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READING FOR INFORMATION

Physical Science

Heat Around Us

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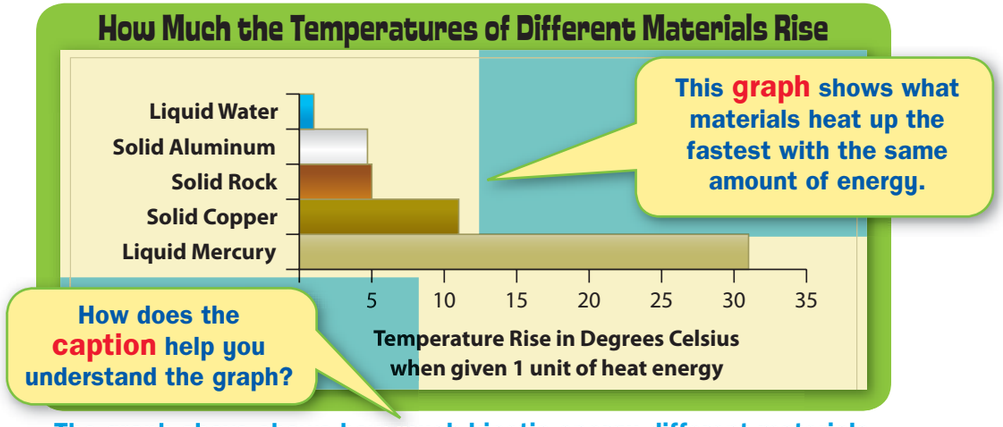
Before You Read

Here are some things you can do to help you read for information.

Features Charts and Graphs

Charts and graphs can help you visually understand information. There are many different kinds of charts and graphs.

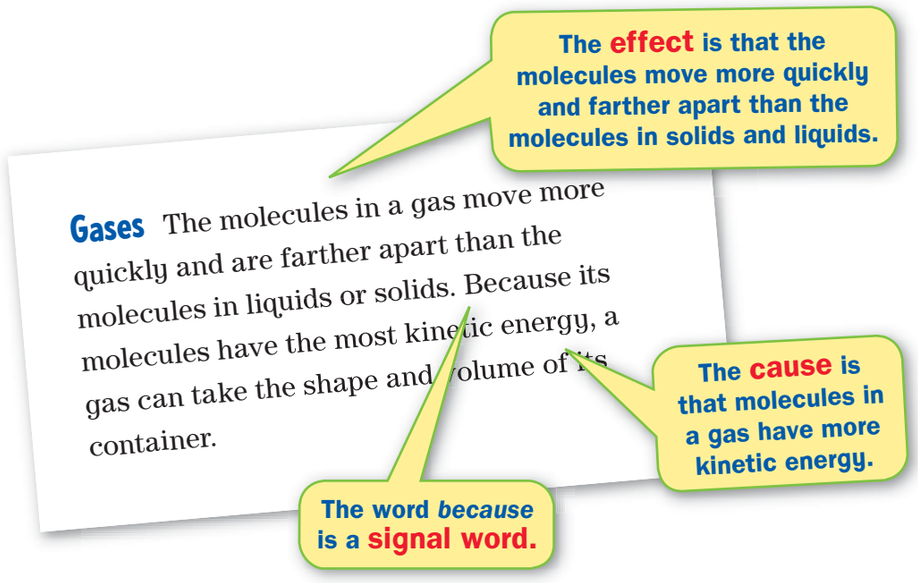
- Sequence charts and flowcharts show the order of steps in a process or an event.
- T-charts and two-column charts compare or contrast two things.
- Organizational charts show the relationships in an organization, group, or family.
- Circle graphs illustrate the parts of a whole group and their values.
- Line graphs, bar graphs, and pictographs compare things on an axis; they are useful for showing specific numbers or changes over time.



The graph above shows how much kinetic energy different materials gain when they are given one unit of heat energy. Heat energy is measured in calories.

Structures Cause and Effect

- A cause is the reason something happens. The signal words *when, if,* and *because* show cause.
- The effect is what happens. The signal words *then, so, as a result,* and *therefore* show effect.



- You can make a simple diagram to help you identify cause-and-effect relationships when you read.

Cause	Effect
Gas molecules have more kinetic energy than the molecules in solids or liquids.	The molecules in a gas move more quickly and are farther apart than those in liquids and solids.

READING for INFORMATION Physical Science

Before You Read

Vocabulary Words to Know

conduction the transfer of energy through direct contact

convection the transfer of energy by the flow of a liquid or gas

electromagnetic wave a wave of light

generate to bring about or produce

heat the transfer of energy from a warmer object to a cooler object

kinetic energy the energy of a moving object

A jumping boy has **kinetic energy.**

transfer the movement from one person or place to another

Heat Around Us

Help from the Sun

Have you ever thought about where you get the energy you need everyday? You might not know it, but you get your energy from the same source as all other living organisms on Earth—the sun!

The sun **generates** light and heat energy. Reptiles keep their bodies warm by lying on rocks to absorb the sun's heat energy. Plants use the sun's energy to make their food. Humans and other mammals use energy from the food provided by plants to create the heat needed to keep their bodies at a constant temperature.

Reptiles use heat energy from the sun to warm up their bodies.

The Big Question

What does heat energy provide for us and how do we use it?

SECTION 1

Heat Energy

Think of all the ways you use heat energy from day to day. Now try to imagine your life without it. Your food and your baths or showers would be cold, and your home might be very uncomfortable during the wintertime.

Let's think about one way we use heat everyday—we use heat to cook our food. When we cook, heat not only warms the food, but also changes it. With the addition of heat energy, cake batter becomes a cake, dough becomes a loaf of bread, and ground beef becomes a hamburger.

When a person bakes, metal in an oven gets hot and also heats the air around the food. The hot metal and the hot air cook the food. When roasting marshmallows, a person places a marshmallow directly over an open flame, and the heat from the fire cooks the food. When food is boiled, it is cooked in very hot water. There are many ways that we use heat to cook. Can you think of any others?

This family is using heat energy to stay warm and roast their marshmallows.

Energy in Motion

Heat is a form of energy, but what is energy? In order to understand energy, try to make a comparison between a time when you had lots of energy and a time when you were less energetic. How was your behavior different during these two times?

When you have lots of energy, you might run around, play sports, or go outside and play a game. When you don't have much energy, you might sit down, lie down, or sleep. If you look at these examples, you may notice a pattern. Having a lot of energy involves moving more; having less energy involves moving less.

People aren't the only ones with energy. Everything that moves has energy. How many objects are in motion during your favorite game or sport? In baseball, the pitcher throws a ball, a player hits it, and players on the field run to catch it as it flies through the air. All of this motion has a type of energy called kinetic energy. **Kinetic energy** is the energy of a moving object.

Moving things have kinetic energy.

Kinetic Energy Is All Around

If you throw a rock into a lake, you have kinetic energy as your body moves. The rock has kinetic energy as it moves through the air. As the rock enters the lake and sinks to the bottom, the splashing and moving water has kinetic energy.

Every moving thing has kinetic energy, but not every moving thing has the same amount of kinetic energy. An airplane traveling at 450 miles per hour has more kinetic energy than an identical airplane moving at 300 miles per hour. When two identical race cars race around a track, the race car that moves faster has more kinetic energy. The faster an object is moving, the more kinetic energy it has.

In this race, the winner will be the car with the most kinetic energy.

Movement That Cannot Be Seen

You can see the movement of a rock splashing into a lake. You can see the movement of an airplane or a race car. However, there is motion all around you that you cannot see as well.

Everything is made of matter, and matter is made of smaller molecules that you cannot see without a powerful microscope. If you look at the molecules in different types of matter with a microscope, you will see that they are constantly in motion. Every object on Earth, even objects that look as if they are lying still, have moving molecules. This means that everything on Earth is constantly moving. The molecules of everything on Earth have some kinetic energy.

How many things in this picture are moving? Remember what you have just learned about molecules

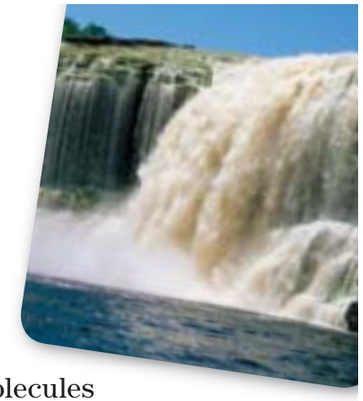
✓**Comprehension**

Summarize why there is motion around you that you cannot see.

Molecules in Motion

There are three states of matter: solids, liquids, and gases. The molecules in solids have the least kinetic energy. The molecules in a solid are close together and move very slowly. The molecules in liquids have more kinetic energy than solids. The molecules in a liquid are less tightly packed and move more quickly. The molecules in gases have the most kinetic energy. The molecules in a gas move around quickly.

