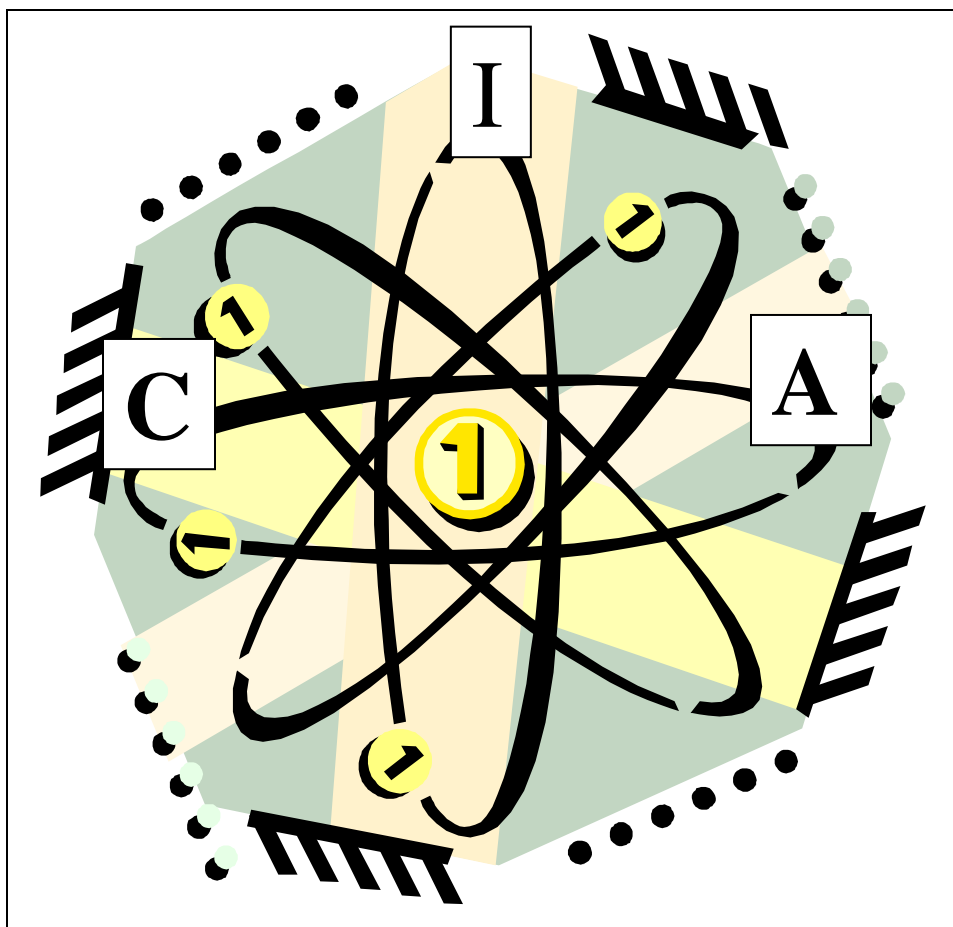


Curriculum, Instruction, Assessment (CIA) Alignment

Science, Grade 2

Unit 5: Sound/Vibrating Motion

Task Analysis and Hands-on Investigations



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Orange County Public Schools
Orlando, Florida

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Subject Area: Science
Strand C: Force and Motion
Grade: 2

Benchmark

SC.C.2.1.2: The student knows that sound is caused by vibrations (pushing and pulling) to cause waves.

TASK ANALYSIS	
The student...	
	SOUND: VIBRATING MOTION
	<ul style="list-style-type: none">• recognizes that vibrating is a rapid back-and-forth movement.• produces sound by vibrating objects.• sees that pitch refers to the rate of vibrating.• varies the pitch of a sound by changing the rate of vibrating.• hears sound travel through solids, liquids, and gases.• classifies sounds according to different criteria (e.g., man-made, nature-made; loud, soft).



GOOD VIBRATIONS

BENCHMARK AND TASKS

SC.C.2.1.2 The student knows that sound is caused by vibrations (pushing and pulling) to cause waves.

