

Atmospheric Heating

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- How does energy travel from the sun to Earth?
- What are the differences between radiation, conduction, and convection?
- Why is Earth's atmosphere so warm?

How Does Energy Travel from the Sun to Earth?

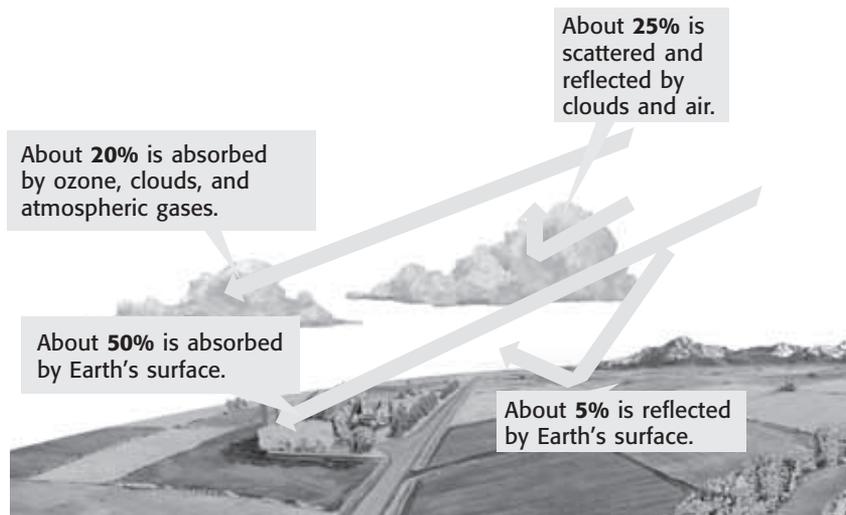
Most of the heat energy on Earth's surface comes from the sun. Energy travels from the sun to Earth by **radiation**, which means that it travels through space as waves. As solar energy (energy from the sun) is absorbed by air, water, and land, it turns into heat energy. This energy causes winds, the water cycle, ocean currents, and changes in the weather.



Outline In your notebook, write an outline of this chapter. Use the questions in bold to make your outline. As you read, fill in information about each question.

What Happens to Radiation from the Sun?

Not all of the radiation from the sun reaches Earth's surface. Much of it gets absorbed by the atmosphere. Some of it is scattered and reflected by clouds and gases.



TAKE A LOOK

1. Identify How much of the sunlight that gets to Earth is absorbed by Earth's surface?

2. Summarize What happens to the sunlight that is not absorbed by Earth's surface?

SECTION 2 Atmospheric Heating *continued*

How Is Heat Transferred by Contact?

Once sunlight is absorbed by Earth’s surface, it is *converted*, or changed, into heat energy. Then, the heat can be transferred to other objects and moved to other places. When a warm object touches a cold object, heat moves from the warm object to the cold one. This movement of heat is called **thermal conduction**.

When you touch the sidewalk on a hot, sunny day, heat energy is conducted from the sidewalk to you. The same thing happens to air molecules in the atmosphere. When they touch the warm ground, the air molecules heat up. ✓

READING CHECK

3. List Name two ways that air gets heated.

Critical Thinking

4. Apply Concepts Before the water in the pot can heat up, the pot itself must heat up. Does the pot heat up by conduction, convection, or radiation? Explain your answer.

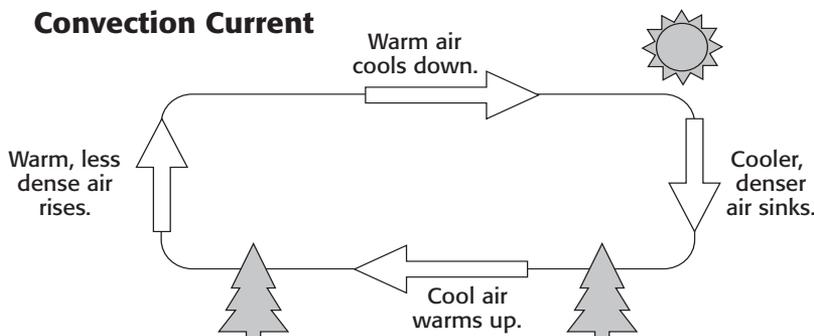
How Is Heat Energy Transferred by Motion?

If you have ever watched a pot of water boil, you have seen convection. During **convection**, warm material, such as air or water, carries heat from one place to another.

When you turn on the stove under a pot of water, the water closest to the pot heats up. As the water heats up, its density decreases. The warm water near the pot is not as dense as the cool water near the air. Therefore, the cool water sinks while the warm water rises.

As it rises, the warm water begins to cool. When it cools, its density increases. It becomes denser than the layer below, so it sinks back to the bottom of the pot. This forms a circular movement called a *convection current*.