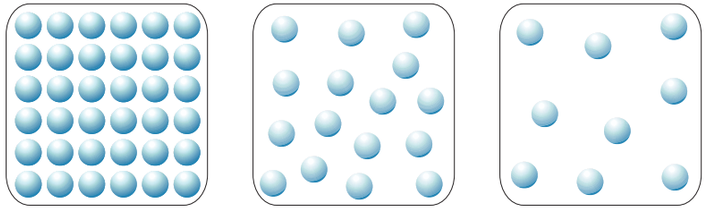
Gases The molecules in a gas move more quickly and are farther apart than the molecules in liquids or solids. Because its molecules have the most kinetic energy, a gas can take the shape and volume of its container.



Liquids The molecules in liquids move more slowly than the molecules in gases. The molecules in a liquid move quickly enough that a liquid takes the shape of its container. However, the molecules in a liquid move too slowly and are too close together for a liquid to take the volume of its container.

Solids The molecules in solids move more slowly and are more tightly packed than both liquids and gases. A solid cannot change its shape to fit a container and cannot change its volume to fit the size of a container.

Molecules in Different States of Matter



molecules in a solid | molecules in a liquid | molecules in a gas

How are molecules spaced differently in different states of matter?

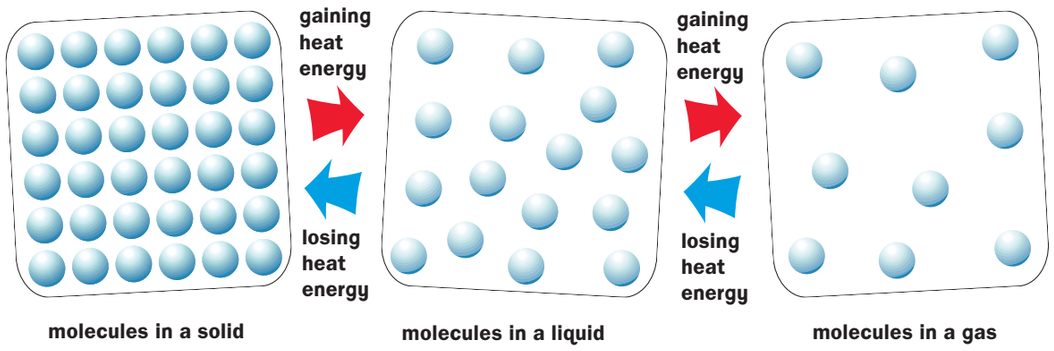
Heat Makes Molecules Move

Every time you make ice cubes or melt butter, you are changing matter from one state to another. Think about what you need to do to make ice cubes. You use the freezer. When you melt butter, you might use the stove or the microwave. What do your stove and your freezer have in common? Both appliances change matter by changing the amount of heat energy a substance has.

In order to convert a solid to a liquid, such as when you melt butter, you have to add heat energy to the solid. When the stove or microwave adds heat energy to the butter, its molecules gain kinetic energy. They begin to move faster and farther apart from each other. The butter melts.

What would happen if, instead of adding heat energy, you took it away? By freezing water, you are actually taking away heat energy from water. When you take enough heat energy away from a liquid, its molecules begin to move more slowly. They don't move away from each other or move past each other. They become more densely packed together. The water freezes into a solid.

Gaining and losing heat energy makes molecules move at different speeds.



When ice melts, does the ice gain or lose heat energy?

When water freezes, is heat energy being added or taken away?

Structures **Cause and Effect**

Does gaining heat energy make molecules move faster or slower?

A solid changes to a liquid when it gains enough heat energy. A liquid changes to a gas when it gains enough heat energy. Gaining heat energy makes molecules in matter move faster.

A gas changes to a liquid when it loses enough heat energy. A liquid changes to a solid when it loses enough heat energy. Losing energy makes molecules in matter slow down.

✓Comprehension

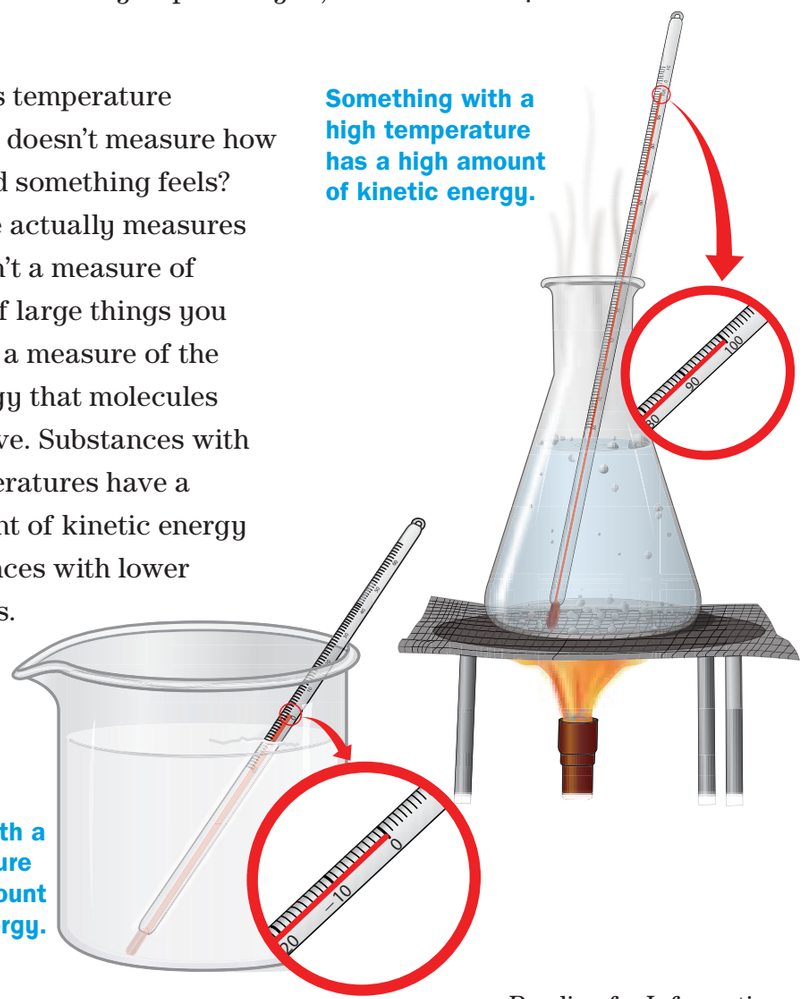
Summarize how heat makes butter melt.

SECTION 2

Temperature Measures Motion

Often, people describe a substance by saying it feels hot or cold, but can a person accurately predict the exact temperature of a substance just by how it feels? Imagine going outside on a very cold winter day wearing lots of warm clothing. Now imagine going outside on the same day wearing shorts and a t-shirt. The air would feel colder without warm clothing to protect you, but the air temperature hasn't changed.

What does temperature measure if it doesn't measure how warm or cold something feels? Temperature actually measures motion. It isn't a measure of the motion of large things you can see. It is a measure of the kinetic energy that molecules in matter have. Substances with higher temperatures have a larger amount of kinetic energy than substances with lower temperatures.



Something with a high temperature has a high amount of kinetic energy.

Something with a low temperature has a low amount of kinetic energy.

Thermometers

Temperature measures the kinetic energy, or the motion of molecules, of a substance. Because molecules are too small to see, we use thermometers to measure their motion.

Some thermometers contain a liquid that expands when heated. When a thermometer is placed in a warm substance, the liquid expands and rises in the thermometer. If a substance is especially cold, the liquid inside the thermometer will contract and fall inside the thermometer.

Structures **Cause and Effect**

What makes the liquid in a thermometer expand or contract?

We use different kinds of thermometers to measure temperature.

FOCUS ON genre

Using a Web Site

A Web site can give you information about science topics. The Web site below describes how two scientists invented two different scales to measure temperature.

Temperature Scales: Fahrenheit and Celsius

In 1714, Gabriel Fahrenheit invented a scale for measuring the temperature of substances. The coldest temperature he was able to create was with a mixture of salt and ice. He labeled the temperature of that mixture "0 degrees." Based on Fahrenheit's temperature scale, the temperature at which water freezes is 32 degrees higher than the temperature of his salt and ice mixture, and the point at which water boils is 212 degrees higher than the temperature of his salt and ice mixture.

Twenty-eight years later, in 1742, a Swedish scientist named Anders Celsius introduced his temperature scale. Celsius made the freezing point of water equal to 0 degrees on his scale. He made the boiling point of water equal to 100 degrees.

1 of 2

Converting Temperature Units

Today, the Celsius scale is used by most of the world. Only the United States and a few other countries still use the Fahrenheit scale. Because different countries use different scales, it is important to know how to change a Fahrenheit temperature into a Celsius temperature or a Celsius temperature into a Fahrenheit temperature.

Some thermometers show both temperatures, but you can also use math to convert temperatures.

To convert Fahrenheit temperatures into Celsius:

- Begin by subtracting 32 from the Fahrenheit number.
- Divide the answer by 9.
- Then multiply that answer by 5.