- The student recognizes that vibrating is a rapid back-and-forth movement.
- The student produces sound by vibrating objects.



KEY QUESTION

How are sounds made?

BACKGROUND INFORMATION

All sounds are caused by vibrations. A vibration is a rapid back and forth movement. When there is no movement, there is no sound to be heard.

Sound is a form of energy. Energy is needed to make a sound, such as striking a drum or blowing a flute. Vibrations make sound waves that are sent in all directions. Vibrations can also cause other things, which are nearby or touching, to vibrate. To hear a sound, the vibrating material must move back and forth at least 16 times per second.

MATERIALS

Teacher

plastic ruler

Per group

container (shoe box, resealable bag or basket)
rubber bands of various sizes
tuning fork
rubber mallet
craft sticks (one for each group member)
raw rice
empty coffee can with a plastic lid
pie pan of water
paper towels
Good Vibrations record sheet

TEACHING TIPS

1. This activity would require fewer materials if each experiment were placed in a center and students rotated to each area.
2. Demonstrate how to strike a tuning fork. Hold the single rod and quickly strike the double prongs with a rubber mallet. If a rubber mallet is not available, hold the single rod and quickly strike the palm of your hand or a plastic bottle of glue with the double prongs. (Never strike something hard, like a table, with a tuning fork.)

ENGAGE

1. Extend the plastic ruler over the edge of a table. As students observe, hold one end of the ruler on the table with your hand and “pluck” the extended edge with your thumb. The ruler will make a sound.

2. Ask:
What happens to the ruler when it makes a sound?
(The ruler moves back and forth very fast. This kind of very fast back-and-forth movement is called a vibration.)
3. Do **not** take the **Engage** any further as it is expanded in *The Highs and Lows of Sound* activity.

EXPLORE

1. Divide students into groups. Distribute a set of the listed materials to each group. Ask students to explore these materials to help them answer the three questions at the bottom of the *Good Vibrations* worksheet.

RUBBER BAND STRETCH

Pluck a stretched rubber band.

What do you see?

Can the rubber band make a sound when it is not vibrating?

Try rubber bands of various sizes.

RICE EXPERIMENT

Place a few grains of rice on top of the coffee can drum (or butter tub drum). Strike the top of the can with a spoon.

What happens to the rice? What causes the rice to bounce?

CRAFT STICK EXPERIMENT

Hold a craft stick with your teeth. Pluck the end of the stick.

What do you feel? What do you see?

TUNING FORK SPLASH

Without striking it on anything, hold the tuning fork near your ear.

Can you hear a sound?

While the tuning fork is not making a sound, place a tip of the fork in the pan of water.

Observe what happens in the water. Draw what you see.

Strike the tuning fork with the rubber mallet or strike the tuning fork against the palm of your hand or a plastic bottle of glue so that it will vibrate. Hold it near your ear while it is vibrating. *Can you hear a sound?*

While it is vibrating, place a tip of the fork into the water. Observe what happens. Draw what you see.

Note: Have paper towels handy in case of a splash.

2. After students have completed the four activities, encourage them to discuss the three questions on the response sheet and record their answers.

EXPLAIN

Gather students together with their response sheets. Have a student from each group share the group's observations.

Discuss:

What causes the water to splash when the vibrating tuning fork touches it?

How do we know the tuning fork is vibrating when it makes a sound?

What has to happen to the tuning fork for it to make sound?

Why can we see the rice bouncing on the coffee can lid?

How did you make sound with the rubber band?

What have you learned about sound?

How are sounds made?

What do all sounds have in common?

Can we see things vibrate?

What does the word vibrate mean?

EXTEND/APPLY

Tell the students:

You make sounds when you hum or talk. What part of you is vibrating? How do people make sounds?

Have students place their fingertips on their throats while being quiet.

Ask: *What do you feel?*

Ask the students to hum: softly, loudly, with a high pitch and with a low pitch. Have them describe what they feel. Then have them turn to a partner and feel the other person's throat while each talks or hums and while each one is quiet.

Ask: *What differences do you feel?*

Do you feel vibrations?

What causes vibrations?

