

Chemical Reactions and Equations



What happens to atoms and energy during a chemical reaction?

Before You Read

Before you read the chapter, think about what you know about chemical reactions. Record three things that you already know about chemical reactions in the first column. Then write three things that you would like to learn about in the second column. Complete the final column of the chart when you have finished this chapter.

K What I Know	W What I Want to Learn	L What I Learned

Chapter Vocabulary

Lesson 1	Lesson 2	Lesson 3
NEW chemical reaction chemical equation reactant product law of conservation of mass coefficient REVIEW chemical bond	NEW synthesis decomposition single replacement double replacement combustion	NEW endothermic exothermic activation energy catalyst enzyme inhibitor

Lesson 1 Understanding Chemical Reactions

Scan Lesson 1. Read the lesson titles and bold words. Look at the pictures. Identify three facts you discovered about chemical reactions. Record your facts in your Science Journal.

Main Idea

Changes in Matter

I found this on page **419**.

Details

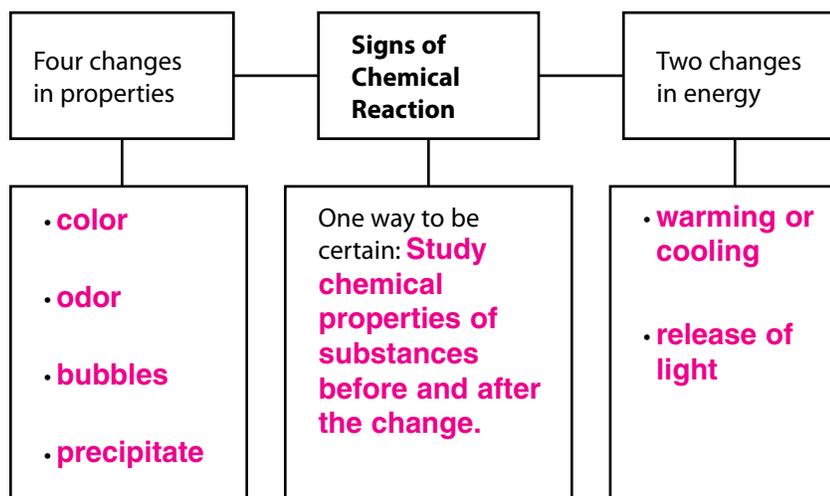
Differentiate a physical change from a chemical change.

Physical Change	Chemical Change
New substances are not produced, but the substances that exist before and after the change might have different physical properties.	One or more substances change into new substances with different physical and chemical properties.

Signs of a Chemical Reaction

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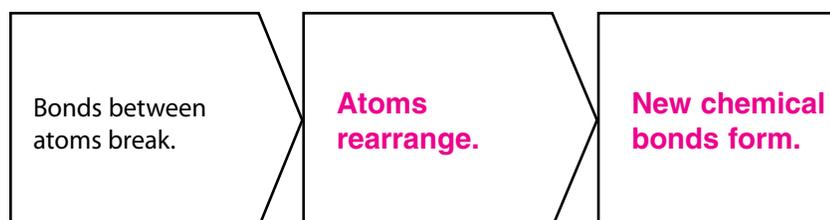
Identify signs of a chemical reaction.



What happens during a chemical reaction?

I found this on page **421**.

Sequence changes in atoms during a chemical reaction.



Lesson 1 | Understanding Chemical Reactions (continued)

Main Idea

Chemical Equations

I found this on page 422.

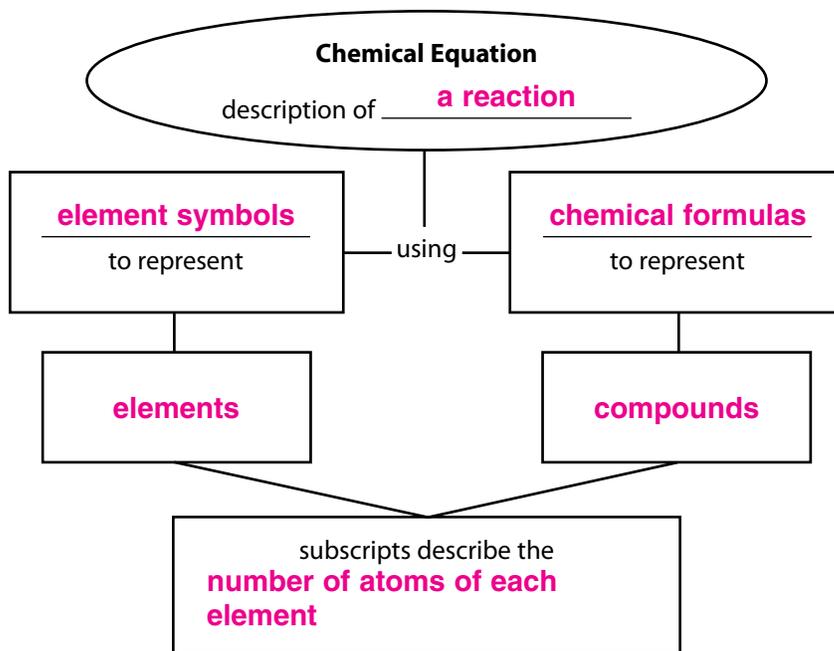
I found this on page 423.

