

# Heat, Light, and Sound



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# **Heat, Light, and Sound**

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# What Is Heat?

## VOCABULARY

- temperature
- heat
- thermal energy
- conduction
- conductor
- insulator



- Temperature** is the measure of how hot or cold something is.
- Heat** is a thermal energy that moves from hotter to cooler objects.
- Thermal energy** is kinetic energy of the random motion of particles in matter.



▶ **Conduction** is the movement of heat between objects that touch. A **conductor** is an object that heat can move through easily. This metal pan is a good conductor.



▶ An **insulator** is an object that heat cannot move through easily. The cover around this pot is an insulator.





## READING FOCUS SKILL

### MAIN IDEA AND DETAILS

A **main idea** is what the text is mostly about. **Details** tell more about the **main idea**.

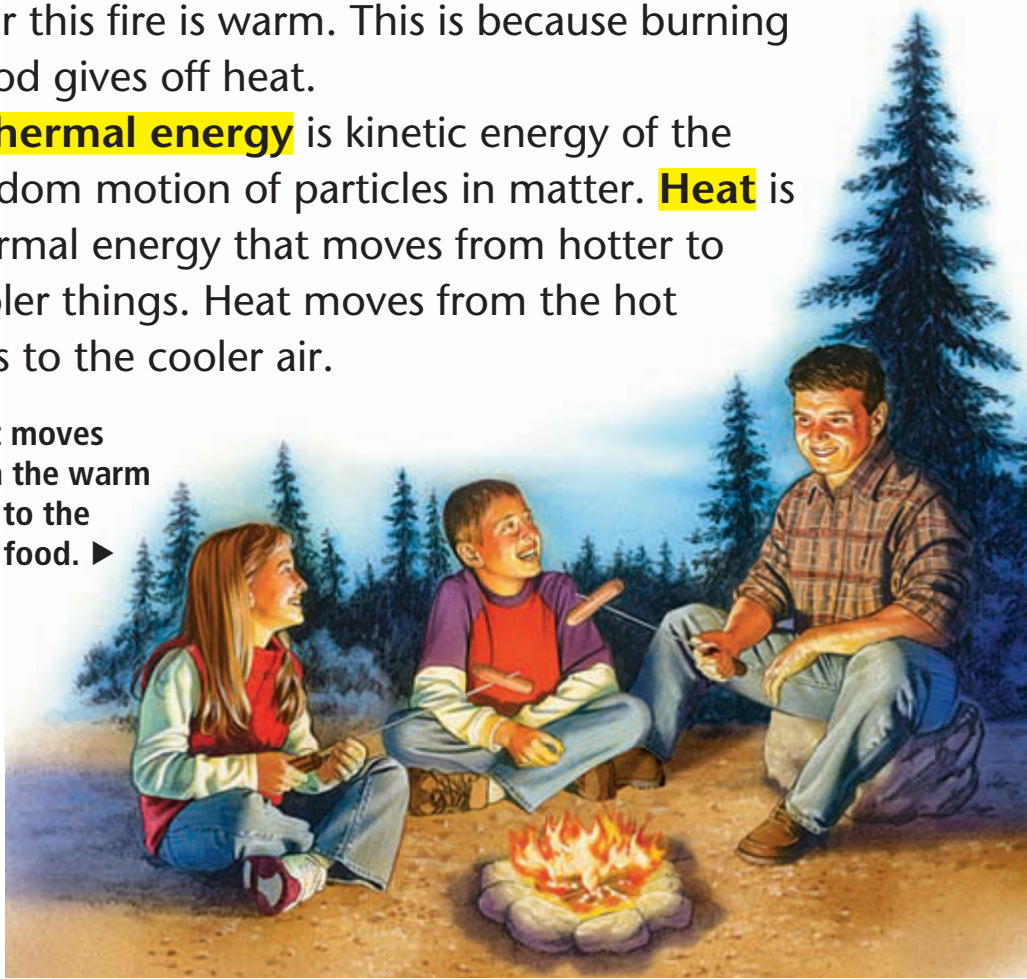
Look for **details** that tell about heat and how it moves.