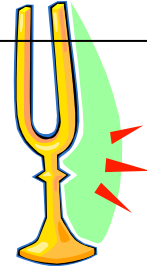
EXTENSIONS

1. Read, *How We Talk*, a *Let's Read and Find Out About Science* book by Franklyn Branley.
2. Ask: *What kind of instrument can you create that makes sound by striking, plucking or blowing?* Have available shoe boxes, rubber bands, empty cans, cups, cardboard tubes, wax paper, beans, rice, straws, wood scraps, etc. Ask students to select materials and create an instrument.
3. Bring in real musical instruments or borrow them from the music teacher. Discuss how the sound is produced with each.
4. Play, "What is Vibrating?" A student creates a common sound and calls on another student to tell exactly what vibrates to cause that sound (e.g., a door slamming, a whistle).

ASSESSMENT

Teacher assessment through observation should include the following criteria:

- tasks have been completed by the student.
- level of detail and specificity found in the *Good Vibrations* worksheet.
- students demonstrate understanding by appropriately using acquired vocabulary.



GOOD VIBRATIONS

Try these activities to help you learn more about sound:

RUBBER BAND STRETCH: Pluck a stretched rubber band. Listen and observe. Try different sizes of rubber bands.

VIBRATING RICE: Place a few grains of rice on top of a coffee can drum (or butter tub drum). Strike the top of the can with a spoon. Watch what happens to the rice.

CRAFT STICK PLUCK: Hold a craft stick with your teeth. Pluck the end of the stick. What do you see? What do you feel?

TUNING FORK SPLASH: Without striking it on anything, hold the tuning fork near your ear. Can you hear a sound?

Fill the pie pan with water. While the tuning fork is not making a sound, place a tip of the fork in the pan of water. Observe what happens in the water. Draw what you see on the back of this sheet.

Strike the tuning fork with the rubber mallet or strike the tuning fork against the palm of your hand or a plastic bottle of glue so that it will vibrate. Hold it near your ear while it is vibrating. Can you hear a sound? While it is still vibrating, place a tip of the tuning fork into the water. Observe what happens. Draw what you see on the back of this sheet.

Think about these questions:

1. Can we see things vibrate? Give an example.

2. How are sounds made? _____

3. What do all sounds have in common? _____

THE HIGHS AND LOWS OF SOUND

BENCHMARK AND TASKS

SC.C.2.1.2 The student knows that sound is caused by vibrations (pushing and pulling) to cause waves.

- The student recognizes that vibrating is a rapid back-and-forth movement.
- The student produces sound by vibrating objects.
- The student sees that pitch refers to the rate of vibrating.
- The student varies the pitch of a sound by changing the rate of vibrating.

KEY QUESTION

How does the movement (vibration) of various objects affect the sound (pitch)?

BACKGROUND INFORMATION

Pitch is the highness or the lowness of a sound. The pitch of the note played is determined by the length of the bar that is struck (e.g., a xylophone) or the level of the water in the bottle (e.g., musical glasses). The shorter the bar, the higher the note sounds; the longer the bar, the lower the note sounds. In contrast, the higher the water level, the lower the pitch. The lower the water level, the higher the pitch.

MATERIALS

Teacher

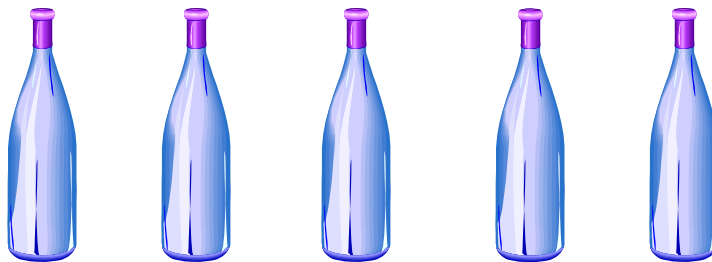
5 identical glass bottles filled to different heights with water
food coloring

Per pair of students

plastic ruler
Ruler Twang response sheet

TEACHING TIPS

Prepare bottles ahead of time. Bottles should all be the same size. When coloring water, use red and yellow to make orange water, and use blue and yellow to make green water.