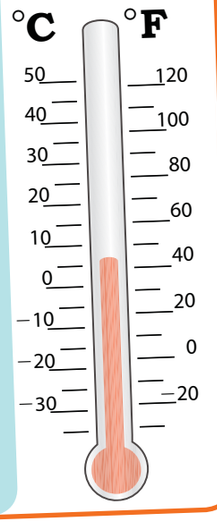
To convert Celsius temperatures into Fahrenheit:

- Begin by multiplying the Celsius temperature by 9.
- Divide the answer by 5.
- Now add 32.

Try the following example. The Celsius temperature outside is 10 degrees. Could you wear shorts outside?

Step 1: 10 X 9 = 90
Step 2: 90 / 5 = 18
Step 3: 18 + 32 = 50

At 50 degrees Fahrenheit, it's still too cold for shorts.



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SECTION 3

The Give and Take of Heat Transfer

If you have ever sat on an uncomfortably hot car seat in the summertime, you have already felt the affects of heat transfer. A **transfer** is the movement of something from one place to another. **Heat** is the transfer of energy from a warmer object to a cooler object.

When your hand touches an object that has less heat energy than you do, the object will feel cold because heat energy is leaving your hand and transferring to the object.

If you touch an object that has more heat energy than you do, the object will feel hot because heat energy is transferring from the object to your body.

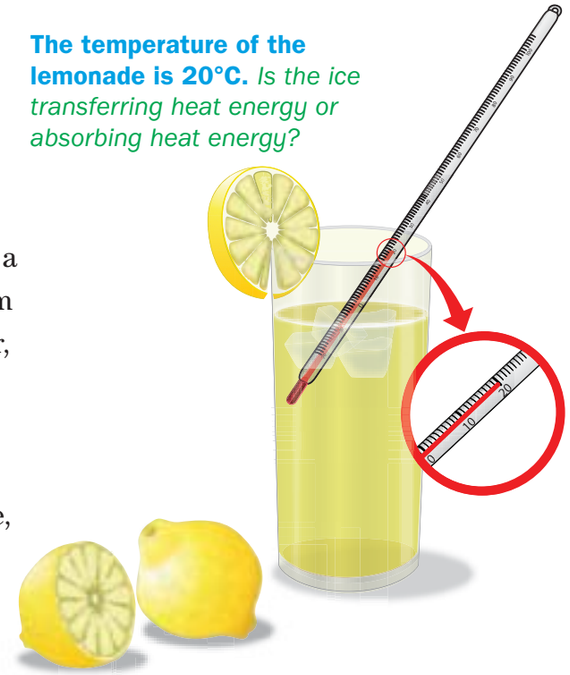
Heat energy moves from a warmer object to a cooler object until both objects are the same temperature. When you sit on a hot car seat, heat transfers from the seat to your skin.

If you were to touch this hot cup of cocoa, would heat transfer to or from your hands?

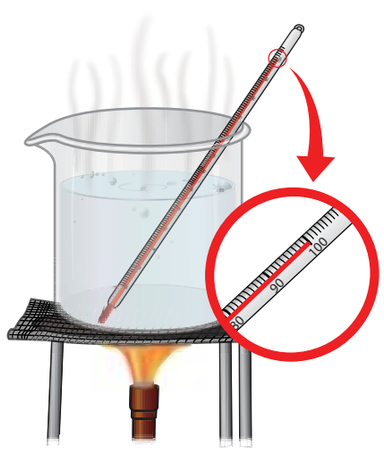
Thermometers Use Heat Transfer

Thermometers rely on heat transfer to measure temperature. When a thermometer is placed in a hot substance, heat transfers from the substance to the thermometer, causing the liquid inside of the thermometer to rise. In a cold substance, heat transfers from the thermometer to the substance, causing the liquid inside the thermometer to fall.

The temperature of the lemonade is 20°C. *Is the ice transferring heat energy or absorbing heat energy?*



Water boils at 100°C



Water freezes at 0°C

✓Comprehension

Summarize how heat transfer affects thermometers.

Types of Heat Transfer

There are three different ways heat can be transferred from one object to another: conduction, convection, and radiation.

Conduction

Conduction occurs when one object transfers heat energy to another through direct contact. Conduction is the only way that heat can transfer from one solid to another.

Conductors Some solids easily conduct heat. These solids are called conductors. The best conductors are metal. Many cooking pots are made from metal because metal conducts heat well. When a metal pan is put on a stove, heat transfers from the burner to the metal until the metal is the same temperature as the burner.

Because copper easily conducts heat, it is an ideal metal for this tea kettle.

Insulators There are also many uses for materials that don't easily conduct heat. Substances that don't easily conduct heat are called insulators. Insulators can be used to keep heat in or to keep heat out.

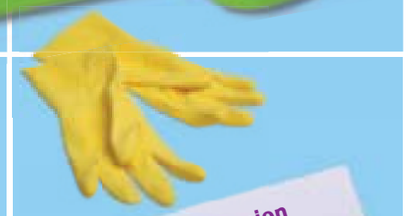
Materials such as plastic, fiberglass, cloth, and rubber make very good insulators.

We use insulators in our everyday lives. Homebuilders use fiberglass to insulate the walls in our homes. Without insulation in winter, indoor heat would escape and the home would not stay warm. Without insulation in summer, heat from outside could come indoors, which would make it difficult to keep the home cool.

Structures Cause and Effect

Look for signal words. Why are many cooking pots made out of metal?

Common Conductors and Insulators

Conductors	gold	
	silver	
	copper	
Insulators	cloth	
	plastic	
	rubber	

A cloth insulator keeps heat from transferring quickly to this boy's hands.

✓Comprehension

Which type of material would be more effective in keeping your soup warm—a metal bowl or a plastic bowl? Why?

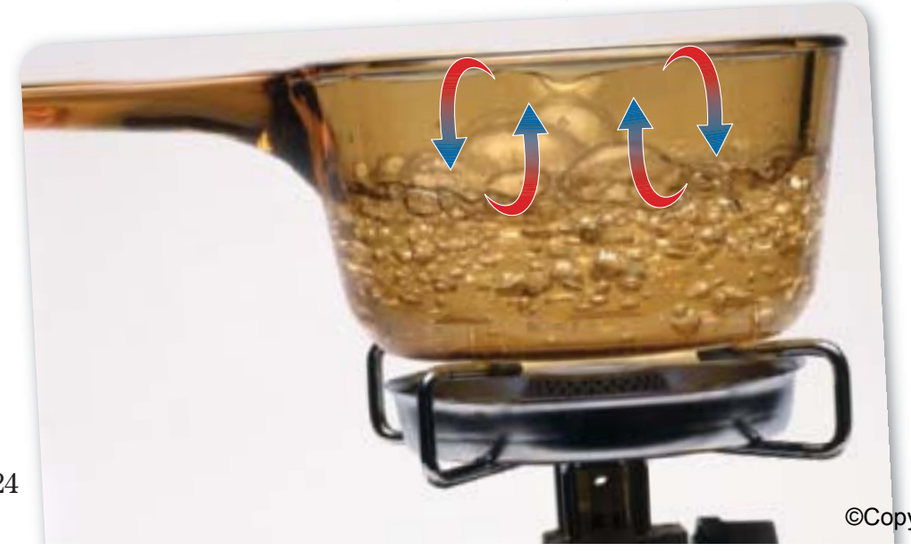
Convection

Liquids and gases heat up evenly through a process called convection. **Convection** is heat transfer caused by the flow of liquid or gas.

Convection works because heat energy makes molecules move faster and farther apart from each other. Heat energy makes molecules become less densely packed together. Hot liquids and gases are made of molecules with a lot of heat energy. The molecules in hot liquids and gases are less densely packed than the molecules in cold liquids and gases. Less densely packed molecules rise above more densely packed molecules, and more densely packed molecules sink below less densely packed molecules.

When you heat soup on a stove, you are creating a convection current. The soup at the bottom of the pot heats up because it touches the pot's hot surface. The molecules of the heated soup become less densely packed. They rise to the top of the pot. The molecules of cold soup at the top of the pot fall to the bottom. The molecules of cold soup heat up because they are now touching the pot's hot surface. They rise back to the top of the pot. The circulation of hot and cold molecules creates a convection current.

Convection is used to cook soup and other liquids.

