

Energy Works!



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Heat in Brief

The introduction to energy in *Heat* presents the different forms of energy that people see, feel, and use every day. The amount of energy in the universe stays the same, but it is constantly changing forms. Sound, light, motion, electricity, and heat are all forms of energy.

Chapter 1 emphasizes the role that heat energy plays in our lives. In the familiar scenario of a birthday party, the author reveals how heat is the unnoticed guest, cooking food, keeping the guests warm, and providing electricity.

Chapter 2 defines heat as energy given off by moving molecules. Cold is a loss of heat. Sources of heat energy include the Sun, the Earth, chemical reactions, fire, friction, and nuclear energy.

The differences between the physical and chemical changes brought about by heat energy are discussed in Chapter 3. In a physical change, the substance changes its form on the outside, but the molecules on the inside remain the same. Melting, boiling, evaporating, condensing, and freezing are physical changes. A chemical change occurs when a substance's molecules change into different molecules. Cooking foods is an example of a chemical change.

Heat also affects the size of an object. Adding heat makes most substances expand. Removing heat causes most substances to contract. Water is an exception to this rule.

Chapter 4 focuses on temperature and the different types of thermometers. Temperature is a measure of how fast the molecules are moving in an object. Faster molecules result in a higher temperature.

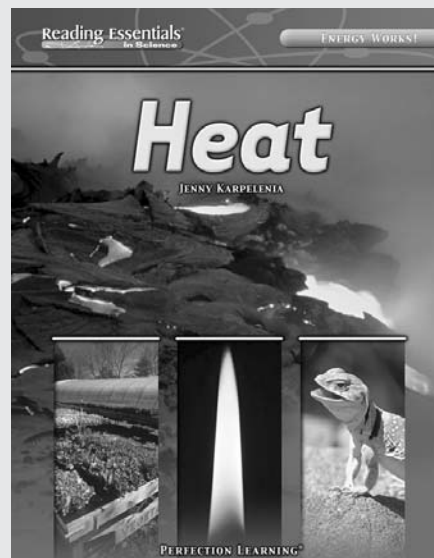
Chapter 5 demonstrates the everyday use of heat radiation. Radiation is energy that travels in waves. The Sun's radiation is a major source of heat. Common appliances and machines such as lamps, ovens, and cars also radiate heat.

Chapter 6 describes the process of convection, the movement of heat through air, water, and other gases. The basis of convection is that hot air rises and cold air sinks.

Chapter 7 provides an explanation of conduction. This occurs when heat passes from one object to another. Most metals are good conductors.

Body heat is the topic of Chapter 8. A cold-blooded animal's body temperature depends on its environment. Warm-blooded animals, including humans, have a stable body temperature not dependent on the outside world.

Chapter 9 highlights the helpfulness of heat. Heat energy is used to make electricity, run machines, warm homes, and cook food. Heat brings warmth to the world.



Reading Exploration Essentials

Vocabulary

adaptation	chemical change	cold
conduction	conductor	convection
energy	force	geyser
greenhouse	heat	insulator
molecule	physical change	radiate
radiation	temperature	theory

Reading Exploration

prereading

Write the word *HEAT* vertically on the board. Ask students to write a quick acrostic poem using information they know about heat. For example,

Hot
Energy
Absolute zero
Temperature

Ask students to share their poems and ideas about heat energy.

during reading

Turn students into “molecules,” and use them to demonstrate important heat concepts throughout the book.

Ask for five volunteers to act as “molecules.” Have them stand still and close together. Explain to the class that the volunteers are molecules in a solid, such as a piece of ice.

Now “heat” the molecules. Ask the students to start moving around slowly. Explain that they have now become a liquid that changes shape as the molecules speed up and move farther apart.

Continue “heating” the molecules by asking students to move even faster and farther apart. Explain that they have now become a gas.

As you progress through the book, use your student molecules to demonstrate physical and chemical changes, expansion and contraction, convection, and conduction.

postreading

Ask students to choose another important word from *Heat* and write an acrostic poem that describes the word.