ENGAGE

1. Place the 5 bottles with different heights of water on the table and ask the students if the bottles will make a sound if they are hit with a pencil. The students should say, “Yes!”
2. Ask students to predict which bottle will make the highest sound or pitch.
3. Have several students come up to test the bottles using a pencil to cause the vibration. Help them to hear that the bottle with the least water has the highest pitch.

4. With the class, order the bottles from lowest to highest pitch.

EXPLORE

1. Place a ruler on the table so that 10 inches of the ruler is extended beyond the edge. While holding down the end of the ruler against the table, push the extended end of the ruler down and then quickly release it. The ruler will make a “twanging” sound.
2. Ask: *How can you produce a high sound using the ruler? How can you produce a low sound using the ruler?*
3. Have students find a partner for Think/Pair/ Share to consider the question.
4. Give each pair a plastic ruler and each student a Ruler Twang response sheet. Students should follow the response sheet as they explore various sound concepts.

EXPLAIN

1. Encourage the pairs to share their observations with the whole class. Discuss their responses on the *Ruler Twang* sheet. Ask: *What do you think would happen if you twanged the ruler at 8 inches? Why?*
2. Continue questioning to develop the concepts. The word **pitch** refers to high/low sounds. The shorter the ruler, the higher the pitch. The length is short, so it vibrates many times quickly. The faster it vibrates, the higher the pitch. As the length of the vibrating part gets longer, the vibrating slows down; thus the pitch gets lower. The longer the vibrating part, the slower the up-and-down movement and the lower the sound produced.

EXTEND/APPLY

1. Either the classroom teacher or the school music teacher could demonstrate how sounds are produced and controlled in various musical instruments. Have students identify the source of vibrations when the instruments are played. Ask: *What causes the change in pitch on the instruments?*
Show the students a wind instrument, such as a flutophone or a recorder. Cover all the holes with your fingers and blow through the recorder. While you are blowing, uncover one hole at a time (from the bottom to the top) of the instrument. Ask students to listen to the sounds. Sounds go up the scale. (When the vibrating air column grows shorter as the holes are uncovered, the pitch of the note goes up.) Blow through the recorder again. This time cover the holes with your fingers one at a time from the top to the bottom. Listen to the sounds. Sounds will go lower. (The column of air that is vibrating as you blow is getting longer; therefore, the pitch becomes lower.)
Demonstrate with a stringed instrument - the shorter the string, the higher the pitch; the longer the string, the lower the pitch.
2. Listen to a piece of music for the variance in pitch. Use a “thumbs up” for pitch that goes up and “thumbs down” for pitch that goes down. Ask:
Why would there be a change in pitch throughout a song?
(Answers will vary: adds beauty, pleasure, a sense of movement, variety, etc.)

EXTENSIONS

Show students a xylophone. Play the xylophone to demonstrate high and low pitch, hitting notes at random. Demonstrate that small objects vibrate fast and large objects vibrate slowly. Ask them what they heard as you played.

Ask:

What is causing the sound?

What is vibrating?

Are the sounds alike?

How are they different?

What do you think causes the differences in sound?

Hit two notes on the xylophone. Ask:

Which note is higher?

Which note is lower?

Do this several times. Ask:

Which bars make the high notes?

Which bars make the low notes?

Hit notes from low to high. Again, ask students to tell what they observed.

ASSESSMENT

Teacher assessment through observation should include the following criteria:

- tasks have been completed by the student.
- student demonstrates ability to identify the source of a sound and how the vibration affects the pitch of the sound.
- level of detail and specificity found in the *Ruler Twang* worksheet.
- student's answers to questions should show evidence of conceptual knowledge.
- student demonstrates understanding by appropriately using acquired vocabulary.
- student's questions should be probing, on task, or reflect the processing of an essential concept.

RULER TWANG

(Think/Pair/Share Response Sheet)

1.

How can you produce a low sound with your ruler?
Draw a picture of the ruler on the table. Write a sentence to describe what you did.

2.

How can you produce a high sound with your ruler?
Draw a picture of the ruler on the table. Write a sentence to describe what you did.