Convection currents also move heat through the atmosphere. In fact, most heat energy in the atmosphere is transferred by convection. Air close to the ground is heated by conduction from the ground. It becomes less dense than the cooler air above it. The warmer air rises while the cooler air sinks. The ground warms up the cooler air by conduction, and the warm air rises again.



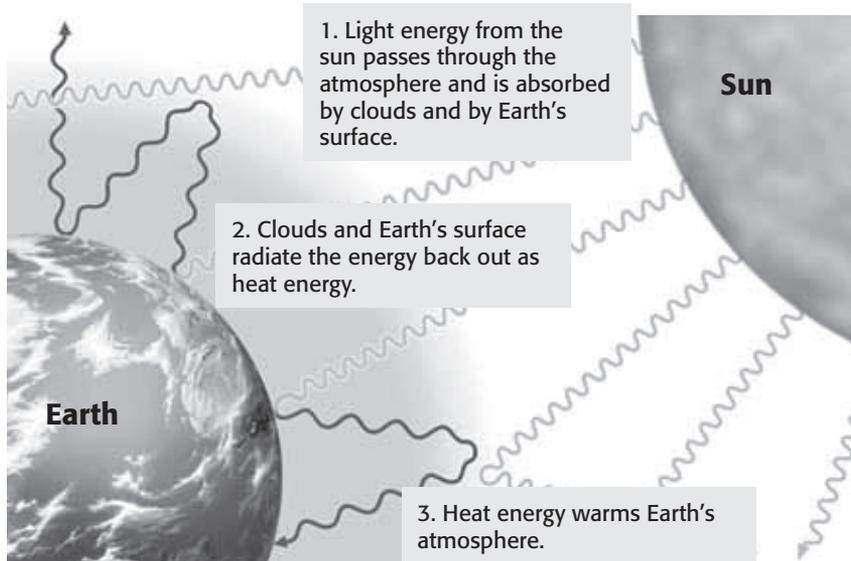
TAKE A LOOK

5. Describe What happens to warm air as it moves through the atmosphere?

SECTION 2 Atmospheric Heating *continued***How Does the Earth Stay Warm?**

A gardener who needs to keep plants warm uses a glass building called a greenhouse. Light travels through the glass into the building, and the air and plants inside absorb the energy. The energy is converted to heat, which cannot travel back through the glass as easily as light came in. Much of the heat energy stays trapped within the greenhouse, keeping the air inside warmer than the air outside.

Earth's atmosphere acts like the glass walls of a greenhouse. Sunlight travels through the atmosphere easily, but heat does not. Gases in the atmosphere, such as water vapor and carbon dioxide, absorb heat energy coming from Earth. Then, they radiate it back to Earth's surface. This is known as the **greenhouse effect**. ✓

The Greenhouse Effect**READING CHECK**

6. List Name two gases in Earth's atmosphere that absorb heat.

TAKE A LOOK

7. Identify On the drawing, label the light coming from the sun with an **L**. Label the heat energy that is trapped by Earth's atmosphere with an **H**.

What Is Global Warming?

Many scientists are worried that Earth has been getting warmer over the past hundred years. This increase in temperatures all over the world is called **global warming**.

Scientists think that human activities may be causing global warming. When we burn fossil fuels, we release greenhouse gases, such as carbon dioxide, into the atmosphere. Because greenhouse gases trap heat in the atmosphere, adding more of them can make Earth even warmer. Global warming can have a strong effect on weather and climate.

Say It

Predict How might global warming affect your community? What can you do to slow global warming? In groups of two or three, discuss how global warming might affect your lives.

Section 2 Review

SECTION VOCABULARY

| | |
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| <p>convection the transfer of thermal energy by the circulation or movement of a liquid or gas</p> <p>global warming a gradual increase in average global temperature</p> <p>greenhouse effect the warming of the surface and lower atmosphere of Earth that occurs when water vapor, carbon dioxide, and other gases absorb and reradiate thermal energy</p> | <p>radiation the transfer of energy as electromagnetic waves</p> <p>thermal conduction the transfer of energy as heat through a material</p> |
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1. Apply Concepts A person is camping outside. The person toasts a marshmallow by holding it above the flames of the fire. Does the marshmallow cook because of convection, conduction, or radiation? Explain your answer.

2. Compare Fill in the table below to name and describe the three ways energy is transferred in Earth’s atmosphere.

| Type of energy transfer | How energy is transferred |
|-------------------------|--|
| | Energy travels as electromagnetic waves. |
| | |
| Conduction | |

3. Explain How does most of the heat in Earth’s atmosphere move from place to place?

4. Identify Relationships Explain how global warming and the greenhouse effect are related.
