

OVERVIEW

PHYSICS OF SOUND



GOALS

The **Physics of Sound Module** consists of four sequential investigations, each designed to expose a specific set of concepts. Students learn to discriminate between sounds generated by dropped objects, how sounds can be made louder or softer and higher or lower, how sounds travel through a variety of materials, and how sounds get from a source to a receiver. The investigations provide opportunities for students to explore the natural and human-made worlds by observing and manipulating materials in focused settings using simple tools.

FOSS EXPECTS STUDENTS TO

- Observe and compare sounds to develop discrimination ability.
- Communicate with others using a drop code.
- Learn that sound originates from a source that is vibrating and is detected at a receiver such as the human ear.
- Understand the relationship between the pitch of a sound and the physical properties of the sound source (i.e. length of vibrating object, frequency of vibrations, and tension of vibrating string).
- Compare methods to amplify sound at the source and at the receiver.
- Observe and compare how sound travels through solids, liquids, and air.
- Use knowledge of the physics of sound to solve simple sound challenges.
- Acquire vocabulary associated with the physics of sound.
- Exercise language, social studies, and math skills in the context of the physics of sound.
- Develop and refine the manipulative skills required for investigating sound.
- Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, and organizing.

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PHYSICS OF SOUND MODULE MATRIX

SYNOPSIS

SCIENCE CONTENT

THINKING PROCESSES

1. DROPPING IN

Students explore their ability to discriminate between sounds, by dropping objects into a drop chamber and identifying each object by the property of its sound. They develop a code by assigning letters to objects and send messages to one another by using their drop code.

- Objects can be identified by the sounds they make when dropped.
- Sounds have identifiable characteristics.
- Sounds can convey information.
- Sound is caused by vibrations.
- A sound source is an object that is vibrating.
- A sound receiver detects sound vibrations.

- Observe sounds made by objects when dropped.
- Communicate with others using a code.
- Compare sounds to develop discrimination.

2. GOOD VIBRATIONS

Students explore sound generators and musical instruments in miniactivities to find out what causes sound and what changes the pitch. They investigate variables that affect changes in pitch: the length of vibrating objects and the tension on vibrating strings.

- Sound originates from vibrating sources.
- Pitch is how high or low a sound is.
- Differences in pitch are caused by differences in the rate at which objects vibrate.
- Several variables affect pitch, including size (length) and tension of the source material.

- Observe that sound originates from a vibrating source.
- Compare high-, low-, and medium-pitched sounds.
- Record observations on sound.
- Relate the pitch of a sound to the physical properties of the sound source.

3. HOW SOUND TRAVELS

Students work in collaborative groups on miniactivities that introduce a sound source and a medium of sound travel. They observe and compare how sound travels through solids, water, and air.

- Sound travels through solids, water, and air.
- Sound vibrations need a medium to travel.
- Sound that is directed travels better through air.
- Our outer ears are designed to receive, focus, and amplify sounds.

- Observe that sound travels through solids, water, and air.
- Compare how sound travels through different mediums.
- Record observations on sound.

4. SOUND CHALLENGES

Students investigate the nature of our sound receivers, ears. They are challenged to put their knowledge of sound sources, sound travel, and sound receivers to work. They take one of the instruments they used earlier and change its pitch, make its sound travel farther, or make it louder.

- Several variables affect pitch, including size (length), tension, and thickness of the source material.
- Sound can be directed through air, water, or solids to the sound receivers.
- The medium that sound passes through affects its volume and the distance at which it can be heard.

- Observe that the outer ear is designed to receive sounds.
- Compare different ways of amplifying sounds and making them travel longer distances.
- Record observations of how sound travels.
- Report findings in a class presentation.

Language Extensions

- Drop multiple-letter objects.
- Send mystery letters.
- Create whole-word codes.
- Drop in other languages.
- Write sound stories with feeling.
- Explore onomatopoeia.

Math Extensions

- Problem of the week.
- Create a number drop.

Science Extensions

- Create a sound-matching game.
- Start a learning center.
- Play Where's That Sound?

See the Science Stories folio.

- *“Seeing” the World through Sound*
- *Listen to This*
- *Animal Babble*
- *Your Source and Receiver*

www.fossweb.com

Check the FOSS website for interactive simulations, to write questions to a scientist, for teaching tips, and to talk with other classes using FOSS.

Home/School Connection: Students look for the noisiest and quietest spots in their neighborhood. They ask family members about hearing protection or augmentation at the job site.

Language Extensions

- Research animal sounds.
- Research the Adam’s apple.

Math Extensions

- Problem of the week.
- Notate string-beam music.

Science Extension

- Make a duck flute or rubber-band guitar.

See the Science Stories folio.

- *Highs and Lows*
- *Making Waves*
- *Sound Off!*
- *Scoping Out Sound*

Home/School Connection: Students and their families assemble a homemade band with pots and pans. If they are able to create a scale, they might play and record a few tunes.

Language Extensions

- Research whale and dolphin communication.
- Research bat navigation.
- Compare animal ears.

Math Extension

- Problem of the week.

Art Extension

- Hold a fabulous ear contest.

Science Extensions

- Observe speed of sound through air.
- Investigate string telephones.
- Compare sound mufflers.
- Make an air cannon.

See the Science Stories folio.

- *Moving Along*
- *Bouncing Back*
- *Energy*

Home/School Connection: Students investigate bathtub science by listening to sounds generated in air and in water while their ears are above water and submerged.

Language Extensions

- Research hearing aids.
- Describe the group experience.

Math Extension

- Problem of the week.

Social Studies and Science

Extensions

- Imagine life without phones and stereos.
- Discuss disability awareness.
- Investigate sound-making toys.
- Make animal quackers.

See the Science Stories folio.

- *Lights! Camera! Action!*
- *Grandmother’s Hearing Test*

Home/School Connection: Students will need some extra time at home to work on their projects and get them ready to present to the class.

FOSS AND NATIONAL STANDARDS

The **Physics of Sound Module** emphasizes the development of observation and description skills and building explanations based on experience. This module supports the following National Science Education Standards.

SCIENCE AS INQUIRY

Develop students' abilities to do and understand scientific inquiry.

- Ask and answer questions.
- Plan and conduct simple investigations.
- Employ tools to gather data.
- Use data to construct reasonable explanations.
- Communicate investigations and explanations.
- Understand that scientists use different kinds of investigations and tools to develop explanations using evidence and knowledge.

CONTENT: PHYSICAL SCIENCE

Develop students' understanding of the physics of sound.

- Sound is produced by vibrating objects. Changing the rate of vibration varies the pitch of the sound.

SCIENCE AND TECHNOLOGY

Develop students' abilities in technological design.

- Identify a simple problem and propose a solution.
- Evaluate a product or design.
- Communicate a problem, design, and solution.

Develop students' understandings about science and technology.

- Scientists work collaboratively in teams and use tools and scientific techniques to make better observations.

HISTORY OF SCIENCE

Develop an understanding of science as a human endeavor.

- Science and technology have been practiced by people for a long time.