3. What is the difference with the ruler placement for high and low sounds?

4. Which will produce the highest sound – 3 inches, 5 inches, or 7 inches?

5. Which will produce the lowest sound – 3 inches, 5 inches, or 7 inches?

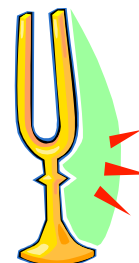
6. What do you think would happen if you twanged the ruler at 8 inches?

SOUNDS ON THE MOVE

BENCHMARK AND TASKS

SC.C.2.1.2 The student knows that sound is caused by vibrations (pushing and pulling) to cause waves.

- The student produces sound by vibrating objects.
- The student hears sound travel through solids, liquids, and gases.



KEY QUESTION

Can sound travel through wood (solid), water (liquid), and air (gas)?

BACKGROUND INFORMATION

All sounds are caused by vibrations. A **vibration** is a back and forth movement. When there is no movement, there is no sound to be heard.

Sound is a form of energy. Energy is needed to make a sound, such as striking a drum or blowing a flute. Vibrations make sound waves that are sent in all directions. Vibrations can also cause other things, which are nearby or touching, to vibrate. Sound waves move best through solids, like the earth, metals or wood. Sound waves also move through liquids, such as water. Sound waves travel through a gas, such as air, yet not as well as through solids or liquids. Materials that absorb sound waves often have air pockets. Air pockets trap sound waves. Some building materials are designed to catch and absorb sounds.

MATERIALS

Teacher

bell

Sounds (Benchmark Education Co.)

Per student

1 animal name card

Per group

1 tuning fork

1 zipper-type bag of water

1 ping pong ball or
cork with a 10" piece of
thread attached with tape
table or desk

TEACHING TIPS

1. Write the names of animals on individual cards. (The number of times an animal's name is written will be determined by the number of students in a group. If you want five students in a group, write each animal name five times.) Place the cards in a bag, so each student can select a card.
2. The first activity is to help students form their small groups by using auditory discrimination.
3. The **Explore** part of the lesson may take more than one class session to complete.

ENGAGE

1. Have each student select an animal name card from a bag. Tell students to keep the animal card a secret for this game. Students should try to locate the other members of their group who are making the same sound (e.g., Cows "moo" and move toward other

cows that are mooing.). Ask students to sit with their groups once all members are together.

- Using a piece of tape, hang the ping-pong ball from the table. Strike a tuning fork with a rubber mallet or against your palm or a plastic bottle of glue and hold it next to the ping-pong ball.

What happens to the ball?

What do you think is causing this?

EXPLORE

- Encourage groups to explore the following questions about sound and to record their predictions and their observations in their science journals:

A. Does sound travel through air?

Send a student to one side of the room with a bell to ring (or any object with a sound that can easily be heard by the group).

After the student rings the bell, ask:

What made the sound?

The sound was made on the other side of the room. Why can we hear the sound on this side of the room? (Sound can travel through air.)

B. Does sound travel through wood?

Try this. Tap the table with a finger. Listen to the sound. Now place your ear on the table and tap again. Listen to the sound. Discuss with your group:

What is the sound traveling through in order for you to hear it?

Which tap was easier to hear: sound traveling through air or sound traveling through wood?

C. Does sound travel through water?

Place the sealed bag of water to your ear. Have a group member strike the tuning fork and place it close to the water bag and then move the fork away from the bag.

Can you hear the sound through water?

- Discuss with your group:

Does sound travel through air? water? wood?

What type of matter is air? Water? Wood?

Which material was the best conductor of sound? Why do you think so?

Record your responses in your science journals.

EXPLAIN

- Ask:

Through what different materials can sound travel?

When was the sound the easiest to hear?

When was the sound the most difficult to hear?

Why do you think the sound is louder when you hear it through wood than through air?

- Listen to see if you can hear sounds coming from another room.

What sounds do you hear?

What are the sources and what is the sound traveling through to reach your ears?

