



You will learn:

- how sound energy moves.
- how sound energy is used.

Lesson 4

What Is Sound Energy?

You lucked out! You got the part of the bell ringer in the school play. No lines to study! When the king appears, just ring the bell that makes the deep sound. But is that the large bell or the small bell?

How Sound Energy Moves

When you shout, ring a bell, or play music through a speaker, you change some form of energy into sound energy. Sometimes you can even feel sound coming from a speaker. What you feel are **vibrations**, rapid back and forth movements of the air. These vibrations can also travel through water, wood, and other matter. Sound energy is the energy of these vibrations.

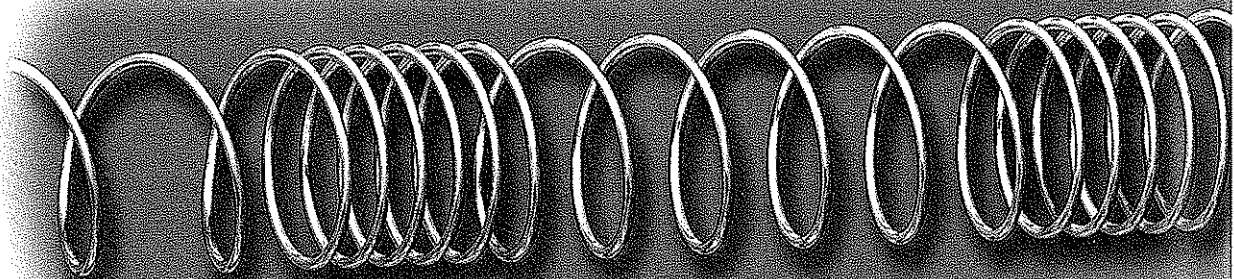
Unlike radiant energy, which can travel through empty space, sound can travel only through matter. This is because there must be something to vibrate. If you and a friend were astronauts on a space walk, you would see each other, but you couldn't hear each other. Outside your spacesuit, there is no matter to vibrate. Fortunately, you could talk using your spacesuit's radio. It uses radiant energy, which doesn't need matter to travel.

Glossary

Glossary

vibration

(vī brā' shən), rapid back and forth motion of air or other matter



Glossary

frequency

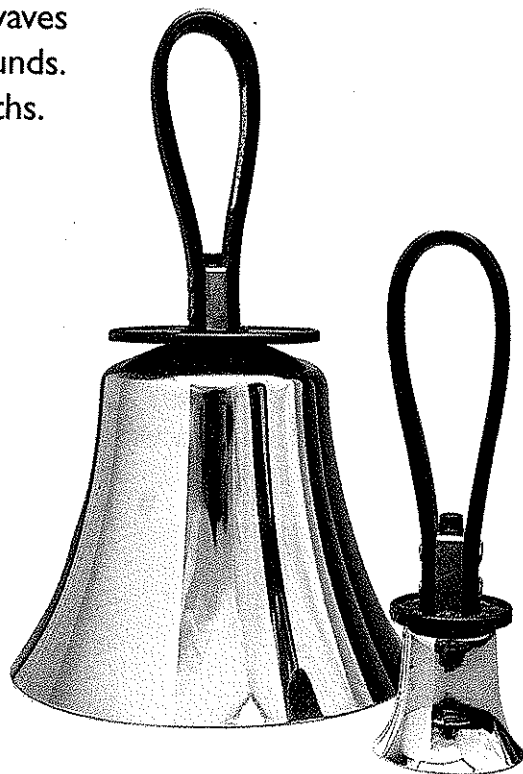
(frē/'kwən se), the number of waves passing a point in one second

Like radiant energy, sound energy travels in waves. To understand how sound waves travel, imagine using a wire spring like the one shown below. First, stretch it between yourself and a friend on a long table. Then give it a quick push toward your friend, but hold on to the spring. As you push out, you press together part of the spring. The pressed-together area moves toward your friend. Press again and again. Notice below how the pressed-together area moves.

Similarly, vibrations from a speaker make sound waves in the air by pressing on the air again and again. Each vibration creates one wave. One wavelength is the distance from one pressed-together area to the next.