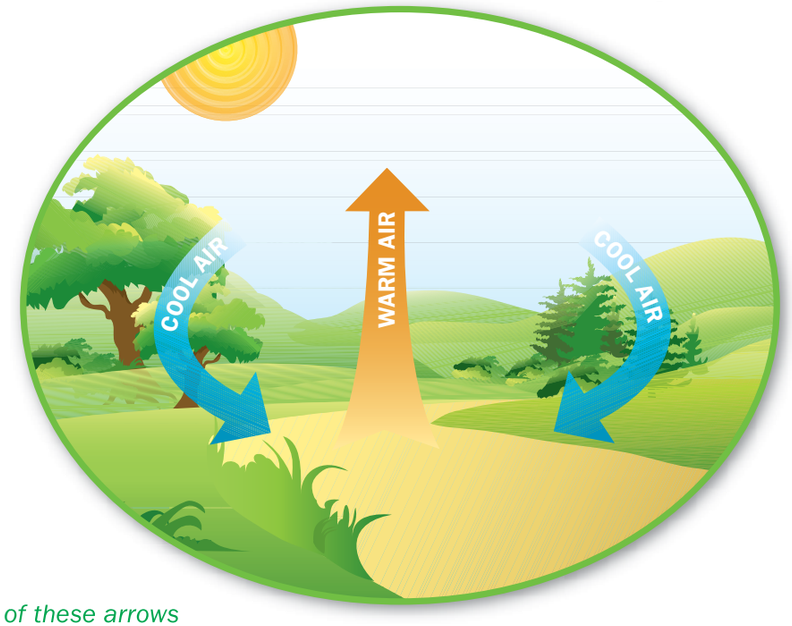


Convection in the Atmosphere

The air in our atmosphere is warmed by convection. Heat energy from the sun warms Earth's surface. The surface then warms the air directly above it. That air becomes less dense and rises. Once warm air rises enough to reach the upper atmosphere, it begins to cool again and sinks back down to Earth, and the process begins all over again.

The movement of air creates very large convection currents. Convection currents are responsible for much of the weather on Earth.

Convection Currents Warm the Atmosphere



Which of these arrows represents warm air? Which of the arrows represents cold air?

Structures **Cause and Effect**

Why do molecules in warmer substances rise above molecules in cooler substances?

Solar panels like the ones on top of these homes use the sun's radiation to heat water and generate electricity.

Radiation

The third and final way that heat energy transfers is by radiation. Radiation is the passage of heat waves through space. When you sit in front of a fire to warm yourself, you feel radiation. Heat waves from fire radiate out and warm the area around you.

Light and heat transfers to Earth from the sun by radiation. Most of the heat and light energy that living things rely on comes from radiation from the sun.

Some people use solar panels to absorb the sun's radiant energy. The solar panels use the light and heat energy from the sun to heat water, heat homes and buildings, and generate electricity.

✓Comprehension

Summarize how the sun's heat and light energy transfers to Earth.

The Electromagnetic Spectrum

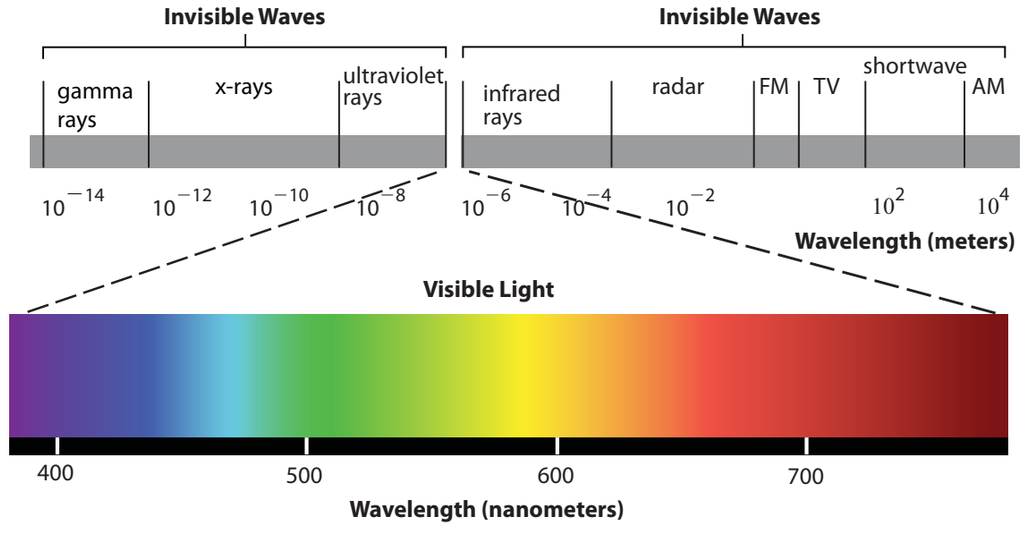
Many different kinds of energy can travel in the form of waves. On a sunny day, it's easy to see waves of light energy and feel waves of heat energy from the sun. However, there are also energy waves that you cannot see or feel. Some examples are ultraviolet waves, radio waves, gamma rays, and x-rays.

Waves of radiation are called **electromagnetic waves,** and they are organized in order by wavelength. Some waves of energy are more powerful than others, so a scale called the electromagnetic spectrum was created to show different waves of energy in the order of how powerful they are. Waves of x-ray radiation are more powerful than waves of visible light.

Energy waves are used in many ways. We use x-rays to see inside our bodies and radio waves to communicate.

Structures **Cause and Effect**

Why was a scale of energy waves created?



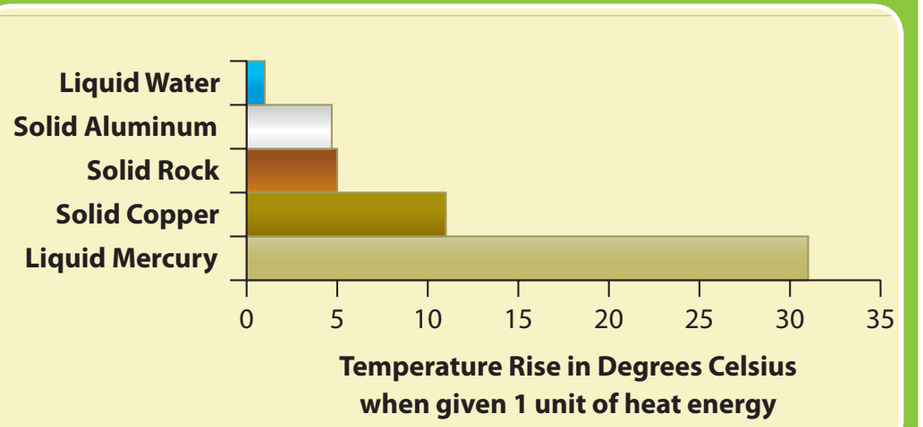
We can see only a small part of the electromagnetic spectrum.

Materials Warm at Different Rates

You have learned that metals are good conductors of heat energy, but why are metals better than other materials? What makes metal better for conducting heat energy than glass or plastic? If you touch the plastic or cloth part of a car seatbelt on a hot day, it may feel warm, but it won't burn you. How about the metal part? It is usually much hotter.

Materials such as glass and plastic do not heat up very easily because it takes a lot of energy to make them warmer. Some materials, such as some metals, take less energy to heat up. Look at the graph below. Which material heats up the most when only one unit of heat energy is added to it?

How Much the Temperatures of Different Materials Rise



The graph above shows how much kinetic energy different materials gain when they are given one unit of heat energy. Heat energy is measured in calories.

Physical Science &you

Heat energy sustains life on Earth. The heat energy we use helps us to stay warm and cook our food.

We use conductors and insulators to help us stay warm in cold temperatures and cool in warm temperatures. Without knowledge of conductors and insulators, we would waste a lot of energy in heating and cooling our homes. Because we understand heat and heat transfer, we are able to stay comfortable and conserve resources. The next time you put on a jacket, warm yourself with a blanket, or heat up some soup, think about how heat transfer, conductors, and insulators are working to help you.

Find all the insulators in this picture.

Think about It! *How do you use insulators every day?*

READING for INFORMATION Physical Science

After You Read

Complete these activities on a separate piece of paper.

Vocabulary Words to Know

Write the word that correctly answers each sentence.

transfer convection heat conduction
kinetic energy generate electromagnetic wave

1. Heat energy can _____ from one object to another.
2. The transfer of heat energy by the flow of a liquid or a gas is called _____ .
3. _____ moves from a warmer object to a cooler object.
4. When two objects touch, _____ transfers heat from one object to another.
5. The sun has energy and can be used to _____ electricity.

Features Charts and Graphs

Look at the graph on page 28.

6. When given one calorie of heat energy, which of the following materials have temperatures that rise only half as much as copper does?
   - **a.** water and mercury
   - **b.** rock and aluminum
   - **c.** rock and mercury
   - **d.** mercury and aluminum

7. Look at this chart from page 23 in your book. Which of these is an insulator?
   - **a.** gold
   - **b.** copper
   - **c.** plastic
   - **d.** tin

Structures Cause and Effect

Answer each question by writing a cause-and-effect sentence that uses signal words.

8. Why does water turn solid when it freezes?
9. Why does the liquid in a thermometer rise when it is put in a warmer liquid?

Write about It

Write a paragraph that describes how insulators and conductors help us efficiently heat and cool our homes. Use cause-and-effect words in your paragraph.

Go To Interactive Skills Handbook

For more practice with
- **charts,** see pages 10–13.
- **graphs,** see pages 18–21.
- **cause and effect,** see pages 46–53.
- **summarizing,** see pages 98–101.

