

How Do Sounds Vary?

OBJECTIVES

Students manipulate a variety of objects to produce sounds and to identify the ways in which those sounds differ from one another.

The students

- ▶ use a variety of objects to produce sounds
- ▶ describe sounds and distinguish between them
- ▶ hypothesize as to what factors determine differences in sounds

SCHEDULE

Session I About 40 minutes

Session II About 30 minutes

VOCABULARY

silence
sound

MATERIALS

For each student

- 1 Activity Sheet 1, Parts A and B

For each team of two

- 1 comb
- 1 board, wooden
- 1 bottle, plastic
- 1 sht paper, plain*
- 2 rubber bands, brown
- 1 straw, plastic
- 1 tongue depressor
- 1 tumbler, plastic

For the class

- 2 buttons, plastic
- 2 cubes, wooden, small
- 2 foam pieces
- 2 marbles
- 2 paper clips*
- 1 pkg rubber bands, brown, 3 widths
- 2 rubber stoppers
- 16 sound boxes, with lids
- tape, masking
- 2 washers

*provided by the teacher

PREPARATION

Session I

- 1 Make a copy of Activity Sheet 1, Parts A and B, for each student.
- 2 Each team of two will need a comb, a wooden board, a bottle, a sheet of paper, two rubber bands, a straw, a tongue depressor, and a tumbler.

Session II

- 1 Use the masking tape to label the sound boxes 1–16.
- 2 Make eight pairs of sound boxes, placing one object in each box according to the following list. Fasten the lids securely.

Box Numbers	Contents
1, 13	rubber band
2, 10	marble
3, 7	washer
4, 9	paper clip
5, 12	wooden cube
6, 14	button
8, 15	foam piece
11, 16	rubber stopper

- 3 Decide the order in which teams will pass on the boxes to the next team when they have finished describing the sounds.

BACKGROUND INFORMATION

In air, **sound** is produced when applied energy makes an object vibrate. In turn, vibrations of the object make the molecules of the surrounding air vibrate. The back-and-forth movement of the vibrating object alternately concentrates and rarefies (expands the spaces between) the air molecules; these rapid pressure changes then travel through the air in the form of sound waves.

Sound waves can also travel through solids and liquids. They cannot, however, travel through a vacuum—empty space—where there are no molecules to set into motion. As a result, outer space, where there is no air (or any other kind of gas), is totally silent. The absence of sound is **silence**.

Sound waves cannot be seen. Animals, including humans, can detect them only with their ears. The outer ear funnels the waves inward to vibrate the eardrum and the small bones in the middle ear. Liquid in the inner ear then receives and transforms the waves into chemical signals, which are passed along nerves to the brain and interpreted there as sounds.

The shape of a sound wave determines the type of sound we hear. Different kinds of energy act on different kinds of materials to produce infinitely varying shapes of sound waves, and so we hear many different kinds of sounds.

Total silence cannot be found on earth, except in an artificially created vacuum. Even in the quietest spots, the air is vibrating with sound waves from one source or another. Outdoors, breezes rustle leaves, and insects buzz; indoors, your own breathing makes a sound.

▼ Activity Sheet 1, Part A

How Do Sounds Vary?

Sound	How Sound Was Produced	Description of Sound
1. _____	Answers will vary.	Answers will vary.
2. _____		
3. _____		
4. _____		
5. _____		
6. _____		
7. _____		
8. _____		

▼ Activity Sheet 1, Part B

Sound Detectives

Describe the sound produced by each box. Descriptions will vary.

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

Which boxes do you think contain the same objects?

Pair A: Box 1 and Box 13

Pair B: Box 2 and Box 10

Pair C: Box 3 and Box 7

Pair D: Box 4 and Box 9

Pair E: Box 5 and Box 12

Pair F: Box 6 and Box 14

Pair G: Box 8 and Box 15

Pair H: Box 11 and Box 16

Guiding the Activity

Session I

- 1 Tell students that they are going to try to create silence. Instruct them to be very, very quiet and to listen very carefully.