More Than One Part

Most of the glossary words in *Heat* are nouns. A *noun* is a person, place, thing, or idea. A greenhouse is a place. A molecule is a thing. A theory is an idea.

Many of the words, however, can easily be changed into verbs. *Verbs* are action words. For example, metal objects are *conductors* (noun). They *conduct* (verb) heat.

In the sentences below, decide whether the underlined words are nouns or verbs. Write N for *noun* or V for *verb* on the line before each number.

- _____ 1. Cold is a loss of heat.
- _____ 2. A thermometer measures temperature.
- _____ 3. The Sun heats up the Earth.
- _____ 4. Volcanoes and geysers release heat from inside the Earth.
- _____ 5. Lamps, ovens, and fires radiate heat.
- _____ 6. Coolers and thermoses insulate liquids so heat cannot move in or out.
- _____ 7. Friction is a force that acts against motion.
- _____ 8. The movement of heat through air and other gases is known as convection.
- _____ 9. Humans adapt to cold weather by wearing thick, heavy clothing to trap body heat.
- _____ 10. Heat energy is used in the engines that run most of the machines used today.
- _____ 11. A liquid changes into a gas during a process known as evaporation.
- _____ 12. A chemical change occurs when heat causes an object's molecules to turn into different molecules.



Important Information

What important information did you learn about heat energy from reading the book? Answer the following questions about facts found in *Heat*.

1. Light and heat energy from the Sun is called _____.

2. What are three sources of heat energy? _____

3. What is the difference between a physical and a chemical change? _____

4. When heat is added to most substances, do they expand (grow larger) or contract (get smaller)?

5. What is temperature? _____

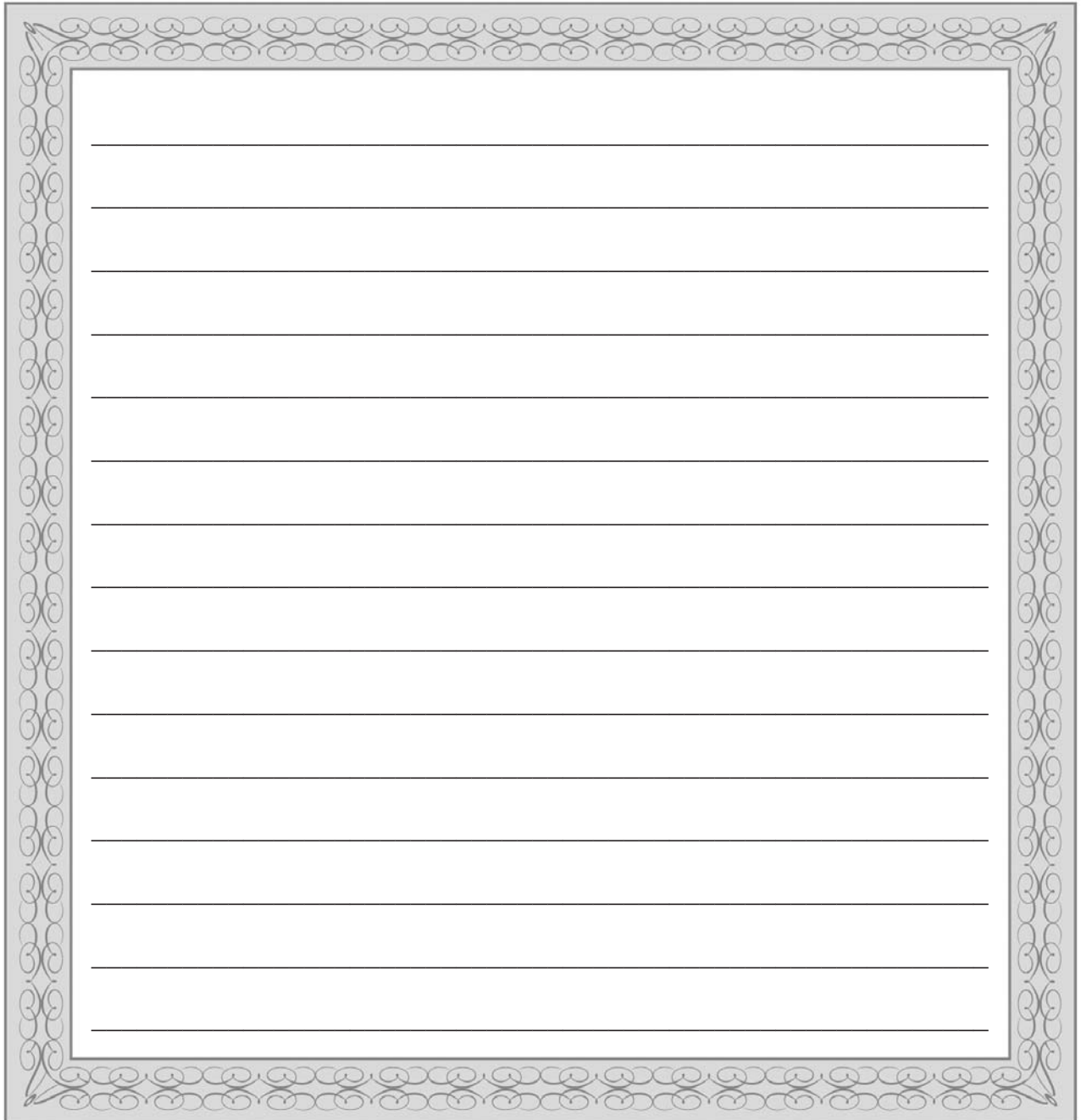
6. What is the most important source of heat energy on Earth?