Glossary

conduction (kən duk' shən) *n.* the transfer of energy through direct contact. *Heat is transferred from a stove to a pan by the process of conduction.*

convection (kən vek' shən) *n.* the transfer of energy by the flow of a liquid or gas. *Convection currents move heat through the atmosphere.*

electromagnetic wave (i lek trō mag' net ik wāv) *n.* a wave of light. *The different colors of the rainbow are electromagnetic waves of different lengths.*

heat (hēt) *n.* the transfer of energy from a warmer object to a cooler object. *The heat from a bonfire feels good on a cool night.*

generate (jen' ər āt) *v.* to bring about or produce. *Coal can be burned to generate electricity.*

kinetic energy (ki net' ik en' ər jē) *n.* the energy of a moving object. *A moving freight train has tremendous kinetic energy.*

transfer (trans' fər) *v.* the movement from one person or place to another. *Electromagnetic waves transfer heat and light energy from the sun to Earth.*

Pronunciation Key

a	at	**ō**	rose	**ə**	about, chicken,
ā	late	**ô**	law, bought		pencil, cannon,
ä	father, ox,	**oi**	coin		circus
	mop	**o͝o**	book, pull	**ch**	chair
âr	care	**o͞o**	food, rude	**hw**	which
e	set,	**or**	form	**ng**	ring
ē	me	**ou**	out	**sh**	shop
îr	ear, pier	**u**	up	**th**	thin
i	it	**ū**	use, mule	**t͟h**	there
ī	kite	**ûr**	turn, learn	**zh**	treasure

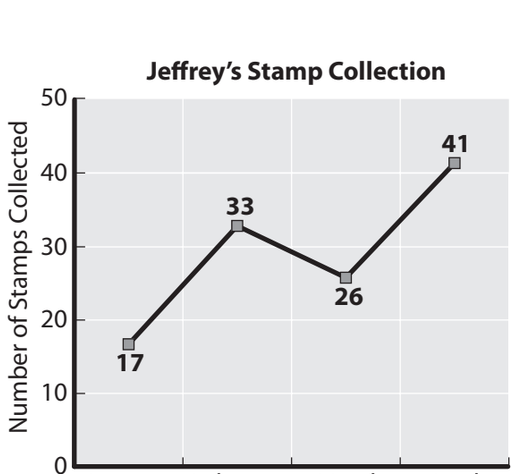
Features

Learn It

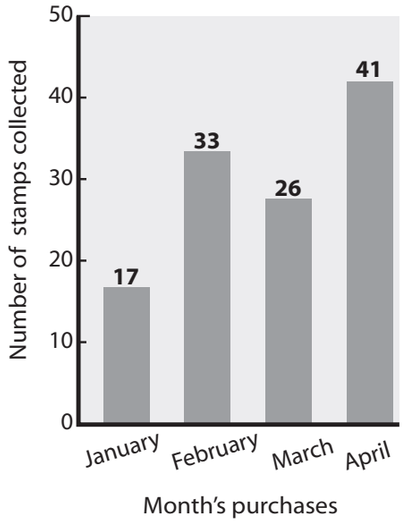
Graphs use bars, pictures, lines, or parts of the whole to show and compare information.

To read a graph:

- read the title and labels.
- determine whether it is a bar graph or a line graph.



On a line graph, points show where the two sides of the graph meet. Lines connect the dots to show change.



A bar graph uses different sized bars. Bars show how many or how much there is of something at different times or in different places.

Take Note

Some information can be shown in more than one style of graph.

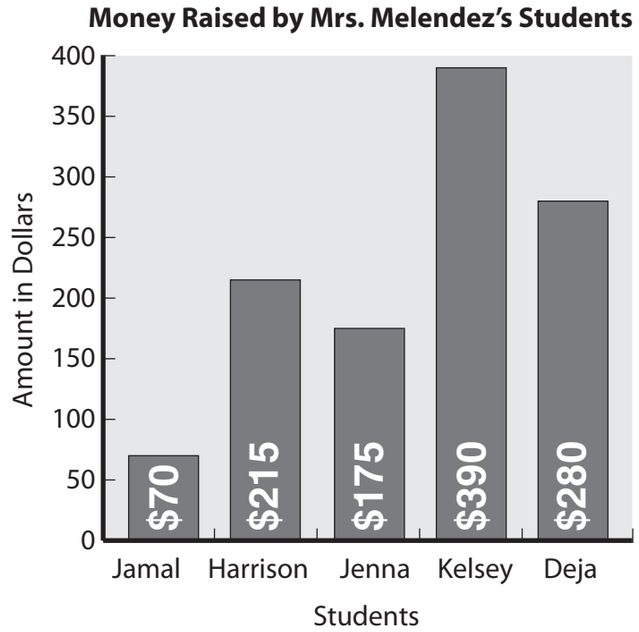
Rule to Remember

Graphs show and compare information.

Features

Try It

Look at the bar graph below. Use what you know about graphs to answer the questions.



1. Who raised the most money?

   Kelsey

2. How much money did Jamal raise?

   $70

3. What information is not part of this graph?

   a. how the money was raised

   b. the name of the teacher

   c. how many students participated

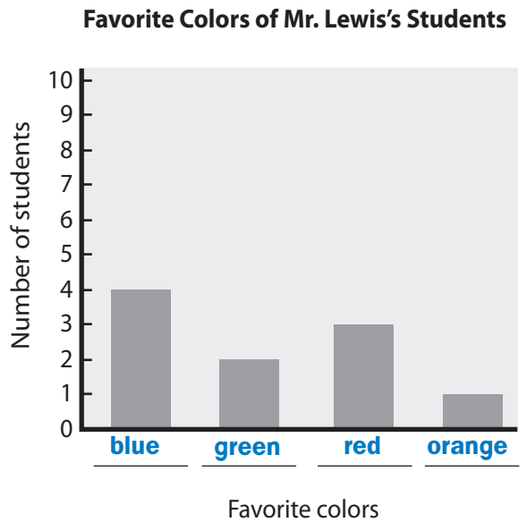
Features

Practice It

Read the information and finish the bar graph below by labeling the bars with the correct colors. Then write a few sentences to explain what your graph shows.

Mr. Lewis's Survey

Mr. Lewis asked ten of his students what their favorite colors were. One said orange, four students said blue, and two students told him their favorite color was green. Three named red as their favorite.



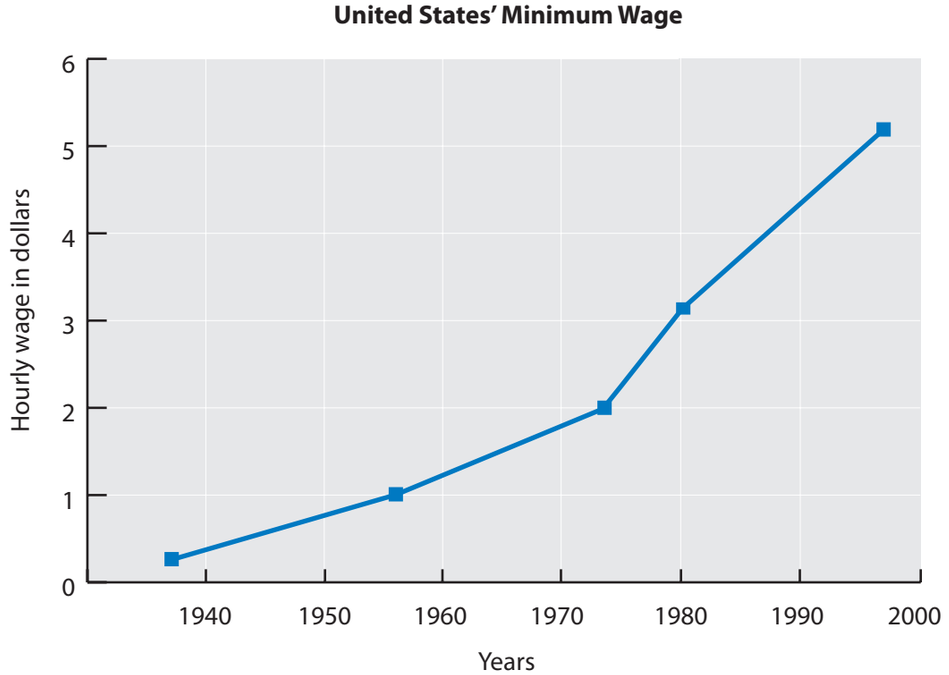
Responses will vary but should include details from the graph.

Apply It

Read the passage below. Use the information to complete the line graph. First draw the points where each wage and year meet. Then draw a line to connect the dots.

