UNIT OVERVIEW

Sound is made of waves that move through tiny particles of matter. Sound moves through air and water, and even through most solid things. The Sound unit explains what sound is, how it travels, and some of the properties of sound, such as pitch and volume. It explores how ears hear and encourages students to take care of their ears.

Certain reading resources are provided at three reading levels within the unit to support differentiated instruction. Other resources are provided as a set, with different titles offered at each reading level. Dots on student resources indicate the reading level as follows:

- low reading level
- middle reading level
- high reading level

THE BIG IDEA

Sound is one of our primary sources of information about the world around us. It can also provide enjoyment in the form of singing and instrumental music. Understanding how sound works can help us appreciate the science behind one of our most important senses.

Other topics

The unit also addresses topics such as: sound-related technology, how musical instruments make sound, noise pollution, ultrasonic sound, and how animals make and hear sounds.

SPARK

The spark is designed to get students thinking about the unit's topics and to generate curiosity and discussion.

Materials

- pencil
- large poster, bookshelf, etc., to obstruct view of students
- objects made of various materials (Examples: tin can, glass bottle, wooden block, plastic bottle, paper plate, metal tool)

Activity

Stand behind the obstruction so students cannot see the objects you have behind it. Make sounds by tapping each item with a pencil and invite students to guess what each object is made of. You can number them and have each student record a guess for each object. Once all objects have been guessed, reveal them.

Why do you think each object sounded different from the others?

Ask students which part of their body helps them hear sounds and then ask how they think your tapping sent sounds to their ears. At this point, it is more important that students begin thinking about an explanation than to arrive at the correct answer. You may even observe some student misconceptions.

Choose one object for the next demonstration. Tap the object while standing near students. Then tap it again as far from students as possible.

How did the sound change? Why do you think the sound was softer when I was farther away?

Now stay in one place, but hit the object softly and then with more force.

Now how did the sound change?

Gather student explanations. You may want to try more sound variations, such as tapping bottles of the same material but different sizes or having students cover their ears while you tap objects.

Explain to students that over the next days and weeks, they will learn more about how sounds are made, how sounds travel, how sounds can change, and how we hear. They will also have opportunities to find answers to their own questions about sound.

Many of the unit's vocabulary terms are related to the spark activity and can be introduced during the spark. For vocabulary work, see the Vocabulary section in this *Unit Guide*.

PRIOR KNOWLEDGE

Ask students to help you produce a posted list of things that make sounds and the kind of sound they each make (duck—quack, car—beep, and so on). Review the list and ask students how they think each item makes its sound. Provide a basic explanation of sound as *vibrations moving through the air or through other things in waves.* If appropriate, write this explanation on the board for students to think about. Examine several items on the list to think about what might vibrate in it or on it to produce a sound. Accuracy is not required at this point.

Probing Questions to Think About

Use the following questions to have students begin thinking of what they know about sound.

- What do we mean when we say something is vibrating? How does a guitar string vibrate? How does a diving board vibrate?
- What does a wave look like? Where have you seen waves before?
- What do we mean when we say someone has a high voice? What do we mean when we say someone has a low voice? What are other examples of high and low sounds?
- What are some loud sounds you have heard? Why do you think they are loud?
- What are some quiet sounds you have heard? Why do you think they are quiet?
- Do loud sounds always come from large things and quiet sounds always come from small things?
- Have you ever heard an echo? Where? Why do you think you heard it in that place?
- Do you think sound waves could travel through water to your ears? Have you ever heard sounds underwater? Can you hear sounds through a wall? (Help students identify the three forms of matter: gas, liquid, and solid.)

Tell students they will learn more about these topics soon.

UNIT MATERIALS

Each unit provides a wide variety of resources related to the unit topic. Students may read books and other passages, work in groups to complete hands-on experiments and investigations, discuss science ideas as a class, watch videos, complete writing tasks, and take assessments.

Resources are available for printing or projecting, and many student resources are also available for students to access digitally on Kids A–Z.

Selected unit resources are available in more than one language.

For a complete list of materials provided with the unit, see the Sound unit page on the Science A–Z website.

