Review Vocabulary: chemical formula

Define chemical formula. Use your book for help.

New Vocabulary: chemical reaction
reactants
products
chemical equation
coefficient
balanced chemical equation
mole
molar mass

Predict Review the objectives of Section 1. Predict three topics that might be discussed.

1.
2.
3.

228 Chemical Reactions
Lavoisier and the Conservation of Mass

Main Idea

I found this information on page ________

Summarize the contributions of Lavoisier by filling out the organizer. Include information on his experiments, observations, and theories.

<table>
<thead>
<tr>
<th>Lavoisier</th>
<th>Conservation of Mass</th>
<th>Father of Modern Chemistry</th>
<th>Naming Compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Identify the reactants and the products in the following chemical equations.

<table>
<thead>
<tr>
<th>Chemical Equation</th>
<th>Reactants</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zn + S → ZnS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AgNO₃ + NaCl → AgCl + NaNO₃</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C₁₂H₂₂O₁₁ → 12C + 11H₂O</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fe + CuSO₄ → FeSO₄ + Cu</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CaCO₃ + 2HCl → H₂O + CO₂ + CaCl₂</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Complete the graphic organizer about symbols used in chemical equations.

Symbols Used in Chemical Equations

4 states of matter
3 conditions that may be required for a reaction to occur
Section 1 Chemical Changes (continued)

Main Idea

Writing Equations
I found this information on page ________.

Coefficients
I found this information on page ________.

Details

Complete the following chemical formula and its translation.

\[ 2\text{Mg} + \_ \rightarrow 2\text{MgO} + \text{light} \]

<table>
<thead>
<tr>
<th>Magnesium</th>
<th>oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>_</td>
<td>_</td>
</tr>
</tbody>
</table>

\_ \_ magnesium oxide

and \_ \_ .

Analyze the role of coefficients in writing chemical equations.

Evaluate the student responses. The science teacher gave students the following equation to balance, and three students made responses as shown in the chart. State who is correct and give an explanation of what the meaning of the two wrong responses would be and why those solutions do not work.

\[ \text{Mg(s)} + \text{O}_2(\text{g}) \rightarrow \text{MgO(s)} \]

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Student’s Answer</th>
<th>Evaluation: Are they right or wrong? What does the student’s answer mean?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melinda</td>
<td>Put a 2 in front of the Mg.</td>
<td></td>
</tr>
<tr>
<td>Barni</td>
<td>Put a 2 in front of the MgO.</td>
<td></td>
</tr>
<tr>
<td>Ali</td>
<td>Put a 0.5 in front of the O_2.</td>
<td></td>
</tr>
</tbody>
</table>

230 Chemical Reactions
Section 1 Chemical Changes (continued)

Main Idea

Balancing Equations

I found this information on page

Details

Summarize information about balancing equations by completing the prompts.

Balancing an equation means

Coefficients are the numbers that show

Subscripts are numbers that show there is

Identify each number 3 below as a coefficient (C) or a subscript (S).

| 2 FeSO₃ | 6 AlH₃ |
| 3 HCl  | 4 Al₂O₃ |
| 3 Na   | 3 H₂   |

Complete The number of atoms for each element on the left side of the equation has been filled in for you. Complete the right side of the equation.

<table>
<thead>
<tr>
<th>Atoms</th>
<th>BaCl₂</th>
<th>H₂SO₄</th>
<th>→ BaSO₄</th>
<th>+ HCl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ba</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cl</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Evaluate whether the equation above is balanced. Give the total number of atoms on the left side and the total number on the right side.

Identify the coefficient for HCl that would balance the equation in the table above.

Chemical Reactions 231
Section 1. Chemical Changes (continued)

Main Idea

Balancing Equations

I found this information on page ________.

Details

Sequence and describe 4 steps involved in balancing a chemical equation. In the right column, write an example for each step.

1. 

2. 

3. 

4. 

I found this information on page ________.

Identify coefficients that balance each equation.