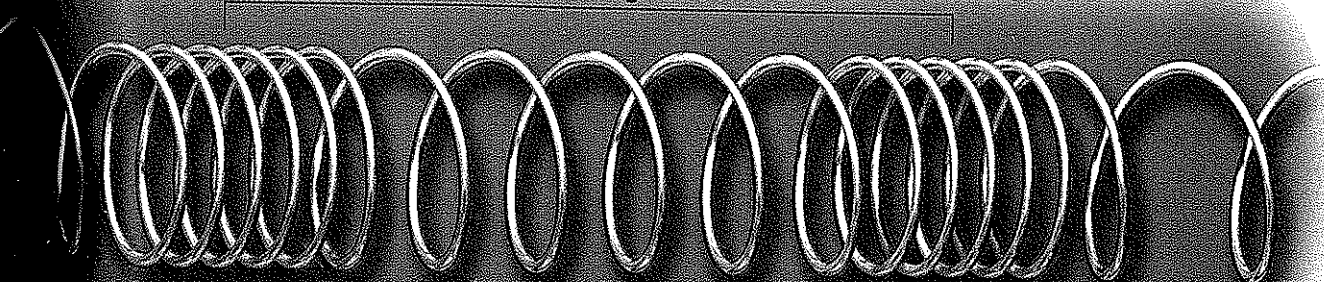
The number of waves passing a point in one second is called the **frequency**. Low-frequency sound waves have long wavelengths. You hear them as deep sounds. High-frequency sound waves have short wavelengths. You hear them as high sounds. Which of the bells shown on this page will make a high-frequency sound? Which will make a low-frequency sound?

Compared to the small bell, the large bell vibrates more slowly. Because it makes fewer sound waves in one second, it has a lower frequency and a deeper sound. ▼



A quick push on the spring presses an area together. This pressed-together area moves along the spring. ▼

Wavelength



Uses of Sound Energy

Like radiant energy, sound energy has many uses. You use it for communication when you talk. You use it for safety when sirens warn you of danger. You use it for fun when you listen to music. Sound energy is even used in medicine. Doctors may check their patients' health with special pictures made using sound waves.

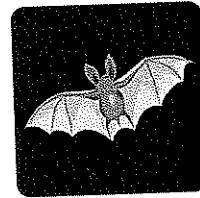
Some animals use sounds too low for people to hear. Other animals use ultrasounds, sounds too high for people to hear. Study the pictures on these two pages to learn some ways sound is used.

Range of Sound

Short wavelength
High frequency

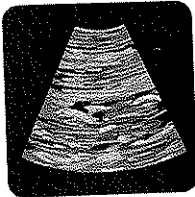
Little Brown Bat

When they fly, many bats make very high-frequency sounds—much higher than even dogs can hear. By listening for echoes, bats avoid running into things in the dark and find mosquitoes to eat. ▶



Bat

Ultrasound machine



◀ Ultrasound Image

People use the highest frequency sound for making ultrasound images. These images show soft body parts such as the liver better than X rays can. ▶

Dog Whistle

People use special high-frequency dog whistles that people can barely hear but that dogs hear easily. Compare dog hearing to human hearing. ▶



Dog Whistle

There is a wide range of sounds. The sounds with the shortest wavelengths and the highest frequencies are on the left. The sounds with the longest wavelengths and the lowest frequencies are on the right. ▼

Long wavelength
Low frequency

Human Hearing



◀ **People**

People have a certain range of hearing. All music has frequencies within this range.

◀ **Domestic Dog**

Dogs have a wider range of hearing than people. They can hear both lower-frequency and higher-frequency sounds.



Dog Hearing

Piano

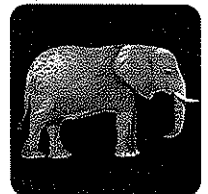
Pianos make sounds with a large range of frequencies, but this is only a part of the range of sounds people can hear. ▼



Piano

African Elephant

African elephants make many sounds. Some of the sounds they make have a frequency that is too low for people to hear. These deep sounds travel well and allow elephants to communicate over long distances. The red line shows just these very low sounds. ▶