VOCABULARY

Use the terms below for vocabulary development throughout the unit. They can be found in boldface in the *Nonfiction Book*, the *Quick Reads*, and/or other unit resources. These terms and definitions are available on *Vocabulary Cards* for student practice. Additional vocabulary lists are provided in the teaching tips for *Investigation Packs* and *FOCUS Books*.

Core Science Terms

These terms are crucial to understanding the unit.

cochlea	the part of the inner ear that changes sound vibrations into nerve signals
compress	to squeeze together
deaf	able to hear very little or not at all
decibel	the unit for measuring the loudness of a sound
eardrum	a thin patch of skin in the ear that vibrates when sound waves strike it
echo	the repetition of a sound caused by sound waves bouncing off a hard surface
energy	any force that can move things or do work
nerve	a thin thread that carries messages between the brain and other parts of the body
particle	a tiny portion of matter
pitch	how high or low a sound is
sound	vibrations sensed by the ear
sound wave	the movement of sound energy through air, liquid, or solid
vibrate	to move back and forth very quickly
volume	how loud or soft a sound is

Other Key Science Terms

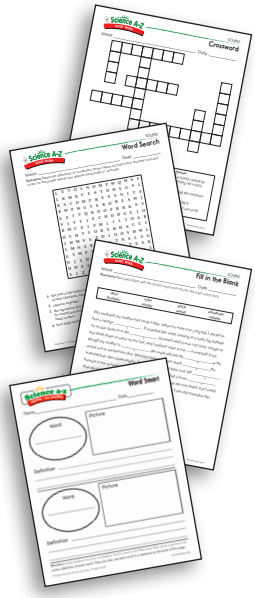
The following vocabulary is not essential for comprehending the unit but may enrich students' vocabulary.

audiologist	a medical specialist who tests a person's hearing, identifies hearing impairments, and helps treat hearing impairments
communicate	to exchange information by words, pictures, gestures, or other means
ear canal	a tube in the ear that carries sound from the outer ear to the eardrum

echolocation	a way to find things by sending out a sound and measuring how long it takes for it to bounce back
hear	to receive sound through the ears
hearing aid	a device worn to help hear better by increasing the volume of sounds
hearing impairment	a difficulty in hearing some sounds
liquid	a state of matter with a definite volume but not a definite shape that falls and flows due to gravity
noise	any kind of sound, often not musical or nice to hear
sign language	a system of hand gestures used to communicate, often by people with hearing impairments
solid	a substance that keeps its shape
sonic boom	a loud noise made by something traveling faster than sound
sonogram	a method of using high-frequency sound waves to form images of the inside of the human body
ultrasound	high-frequency sound waves used in sonograms to form images of the inside of the human body

Vocabulary Activities

You may choose to introduce all the terms that will be encountered in the unit before assigning any of the reading components. *Vocabulary Cards* with the key science terms and definitions are provided. Dots on the cards indicate the reading levels of the *Nonfiction Book* or the *Quick Reads* in which each term can be found. If all level dots appear, the term may come from another resource in the unit. Students can use these cards to review and practice the terms in small groups or pairs. The cards can also be used for center activity games such as Concentration.



The *Word Work* activity sheets offer fun puzzles and practice with key vocabulary terms from the unit. For further vocabulary practice and reinforcement, you can choose from the vocabulary *Graphic Organizers*. To build customized vocabulary lessons with terms related to the topic, see Vocabulary A-Z.

Students can use the *Word Smart* vocabulary *Graphic Organizer* to organize information on the science terms. You may want to assign each student one to three words to share his or her *Word Smart* knowledge with classmates. Students who have the same word should first compare their *Word Smart* sheets with each other and then report to the larger group.

The science terms can be used in oral practice. Have students use each term in a spoken sentence.

As students read, encourage them to create a science dictionary by recording new vocabulary terms and definitions in their *SAZ Journal*.

BACKGROUND AND MISCONCEPTIONS

Use this section as a resource for more background knowledge on unit content and to clarify the content for students if misconceptions arise. Refer to Using the Internet below for more ways to extend the learning.

