



Good Vibrations

Students experiment with various sound sources, including their own voices, to gain an understanding of the connection between sound and vibration.

SCIENCE TOPICS

Hearing
Sound
Vibrations
Energy

PROCESS SKILLS

Listening
Observing
Scientific Inquiry
Health Skills

GRADE LEVEL

K – 12

TIME REQUIRED

Advance Preparation

30 minutes

Set-Up

15 minutes

Activity

30 minutes

Clean-Up

5 minutes

MATERIALS

- Tuning fork
- Pan or unbreakable bowl, approx. (1–2 quart)
- Water (2–3 cups)
- Paper
- Crayons
- Ping-Pong ball
- String (about 18 inches)
- Tape

SET UP

Set the supplies at each station as follows:

Station 1– Ripples on Water/Tuning Fork:

- Add water to the pan or bowl to approximately two inches deep.
- Place crayons, paper, a tuning fork, and the pan of water at the table.

Station 2 – Sound Moves/Tuning Fork:

- Cut a piece of string approximately one foot long
- Tape one end of string to a ping-pong ball
- Place string with ping-pong ball and a tuning fork at the table

INTRODUCING THE ACTIVITY

Let the students speculate. Do not encourage a single correct answer. Do not offer answers to any questions. The answers at the right are provided primarily for the teacher's benefit.

Begin with an introductory, interactive demonstration in which students feel the vibrations created by their own voices. **Talk to or ask the students the questions in bold.** *Possible student responses are shown in italics.*

- **We are going to feel the movement made by our voices when we talk, sing, hum, or shout.**
(Note: Tiny repeating movements are called vibrations)
- **Can you feel the sound of your voice by putting your hand on your body while you talk?**
- **Where do you think is the best place to feel your body move when you talk, sing, or hum?**
(Note: Encourage a variety of answers. Each answer represents what they know about sound. Students may think the vibrations will be strongest coming from their mouths, but they are actually stronger at the throat.)
- **Test your hypotheses with a partner.** Have students test various hypotheses suggested by the class and possibly the teacher. Test by having students place their hand on a part of their body while they talk.

- **Include testing of the face and throat.** Have each student hold her hand against her own face as she talks and feel the movement (vibrations).

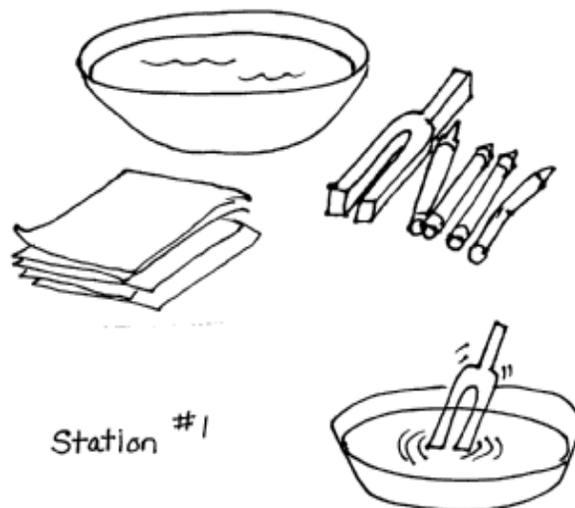
Next, have students put a finger on the front of their throat, close to their "voice box," (*middle of the throat*) being careful not to press too hard.

- **Do you feel tiny movements from speaking? Where do you feel them best?**
- **Ask students to share their observations.**

Demonstrate the two activity stations before students divide into groups and do the activities.

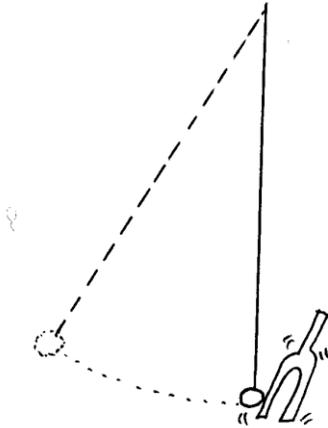
Station 1– Ripples on Water/Tuning Fork:

- Strike a tuning fork against a book and dip the fork in the pan or bowl of water.
- Tell students that when they do this activity, they will also have paper and crayons to draw what they see.
- To think about: What did you feel when you touched the tuning fork after you hit it?