EXTEND/APPLY

1. Have your students put their ears to the floor. Walk across the floor or bounce a ball at a distance from the students. Ask the students if they can hear you. Explain that the Native Americans used this method to hear approaching people and herds. They could feel the vibrations through the earth before they could hear them through the air. Just as the Native Americans used “sound” messages in their day-to-day living, people today still rely on sounds to convey messages. Ask if they can think of any examples (e.g., police, fire and other emergency sirens, phone ringing, doorbell, knocking on the door).
2. Read and discuss *Sounds*.

EXTENSIONS

Make a string telephone:

Materials

Per student

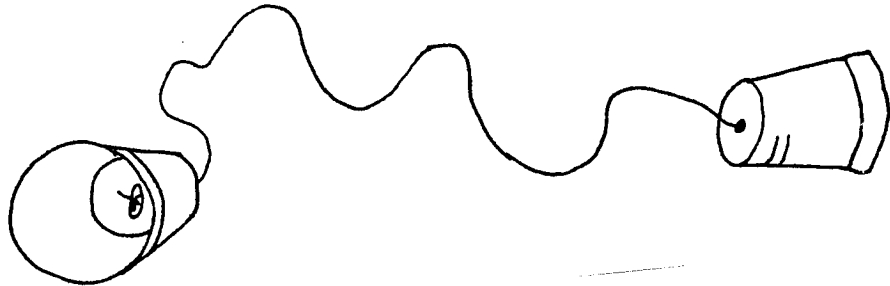
paper clip

kite string (2-6 m long)

assorted containers, such as: paper cups, tin cans, plastic cups, styrofoam cups

assorted connectors, such as wire, yarn, rope, thick string (2m – 8m long)

1. Have students poke a small hole in the bottom of their cups with a pencil. Ask them to work with a partner. One partner puts one end of the string through the hole in his or her cup. The string must go from the outside bottom of the cup to the inside. Once it is inside, that student can pull it through further and tie a paper clip to that end. Then the other partner pulls the other end through the hole in his cup in the same manner and attaches a paper clip to that end. Once that is done, the string can be pulled taut between the two cups.



2. Let one student talk into the open end of the cup while the partner places the other cup's open end at his ear. Ask:
What happens when the string is stretched taut as you speak? What happens if the string is not stretched taut?
3. Students should trade telephones with others that have different length strings.
Ask:
Did the telephones sound the same?
Did they sound different? Why or why not?

4. Discuss the variables that affect the telephone's clearness and loudness. Make a list of the variables on the board: different containers for speaking and listening and differences in connectors (different materials or length).
5. Have the same pairs of two students decide what materials they will use to construct another telephone. From the assorted materials, the pair must choose 2 containers and 1 connector.
6. Allow various pairs to tell what materials they used to make their telephone and describe the sounds they heard (e.g., loud, soft, high, low, clear). Ask:
What causes the sounds you heard? (The connector vibrates and the container helps to amplify the sound in the container.)

ASSESSMENT

Teacher assessment through observation should include the following criteria:

- tasks have been completed by the student.
- student demonstrates the ability to identify the source of a sound and to recognize that sound travels through many different materials.

SIMPLY SOUND



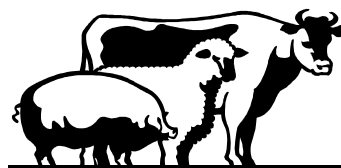
BENCHMARK AND TASKS

SC.C.2.1.2 The student knows that sound is caused by vibrations (pushing and pulling) to cause waves.

- The student produces sound by vibrating objects.
- The student classifies sounds according to different criteria (e.g., man-made, nature-made; loud, soft).

KEY QUESTION

How can sounds be classified?



BACKGROUND INFORMATION

All sounds are caused by vibrations. A **vibration** is a back and forth movement. When there is no movement, there is no sound to be heard.

Sounds come from a variety of sources: people, animals, machines, nature, and musical instruments. The environment is filled with both natural and man-made sounds. Through experience we have learned to match sounds to ideas and events; they convey messages. Whatever the sound, we can be certain that it was caused by a vibration.