## Producing Heat

**Temperature** is the measure of how hot or cold something is. The temperature of the air near this fire is warm. This is because burning wood gives off heat.

**Thermal energy** is kinetic energy of the random motion of particles in matter. **Heat** is thermal energy that moves from hotter to cooler things. Heat moves from the hot logs to the cooler air.

Heat moves  
from the warm  
logs to the  
cool food. ►



What do you feel when you rub your hands? ►



Heat can be made in different ways. Burning wood gives off heat. Rubbing your hands makes heat. A hot-water bottle gives off heat when water inside has been heated.




**Tell what heat is.**

▼ A hot-water bottle gives off heat.




## Conductors

What happens when you cook eggs?  
Heat moves from the burner to the pan.  
Then it moves through the pan to the eggs.  
**Conduction** is the movement of heat through objects that touch.


 Heat moves through the metal pan. The pan is a conductor. A **conductor** is something that heat moves through easily. Most metals are good conductors.



 What is a conductor?

 Heat moves through the pan to the eggs.



 Iron, copper, and other metals are good conductors.





## Insulators

Some things are not good conductors. Heat does not move through them easily. They are called insulators.

An **insulator** does not conduct heat well.

A potholder is an insulator. It keeps a pan's heat from moving to your hand. Wood, cloth, and plastic are good insulators.



Name two good insulators.

▲ This cover is an insulator.

## Review



Complete this **main idea** statement.

1. Heat is a form of \_\_\_\_\_ that moves from hotter to \_\_\_\_\_ things.

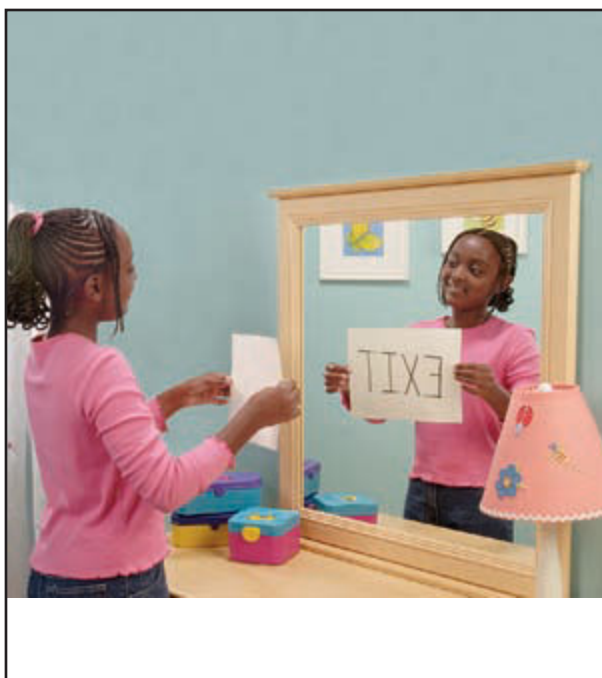
Complete these **detail** sentences.

2. A \_\_\_\_\_ is the measure of how hot or cold something is.
3. A \_\_\_\_\_ is an object that heat can move through easily.
4. Wood, cloth, and plastic are kinds of \_\_\_\_\_.

VOCABULARY

- reflection
- refraction
- shadow

# What Is Light?



A **reflection** is the bouncing of light off something. This girl sees her reflection in the mirror.



▶ **Refraction** is the bending of light as it moves from one material to another. Refraction makes this bank look broken.



▶ A **shadow** is a dark area that forms when an object blocks the path of light. This umbrella and ball block sunlight and make shadows.



## READING FOCUS SKILL

### SEQUENCE

- A **sequence** is the order in which things happen.
- Look for **sequences** that describe ways that light moves.



## Ways Light Moves

Light is a form of energy. Light moves in a straight line. When light hits an object, some of the light bounces off the object. The bouncing of light is called **reflection**. If the object is shiny and smooth, then the light reflects a pattern you can see.