After a minute or so, ask, **Did you hear silence? Why or why not?**

Ask, **What sounds did you hear?**

Write the words *sound* and *silence* on the board. Ask a volunteer to define these two terms.

Ask, **Why is it important that we hear the sounds around us?**

Ask, **Can you think of a time when you have been in total silence?**

- 2 Divide the class into teams of two. Distribute to each team a comb, a large wooden block, a bottle, a sheet of paper, two rubber bands, a straw, a tongue depressor, and a tumbler.

Tell students to experiment with the objects in front of them to see what types of sounds the objects can produce (see Figure 1-1).

Ask, **In what ways could you produce sound with these objects?**

Ask, **Are all the sounds the same?**

Additional Information

Students should respond that they did not hear silence but instead heard a variety of sounds.

Students may mention coughing, breathing, a pencil dropping, voices from other rooms, traffic outside, and so on.

*A **sound** is something you can hear. **Silence** is the absence of all sounds.*

Students may suggest several important functions: sounds allow people to communicate with words and signals, they warn of danger, they provide enjoyment through music, and so on.

Allow students to describe times they have been in very quiet situations. If they say a situation was silent, remind them that there were still very soft sounds, such as their own breathing.

Safety Note: *Tell students not to snap the rubber bands or stretch them too taut.*

Allow students about 5 minutes to explore the sounds that the various objects can produce.

Students may suggest hitting them against each other, hitting them against other objects, blowing through them, putting something inside something else and shaking it, and so on.

no

Guiding the Activity

Additional Information

- 3 Tell students that they will now listen more carefully to the sounds they produce. Give each student a copy of **Activity Sheet 1, Part A**.



▲ *Figure 1-1. Students explore ways to produce sounds by manipulating a variety of objects.*

Instruct students to record in the first column of the chart on the activity sheet the eight different sounds their team produced. Then have them look at the other two columns. Ask, **What information are you going to record about each sound?**

Ask, **What information is needed to tell how a sound is produced?**

Tell students that when they tell what a sound is like, they may use such descriptive words as *bang*, *clack*, *tinkle*, *thunk*, or *rattle*; or they may compare it to another sound, such as a bell ringing, a stick breaking, and so on.

Have students complete the activity sheet.

how they produced it and what the sound is like

The information students suggest will vary; but they may say, for example, if they hit a block against something, what they hit it against. They need to write down both the materials and the kind of action they used to produce each sound.

Guiding the Activity

4 Have individual students take turns demonstrating to the class the sounds they produced. Ask them to explain how they produced each sound and how they described it. As they describe their sounds, write key words from their descriptions in a list on the board.

5 Instruct students to study the list of key words and think about the sounds they heard. Ask, **How do the sounds you produced differ from one another?**

Ask students, **What do you think causes the differences in the sounds?**

Have students return all the objects to the kit.

Session II

6 Give each student a copy of **Activity Sheet 1, Part B**. Point out that the activity sheet contains sixteen numbered squares. Tell students that in a moment you will distribute sixteen numbered boxes. Explain that each box contains an object and that each box has a matching partner—another box with a different number but containing the same kind of object.

Tell students that when they receive their box, they are to shake it and turn it upside down and listen to the sound produced. Then, in the square on the activity sheet under the number of that box, they should write a short description of the sound they heard.

Give each team of two a sound box. Tell students that after they have handled the box and described the sound on the activity sheet, they are to pass the box to the next team. Tell each team which team they will pass their box to when they are finished with it. All the teams should have the opportunity to shake all the boxes and describe all the sounds.

Additional Information

Encourage students to demonstrate sounds that are different from those already demonstrated.

Some are louder and some are softer; some are higher and some are lower; some are like thuds; some are metallic-sounding; and so on.

Accept all reasonable suggestions at this time.

Remind students that they may use any of the descriptive key words from the list on the board as well as any new ones they might think of.

Remind them to write their description in the square whose number matches the number of the box they are working with.

Guiding the Activity

Additional Information

7 Challenge teams to identify the pairs of boxes that contain identical objects by examining the information they have recorded. Instruct them to write the numbers of those pairs of boxes on the lines at the bottom of the activity sheet.