Minimum Wage

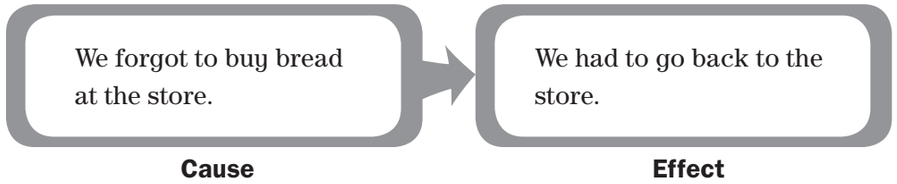
In 1938, the United States government created the minimum wage. This means workers must be paid at least a certain amount of money. When the minimum wage was created, workers could not earn less than $0.25 per hour. Over the years, the government has increased the minimum wage. The wage goes up because the cost of goods also rises. By 1956, minimum wage was $1.00 per hour. In 1974, workers could not earn less than $2.00 per hour. By 1980, the wage was $3.10. In 1997, $5.15 per hour was the minimum wage.



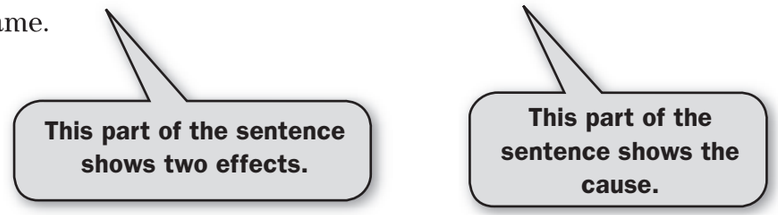
Structures

Learn It

When you read, look for cause-and-effect relationships. A cause is why something happens. An effect is the result of a cause.



There can be more than one cause or more than one effect.
We will get a trophy and go to the finals **because** our team won the soccer game.



Often, cause-and-effect relationships are shown with signal words.

Cause-and-Effect Signal Words

because	if...then	so	as a result	for this reason
cause	leads to	after	when	in order to

Take Note **Cause-and-effect relationships can be about something that has happened, will happen, or could happen.**

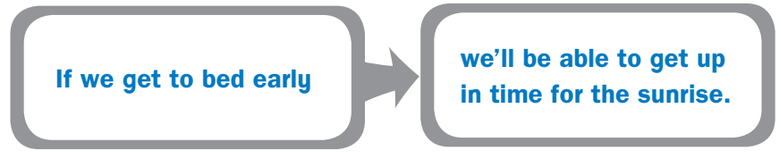
Rule to Remember **A cause can have more than one effect, and an effect can have more than one cause.**

Structures

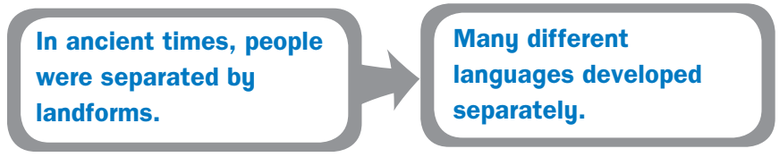
Try It

Circle the cause-and-effect signal words in each sentence. Then complete the organizers with causes and effects. Remember that n cause can have more than one effect.

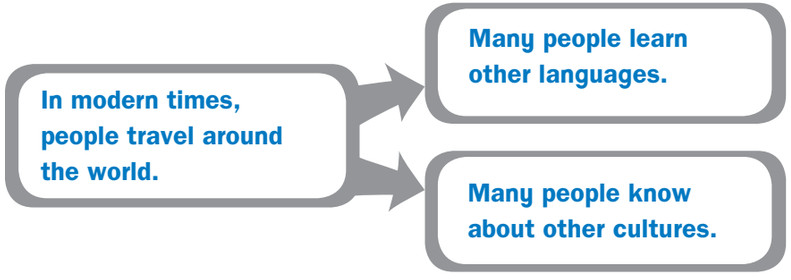
1. (If) we get to bed early, (then) we'll be able to get up in time for sunrise.



2. In ancient times, people were separated by landforms, such as mountains and seas, (so) many different languages developed.



3. In modern times, people travel around the world. (For this reason,) many people learn other languages and know about other cultures.



Structures

Practice It

Read this passage, and look for cause-and-effect relationships. Circle the signal words.

Earth's Moving Plates

Earth's crust is made of a number of separate pieces, called plates. The plates are always moving, so Earth is always changing. When the plates pull apart under the ocean, sea-floor spreading takes place. If one plate moves under another, then an earthquake may occur. Mountains and major earthquakes can be caused by two plates running into each other. Plates also slide past each other. This sometimes results in cracks called faults, such as the San Andreas Fault in California.

Draw a line to match each cause to its effect.

Causes	Effects
moving plates	**a.** mountains and major earthquakes
plates pull apart	**b.** sea-floor spreading
one plate moves under another	**c.** faults
two plates run into each other	**d.** changes in Earth
plates slide past each other	**e.** earthquake

Apply It

Write the missing cause or effect. Then write a sentence for each example.

4. I study hard. → Answers will vary.

Sentence should include the cause, the effect, and a signal word.

5. Answers will vary. → I wrote back.

Sentence should include the cause, the effect, and a signal word.

6. We wanted to dance. → Answers will vary.

Sentence should include the cause, the effect, and a signal word.

7. Answers will vary. → She will be ready to leave

Sentence should include the cause, the effect, and a signal word.

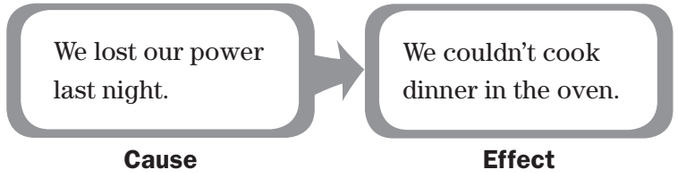
Structures

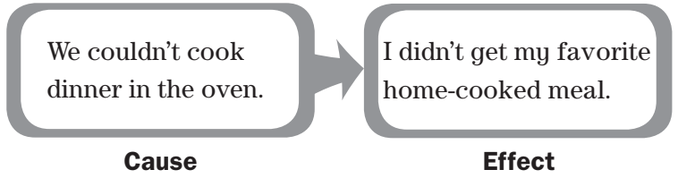
Learn It

When you read, look for cause-and-effect relationships. A cause is why something happens. An effect is the result of a cause.

There can be more than one cause for an effect. Sometimes, an effect can cause a new event.

This chain of causes and effects could be written out like this:





We lost our power last night, so we couldn't cook dinner in the oven. Because we couldn't cook dinner in the oven, I didn't get my favorite home-cooked meal.

Rule to Remember

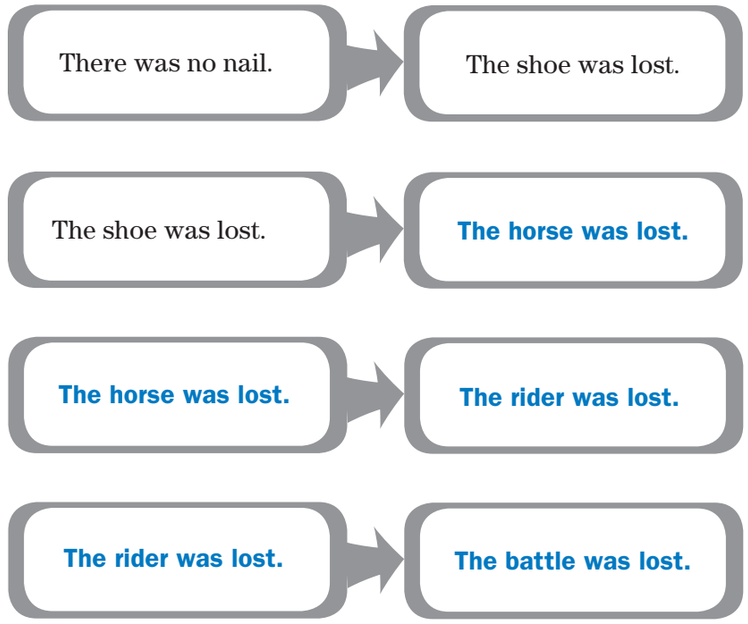
A cause is why something happens. An effect is the result of a cause.

Try It

Read this saying by Benjamin Franklin. In this saying, the phrase *for want of* means "something was missing."

"For want of a nail, the shoe was lost. For want of the shoe, the horse was lost. For want of the horse, the rider was lost. For want of the rider, the battle was lost. And all for the want of a horseshoe nail." —Benjamin Franklin

Complete this cause-and-effect chain. The first one has been done for you.



Structures

Practice It

Use the information in the passage to answer the questions.

The Rise and Fall of Julius Caesar

Julius Caesar was a leader in the Roman Republic in the first century B.C. He won a war against Pompeii's armies and gained power over Rome. Caesar made laws that helped the citizens and many people liked him. But his power became so great that he seemed like a king. The Romans had driven out the last kings by 510 B.C. Rome had become a republic instead of a kingdom. Since then, senators and other important people had controlled Rome. They didn't want to lose their control. Threatened by Julius Caesar's power, a group of senators killed him in 44 B.C.

1. What happened as a result of Julius Caesar winning a war against Pompeii's armies?

   Julius Caesar gained power.