Caution: the resonating (fork) end of the tuning fork should *only* be placed in the water. Do not put the resonating end of the fork against the windows, eye glasses, or teeth. The tuning fork can shatter glass.

Station 2 – Sound Moves:



- Have one student in a standing position hold the string with the ping-pong ball at arm's length. Be sure the student is holding it as still as possible.
- Have another student gently move the tuning fork towards the ping-pong ball until it just barely touches it.
- Have the second student strike the tuning fork against a book or shoe and again gently move the tuning fork towards the ping-pong ball until it just barely touches it.
- One more time, have the same student gently touch the ping-pong ball with the tuning fork.

Ask the students the questions in bold and facilitate an open-ended discussion. *Possible answers are shown in italics.*

Questions from Stations:

Station 1– Ripples on Water/Tuning Fork:

What did you feel when you touched the tuning fork after you hit it? What did you observe happening to the water?

Station 2 – Sound Moves/Tuning Fork:

What happened when you touched the ping-pong ball with the tuning fork the first time?

What happened to the ping-pong ball when you touched it the first time after hitting the tuning fork on a book?

What happened when you touched it a second time?

Did anything surprise you when the tuning fork touched the ping-pong ball? Why do you think the ping-pong ball moved?

What else did you notice (observe) with your eyes or ears?

Can we see sound move?

The sound made by the tuning fork made a pattern of waves that showed in the water. If we could see the air around us, we would be able to see the same kind of waves as sound moves through the air from a radio to your ears.

Can sound move things?

Energy (vibration) is transferred from the tuning fork to the ping-pong ball. The amount of energy transferred will determine how far the ping-pong ball moves.

This sound movement is felt by special parts of your ear (tiny hair cells of the inner ear). Deep inside your ear, sound waves actually move small vibration sensors called hair bundles. These parts of your ear are much smaller than grains of sand. If sound is strong (loud) enough, the sound waves cause some of them to bend or break. When you are around loud sounds often, or for a long time, you may begin to have trouble hearing.

Do you know anyone who seems to have trouble hearing some sounds?

Give examples of some loud sounds you are exposed to in your environment.

Note: Loud sounds are not the only cause of hearing loss, but it is the most common cause in America (and in other industrialized nations). Loud sounds (above 85 dB for 8 hours or more) can hurt your ears by damaging the sensitive hair cells of the inner ear. It makes no difference whether you like the loud sounds or not – if they are 85 dB and over, they can begin to damage hair cells in your inner ear.

Doctors cannot fix ears that have been damaged by loud sound so it is very important to protect your ears.

Here is what you can do:

- Turn it down (turn the volume down)
- Walk away (get far away from the loud sound)
- Wear ear muffs or ear plugs



QUESTIONS TO TELL IF YOU ARE AROUND SOUND THAT MAY HARM YOUR HEARING:

- Do you often have to shout for people to hear you?
- After being around loud sound, did you ever have a ringing or other noises in your ears or head (tinnitus)?
- Does music sound a little strange after you listen for a while?
- After being near loud sound, does it sound like people are talking to you through a pillow or underwater?
- After being near loud sound, do your ears sometimes feel “full” or “stopped up”?
- When you are listening to stereo headphones does the person next to you need to raise their voice for you to understand what they are saying?

If you answered YES to any of these questions, you may have been exposed to damaging sound levels.

EXPLANATION

In-depth background information for teachers and interested students.

Sound is produced when an object vibrates. Near the vibrating surface, air follows that surface and the air molecules begin to vibrate, or **oscillate**. These oscillations spread from one molecule to the next, and a sound wave moves outward from the vibrating surface. The intensity of the waves (**amplitude**) and how rapidly they repeat (**frequency**) produce the differences in sound. More intense oscillation produces a louder sound. Faster oscillations produce higher pitched sounds. When sound waves travel through the air, the oscillation of the air molecules next to the surface of an object (such as the surface of the drum) will cause that object to vibrate. You can even feel the sound energy with a light fingertip touch on many of the objects used in this activity.

