Unit 2: Sound and Light

Content Area: **Science**
Course(s): **Science**
Time Period: **Marking Period 2**
Length: **10 Weeks**
Status: **Published**

Unit Overview

In this unit, students will develop an understanding of how to observe and manipulate sound and light. Students will explore these dimensions of the natural world using simple tools and musical instruments. Throughout the unit students will explore how to change sound, volume, and pitch, develop simple models for how sound and light travel from a source to a receiver. In addition, they will explore how to create and change shadows and reflections, while finding out what happens when materials with different properties are placed in a beam of light. Finally, students will explore how to use sound and light devices to communicate information and compare the ways that animals use their senses (ears and eyes) to gather information about their environment.

Standards

Disciplinary Core Ideas (DCI's)

1-PS4-1	Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
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.
1-PS4-2	Make observations to construct an evidence-based account that objects can be seen only when illuminated.
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.
1-PS4-3	Plan and conduct an investigation 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.
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.

Crosscutting Concepts (CC's)

CCC.1.1	children recognize that patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.
CCC.2.1	students learn that events have causes that generate observable patterns. They design simple tests to gather evidence to support or refute their own ideas about causes.
CCC.4.1	students understand objects and organisms can be described in terms of their parts; and systems in the natural and designed world have parts that work together.

Science and Engineering Practices (SEP's)

SEP.1	Asking Questions and Defining Problems
SEP.2	Developing and Using Models
SEP.3	Planning and Carrying Out Investigations
SEP.4	Analyzing and Interpreting Data
SEP.6	Constructing Explanations and Designing Solutions
SEP.8	Obtaining, Evaluating, and Communicating Information

Essential Questions

Investigation 1- Sound and Vibrations

- What causes sound?
- What kinds of sounds are easy to identify?
- What information does sound give us?

Investigation 2- Changing Sound

- How can we make loud and soft sounds?
- How can we make low-pitched and high-pitched sounds?
- How does sound travel from the source to the receiver?

Investigation 3- Light and Shadows

- What makes a shadow?
- How can we use the Sun to create shadows?
- What happens when different materials block light?

Investigation 4- Light and Mirrors

- How can we redirect a light beam?
- What can we see with a mirror?
- What can be seen with no light?
- How can we communicate with light?

Application of Knowledge: Students will know that...

- Ears are one kind of sound receiver.
- Engineers design communication devices.
- High-pitched sounds come from sources that vibrate rapidly.
- Large objects tend to vibrate slower than small objects.
- Light can be used to communicate over long distances. Flashing lights of different colors communicate different information.
- Light is necessary for animals to see. Animal eyes receive light from objects and transfer the light to the brain to interpret as vision. Animal eyes are not all the same. There are different sizes, shapes, and placements on the head.
- Light sources are objects or systems that give off light (radiate), such as lamps, flashlights, candles, and the Sun.
- Light travels away from a source in all directions.
- Light travels in straight lines. A mirror can be used to redirect light.
- Materials that are opaque block light. Materials that are transparent allow light to pass through. Materials that are translucent allow some light to pass through.
- Mirror images are the result of light reflected from a surface. An image produced by something that reflects, such as a mirror, is always reversed.
- Pitch is how high or low a sound is.
- Shadows are the dark areas that result when light is blocked.
- Sound sources can be natural or human-made.
- Sounds can convey information.
- Sounds can make objects vibrate.
- The length and direction of a shadow depends on the position of the light source. Shadows change during the day because the position of the Sun changes in the sky.
- Vibrating objects make sound; sound always comes from vibrating matter. Objects stop making sound when they stop vibrating.
- Vibration is a rapid back-and-fourth motion.
- Volume is how loud or soft a sound is.

Application of Skills: Students will be able to...

- Analyze and interpret data about materials blocking light.
- Analyze and interpret sound data.
- Analyze and interpret sound information.
- Design a device to send messages.
- Identify a variety of sound sources and receivers.
- Meet design challenges using light and mirrors.
- Plan and carry out investigations with light and mirrors.

- Plan and carry out shadow investigations.
- Plan and carry out sound investigations.