When students have finished, collect and put on display all the sound boxes.

Ask, **Which boxes do you think are pairs? Why?**

Place the boxes about which there is general agreement in pairs. If there is disagreement about a pair, give students the opportunity to explain why they disagree.

Make sure that students can explain and justify their answers, based on the type of sounds they heard. Have them read their descriptions of those sounds.

8 Invite a volunteer to open each pair of boxes. Have students review their guesses. Ask, **How accurate were you?**

Ask, **Were some pairs easier to match up than others? Why or why not?**

Ask, **Were you surprised to find out what produced any of the sounds in the boxes?**

Tell students that in the upcoming activities they will explore sound further and find out more about what produces differences in sounds.

Answers will vary.

Most students will say yes. Some sounds were clearly different from others, but some were almost alike.

Answers will vary.

REINFORCEMENT

Give students a single object, such as a block of wood or a marble. Challenge them to produce as many different sounds as they can with that object. They can bang it against various other objects in the classroom and note that the sound is different each time. Have them describe each sound.

SCIENCE JOURNALS

Have students place their completed activity sheets in their science journals.

CLEANUP

Return the objects used in the sound boxes and the sound boxes to the kit.

SCIENCE AT HOME

Invite students to perform at home the same “silence” test they did in class. Have them sit very quietly in different rooms and listen for sounds. Which is the noisiest room? the quietest room? When is the noisiest time of day? the quietest time?

Students can make an at-home version of the “noisemaker” game. They can put pairs of objects (such as marbles, sand, rice, dry cereal, coins, pebbles, and so on) in film canisters, yogurt containers, or plastic eggs. Then they can challenge family members to make sound matches.

Connections

Science Challenge

Encourage students to use a small, hand-held tape recorder to record sounds at home or in other locations outside of the classroom. Tell them that the sounds should be common ones but not easily recognized out of context—for example, a dog lapping water from a dish, a key unlocking a door, or clothes tumbling in a dryer. Have students play their recordings for the rest of the class, and have the listeners try to identify each sound and explain the reasoning behind their inferences. Let the student who recorded the sound identify it.

Science Extension

Ask each student to collect six small, common objects that make a distinctive sound when dropped on a tabletop—for example, a pencil, a paper clip, a stone, a table tennis ball, a wooden block, and a coin. With students working in pairs, one student should cover his or her eyes with a blindfold, and the other student should drop the objects one by one on a table or desk. The blindfolded student should try to identify each object by its sound alone. Tell the second student to record the other student's responses. Then have the first student remove the blindfold, examine the objects, and note his or her responses. The student should then replace the blindfold and be tested a second time knowing the identity of the objects. Have the students change places and repeat the procedure. To provide more challenge, tell the blindfolded student to wait until all six objects are dropped and then name them in the order in which they were dropped.

Science and the Arts

Ask students whether they have ever seen a comedian on television whose act included using his or her mouth to create the sounds made by objects or animals—a galloping horse, a racing car speeding past an observer, a clucking chicken, a hand saw, and so forth. Let students experiment to see how many different types of sounds they can imitate with just their mouths and hands and no other props. Then ask teams to write and perform a brief humorous story or tell a joke accompanied by several different mouth sounds.

Science and Language Arts

Point out to students that stories, songs, and poems often include words that mimic the sounds of things. For example, in the descriptive phrase “the buzz of a bee,” the word *buzz* sounds like a bee flying. Offer a few other examples: the *swish* of a bat as it swings through the air and the *crack* as it hits the ball, a snake *hissing*, and the *tick-tock* of a clock. Ask students to suggest other examples, and encourage them to look through literature books and other sources to find additional examples. With older students, you may want to explain that this literary device is called *onomatopoeia* (on-uh-mat-uh-PEE-uh). When students have a good understanding of the concept, have each student write a poem or a descriptive paragraph that includes at least three or four examples of words that imitate sounds. Give each student an opportunity to read his or her creation aloud, and have the other students identify the sound words in it.