What can you see reflected in this lake's smooth surface? ▼



🔊 Sometimes light bends. Look at this bank. It appears broken in two. That is because light bends when it goes from the air to the water. This is called refraction. **Refraction** is the bending of light as it moves from one material to another.



**Tell what happens to light after it hits a smooth object.**

🔊 Refraction makes this piggy bank look broken. ▼





## Shadows

Look at this picture. Do you see a dark shape on the grass? This shape is a shadow. A **shadow** is made when an object blocks the path of light.

 **Tell what happens when an object blocks light.**

 This girl blocks sunlight.



## Ways Shadows Move and Change

When an object moves, its shadow moves. Shadows also change during the day as the sun's light shines on objects from different directions. Look at these pictures. How do the shadows change from morning to afternoon?



**When an object moves, what happens to its shadow?**



 ▲ Morning






 ▲ Afternoon

## Review



Complete these **sequence** statements telling about light.

-  1. After light hits an object, some of the light \_\_\_\_\_ off the object.
-  2. Light \_\_\_\_\_ when it moves from water to air.
-  3. When an object moves, its \_\_\_\_\_ will move, too.

**VOCABULARY**

- absorbed
- opaque
- transparent
- translucent

# How Are Light and Color Related?



- When something is **absorbed**, it is taken in by an object. Dark objects absorb most of the light that strikes them. These dark stones absorb most light.



▶ An **opaque** object does not let light pass through it. People are opaque.



▶ A **transparent** object lets most light pass through it. These glass windows are transparent.



▶ A **translucent** object lets some light pass through it. These frosted marbles are translucent.



## READING FOCUS SKILL

### CAUSE AND EFFECT

- A **cause** is what makes something happen. An **effect** is what happens.
- Look for the **effects** that different materials have on light.

## How to Stop Light

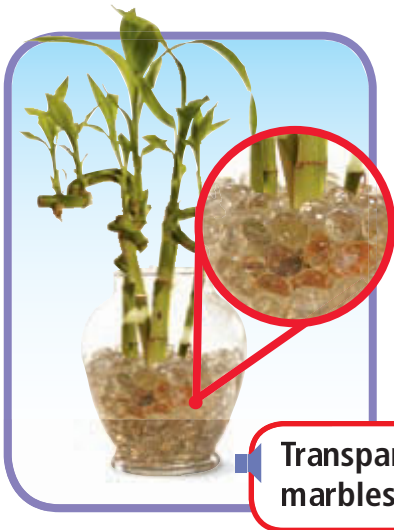
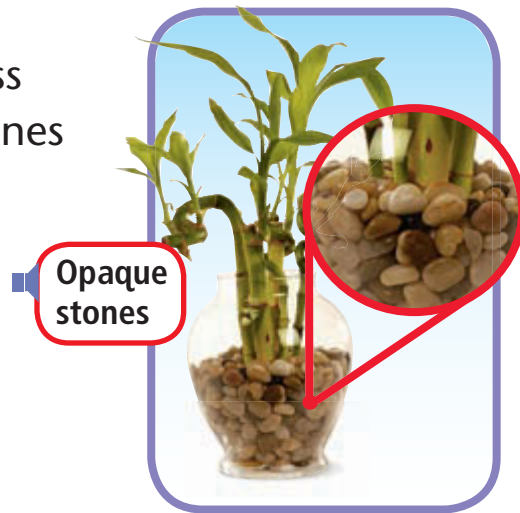
When light hits an object, some light is reflected. The rest of the light is **absorbed**, or taken in by the object. Different objects absorb more or less light. Shiny objects absorb very little light. Dull, dark objects absorb most light.