continued

Dear Mr. Fahrenheit . . .

The book *Heat* had lots of information on temperature and thermometers. Imagine you are writing a letter to Daniel Fahrenheit or Anders Celsius. Tell him what you learned about temperature and his scale to measure temperature. Personalize the letter by adding facts about the scientist's life. You may want to do additional research on Mr. Fahrenheit or Mr. Celsius. Write your letter in the space below.



A Day in the Sun

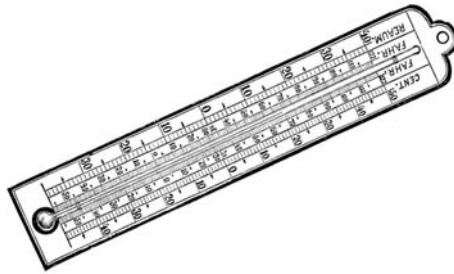
Which do you think is warmed more quickly by the Sun's heat energy—land or water? Write your prediction below. Then try this experiment to find out.

Prediction

I think _____ will change its temperature more quickly because

Materials

- bucket of water
- bucket of soil
- two thermometers



Procedure

- Place the buckets of soil and water indoors or in the shade until they reach the same temperature. Then move the buckets to an area of direct sunlight. Measure the temperature of each bucket every half hour for three hours. Record the temperature in the chart below.
- Then move the buckets back indoors or in the shade. Measure the temperature of each bucket every half hour for three hours. Record your results in the chart on the next page.

Temperatures in the Sun

Temperature Trials	Temperature of the Soil	Temperature of the Water
1		
2		
3		
4		
5		
6		

continued

Twenty-Question Objective Test

Directions: Match each word and its definition.

- | | |
|---------------------|--|
| _____ 1. insulator | a. movement of rising hot air and sinking cold air |
| _____ 2. radiation | b. adjustment to conditions in the environment |
| _____ 3. convection | c. energy that travels in the form of waves |
| _____ 4. adaptation | d. building used to grow plants |
| _____ 5. greenhouse | e. material that doesn't allow heat to move through easily |

Directions: Answer each statement True (T) or False (F).

- _____ 6. Heat energy is also known as thermal energy.
- _____ 7. Cold is not a form of energy.
- _____ 8. Sublimation is the changing of a solid into a liquid.
- _____ 9. In a chemical change, only the shape of the substance changes.
- _____ 10. Most liquids expand when heated.

Directions: Choose the best answer to complete each statement.

11. Heat energy is given off by
- moving molecules.
 - fast waves.
 - slow electrons.
12. The most important source of energy on Earth is
- electricity.
 - gas.
 - the Sun.

continued