



K-2 Physical Science
K-2 Nature of Science

Southern Nevada Regional Professional Development Program

Sound Vibrations

INTRODUCTION

From the time we wake up until the time we go to bed, we are surrounded by sounds. We hear sounds from people, machines, vehicles, technology, musical instruments and nature. Some sounds are quite pleasant to hear, some are not. But all sounds help us make sense of our world. No matter where we are or what we are doing, we are exposed to sounds. Because of this, our students probably have never given much thought to how sounds are created. The activity *Sound Vibrations* will allow students to understand just what sound is—what causes sound.

WHERE'S THE SCIENCE?

All **sound** is made by something moving. We call this type of movement **vibration**. Vibration is a very fast, back and forth type of movement. Without this movement, sound cannot happen. A vibrating object, such as a bell, receives **energy** from some source, and transfers that energy through some form of matter, such as air. As this happens, the air in and around the bell is squeezed over and over as the vibration continues to move through the air; we call these **sound waves**. When those vibrations reach our ear, we can hear the sound of the bell.



In this activity, *Sound Vibrations*, students will have the opportunity to investigate this phenomenon called sound.

MATERIALS:

- Rubber bands
- A plastic ruler or tongue depressor, one per pair of students
- A slinky
- A metal clothes hanger, one per student
- A piece of string, about 1 meter long, one per student
- a metal spoon or fork, one per student
- 5-6 plastic spoons or forks
- 5-6 wooden rulers or thick, wooden dowels
- Science notebook, one per student
- Chart paper

PROCEDURES

Lesson One:

1. Call the students to the group area to discuss sound. You may want to have chart paper up to record their thinking, or if working with second graders, you may ask them to respond to these questions in their notebooks prior to coming to the group area. Ask these questions: What do you think you know about sound? What causes sound? What is a vibration?
2. Next, ask each of the students to hold their fingers lightly in the middle of their throats. Ask them if they can feel anything. Now ask them to hum, talk or sing loudly; are they able to feel anything this time? (There should be a vibrating feeling from their vocal chords moving.)
3. Give each of the students a rubber band and ask them to stretch it over their fingers. Listen to the rubber band. Is there any sound? (No.) Now gently pluck the rubber band and listen again. Is there a sound? (Yes.) If this is difficult for the younger students, they

- may work with a partner—one person uses both hands to stretch the rubber band about 4-5 inches long; the other will pluck it and listen. Then they should switch roles.
4. Now give each pair of students a ruler or a tongue depressor and have them go back to the tables/desks. One student should place the ruler so it overhangs the edge of the table and place his/her hand on the part that is sitting on the table. Observe the ruler. The other student should now bend the overhanging part of the ruler down and then let go. What happens? When do you hear a sound?
 5. Now ask the students to think over each of the investigations. What was the same about their neck (vocal chords), the rubber band and the ruler? Second graders could sit down with their science notebooks to record their thinking, and then come back to the group area. Younger students could discuss these questions with a partner before sharing with the whole group.
 6. Allow them to share their thinking about the above questions. Then explain that in each of the investigations, something had to move in order to create a sound. Introduce the term **vibration**. Sound is produced when something vibrates. When an object moves, it pushes against the air around it, sending sound waves through the air. This **energy** (of the air being moved) reaches your ears and is interpreted as **sound**.
 7. Have the students sit in a circle to see a demonstration of sound waves done with a slinky. Tell the class to observe carefully. Ask two students to stretch a slinky until it is about 4 times its length. Have one student gently shake one end of the slinky up and down a few times. Tell the class to observe what happens with the slinky. Next ask the other student to reach as far as s/he can down the stretched springs and gather some of the coils together, then quickly release them. What happens? (Shaking the slinky up and down causes it to look like waves. The compressed slinky demonstrates how energy is being transferred from a vibrating object through a medium, such as air.)
 8. Ask the students this question: Why were we able to hear sounds with the materials we used today? Allow the students time to

discuss this with a partner (or to write in their science notebooks), then share whole group. Chart their responses.