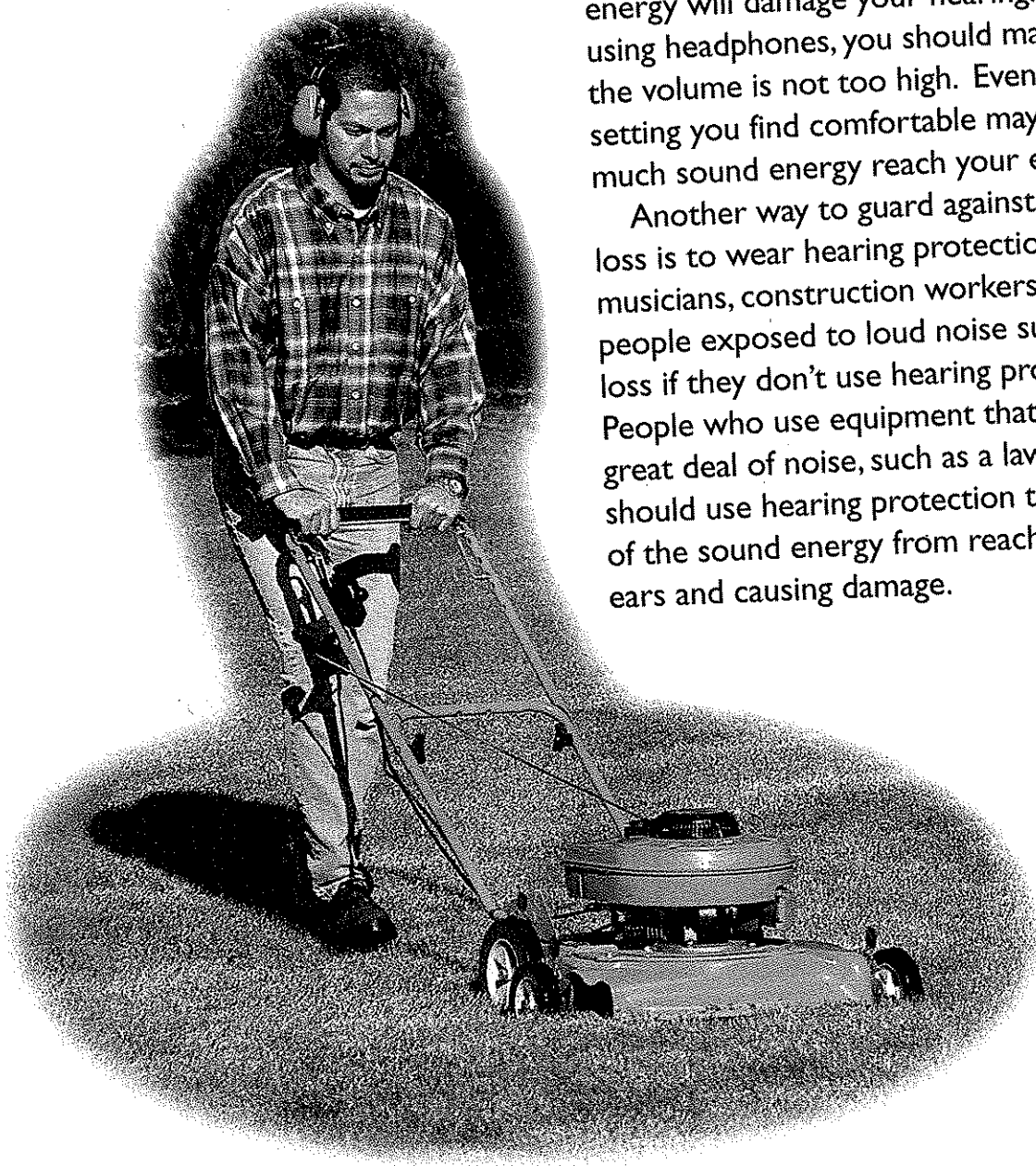


Elephant



It is important to use sound energy safely. You know that too much sound energy will damage your hearing. When using headphones, you should make sure the volume is not too high. Even a volume setting you find comfortable may let too much sound energy reach your ears.

Another way to guard against hearing loss is to wear hearing protection. Rock musicians, construction workers, and other people exposed to loud noise suffer hearing loss if they don't use hearing protection. People who use equipment that makes a great deal of noise, such as a lawnmower, should use hearing protection to stop some of the sound energy from reaching their ears and causing damage.



▲ When the man mows his lawn he wears hearing protection. Hearing damage is usually gradual. You may not notice it until long after exposure to loud sounds. Using hearing protection helps guard your hearing, both now and for the future.

Lesson 4 Review

1. Why must sound travel through matter?
2. List two examples of how animals use sounds that people can't hear.
3. **Draw Conclusions**
Examine the chart on pages B100–B101.
Can a dog hear the high-frequency sounds an ultrasound machine makes?