- Mirrors absorb very little light. ►



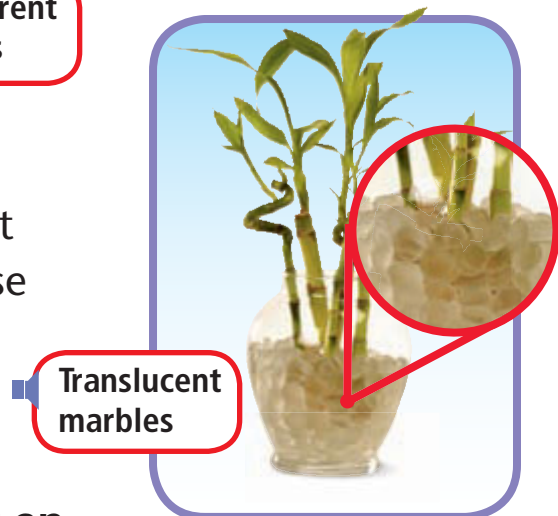


■ An **opaque** object does not let light pass through it. These stones are opaque.



■ A **transparent** object lets most light pass through it. These clear marbles are transparent.


■ A **translucent** object lets some light pass through it. These frosted marbles are translucent.



Tell what effect an opaque object has on light.

## **Light and Color**

Sunlight seems to have no color. But light is a mixture of many colors. You can see these colors when sunlight passes through a prism.

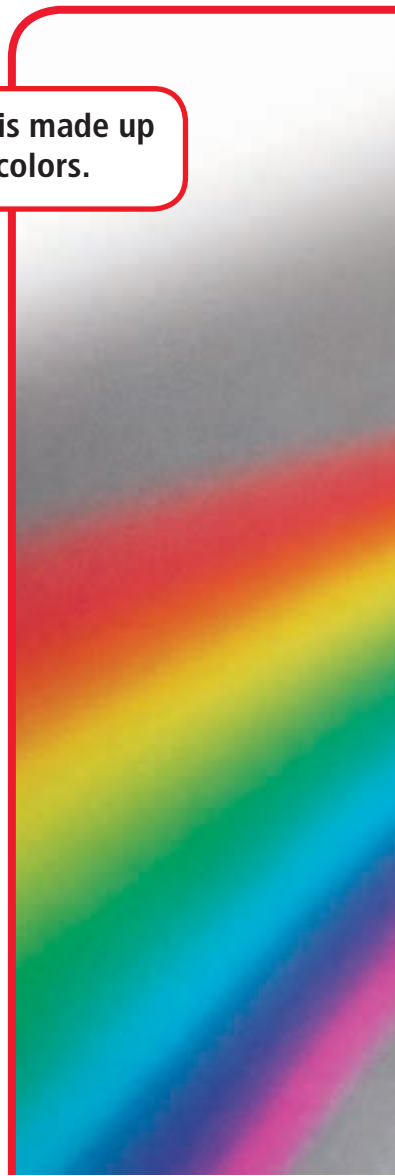
 Light bends as it goes through a prism. This bending separates light into its different colors.