2. Why did the citizens like Julius Caesar?

   Because he made laws that helped them.

3. What was the effect of the Romans driving out the kings by 510 B.C.?

   Rome became a republic.

4. What caused Julius Caesar to be killed?

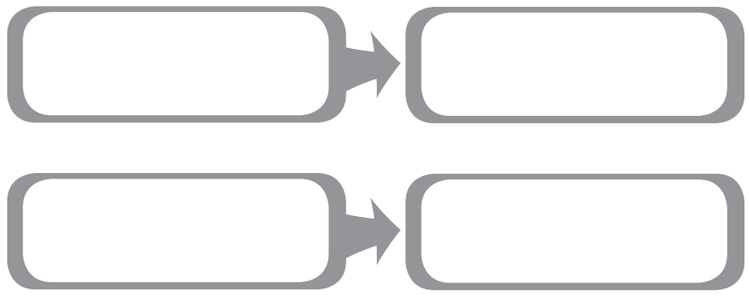
   Senators and other men were threatened by his power and didn't want to lose their control over Rome.

Apply It

Imagine you are doing a science experiment on growing plants. Choose one of the questions and write a short paragraph that describes what the effects might be. Complete the graphic organizer to show the information in your paragraph. Add additional cause-and-effect boxes if you need to.

What might happen if you put a plant in a dark corner of a room? What might happen if you keep a plant on a sunny ledge and give it plenty of water?

Student responses will vary but should include a cause-and-effect relationship using details from one question.



Skills

Learn It

Summarizing is briefly retelling a passage while still including all the important details.

- As you read, try to determine what the main idea of the passage is.
- The most important details often answer the questions Who? What? Where? When? and Why?—sometimes called the "Five W's."

The Peregrine Falcon

The gray Peregrine falcon has long, pointed wings that can stretch up to forty-five inches from tip to tip. On its head, a Peregrine has what looks like a black cap and a black mustache. Its beak is dark and hooked.

A Peregrine uses its sharp-taloned feet and beak to capture and eat other birds. When it hunts, it can dive at a speed of more than two hundred miles an hour! This makes the Peregrine falcon the fastest animal on Earth. Peregrines live all over the world. They are endangered in many places.

Summary:

Peregrine falcons are the fastest animals on Earth. Peregrines are gray with large wings. Peregrines live all over the world, but they are endangered in many places.

A summary includes only the most important information in a passage.

Skills

Try It

Read the passage and answer the questions below.

The Dust Bowl

In the 1930s, a large area of the Great Plains became known as the Dust Bowl. For years, farmers had plowed their fields without giving the soil a rest. Long droughts, or times without enough rain, also harmed the soil. The ground eventually dried up and became dust.

Unfortunately, the Great Plains is known for strong winds. Sometimes so much dusty wind blew that people called it a dust storm. Because these storms could last for hours, even well-sealed homes filled with inches of dust. The insides and outsides of homes looked as though a snowstorm had taken place.

1. Write one sentence from the passage that states an important idea about the Dust Bowl?

   In the 1930s, the Great Plains became known as the Dust Bowl.

2. Which detail is **NOT** an important idea to include in a summary?

   a. Even well-sealed homes filled with inches of dust.

   b. The rich dirt turned to dust.

Skills

Practice It

Read the passage. Underline important details. Use those details to write a summary of the passage.

How Do We Feel?

How do you know if you have touched something hot or cold, smooth or bumpy? First, your skin, or the hair on your skin, touches something. Next, the nerves in your skin send a message up through your fingers, through your arm, through your spinal cord, to your brain. This pathway is called your central nervous system. Your brain then decides what to do next, such as stop touching the object because it might hurt you. If not, then your brain will probably gather more information about what you are touching. It will probably try to use other senses as well, such as your sense of sight or smell.

Answers will vary but should include a summary of the passage using some of the details the students underline.

Apply It

Read the passage and write a paragraph summarizing it.

Feeling Faint?

Have you ever stood up too fast and felt off-balance for a minute? A giraffe can lift its head from the ground to a tree branch in seconds without feeling faint. That kind of movement would make a human faint.

Several things about giraffes' bodies keep them from fainting. A giraffe always needs to keep blood flowing to its head, because a lack of blood flow is the main cause of fainting. Gravity pulls blood to the giraffe's legs and feet, but the giraffe has tight skin and leg muscles that squeeze blood out of its lower body. That increases the flow of blood, especially to its head. A giraffe's heart weighs about 26 pounds. This big heart is great for keeping blood flowing! Finally, the giraffe's blood vessels are very flexible. The blood doesn't get stuck going through its long neck or long legs. Because most giraffes are about 18 feet tall, their blood has plenty of traveling to do!

Answers will vary but should include a summary of the important ideas of the passage.

Heat Energy
Unit Overview

Ability Level Key
◆ = Approaching Level
★ = On Level
▲ = Above Level

Unit Objectives

3 Key Elements:

Vocabulary Students will learn key science and academic words.

Features Students will learn how to read and obtain information from charts and graphs.

Structures Students will be able to identify cause-and-effect text.

Unit Vocabulary

Science		Academic	
conduction	◆★▲	generate	◆★▲
convection	◆★▲	transfer	◆★▲
heat	◆★▲		
kinetic energy	◆★▲		
electromagnetic wave	★▲		
chemical reaction	▲		

Materials:

Student Readers
- *Heating Up* ◆
- *Heat Around Us* ★
- *Understanding Heat* ▲

Activity Masters #1–4, pp. 76–79

Interactive Skills Handbook, pp. 10–13, pp. 18–21, pp. 46–53, pp. 98–101

Genre:
Web Sites

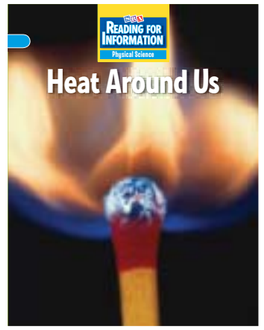
Comprehension Skill:
Summarizing

Background Information

The **3 Key Elements** of this unit are **vocabulary, charts and graphs,** and **cause-and-effect text.** Students will apply these elements as they read about heat energy and how the sun provides much of the energy we use on Earth. Students will also learn the basic concepts of heat transfer and how heat energy relates to the speed that molecules move in matter.

1 Focus
Preparing to Read

In this unit, students will read about where heat comes from, the three ways that heat transfers, heat conductors and heat insulators, and how heat energy relates to solid, liquid, and gaseous states of matter.

◆ Approaching Level	★ On Level	▲ Above Level
		
Heating Up	*Heat Around Us*	*Understanding Heat*

Getting Started
Connecting to Prior Knowledge

- Refer to the **Fun Facts!** to start a discussion about heat energy. Ask students whether they have ever roasted a marshmallow or watched someone grill a hot dog in the summertime.
- Ask students how it feels to sit near a fire while roasting marshmallows or near a grill while roasting hot dogs. Ask students how it feels to sit in the sun in the summertime.
- Ask students to suggest reasons why they can feel the heat from a fire or the sun even if they aren't touching them. Agree that heat transfers from its source to other objects, including people. Tell students that they are going to read about heat and the ways that heat transfers.

Fun Facts!

- Americans buy 90 million pounds of marshmallows a year!
- Almost half of Americans think that summertime is the best time to eat a hot dog!

2 Teach

Prereading Activities

Whole Group Use the following activities with all students to introduce the **3 Key Elements** of the unit.

Ability Level Key
◆ = Approaching Level
★ = On Level
▲ = Above Level

5 min **Vocabulary** ◆★▲

- **Science** Distribute copies of **Activity Master #1.** With the class, pronounce ***conduction, convection, heat,*** and ***kinetic energy*** and read their definitions aloud. Reinforce the concept that conduction and convection describe two ways that heat transfers and that kinetic energy is the energy of motion.
- **Academic** With the class, pronounce ***generate*** and ***transfer*** and read their definitions aloud. Have students complete the worksheet in pairs or independently. Remind students to look for the boldface vocabulary words as they read.

For more practice with
- **cause and effect,** use Activity Master #3, page 78.

15 min **Features** ◆★▲

- **Charts** Tell students that charts organize information visually. Tell students that charts, such as T-charts and flowcharts, show relationships. Distribute copies of **Activity Master #2.** Have students identify key elements of the chart, such as headings and columns. Ask students to identify the purpose of the chart.
- **Graphs** Tell students that graphs also organize information visually. Some graphs, such as bar graphs and circle graphs, show amounts of things. Discuss the graph on Activity Master #2. Have students complete the worksheet in pairs or independently. Remind students to look for charts and graphs as they read.

10 min **Structures** ◆★▲

- **Signal Words** Write the signal words *when, if, because, then, so, as a result,* and *therefore* on the board.
- Have students suggest cause-and-effect sentences that are heat related. Prompt them with questions such as, "What happens if I feel cold and touch something warm?" and "If it's cold outside, why would I want to put a coat on?" Write the sentences with signal words on the board.