1. \( _{\text{P}}(\text{s}) + _{\text{O}}(\text{g}) \rightarrow _{\text{P}_4}\text{O}_{10}(\text{s}) \)
2. \( _{\text{KClO}_3}(\text{s}) \rightarrow _{\text{KCl}(\text{s}) + _{\text{O}}(\text{g})} \)
3. \( _{\text{H}_2}\text{O}(\text{l}) \rightarrow _{\text{H}_2(\text{s}) + _{\text{O}}(\text{g})} \)
4. \( _{\text{CH}_4(\text{s}) + _{\text{O}}(\text{g})} \rightarrow _{\text{CO}_2(\text{g}) + _{\text{H}}\text{O}(\text{g})} \)
5. \( _{\text{Al}_2}\text{O}_3(\text{s}) \rightarrow _{\text{Al}(\text{s}) + _{\text{O}}(\text{g})} \)
6. \( _{\text{MgSO}_4(\text{aq}) + _{\text{KCl}(\text{aq})} \rightarrow _{\text{MgCl}_2(\text{s}) + _{\text{K}_2}\text{SO}_4(\text{aq})} \)

CONNECT IT

Compare chemical equations and mathematical equations.
Chemical Reactions

Section 2 Classifying Chemical Reactions

**Review Vocabulary**

**states of matter**

**Define** states of matter.

**New Vocabulary**

*Read the definitions below. Then write the key term for each one in the left column.*

- a reaction in which a substance reacts with oxygen to produce heat and light
- a reaction in which two or more substances combine to form another substance
- a reaction in which one substance breaks down, or decomposes, into two or more substances
- a reaction in which one element replaces another element in a compound
- a reaction in which the positive ion of one compound replaces the positive ion of the other compound to form two new compounds
- an insoluble compound that comes out of a solution during a double-displacement reaction
- a loss of electrons during a chemical reaction
- a gain of electrons during a chemical reaction

**Sidem** Section 2. Write two statements about what you plan to learn from the reading.

1. 

2. 

---

*Chemical Reactions 233*
Section 2: Classifying Chemical Reactions (continued)

**Main Idea**

**Types of Reactions**

_I found this information on page _________._

**Details**

Describ each type of chemical reaction in words. Give the general form if it exists and an example for each.

I. Combustion Reaction
   - **Description:**
   - **Example:**

II. Synthesis Reaction
   - **Description:**
   - **General form:**
   - **Example:**

III. Decomposition Reaction
   - **Description:**
   - **General form:**
   - **Example:**

IV. Single-Displacement Reaction
   - **Description:**
   - **General form:**
   - **Example:**

V. Double-Displacement Reaction
   - **Description:**
   - **General form:**
   - **Example:**

VI. Oxidation-Reduction Reaction
   - **Description:**

---

234. Chemical Reactions
Section 2  Classifying Chemical Reactions (continued)

Main Idea

Type of Reactions
I found this information on page ____________.

Details

________________________________________________________________________________________________

Analyze the activity series chart in your book to decide which metal will replace the other in a displacement reaction.
1. calcium        2. tin         3. copper
lead                zinc         aluminum

______________________________________________________________________________________________

Classify each chemical reaction by writing the reaction type in the blank to the left.
- decomposition
- double displacement
- single displacement
- synthesis

2LiBr + Pb(NO₃)₂ → PbBr₂ + 2LiNO₃
Fe + 2HCl → FeCl₂ + H₂
CaO + H₂O → Ca(OH)₂
NiCl₂ → Ni + Cl₂

Model a synthesis reaction and a decomposition reaction using the following elements. Balance the equations.

Calcium        Hydrogen        Oxygen
Synthesis

Decomposition

[energy will be required to cause the decomposition reaction]

CONNECT IT

Select an example of a chemical reaction that you have observed.
Describe the reaction and try to write an equation for it.
Preview Section 3 of this chapter. Read the headings and the illustration captions. Write three questions that come to mind.

1. 
2. 
3. 