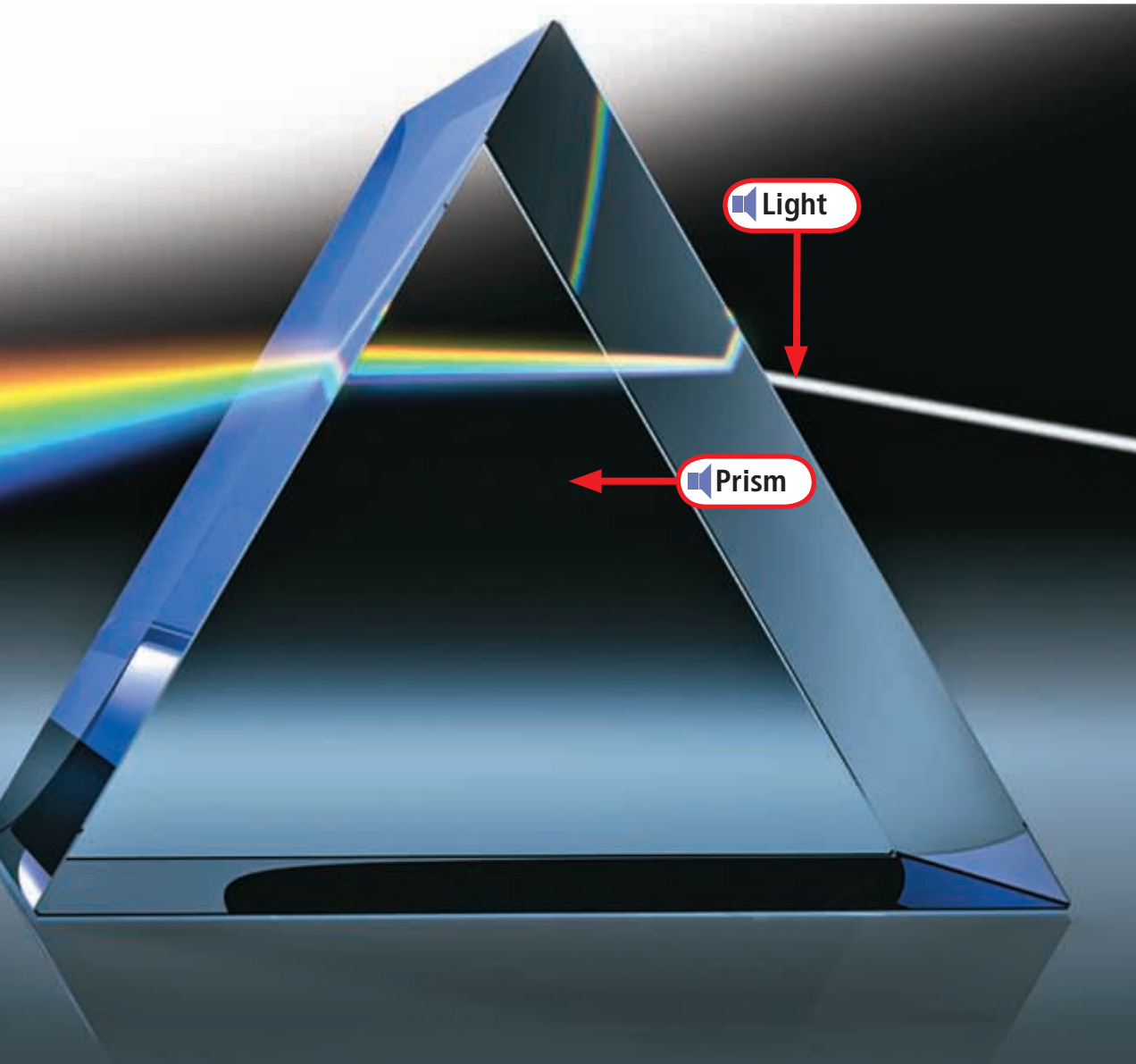
**What effect does a prism have on light?**



Sunlight is made up of many colors.



A prism bends light. Each color of light bends differently. This is why we see separate colors.