Assign the Reading
- Distribute the Student Readers for this lesson on the basis of students' reading levels, and have students begin reading.
- Encourage students to pay attention to **vocabulary, charts and graphs,** and **cause-and-effect text** as they read.

Reinforcing the 3 Key Elements

Small Group Use these lessons for an in-depth treatment of the **3 Key Elements** of reading for information.

15 min **Vocabulary** Convection and Conduction ◆★▲

- **Review** Review the definitions of *convection* and *conduction* with students. Draw a Venn diagram on the board. Ask students to compare and contrast the processes of conduction and convection. For example, students might note that both are ways heat transfers or that conduction is the only way heat moves between solids, but heat can move through liquids and gases both ways.

Activity Draw a T-chart on the board. Label one side *Conduction* and one side, *Convection.* Name at least four examples of heat transfer, such as boiling water (convection) or roasting marshmallows (conduction), and ask students which goes under each heading.

10 min **Features** Charts and Graphs ◆★▲

- **Charts** Have students find a chart in their readers. Help students identify its parts, such as its title, headings, captions, and data. Ask students to identify what the chart shows.
- **Graphs** Have students find a graph in their readers. Help students identify its parts, such as its title, headings, captions, and data. Ask students to identify what the graph shows.

Brainstorm Have students suggest reasons why some information is organized in a chart and why some information is organized in a graph. For example, charts can show how things are organized, and graphs show numerical information. Encourage students to describe ways charts and graphs are similar and ways they are different.

5 min **Structures** Cause and Effect ◆★▲

- **Author's Purpose** Remind students that cause-and-effect relationships show how and why things happen.
- **Preview the Text** Have students skim their readers and use sticky notes or pieces of paper to mark cause-and-effect relationships.

Wrap-up Have students share the relationships that they found and write them on the board. Have students identify the signal words in the sentences and underline them.

Extending the Lesson

Small Group Use the following lessons to customize instruction according to your student's needs.

Reader's Workshop: Writing a Summary

- **Summarizing** Review that to summarize means to restate the main ideas of a text in a reader's own words.
- **Model** Choose a short section and read it with the students. Find the main idea and write a short summary on the board for students.
- **Readers** Have students choose a section in their readers. Ensure that students choose different sections. When students have finished reading, ask them to write the main idea of the section and some necessary details. Ask students to use this information to write a short summary.

Wrap up Have students share the section they chose and their summaries.

Differentiating Instruction

- **Intervention** On the board, make a three-column chart with the following labels: "convection," "conduction," and "radiation." Help students complete the chart with how heat transfers through these ways.
- **Reteach** Have students answer the comprehension skill questions found in the Student Readers. Comprehension skill questions that help students summarize information can be found on pages:
  - Approaching Level 11, 12, 15, 19, 23
  - On Level 12, 15, 21, 23, 26
  - Above Level 17, 19, 21, 22
- **Challenge** Have students research the electromagnetic spectrum and write a few paragraphs summarizing what they learned.

Assign ELL Activity Master #4
Complete the activity with students or assign it as independent work.

Genre Focus

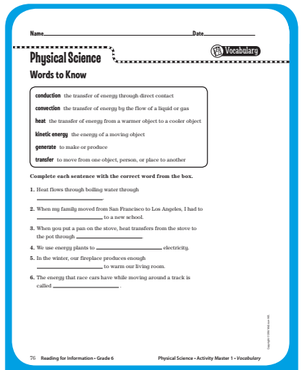
- Have students turn to the Web site shown in each reader. Ask students the different purposes of Web sites, such as entertainment, information, and shopping.
- Ask students to compare the way information is presented on a Web site with the way it is presented in their reader. For example, a book has chapters, while a Web site has pages. Books are navigated by turning pages, while Web sites are navigated by using links. Both have photographs, graphics, and captions.
- Ask students to indicate why Web sites might not always be reliable. Point out that Web sites associated with the government, schools, and universities usually contain reliable information.

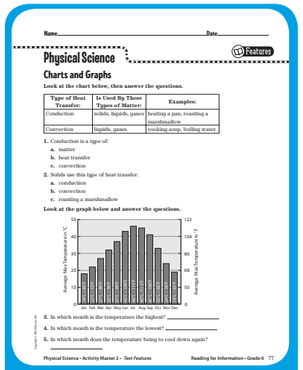
3 Review and Assess

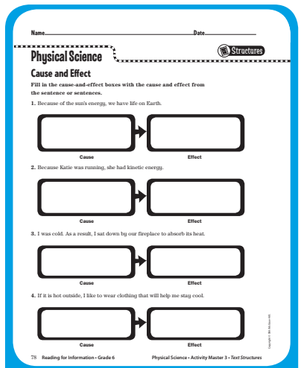
Monitor Progress

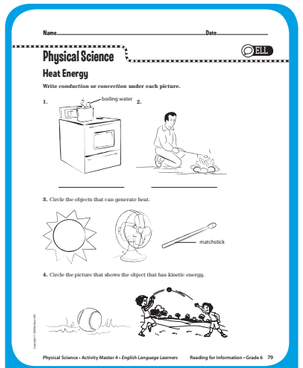
Use the **Activity Masters** and ***Interactive Skills Handbook*** pages to monitor progress and to review.

Ability Level Key
◆ = Approaching Level
★ = On Level
▲ = Above Level


Activity Master 1, page 76


Activity Master 2, page 77


Activity Master 3, page 78


Activity Master 4, page 79

Skills Practice

Go To Interactive Skills Handbook

For more practice with
- **graphs,** see pages 10–13.
- **charts,** see pages 18–21.
- **cause and effect,** see pages 46–53.
- **summarizing,** see pages 98–101.

Assessment

To assess student learning in this unit, use the following resources.

ExamView Assessment Suite ◆★▲

To assess student progress in the **3 Key Elements,** use the *ExamView® Assessment Suite* CD-ROM to create a custom test or administer the prepared **Leveled Unit Tests.**

PuzzleMaker VERSION 3.2

Use the ***PuzzleMaker*** CD-ROM to create fun interactive activities that measure student mastery of the unit vocabulary.

Name_____ Date_____

Physical Science

Features

Charts and Graphs

Look at the chart below, then answer the questions.

Type of Heat Transfer:	Is Used By These Types of Matter:	Examples:
Conduction	solids, liquids, gases	heating a pan, roasting a marshmallow
Convection	liquids, gases	cooking soup, boiling water

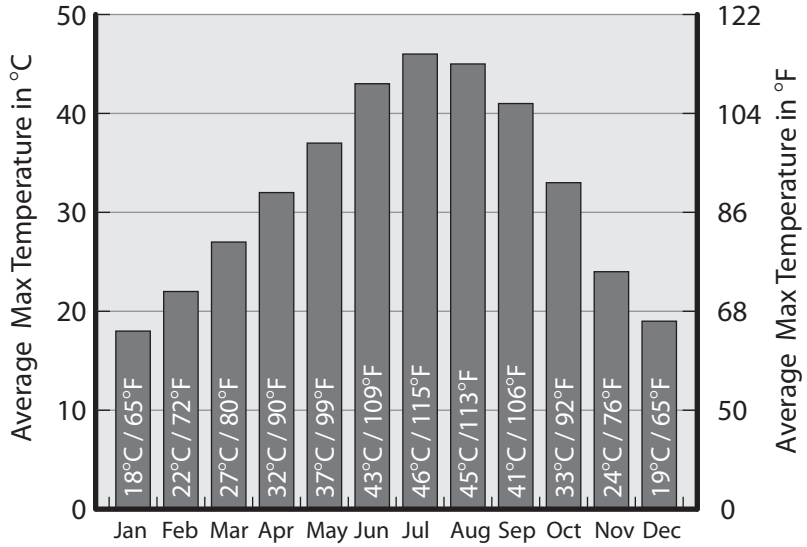
1. Conduction is a type of:

- **a.** matter
- **b.** heat transfer
- **c.** convection

2. Solids use this type of heat transfer:

- **a.** conduction
- **b.** convection
- **c.** roasting a marshmallow

Look at the graph below and answer the questions.



3. In which month is the temperature the highest? _____

4. In which month is the temperature the lowest? _____

5. In which month does the temperature being to cool down again?

_____

Name_____ Date_____

Physical Science

Vocabulary

Words to Know

conduction the transfer of energy through direct contact

convection the transfer of energy by the flow of a liquid or gas

heat the transfer of energy from a warmer object to a cooler object

kinetic energy the energy of a moving object

generate to make or produce

transfer to move from one object, person, or place to another

Complete each sentence with the correct word from the box.

1. Heat flows through boiling water through _____.
2. When my family moved from San Francisco to Los Angeles, I had to _____ to a new school.
3. When you put a pan on the stove, heat transfers from the stove to the pot through _____.
4. We use energy plants to _____ electricity.
5. In the winter, our fireplace produces enough _____ to warm our living room.
6. The energy that race cars have while moving around a track is called _____ .