Conservation of Mass

I found this on page 424.

Details

Distinguish the parts of a chemical equation.



Detail information regarding the writing of chemical equations.

Define <i>reactant</i> .	the starting substances in a chemical reaction
Define <i>product</i> .	the substances produced by a chemical reaction
Write the general structure for a chemical equation.	reactant + reactant → product + product
How is the arrow sign read?	as “produces” or “yields”
Write the equation for “carbon plus oxygen produces carbon dioxide.”	C + O₂ → CO₂

Restate the law of conservation of mass.

The total mass before a chemical reaction is the same as

the total mass after a chemical reaction.

Lesson 1 | Understanding Chemical Reactions (continued)

Main Idea

I found this on page 424.

I found this on page 425.

I found this on page 426.

I found this on page 426.

I found this on page 426.

Details

 **Relate** atoms to mass in a chemical reaction.

Mass before a chemical reaction	is equal to	mass after a chemical reaction
Number of atoms in the reactants		number of atoms in the products

Paraphrase what it means when you say a chemical equation is balanced.

The specific numbers of types of atoms are the same on both sides of the equation.

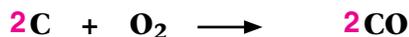
Explain the meaning of chemical formulas. Circle the coefficient.

H₂O	2H₂O
means one water molecule	means two water molecules

Order the steps in balancing a chemical equation.

- Write the unbalanced equation.**
- Count atoms of each element in the reactants and products.**
- Add coefficients to balance the atoms.**
- Write the balanced chemical equation.**

Balance the chemical equation for carbon monoxide.



 **Analyze It** Look back at the picture of the firefly on the first page of Lesson 1. How could you conclude that the firefly's blinking is a chemical rather than a physical change simply by viewing the picture and without reading the text on the page?

Accept all reasonable responses. Sample answer: The firefly's blink gives off light energy. The release of light is an energy change, which is characteristic of a chemical change, not a physical change.

Lesson 2 Types of Chemical Reactions

Predict three facts that will be discussed in Lesson 2 after reading the headings. Write your facts in your Science Journal.

Main Idea

Patterns in Reactions

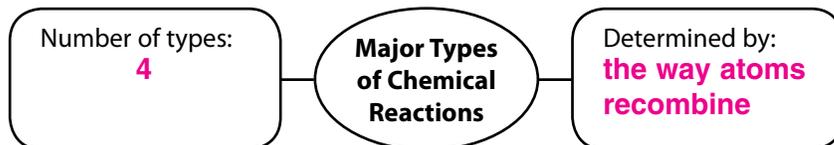
I found this on page **430**.

Types of Chemical Reactions

I found this on page **431**.

Details

Generalize the concept of patterns in chemical reactions.



Describe and model synthesis and decomposition reactions. First, describe the reactions. Then draw simple shapes to model how substances behave during these reactions.

	Synthesis	Decomposition
Explanation	Two or more substances combine and form one compound.	One compound breaks down and forms two or more substances.
Diagram	Student drawing should show different shapes for two or more elements on the left side of the equation and the shapes side by side to represent a single compound on the right side of the equation.	Student drawing should show different shapes side by side to represent a single compound on the left side of the equation and the shapes separated to represent two or more elements on the right side of the equation.

Lesson 2 | Types of Chemical Reactions (continued)

Main Idea

I found this on page 432.

Details

Describe replacement reactions. Include a model of single- and double-replacement reactions with your descriptions.

Replacement Reactions

An atom or group of atoms replaces part of a compound.

Single-replacement

One element replaces another element in a compound.