OPTIONAL EXTENSIONS

Drum Vibrations, Kazoos, Rubber Band Guitar

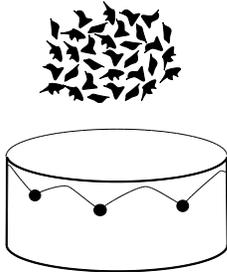
MATERIALS

- Drum(s) (any drum or tambourine will work)
- 2–5 small unbreakable containers (e.g., a plastic cup or 8 oz. clean, empty yogurt container)
- Spoon (plastic or metal, coffee spoon size is fine)
- Rice grains
- Cornflake-type cereal flakes;
- Optional: other small dry ingredients similar to rice and cornflakes
- Wastebasket
- Empty tissue box (flat rectangular variety)
- Rubber bands of various sizes
- Waxed paper
- New, small plastic combs (1 per pupil) (small combs work well)

ADVANCE PREPARATIONS

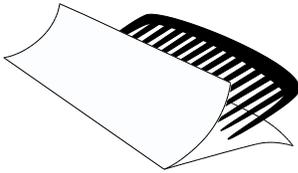
- Set up desks to create spaces for additional “sound stations” with desks arranged in 4 groups.
- Gather supplies (see materials above).
- Cut one square of waxed paper per student (have a few to spare). The wax paper squares should be approximately 10–20 cm. per side (about 4–8 inches).
- Make a Rubber Band Guitar:
Stretch a rubber band around tissue box so that the elastic crosses over the box opening. Place other rubber bands of different widths across the box in the same way. *Depending on the size of class, teachers may want to make several Rubber Band Guitars.*

Station 1 – Drum Vibrations:



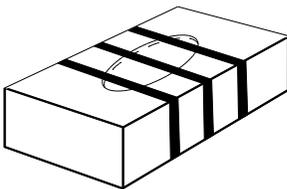
- Fill 3 – 5 small unbreakable containers (e.g., clean, empty 8 oz. yogurt containers) halfway with different dry ingredients including uncooked rice grains, cereal flakes, etc. (*Note: you may need to refill these during the class period as groups use up the ingredients*).
- Place the containers of ingredients, a spoon, and a drum at the station.
- Place a wastebasket near the station for the dry ingredients once the session is complete.

Station 2 – Kazoos:



- Make a kazoo by folding a piece of waxed paper in half.
- Slip a comb into the waxed paper so that the teeth are against the fold.
- Put the comb into your mouth so that your lips rest on the folded edge of the waxed paper. (It is best if students avoid getting the paper wet.)
- Blow or hum.
- Question: How did your lips feel when you played your “kazoo”? What happened to the waxed paper when you hummed?

Station 3 – Rubber Band Guitar:



- Make a rubber band guitar by putting 3-4 rubber bands around an empty tissue box.
- Strum the rubber band guitar. Watch the rubber bands as they are plucked.
- Question: What did the rubber band do when you plucked it? Did you feel movements (vibrations) in your other hand (the hand holding the box)?

DISCUSSION

Ask the students the questions to facilitate an open-ended discussion.

Questions from Stations:

Station 1– Tuning Fork - Ripples on Water and Ping-Pong Ball:

What did you feel when you touched the tuning fork after you hit it?

Station 2 – Drum Vibrations:

Did the cereal flakes move or stand still? Did some materials move more than others?

Station 3 – Kazoos:

How did your lips feel when you played your “kazoo”? What happened to the waxed paper when you hummed?

Station 4 – Rubber Band Guitar:

For the rubber band guitar, what did the rubber band do when you plucked it? Did you feel movements (vibrations) in your other hand (the hand holding the box)?

What was each one of these objects doing as it was making a sound (including your throat)?

What else did you notice (observe) with your eyes or ears?

EXPLANATION

In-depth background information for teachers and interested students.

Read about the **Physics of Sound** on page 4.

Sound is produced when an object vibrates. Near the vibrating surface, air follows that surface and the air molecules begin to vibrate, or **oscillate**. These oscillations spread from one molecule to the next, and a sound wave moves outward from the vibrating surface. The intensity of the waves (**amplitude**) and how rapidly they repeat (**frequency**) produce the differences in sound. More intense oscillation produces a louder sound. Faster oscillations produce higher pitched sounds. When sound waves travel through the air, the oscillation of the air molecules next to the surface of an object (such as the surface of the drum) will cause that object to vibrate. You can even feel the sound energy with a light fingertip touch on many of the objects used in this activity.

OPTIONAL EXTENSIONS

Music

Have a class concert, using the drum(s), kazoos, guitar(s), and voices!