MATERIALS

Teacher

coin
Venn diagram
rice, beans, pennies, cotton, paper clips,
jingle bells, sand, etc. (to fill sound canisters)
film canisters – 1 per student

Per student

Sounds We Hear... record sheet
pencil
clipboard or surface for writing outside

TEACHING TIPS

Make sound canisters by filling opaque film canisters with items that create distinct sounds: rice, beans, pennies, cotton, paper clips, jingle bells, sand, etc. Prepare one set of canisters for each group (e.g., If you have 24 students, you may choose to have 6 groups. You would need 6 different items to fill the canisters. Group 1 would all have pennies, group 2 would all have sand, etc.).

ENGAGE

1. Ask students to close their eyes and listen carefully. Drop a coin onto a table and ask students to identify the object that made the sound.
2. Have students select one of the previously filled film canisters. Ask them not to open their canister but to shake it and listen carefully to the sound produced. Tell students to walk around the room, shaking their canisters to find members of their group by matching their sound canisters to others with similar sounding canisters.
3. After all members of the group have come together, have them discuss and predict what is inside their film canisters before they open them to verify their predictions.
4. Students with matching canisters should form their groups.

5. Ask:

Do you think you have a solid, liquid, or gas?

Why do you think so?

Do you have one object or more than one?

Is the object likely made of metal, plastic, cloth, or some other material?

What are some other ways you can describe the sound?

What do you infer is in the canister?

EXPLORE

1. Give each student a *Sounds We Hear...* record sheet.
2. Ask students to close their eyes and listen to indoor sounds for one minute. They should record their responses on the top section of the record sheet.
3. Take the children outdoors and again ask them to close their eyes and listen to the outdoor sounds for one minute. Give them time to write their responses on the top section of the record sheet.

EXPLAIN

Discuss with the students:

What sounds did you hear in the classroom?

What sounds did you hear outdoors?

How are indoor sounds different from outdoor sounds?

Did you hear any of the same sounds in both places?

Were the sounds louder indoors or outdoors?

Did you hear more sounds indoors or outdoors?

What do you know about sound?

EXTEND/APPLY

Tell groups to brainstorm and compile a list of sounds and their sources at the bottom section of the record sheet. Direct students to classify the sounds as man-made/nature-made, loud/soft, and pleasant/unpleasant. After groups have completed their lists, discuss their ideas:

What kinds of sounds are pleasant to your ears?

What characteristics make a sound unpleasant to hear?

Are all the loud sounds also unpleasant sounds? (Discuss the possibility of hearing loss or damage to the ear, resulting from loud sounds, including prolonged listening to loud rock music.)

Are all soft sounds also pleasant sounds?

Are nature-made sounds usually pleasant or unpleasant sounds?

Are there any nature-made sounds that are unpleasant? If so, what are they?

Are man-made sounds usually pleasant or unpleasant sounds?

Are there any sounds that could be both pleasant and unpleasant, depending on the circumstances?

EXTENSIONS

1. Make a collage of pictures or drawings of sounds you hear every day.
2. In collaborative groups, create sound effects for a story or poem that is being read in class.

3. Illustrate one of the following scenes and list the sounds you might hear at: the beach, a birthday party or in physical education class.

ASSESSMENT

The student demonstrates the ability to identify the source of a sound and classify sounds as indoor/outdoor, loud/soft, and man-made/nature-made.

The *Sounds We Hear* record sheet is satisfactorily completed.



SOUNDS WE HEAR...

INDOOR SOUNDS

<u>phone ringing</u>	<u>Tom's cough</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

OUTDOOR SOUNDS

<u>train whistle</u>	<u>wind</u>
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

SOUND and SOURCE

MAN-MADE NATURE-MADE

LOUD/SOFT

PLEASANT/ UNPLEASANT

<u>cow mooing</u>	<u>nature made</u>	<u>loud</u>	<u>pleasant</u>
<u>buzz of microwave timer</u>	<u>man-made</u>	<u>loud</u>	<u>unpleasant</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Discuss the following questions with your group:

- Are all **loud** sounds pleasant to the ear? Why?
- Are all **nature-made** sounds **pleasant** to the ear? Why?
- Are there any sounds both **indoors** and **outdoors**?