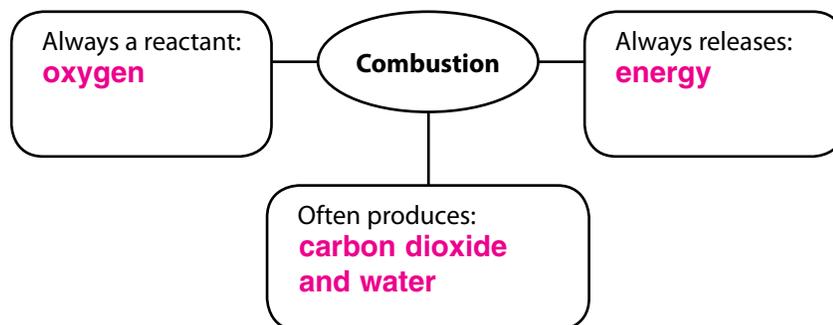
Double-replacement

The negative ions in two compounds switch places.



I found this on page 432.

Characterize combustion.



I found this on page 432.

Identify the two types of energy typically released during combustion reactions.

1. thermal energy
2. light energy

Synthesize It Summarize the four major types of chemical reactions you learned about in Lesson 2.

Synthesis reactions combine two or more elements or compounds into one

compound; decomposition breaks one compound into two or more substances. In

replacement reactions, component parts of compounds recombine to form different

compounds. Combustion always involves oxygen as a reactant and releases energy.

Lesson 3 Energy Changes and Chemical Reactions

Skim Lesson 3 in your book. Read the headings and look at the photos and illustrations. Identify three things you want to learn more about as you read the lesson. Record your ideas in your Science Journal.

Main Idea

Energy Changes

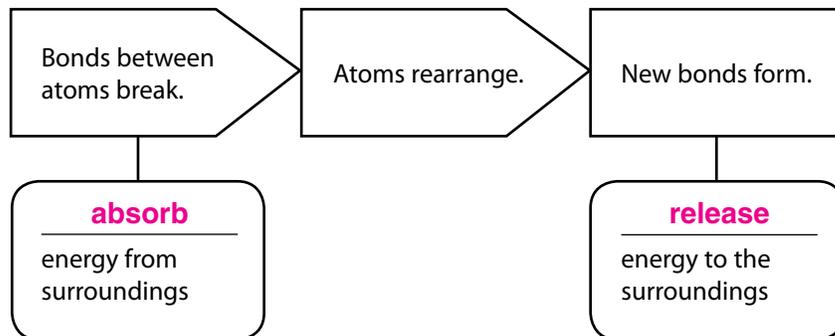
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Details

Expand the model of a chemical reaction to represent energy changes that occur.



Differentiate endothermic and exothermic reactions.

Reaction	reactants + thermal energy \longrightarrow products
Type	endothermic
Energy change	thermal energy absorbed
Bonds that contain more energy	products
Reaction	reactants \longrightarrow thermal energy + products
Type	exothermic
Energy change	thermal energy released
Bonds that contain more energy	reactants

Define activation energy, and identify types of reactions that use it.

Activation energy: the minimum amount of energy needed to start a chemical reaction

Types of reactions: both exothermic and endothermic

Lesson 3 | Energy Changes and Chemical Reactions (continued)

Main Idea

Reaction Rates

I found this on page 438.

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Details

Record two factors about particle collisions that affect the rate of chemical reactions.

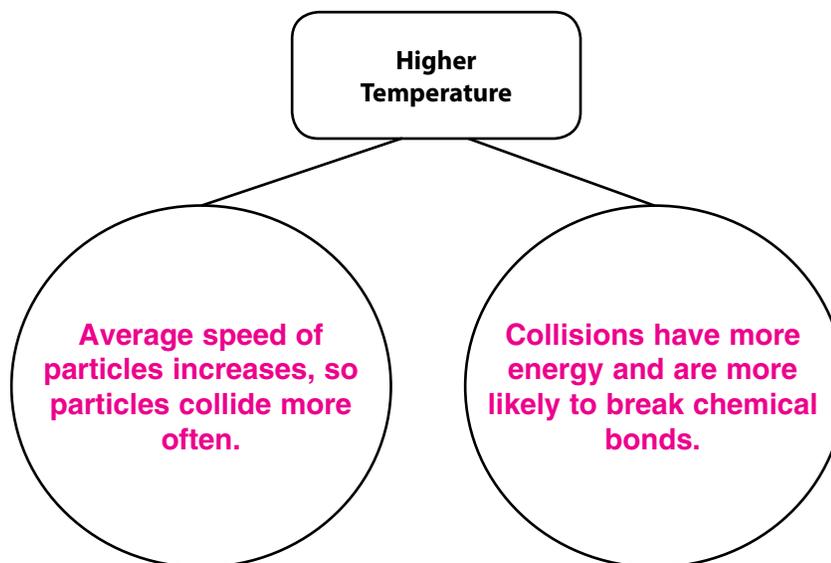
1. how often particles collide
2. how fast particles are moving when they collide

Relate surface area to reaction rate in the following example.