**Review Vocabulary**
chemical bond

**Define chemical bond.**

**New Vocabulary**
exergonic reaction
exothermic reaction
endergonic reaction
endothermic reaction

Use your book to define the following key terms.

**Academic Vocabulary**
release

Use a dictionary to define release.
Section 3 Chemical Reactions and Energy (continued)

Main Idea

Chemical Reactions—Energy Exchanges

I found this information on page ________.

More Energy Out, More Energy In

I found this information on page ________.

Details

Identify three pieces of information about chemical reactions and energy.

1. ________________________________________
2. ________________________________________
3. ________________________________________

Complete the following sentences about energy reactions.

All exothermic reactions are ________, but not all exergonic reactions are __________. ____________. Give off thermal energy, and __________ give off any type of energy.

All ________ reactions are endergonic, but not all ________ reactions are endothermic. __________ reactions absorb thermal energy, and __________ reactions absorb any type of energy.

Classify each reaction as endergonic or exergonic.

- combustion of fossil fuels
- dissolving salt in water
- dynamite explosions
- electroplating
- fireflies' light
- glow sticks
- photosynthesis
- rusting iron
- separating aluminum metal from its ore

<table>
<thead>
<tr>
<th>Exergonic</th>
<th>Endergonic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chemical Reactions 237
Section 3 Chemical Reactions and Energy (continued)

Main Idea

More Energy Out, More Energy In

I found this information on page _______.

Details

Model the exergonic/exothermic and endothermic/endergonic relationships by completing the Venn Diagram below. The first step has been done for you.

Exothermic

Compare and contrast the conservation of mass and the conservation of energy in the equation below. Fill the Venn diagram using phrases from the bank below the equation.

\[ \text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g}) + \text{energy} \]

- Balanced equation
- Chemical energy is released as thermal energy.
- New compounds are created.
- Matter is not created or destroyed.
- Light is a product.

Conservation of Mass

Conservation of Energy

Both

CONNECT IT

Use what you have learned in this section to explain why a match will not light if you do not strike it hard enough.
Chemical Reaction
Section 4 Reaction Rates and Equilibrium

Read the section headings and ask three questions that come to mind.
1. 
2. 
3. 

Define pressure using your own words.

Use your book or a dictionary to define these key terms.

reaction rate
collision model
catalyst
inhibitor
reversible reaction
equilibrium
Le Chatelier's principle

Use a dictionary to define principle.
### Main Idea

**Reaction Rates**

I found this information on page

---

### Details

Explain whether each of the factors in the chart speeds up a reaction, or slows it down, and how they work.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Speeds up the reaction...</th>
<th>Slows down the reaction...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concentration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pressure and Volume</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface Area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catalyst</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inhibitor</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Compare and contrast the roles of catalysts and inhibitors in reactions. Fill in the Venn diagram with phrases from the bank.

- does not enter into the reaction itself
- enzymes in body
- food preservatives
- temperature change
- used in auto industry
- used to make polymers

---

**Venn Diagram:**

- Catalyst
- Inhibitors
- Both

---

240 Chemical Reactions
Section 4 Reaction Rates and Equilibrium (continued)

Main Idea

Equilibrium

I found this information on page __________

Details

Explain reversible reactions by inserting the words left and right in the following statements.

The reactants for the forward reaction are on the _________. The products are on the _________. The reactants for the reverse reaction are on the _________. The products are on the _________.

List the reactants and products of the following reversible reaction.

\[ \text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g}) \]

<table>
<thead>
<tr>
<th>Reactant(s)</th>
<th>Product(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward reaction</td>
<td></td>
</tr>
<tr>
<td>Reverse reaction</td>
<td></td>
</tr>
</tbody>
</table>

Complete the following statement.

The state in which forward and reverse reactions balance each other because they take place at equal rates is called _________. Although a chemical reaction might be in equilibrium, the ________ and ________ can continually be ________ because chemical equilibrium is a dynamic process.

Determine how each of the following changes affects a system in equilibrium.

Changes in concentration (collisions)

Changes in volume (pressure, products)

Changes in temperature (endothermic, exothermic)