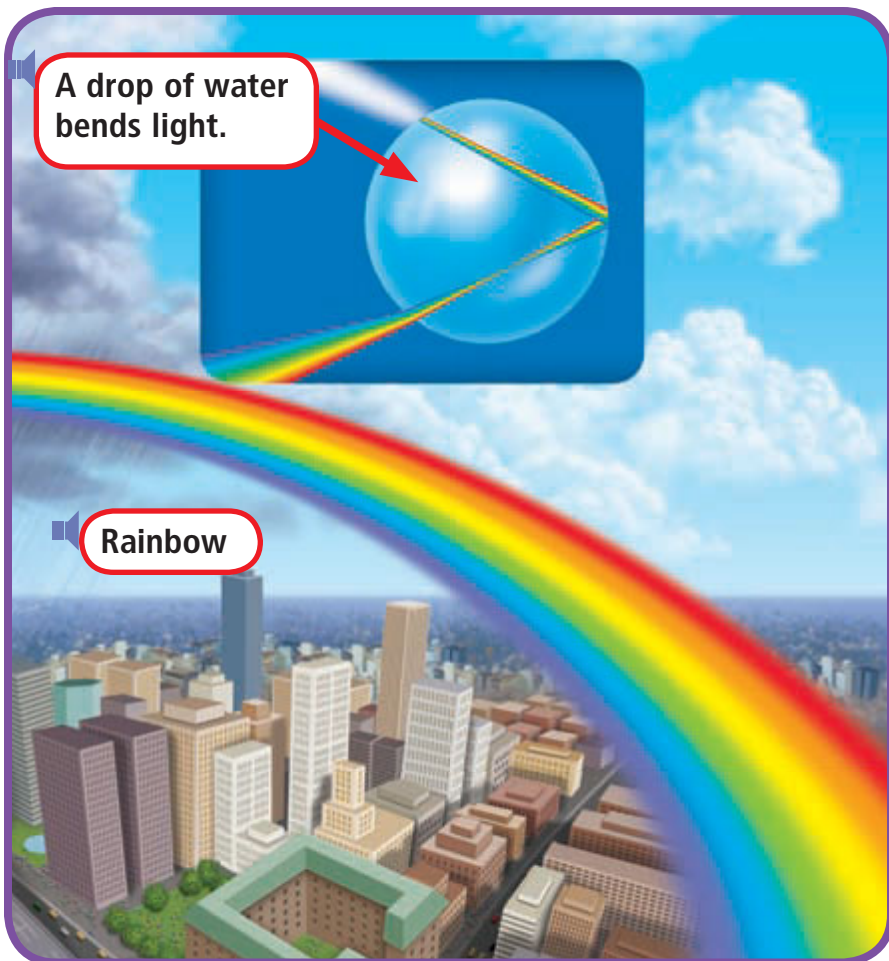


## How Rainbows Form

It takes both sunlight and rain to make a rainbow. Water drops in the air are like tiny prisms. When sun shines through the drops, they bend the light. The drops break the light into separate colors. These colors form a rainbow.



**Tell what effect drops of water have on sunlight.**



## ■ Making White Light

You can make white light by combining three colors. Red, green, and blue light make white light. Shine red, green, and blue lights on a white table. Find the place where the lights overlap. You will see white light.



**Tell the effect of combining red, blue, and green light.**

■ How do these children make white light? ►



## Review



Complete these **cause and effect** statements.

- 1. Dull, dark objects cause most light to be \_\_\_\_.
- 2. In order for most light to pass through an object, the object must be \_\_\_\_.
- 3. A prism causes light to \_\_\_\_ and break into separate colors.
- 4. Sunlight passing through drops of water in the air can cause a \_\_\_\_ to form.

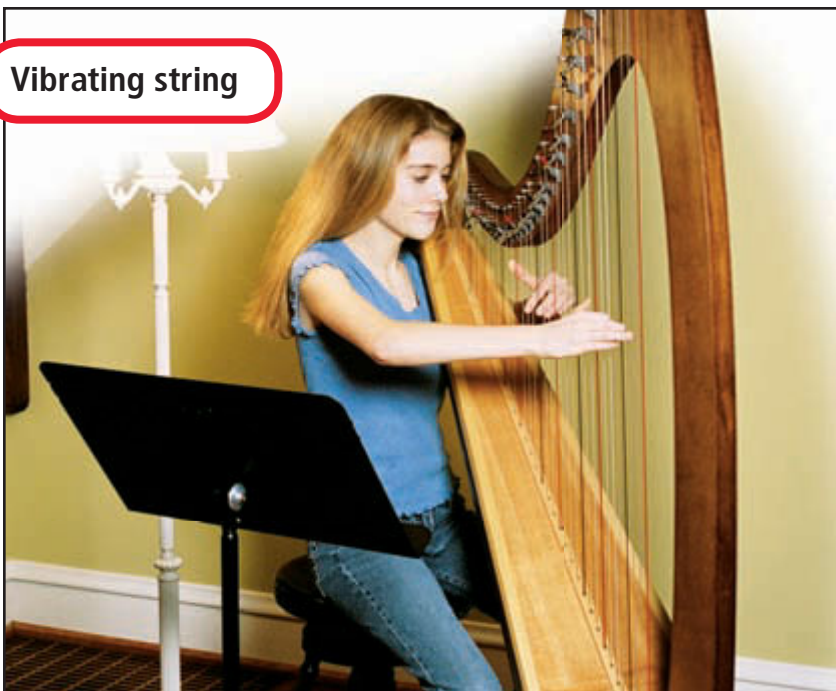


# What Is Sound?

## VOCABULARY

- vibration
- loudness
- pitch

Vibrating string



- Vibrations** are back-and-forth movements. The vibrations of the harp's strings make sounds.