A chunk of chalk reacts with vinegar.	Speed of reaction rate: slower Explanation: Acid is in contact only with particles on the surface of the chalk.
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Crushed chalk powder reacts with vinegar.	Speed of reaction rate: faster Explanation: More chalk particles are in contact with the acid.
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Distinguish two reasons that higher temperature speeds reaction rate.



Lesson 3 | Energy Changes and Chemical Reactions (continued)

Main Idea

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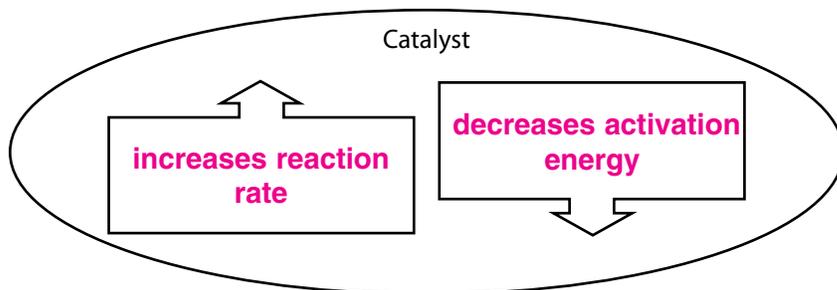
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Details

Compare higher concentration and increased pressure as means to increase reaction rate.

In both situations, particles are closer together, which causes more collisions between particles to occur.

Relate the presence of a catalyst in a chemical reaction to activation energy and reaction rate.



Express the relationship between catalysts and enzymes.

An enzyme is a type of catalyst. It speeds up chemical reactions in living cells.

Contrast catalysts and inhibitors

	Catalyst	Inhibitor
Description	increases reaction rate by lowering activation energy	slows, or even stops, a chemical reaction

Connect It Consider the example of the rocket launch shown in the picture on the first page of Lesson 3. Hypothesize why it would be important to understand both catalysts and inhibitors in this series of chemical reactions.

Accept all reasonable responses. Sample answer: A rocket launch requires a massive amount of energy to be released rapidly, so catalysts that speed the reaction are helpful. However, rocket fuel sources can react so quickly, in fact, that they can be highly explosive. Inhibitors keep the fuel under control until the right time.

Chemical Reactions and Equations

Chapter Wrap-Up

Now that you have read the chapter, think about what you have learned. Complete the final column in the chart on the first page of the chapter.

Use this checklist to help you study.

- Complete your Foldables[®] Chapter Project.
- Study your *Science Notebook* on this chapter.
- Study the definitions of vocabulary words.
- Reread the chapter, and review the charts, graphs, and illustrations.
- Review the Understanding Key Concepts at the end of each lesson.
- Look over the Chapter Review at the end of the chapter.



Summarize It Reread the chapter Big Idea and the lesson Key Concepts. Summarize what you have learned by converting each of the Key Concept questions into a factual answer. **Accept all reasonable responses. Sample answers:**

Lesson 1 (three Key Concepts)

1. Warming or cooling and the release of light are some signs that a chemical reaction might have occurred. 2. Atoms are conserved during a chemical reaction.

3. Total mass is conserved in a chemical reaction.

Lesson 2 (two Key Concepts)

1. You can recognize a synthesis reaction by the multiple reactants that combine to form one compound as a product. 2. The four main types of chemical reactions are synthesis, decomposition, replacement, and combustion.

Lesson 3 (three Key Concepts)

1. Chemical reactions always involve a change in energy because chemical bonds contain chemical energy. 2. The difference between endothermic and exothermic reactions is that endothermic reactions absorb energy and exothermic reactions release energy. 3. Surface area, temperature, and pressure affect the rate of a chemical reaction.

Challenge Choose a chemical reaction that you routinely observe. This could be anything from rust forming on playground equipment, to photosynthesis in grass, to the combustion of fuel in your family's car. Make an illustrated poster that describes the reactants, products, and energy processes in the reaction. Be sure to use balanced chemical equations in your captions. Display your poster in your class.