrow AB + C \)
   b. \( A + BC \rightarrow AB + C \)
   c. \( AB \rightarrow A + B \)
   d. none of the above

3. Which type of reaction is represented by the following chemical equation? \( NaCl + AgF \rightarrow NaF + AgCl \)
   a. synthesis
   b. decomposition
   c. single replacement
   d. double replacement

4. Which of the following is always a reactant in a combustion reaction?
   a. water
   b. oxygen
   c. carbon dioxide
   d. two of the above

5. Methane is a
   a. hydrocarbon.
   b. component of natural gas.
   c. compound containing only carbon and hydrogen.
   d. all of the above

6. What do living cells use for fuel?
   a. oxygen
   b. water
   c. glucose
1.3. Types of Chemical Reactions

7. The reaction in which carbon dioxide and water combine to form glucose
   a. is a combustion reaction.
   b. is called photosynthesis.
   c. takes place in all living cells.
   d. all of the above

Lesson 8.3: Matching

Name___________________ Class________________ Date________

Match each definition with the correct term.

Definitions
   _____ 1. one reactant breaking down into two or more products
   _____ 2. ions changing places in two compounds
   _____ 3. two reactants combining to form a single product
   _____ 4. substance reacting quickly with oxygen
   _____ 5. one of the reactants in a combustion reaction
   _____ 6. one ion taking the place of another in a compound
   _____ 7. another term for a combustion reaction

Terms
   a. synthesis reaction
   b. combustion reaction
   c. decomposition reaction
   d. single replacement reaction
   e. double replacement reaction
   f. burning
   g. fuel

Lesson 8.3: Fill in the Blank

Name___________________ Class________________ Date________

Fill in the blank with the appropriate term.

1. A(n) __________ reaction is represented by the general equation A + B → C.
2. The reaction H₂CO₂ → H₂O + CO₂ is a(n) __________ reaction.
3. A(n) __________ reaction is the reverse of a synthesis reaction.
4. The general equation A + BC → B + AC represents a(n) __________ reaction.
5. A(n) __________ replacement reaction produces two new compounds.
6. Replacement reactions involve the exchange of one or more __________.
Lesson 8.3: Critical Writing

Name___________________ Class______________ Date________

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Compare and contrast single and double replacement reactions. Identify ways they are similar as well as how they differ.
Lesson 8.4: Chemical Reactions and Energy

Lesson 8.4: True or False

Determine if the following statements are true or false.

1. All chemical reactions involve energy.
2. One of the most important endothermic reactions is photosynthesis.
3. In an exothermic reaction, it takes more energy to break bonds in reactants than is released when bonds form in products.
4. Combustion is an example of an endothermic reaction.
5. There is no overall change in the amount of energy in chemical reactions.
6. Only endothermic reactions need energy to get started.
7. Energy is absorbed in exothermic reactions.
8. An increase in temperature is a sign of an exothermic reaction.
9. Products have less stored chemical energy than reactants in an endothermic reaction.
10. Catalysts in living things are called enzymes.

Lesson 8.4: Critical Reading

Read this passage from the text and answer the questions that follow.

Conservation of Energy

Whether a reaction absorbs energy or releases energy, there is no overall change in the amount of energy in a chemical reaction. That’s because energy cannot be created or destroyed. This is the law of conservation of energy. Energy can change form—for example, from electricity to light—but the same amount of energy always remains.

If energy cannot be destroyed, what happens to the energy that is absorbed in an endothermic reaction? The energy is stored in the chemical bonds of the products. This form of energy is called chemical energy. In an endothermic reaction, the products have more stored chemical energy than the reactants. In an exothermic reaction, the opposite is true. The products have less stored chemical energy than the reactants. The excess energy in the reactants is released to the surroundings when the reaction occurs.

Questions

1. State the law of conservation of energy.
2. Explain what happens to the energy that is absorbed in an endothermic reaction.
3. Compare the energy of reactants and products in an exothermic reaction.
Lesson 8.4: Multiple Choice

Name___________________ Class______________ Date__________

Circle the letter of the correct choice.

1. Which statement describes a role of energy in chemical reactions?
   a. Energy is created in exothermic reactions.
   b. Energy is always released in chemical reactions.
   c. Energy is needed for chemical reactions to start.
   d. Energy is destroyed in endothermic reactions.

2. The energy needed for photosynthesis is in the form of
   a. glucose.
   b. oxygen.
   c. light.
   d. heat.

3. When products have less chemical energy than reactants, a chemical reaction
   a. is endothermic.
   b. is exothermic.
   c. absorbs energy.
   d. two of the above

4. According to the law of conservation of energy, energy
   a. cannot be created.
   b. cannot be destroyed.
   c. cannot change form.
   d. two of the above

5. Factors that affect reaction rates include
   a. temperature.
   b. concentration.
   c. surface area.
   d. all of the above

6. Crushing a solid reactant into a powder will
   a. decrease the reactant’s surface area.
   b. increase the rate of the reaction.
   c. decrease the concentration of products.
   d. increase the temperature of reactants.

7. Which statement about catalysts is true?
   a. They change the rate of chemical reactions.
   b. They are reactants in chemical reactions.
   c. They are used up in chemical reactions.
   d. two of the above

Lesson 8.4: Matching

Name___________________ Class______________ Date__________
Match each definition with the correct term.

Definitions
1. energy stored in chemical bonds
2. substance that speeds up chemical reactions
3. turning out heat
4. how fast a reaction occurs
5. energy needed to start a reaction
6. taking in heat
7. number of particles of a substance in a given volume

Terms
a. activation energy
b. catalyst
c. concentration
d. endothermic
e. exothermic
f. reaction rate
g. chemical energy

Lesson 8.4: Fill in the Blank

Name _____________________ Class _____________ Date ______

Fill in the blank with the appropriate term.

1. In a(n) _______ chemical reaction, less energy is needed to break bonds in reactants than is released when bonds form in products.
2. A constant input of energy is needed to keep a(n) _______ chemical reaction going.
3. The general equation for a(n) _______ chemical reaction is: Reactants → Products + Energy
4. A drop in temperature is a sign that a chemical reaction is _________.
5. Chemical reactions occur more _________ when the temperature is higher.
6. A greater concentration of reactants _________ the reaction rate.
7. Catalysts increase reaction rates by decreasing the amount of _________ energy needed.

Lesson 8.4: Critical Writing

Name _____________________ Class _____________ Date ______

Thoroughly answer the question below. Use appropriate academic vocabulary and clear and complete sentences.

Explain why all chemical reactions—even exothermic reactions—require activation energy to begin.