▶ The **loudness** of a sound is how much energy a sound has. This drum makes a loud sound. The sound has a lot of energy.



▶ The **pitch** of a sound is how high or low a sound is. This bird's song has a high pitch.



## READING FOCUS SKILL

### CAUSE AND EFFECT

- A **cause** is what makes something happen. An **effect** is what happens.
- Look for what **causes** sounds to be made.



## Sound

Sound is energy you can hear. Sound is caused by vibrations. **Vibrations** are back-and-forth movements. Instruments make vibrations when they are plucked, blown, or tapped.



When something vibrates, it makes the air vibrate. You hear the air's vibrations as sounds.



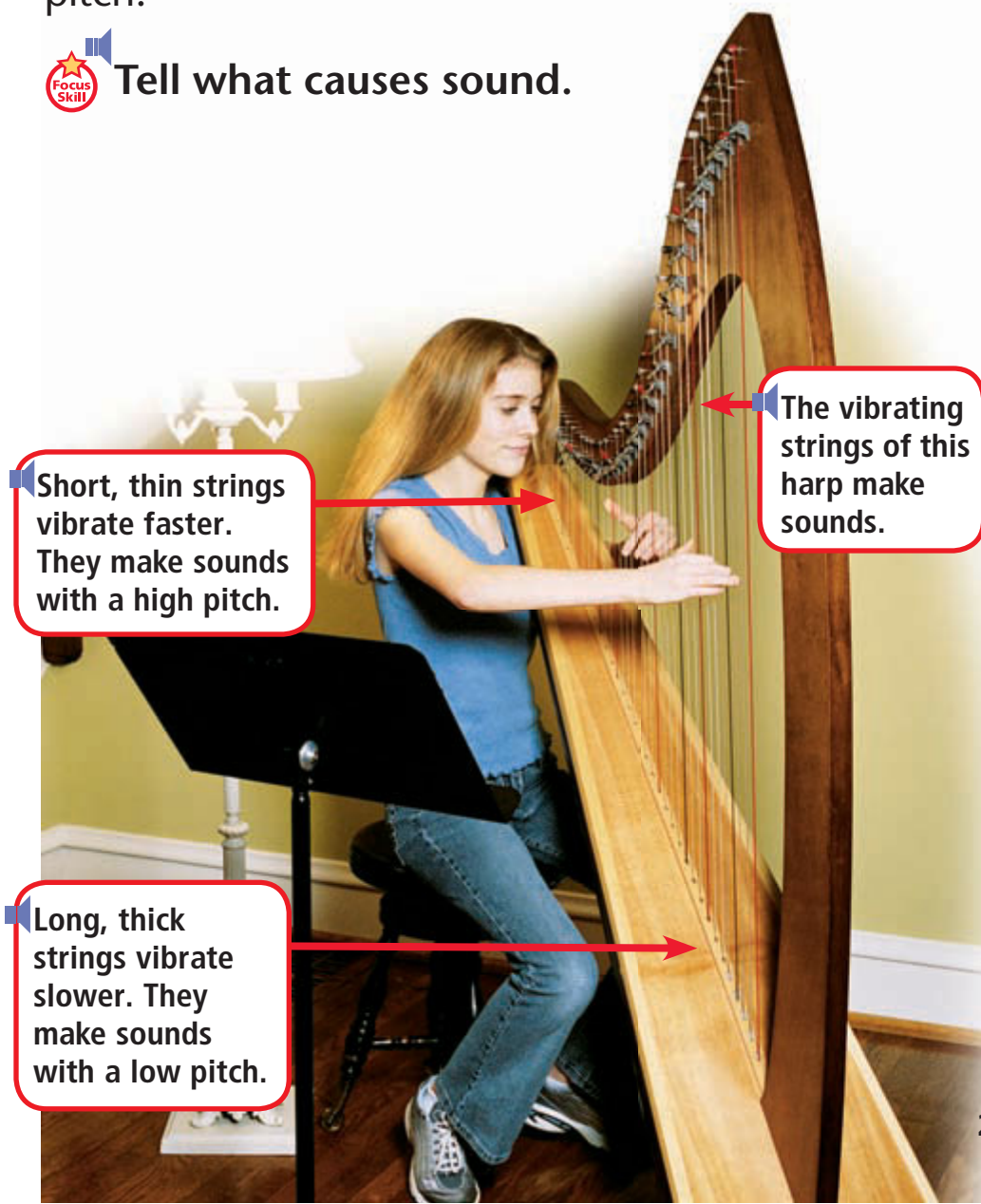
Instruments make vibrations. They cause the air to vibrate.

