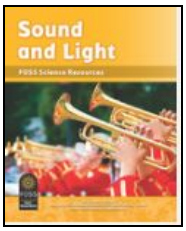
Investigation 1 - Sound and Vibration



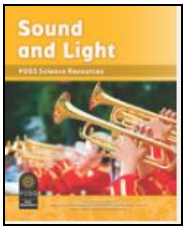
Students explore the production of sound with a table fiddle, tuning forks, a tone generator, cups, sticks, and rubber bands. Students look for vibrations at the sound source and come up with words to describe different sounds. They learn how to discriminate between different kinds of sounds and what information sounds convey. Students find out about sounds that different animals make.

Standards - 1-PS4-1

Investigation 1	Summary of Lesson	Priority
Part 1: Making Sounds	Students discuss common animals machines, and objects that make sound. They use cups with rubber bands and flat sticks to produce sound. They focus on the source of the sound and find that it is vibrating. Students explore a table fiddle to confirm their observations. They find that sounds always come from objects that are vibrating, and that vibrating objects always make sound. Sound can be stopped by stopping the object's vibration. *Read, "Vibrations and Sound".* *FQ - What causes sound?*	High Introduction to concepts of sound and content vocabulary.
Part 2: Hearing Sounds	Students practice sound discrimination by listening to the sounds that objects make when dropped. They work with a partner to identify objects by the properties of their sound. They investigate how tuning forks and a tone generator make sounds and observe the effect of those sounds on other objects. *Read, "Listen to This"* *FQ - What kinds of sounds are easy to identify?*	High Introduction to sound as a property and sound as waves that you can see.
Part 3: Outdoor Sounds	Students go outside and sit quietly to listen for sounds in the environment. Some sounds are the result of human activities, and some have natural sources. Students attempt to determine the sound source for each environmental sound they identify. *Activity, "Sorting Sounds".* *FQ - What information does sound give us?*	Medium This lesson has new vocabulary around sound waves. Instead of planning a separate trip outside to make observations, you could do this at the end of a recess. This could reduce the length of the lesson.
Assessment	i-Check	

1-PS4-1 Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.

Investigation 2 - Changing Sound



Students use simple instruments (xylophone, one-string guitar) to investigate how to change the volume of sound (loud and soft) and the pitch of sound (high and low). Using a spoon gong, students develop a model of how sound travels from a source to a receiver. They redesign the spoon gong to make a device to both send and receive sound. Students learn about sound receivers used by different animals.

Standards - 1-PS4-1, 1-PS4-4, 1-LS1-1, K-2 ETS1-1, K-2 ETS1-2

Investigation 2	**Summary of Lesson**	**Priority**
Part 1: Changing Volume	Students investigate two systems; the one-string guitar and the xylophone. They confirm that sounds come from objects that are vibrating, and that vibrating objects always make sound. Sound can be stopped by stopping the object's vibration. The added concept is that sounds can differ in volume over a range from soft to loud. Students find a relationship between the amount of energy used to produce a sound and the volume of the sound. *Read, "Animal Ears and Hearing".* *FQ - How can we make loud and soft sounds?*	High Students are exposed to vocabulary around sound. *(The use of Sound Generators will come again in 4th grade.)*
Part 2: Changing Pitch	Students observe the volume and pitch of the table fiddle. They use the one-string guitar and xylophone to change the pitch of the sound. Students record their understanding of the relationship between length and pitch. They apply their understanding of pitch and volume to a kalimba. *Read, "Strings in Motion"* *FQ -How can we make low-pitched and high-pitched sounds?*	High Students are exposed to vocabulary around pitch. An extension of this activity could be with your music teacher.
Part 3: Spoon-Gong Systems	Students use a spoon-gong system to review their understanding of how to produce sound and to develop a simple model of how sound travels. *Read, "More Musical Instruments". Video, "All About Sound".* *FQ - How does sound travel from source to the receiver?*	High Students are testing and planning out investigations around sound and sound waves and reinforcing concepts of receiver and source of sound.
Part 4: Sound Challenges	Students apply their knowledge of how sounds travel to make a device to send whisper messages over a distance. They modify two spoon-gong systems to make a device to send a message from one end of the string to the other. They improve on the device to make a better string telephone. *FQ - How can we use sound to communicate over long distances?*	High This activity directly address the standard, 1-PS4-4.
Assessment	i-Check	

Investigation 2 cont. - Changing Sound

1-PS4-1 Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.