Lesson Two:

1. Bring the students to the group area and review what they learned yesterday about what causes sounds. (Sounds are caused by something vibrating.)
2. Review the vocabulary they learned: **sound, sound waves, energy, vibrate, vibration**
3. Explain that today they will be investigating sounds by causing a metal object to vibrate.
4. Before you do this lesson with the students, you may wish to prepare the metal hangers by tying the string to the hooked part of each hanger. First fold the string in half and loop the folded part over the hanger's hook. Tie it loosely.
5. Demonstrate for the students how to wrap each of the ends of the string a couple of times around your two index fingers. Explain that the students will do the same, and then walk around, gently swinging their hanger so it bumps against some solid objects in the room.
6. Remind them to work safely and to observe carefully what happens each time they make the hanger bump something.
7. Encourage them to also make the hanger bump soft solids, such as a pillow, a jacket or backpack.
8. Allow just a few minutes for the students to complete this part of the investigation. Be sure to walk around and ask students what they are observing. The following questions might be helpful: What does it sound like when you bumped the ___? How did it feel? Can you feel any vibration?
9. Have the students leave their hangers at their desks/tables and come back to the group area to discuss what happened. (At this point, older students could be asked to write what they observed in their notebooks, then bring their notebooks to the group to share.)

- Chart their responses. Be sure to get responses explaining how hard and soft solids sounded when bumped.
10. Now tell them that they will do the experiment again, but this time they will hold their wrapped index fingers to their ears. (**Safety precaution:** Tell them to just put their fingers over the openings of their ears; they should not put their fingers in their ears.)
 11. Allow time for students to walk around again, bumping the same solids they did in the first part of the investigation. Walk around as before asking them what they are observing.
 12. Bring them together to the group area, and again, process what they observed. (Older students could be asked to write this part in their notebooks.) Use these questions to guide their thinking: Did you get the same results? How were the results different? (They should say things sounded louder.) Could you feel any vibration?
 13. Explain that in both parts of this investigation, they could hear sounds because vibrations move the air back and forth through the air, eventually reaching their ears. When they put their fingers near their ears, they create a direct path that allows more vibrations to reach their ears, thus directing more of the sound to their ears.
 14. Have the students process what they learned in this lesson. In order to give every student an opportunity to explain his/her thinking which will have helped them clarify what they learned, direct them to do a “think, pair, share”. Have the students work with a partner; one partner gets 1 minute to explain his/her thinking, then the other person shares. Then ask several people to share with the whole group.

Lesson Three: (Optional)

Students should be encouraged to ask questions during science investigations in order to further their own understanding of concepts. Lesson Three could be set up as a way for questions to be examined.

1. Call the students to the group area. Review what was learned in lessons one and two. If students have been posing questions in those

- I wonder what would happen if we tied our string to a _____ (a metal or plastic fork or spoon, a wooden ruler or dowel, etc.) instead of a hanger to listen for sounds?
 - I wonder what would happen if we used yarn instead of string on our hangers?
 - I wonder what would happen if we lengthened or shortened the string?
2. As a group, choose one of the questions to investigate. Help the class design an experiment to test the new materials. Be sure to explain to them that only one change (**variable**) can be made when setting up this new investigation. On a chart, help the students compose a procedure that they will need to follow. (Second graders could do this part in small teams of 3-4 students; each team could be encouraged to choose their own investigable question and design an investigation. They can write their questions, predictions and procedures in their science notebooks.)
 3. Allow time for the students to carry out their investigation/s. In their notebooks, they should write the observations they are making.
 4. Call the group together to share their findings. What further learning have they acquired about sound? What new questions do they still have?
 5. Explain to the students that they have been working just like grown-up scientists do.

VOCABULARY

- Energy:** the ability to make things happen
- Sound:** a form of energy carried by sound waves
- Sound waves:** a wave produced by the energy of a vibrating object
- Vibrate:** to move back and forth quickly
- Vibration:** a quick back and forth movement

Additional Resources:

- *Sound: Stop Faking It! Finally Understanding Science So You Can Teach It*

ISBN 978-0-87355-216-5 NSTA Press, Arlington, VA, 2003.

- *Sound and Vibrations* ISBN 0237530082, 9780237530082 Gerard Cheshire, Evan Brothers Publishers, 2006.
- www.teachersdomain.org/resource/phy03.sci.phys.howmove.lp_sound/
- *Sound*, DeltaScience Readers, ISBN- 10:1-59242-377-9/ISBN-13:978-1-59242-377-4

Nevada State Science Standards

P2C1 Students know sound is produced by vibrating objects. I/L

N2A1 Students know how to make observations and give descriptions using words, numbers, and drawings. E/S

N2A2 Students know tools can be used safely to gather data and extend the senses. I/L

N2B1 Students know science engages men and women of all ages and backgrounds. E/S

N2B2 Students know that, in science, it is helpful to work in a team and share findings with others. E/L

Safety Reminders:

- Remind students that they must be careful not to get the tools, especially the metal coat hanger, near their faces. Also, when swinging the hanger, they need to be careful not to hit it hard against anything as this could hurt their ears or break something.

- The rubber band should be held so that it does not go flying into someone's face.