Q: *Is sound like a stream of moving water?*

A: No. A wave of energy (in this case, a sound wave) passes through matter as it moves from one place to another. Air molecules move back and forth for a brief moment as sound waves pass through the air. But the air itself does not move from one place to another. This is similar to how an object floating in water may move up and down as a wave passes, but the object does not travel with the wave. Sound waves can also travel through solids and liquids, but the molecules of matter do not travel with those waves.

Q: *Can sound travel in outer space?*

A: No. Sound is carried through the vibration of matter, not through empty space. Students may think that sound can travel through space because sounds are used in science fiction movies. But in space there are no air molecules, so there is no sound. Inside a space station or a spacecraft there is air, therefore the astronauts can talk and breathe.

Q: *Isn't air nothingness? How does air allow sound to travel?*

A: No. The small molecules/particles that make up air are largely invisible because they are so small. Students may think that because they can't see air, nothing is there. Remind them that they can feel moving air as wind, which is contact with millions of particles of air. Sound makes these particles vibrate.

Q: *What is the difference between pitch and volume?*

A: Hitting an object harder may make a louder sound, but it will not change the pitch. The pitch of a tuning fork or bell does not change as it "slows down" or "runs out of energy." The sound gets softer, but the frequency remains the same. Pitch generally stays the same for a vibrating object, but the volume gets softer as the sound diminishes.

Q: *Do sound waves make phone lines vibrate when I talk on the phone?*

A: No. In a "string telephone," sound vibrations are actually carried through the string. But in a modern telephone, sound is changed into an electrical pulse, which passes through the wire until it is again transformed into sound at the receiving telephone.

Q: *I can't see this musical instrument vibrating. How does it make a sound?*

A: In many musical instruments, the air inside a chamber vibrates, not the instrument itself. Some modern instruments create sounds electronically. We only hear them once a speaker transforms electrical pulses to sound waves.

EXTENSION ACTIVITIES

Using the Internet

Most search engines will offer a wealth of options when *sound* is entered. Try pairing the word *sound* with related terms from the unit. Be aware that some sites may not be educational or intended for the elementary classroom. More specific inquiries are recommended, such as:

- sound waves
- parts of the ear
- decibel scale
- hearing loss

Projects and Activities

- **Writing/Project:** Create an activity in which students can learn what it is like to be hearing-impaired. Try making a rule that for a given period of time, no words may be spoken. Only nonverbal communication may be used. (This should be more manageable than having students cover their ears.) Afterward, have students write about the experience.
- **Project:** Have students create board games or outdoor games related to sound. For example, sounds may have to be matched with pictures of their sources, or sounds can be used as cues for certain types of movement.
- **Community Service:** If students can identify any noise issues in their schools or communities, guide them through an action project to propose solutions to those who have the power to enact changes. This could range from loud cafeterias and school bells to noisy vehicles and undesirable airplane flight paths.
- **Guest:** Bring in a guest speaker who is deaf or hearing-impaired to address students' questions.
- **Guest:** Ask a musician or a music teacher to demonstrate how vibrations occur when various instruments are hit, strummed, or plucked. Ask the guest to produce a range of pitch and volume on various instruments.

- **Guest:** Invite a school nurse or an audiologist to visit your class and demonstrate how an audiometer is used to test hearing.
- **Research:** Help students research common sounds that may be loud enough to damage their ears. Then have students create posters that combine words and pictures to warn against potentially harmful noises in our environment. Urge students to look at the damage that listening to very loud live or recorded music can cause.
- **Arts:** Many sounds create certain moods and evoke images in our minds. Provide art materials and have students draw or paint what they imagine as they listen to songs from different genres. Have them write the song titles on the pictures and display them publicly. This can also be done in reverse for students who are ready to explore composing music. (Looking at works of art has inspired many pieces of music, including Mussorgsky's *Pictures at an Exhibition*.)
- **Research/Home Connection:** Students can conduct research as a family/home project or in the library/media center to extend the learning about a topic in one of the *Quick Reads* or other unit resources.