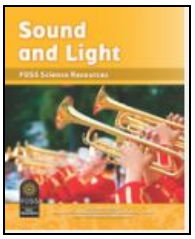
1-PS4-4 Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.

1-LS1-1 Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

K-2 ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

K-2 ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Investigation 3 - Light and Shadows



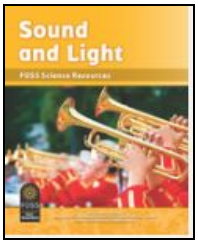
Students use flashlights, sunlight, and solid materials that block light to create and change shadows. Students investigate how light interacts with objects that are transparent, translucent, and opaque.

Standards - 1-PS4-3

Investigation 3	Summary of Lesson	Priority
Part 1: Making Shadows	Students use a flashlight as a light source to find out what happens when you block light with an object. They determine how to position the light source relative to the object and observe the resulting shape and size of the shadow. They observe what happens to the shadow when the object gets closer to and farther away from the light source. *FQ - What makes a shadow?*	High Students are exposed to content and vocabulary around light and shadows. This connects with standard 1-PS4-3 and comes back in Part 3.
Part 2: Sun and Shadows	Students continue to explore how to make shadows, this time using a natural source of light, the Sun. They go outside to look for shadows and determine what objects are creating those shadows. They work as individuals and teams to meet shadow challenges. *Video, "Light and Shadows". Read, "Playing in the Light".* *FQ - How can we use the Sun to create shadows?*	Low This lesson reinforces the concept of shadows, however, could be skipped. *(This lesson might be difficult at certain times of the day/year.)* The important piece will be the reading.
Part 3:Light and Materials	Students use objects made of different materials to see what happens when they place the objects over the lens of a flashlight. Students find that opaque materials block the light. Transparent materials allow light to travel through the materials. Translucent objects allow some of the light to travel through. The darkest shadows are made by objects that are opaque, whereas translucent objects create lighter shadows. *Video, "All About Light"* *FQ - What happens when different materials block light?*	High This lesson directly meets standard 1-PS4-3.
Assessment	i-Check	

1-PS4-3 Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.

Investigation 4 - Light and Mirrors



Students position mirrors to reflect images so they can see their own eyes and view objects behind them. They investigate how to use one and two mirrors to direct light to different locations. They experience what they can see when there is no light, and learn that objects can be seen only when light is available. They explore the shapes and location of eyes on different animals. Students read about devices that use light to communicate information.

Standards - 1-PS4-2, 1-PS4-3, 1-PS4-4, K-2 ETS1-1, K-2 ETS1-2, K-2 ETS1-3

Investigation 4	Summary of Lesson	Priority
Part 1: Mirrors and Light Beams	Students are introduced to a mirror as an opaque object with a reflective surface. They use a flashlight and mirror to redirect a beam of light from their desks to the ceiling. Students go outside and use the mirror to redirect sunlight onto a wall. *FQ - How can we redirect a light beam?*	Medium This lesson introduces new concepts and vocabulary. Depending on the time of the year, the sun might not be available to do the part of the lesson outdoors.
Part 2: Reflections	Students explore how they can use a mirror to see things behind them, to the side of them, and on their face. They use a mirror to study and make a drawing of their own eyes. Students discuss photographs that have images reflected from smooth surfaces such as mirrors, glass, and water. *Read, " Reflections."* *FQ - What can we see with a mirror?*	Low The important piece of this lesson is the reading.
Part 3: Eyes and Seeing	Students investigate what they can see in the dark, using a small closed box. On the back wall of the box is a card with four images of different shapes and colors. At first, students cannot see anything. As they gradually allow more light into the box, students find that they can first detect shapes and then color. They read about the process of seeing and compare a variety of animal eyes. *Video, "Light and Darkness Read, "Seeing the Light"* *FQ - What can be seen with no light?*	High This activity directly meets standard 1-PS4-2.
Part 4: Designing with Light	Students review how to redirect light using one mirro. They design a way to redirect light with two mirrors. Students explore ways to communicate long distances, using light. *Read, "Communicating with Light".* *FQ - How can we communicate with light?*	High This lesson meets the Engineering standards at 1st grade.
Assessment		

Investigation 4 cont. - Light and Mirrors

1-PS4-2 Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.

1-PS4-3 Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.

1-PS4-4 Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.

K-2 ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

K-2 ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

K-2 ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.