🔊 A sound's **loudness** is how much energy the sound has. The more energy the vibrations have, the louder the sound. The less energy they have, the softer the sound.

🔊 A sound's **pitch** is how high or low the sound is. The faster an object vibrates, the higher its pitch.



**Tell what causes sound.**



## **Sound Moves Through Matter**

Sound can move through different kinds of matter. Sound can move through gases, such as air. It can also move through solids and liquids. Solids and liquids carry sound better than air. Sound moves faster and farther through them than it does through air.



**Tell what happens when sound in air moves through solids.**

 **Sound travels through water.**





## Hearing Sounds

Sounds come from things that vibrate. Sounds can also make things vibrate. You hear sounds when vibrations move through the air to your ears. The vibrating air makes your eardrums vibrate, and you hear sounds.







**What effect does vibrating air have when it reaches your ear?**



















## **Review**





Complete these **cause and effect** statements.

-  1. When matter vibrates, the vibrations can cause \_\_\_\_\_.
-  2. When you make a loud sound, the sound has a lot of \_\_\_\_\_.
-  3. The faster an object vibrates, the higher its \_\_\_\_\_ will be.
-  4. Sounds traveling through the air cause your eardrum to \_\_\_\_\_.

## **GLOSSARY**



-  **absorbed** (ab•SAWRBD) taken in by an object
-  **conduction** (kuhn•DUK•shuhn) the movement of heat between objects that are touching each other
-  **conductor** (kuhn•DUK•ter) an object that heat can move through easily
-  **heat** (HEET) the movement of thermal energy from hotter to cooler objects
-  **insulator** (IN•suh•layt•er) an object that doesn't conduct heat well
-  **loudness** (LOUD•nuhs) how much energy a sound has
-  **opaque** (oh•PAYK) relating to objects that don't let light pass through
-  **pitch** (PICH) how high or low a sound is
-  **reflection** (rih•FLEK•shuhn) the bouncing of light off an object
-  **refraction** (rih•FRAK•shuhn) the bending of light as it moves from one material to another
-  **shadow** (SHAD•oh) a dark area that forms when an object blocks the path of light
-  **temperature** (TEM•per•uh•cher) the measure of how hot or cold something is
-  **thermal energy** (THER•muhl EN•er•jee) energy due to the random movement of particles in matter
-  **translucent** (tranz•LOO•suhnt) relating to an object that lets some light pass through
-  **transparent** (tranz•PAR•uhnt) relating to an object that lets most light pass through
-  **vibration** (vy•BRAY•shuhn) a series of back-and-forth movements

## **Think About the Reading**

-  **1.** Tell how heat, light, and sound are related. Describe how each travels through materials.
-  **2.** Explain what can stop heat and light from passing through objects. Use the words *insulator*, *opaque*, and *translucent* in your explanation.

## **Hands-On Activity**

Make a shoebox guitar using a shoebox and different widths of rubber bands.

-  **1.** Use your guitar to demonstrate and explain how to make sounds of different loudness and pitch.
-  **2.** Explain how you can hear these sounds.

## **School-Home Connection**

Look for examples of insulators and conductors of heat as well as opaque, translucent, and transparent objects in your home. Draw and label each and write several sentences telling how each object is used.

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Book 14

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