

Chapter 2 The Nature of Matter ▪ Section 3 Summary

Energy and Matter

Key Concepts

- What are some forms of energy that are related to changes in matter?
- How is chemical energy related to chemical change?

Like matter, energy cannot be created or destroyed in chemical reactions. However, energy does change from one form to another. **Forms of energy related to changes in matter include chemical, electromagnetic, electrical, and thermal energy.**

The energy stored in the chemical bonds between atoms is a form of energy called **chemical energy**. When a chemical change occurs, the bonds are broken and new bonds may form. If the chemical change is exothermic, some of the chemical energy is released in other forms like thermal energy.

Chemical changes also release a form of energy called **electromagnetic energy**, which travels through space as waves. Light is one kind of electromagnetic energy. Other examples include radio waves, microwaves, and X-rays. Burning wood is a chemical change that gives off electromagnetic energy and thermal energy. Electromagnetic energy can also cause matter to change. For example, a microwave oven can change a frozen block of spaghetti and sauce into a hot meal—a physical change.

The energy of electrically charged particles moving from one place to another is called **electrical energy**. In many chemical changes, electrons move from one atom to another. Another chemical change, electrolysis, involves electrical energy. In electrolysis, two metal strips called **electrodes** are placed in a solution. Electrical energy from a battery is used to cause the atoms of one electrode to lose electrons. These electrons move through the solution to the other electrode, where different atoms gain them.

Temperature is a measure of the average energy of random motion of the particles in an object. **Thermal energy** is the *total* energy of all the particles in an object. Temperature is different from thermal energy, but temperature does depend on the amount of thermal energy an object has. Thermal energy always moves from warm matter to cool matter.

When ice absorbs thermal energy from its surroundings, it melts. The melting of ice is an endothermic change. An **endothermic change** is a change in which energy is taken in, or absorbed. When wood burns, energy is given off in the form of heat and light. An **exothermic change** releases, or gives off, energy.

Every time matter changes, energy is involved. **During a chemical change, chemical energy may be changed to other forms of energy. Other forms of energy may also be changed to chemical energy.** One important example of energy change is photosynthesis. In photosynthesis, plants change electromagnetic energy from the sun into chemical energy as they make sugar. These plants, as well as the animals that eat them, change this chemical energy into the energy needed for life activities.

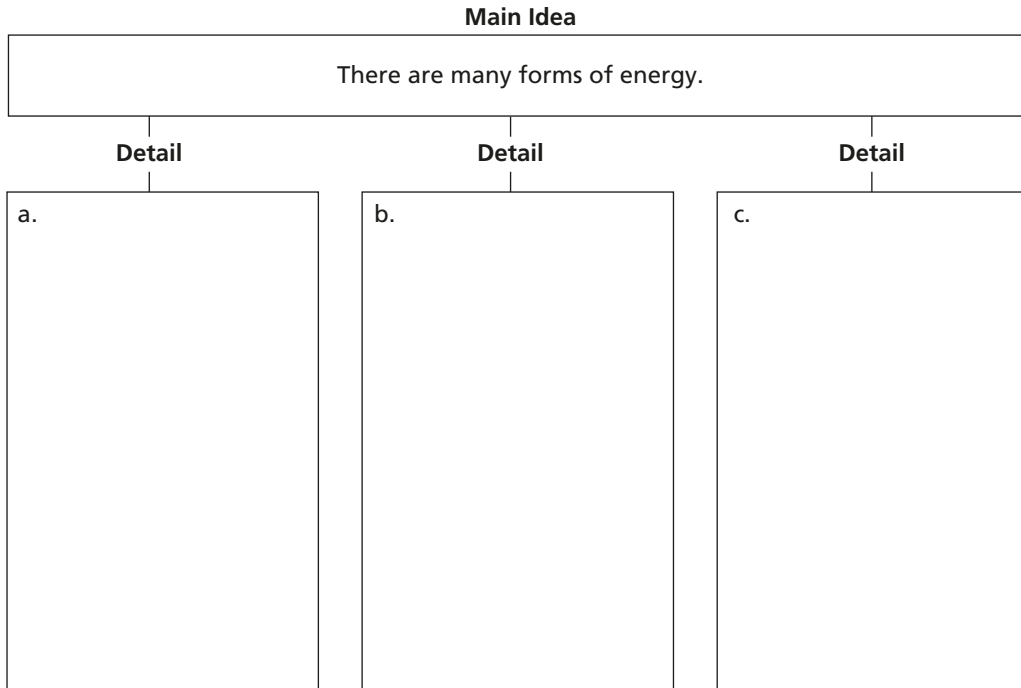
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Energy and Matter (pp. 73–77)

This section describes some forms of energy that are related to changes in matter and how chemical energy is related to chemical change.

Use Target Reading Skills

As you read about forms of energy, complete the graphic organizer by writing three supporting details that give examples of the main idea.



Forms of Energy (pp. 74–76)

1. List four forms of energy related to changes in matter.

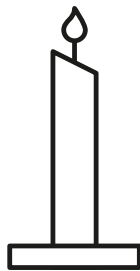
2. How does temperature differ from thermal energy?

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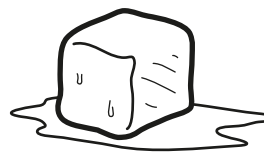
Energy and Matter (continued)

3. Classify the following as an endothermic or exothermic change.

a.



b.



4. What is chemical energy?

5. Circle the letter of the best description of electromagnetic energy.

- a. moves electrons
- b. travels through spaces as waves
- c. forms chemical bonds
- d. gives off heat

6. Give an example of how electromagnetic energy can cause changes in matter.

7. The energy of electrically charged particles moving from one place to another is _____ energy.

8. In electrolysis, electrons move between two metal strips called _____.

Transforming Energy (p. 77)

9. Circle the letter of each kind of energy released when fuel is burned.

- a. chemical energy
- b. thermal energy
- c. electrical energy
- d. electromagnetic energy

10. Is the following sentence true or false? In a chemical change, other forms of energy cannot be changed to chemical energy.

11. During photosynthesis, plants transform _____ energy from the sun to _____ energy.