Assessments

Pre-Assessment/Survey

Investigation 1:

- Formative Assessments: Science Notebook entry, Embedded Assessment, and Performance Assessment
- Benchmark Assessments: Survey, Investigation 1 I-Check

Investigation 2 - Landforms:

- Formative Assessments: Science Notebook entry and Embedded Assessment
- Benchmark Assessments: Investigation 2 I-Check

Investigation 3 - Mapping Earth's Surface:

- Formative Assessments: Science Notebook entry, Embedded Assessment, and Performance Assessment
- Benchmark Assessments: Investigation 3 I-Check

Investigation 4 - Natural Resources:

- Formative Assessments: Science Notebook entry, Embedded Assessment, and Performance Assessment
- Benchmark Assessments: Posttest

Suggested Activities

Investigation 1 Sound and Vibrations

- 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 sound always come from objects that are vibrating, and that vibrating objects always make sound. Sound can be stopped by stopping the object's vibration.
    - Investigation time: 1 session
    - Reading time: 1 session
    - Writing/Reading- Science notebook entry "Making Sounds"
    - Science resources book- "Vibrations and Sound"
- 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.
    - Investigation time: 1 session
    - Reading time: 1 session
    - Writing/Reading- Science notebook entry "Hearing Sounds"
    - Science Resources book- "Listen to This"
- 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.
    - Investigation time: 1 session
    - Assessment: 1 session
    - Writing/Reading- Science notebook entry- Answer the focus question
    - Online activity: "Sorting Sounds" https://www.fossweb.com/delegate/ssi-wdf-ucm-webContent/Contribution%20Folders/FOSS/multimedia/Sound_Light_NG/Sound_Card_Sort/activity.html

Investigation 2 Changing Sound

- 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.
    - Investigation time: 1 session
    - Reading time: 1 session
    - Writing/Reading: Science notebook entry- "Changing Volume"
    - Science resources book- "Animal Ears and Hearing"

- 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.
    - Investigation time: 1 session
    - Reading time: 1 session
    - Writing/Reading: Science Notebook Entry- "Changing Pitch" and "The Kalimba"
    - Science resources book- "Strings in Motion"
- 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.
    - Investigation time: 1 session
    - Writing/Reading: Science notebook entry- "Spoon-Gong Systems"
    - Science resources book- "More Musical Instruments"
    - Video- "All about Sound" https://www.fossweb.com/video?videoID=G3839269
- 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 a string to the other. They improve on the device to make a better string telephone.
    - Investigation time: 2 sessions
    - Assessment: 1 session
    - Writing/Reading: Science notebook entry- String-Cup Telephone

Investigation 3 Light and Shadows

- 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.
    - Investigation time: 1 sessions
    - Writing/Reading: Science notebook entry- "Making Shadows"
- 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.
    - Investigation time: 1 session
    - Reading time: 1 session
    - Writing/Reading: Science notebook entry- "Sun and Shadows"
    - Science resources book: "Playing in the Light"
    - Video: "Light and Shadows" https://www.fossweb.com/video?videoID=G3839266
- 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.
    - Investigation time: 1 session
    - Assessment: 1 session
    - Writing/Reading: Science notebook entry- "Light and Materials"
    - Video: "All about Light" https://www.fossweb.com/video?videoID=G4571602 and "My Shadow" https://www.fossweb.com/video?videoID=G4303001

Investigation 4- Light and Mirrors

- Part 1: Mirrors and Light Beams
    - Students are introduced to a mirror as an opaque object with 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.
    - Investigation time: 1 session
    - Writing/Reading: Science notebook entry- "Mirrors and Light Beams" (optional)
- 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.

    - Investigation time: 1 session

    - Reading time: 1 session
    - Writing/Reading: Science notebook entry- "Reflections"
    - Science resources book: "Reflections"

- 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.
    - Investigation time: 1 session
    - Reading time: 1 session
    - Writing/Reading: Science notebook entry- "Eyes and Seeing"
    - Science resources book: "Seeing the Light"
    - Video: "Light and Darkness" https://www.fossweb.com/video?videoID=G4285429
- Part 4: Designing with Light
    - Students review how to redirect light using one mirror. They design a way to redirect light with two mirrors. Students explore ways to communicate long distances, using light.
    - investigation time: 2 sessions
    - Reading time: 1 session
    - Assessment: 1 session
    - Writing/Reading: Science notebook entry- "Designing with Light"
    - Science resources book: "Communicating with Light"

Activities to Differentiate Instruction

Differentiation for special education:

- General modifications may include:
    - Modifications & accommodations as listed in the student's IEP
    - Assign a peer to help keep student on task
    - Modified or reduced assignments
    - Reduce length of assignment for different mode of delivery
    - Increase one-to-one time
    - Working contract between you and student at risk
    - Prioritize tasks
    - Think in concrete terms and provide hands-on-tasks
    - Position student near helping peer or have quick access to teacher
    - Anticipate where needs will be
    - Break tests down in smaller increments
- Content specific modifications may include:
    - Provide equipment photo cards for each object with the object name
    - Add words to the word wall as needed

- Scaffolding thinking through graphic organizers
- Design individual projects or small-group investigations

Differentiation for ELL's:

- General modifications may include:
  - Strategy groups
  - Teacher conferences
  - Graphic organizers
  - Modification plan
  - Collaboration with ELL Teacher
  - Model and encourage the use of new vocabulary
  - Project the equipment photo card for each object and write the object's name on the word wall.
  - Provide sentence frames for students who need them
  - Use Spanish provided resources if applicable
- **Content specific vocabulary for ELL students may include**: back-and- fourth motion, compare, ear, hear, identify, information, listen, loud, observe, pluck, property, soft, sound, sound receiver, sound source, table fiddle, tuning fork, vibrate, vibration, communicate, direction (away, toward), gentle, guitar, hard, high-pitched, instrument, kalimba, length, low-pitched, medium-pitched, message, pitch, spoon-gong system, string, system, travel, volume, xylophone, block, dark, flashlight, light, light source, opaque, shade, shadow, sun, sunlight, translucent, transparent, angle, eye, light detector, mirror, model, redirect, reflect, reflection, vision

Differentiation to extend learning for gifted students may include:

- Explore animal ears- find images of animals with different ears. As students to draw a picture of the animal's head with the ears and show shape, size, and position.
- Design a string-cup party line- Challenge students to design a phone line for three or four listeners at a time, thus making a party line.
- Make a sundial
- Research animal eyes- Pick two different animals and find out about their eyes and vision. They should compare the eyes of the two animals and find out how the eyes help the animals survive.
- Research animal sounds- Have students find out how a certain type of animal makes sounds. Prepare a board for the class to display their findings. Suggest animals such as crickets, frogs, hummingbirds, and whales.
- Look at multiple images- Get a coin and two mirrors with clips. How can you position the mirrors to see multiple images of the coin? How do you position the mirrors to see the greatest number of images? How can you explain the multiple images?

Integrated/Cross-Disciplinary Instruction

Language Extensions

- Make a list of sound words (bang, boom, hiss, pop, rattle, rustle, slam, splat, tick, and tinkle for example)
- Read books about light and shadows
    - "My Shadow" by Robert Louis Stevenson
    - "Me and My Shadow" by Elizabeth Adams and Bud Banis
    - "Nothing Sticks like a Shadow" by Ann Tompert
    - "What Makes a Shadow" by Clyde Robert Bulla
    - "Making Shadow Puppets" by Jill Bryant and Catherine Heard
- Read books about light and reflections
    - "Light, Shadows, Mirrors, and Rainbows" by Natalie M. Rosinsky
    - "Shadows and Reflections" by Tana Hoban

Math Extension

- Complete extension math problems found in Teacher's Manual (pgs. 112, pg. 160, pg. 194)
- Observe symmetry

Art extensions

- Hold a fabulous ear contest- Provide students with tagboard, construction paper, tape, crayons, markers, and scissors. Have students design ear flaps that will serve a variety of purposes. One style should be for listening to sound on the ground. Another style should be for sounds heard in the air, or for listening to sounds behind the head. Encourage originality, style, inventiveness, and creative design.
- Create shadow puppets
- Hold a fabulous eye contest- Provide students with different colors of construction paper, tape, crayons, markers, and scissors. Have students design eyes on an imaginary animal and describe how the animal uses them to see. One style could be for seeing things close to the ground and another for seeing things in the sky. Encourage originality, style, inventiveness, and creative design.

Music extension

- Show and tell about musical instruments- have students bring their instruments, or pictures of the instruments, to the classroom. Challenge students to figure out what is vibrating when the instrument is sounding.

MA.1.OA.A	Represent and solve problems involving addition and subtraction.
LA.RL.1.2	Retell stories, including key details, and demonstrate understanding of their central message or lesson.
MA.1.OA.B	Understand and apply properties of operations and the relationship between addition and subtraction.
MA.1.OA.C	Add and subtract within 20.
LA.RL.1.10	With prompting and support, read and comprehend stories and poetry at grade level text complexity or above.
LA.RI.1.3	Describe the connection between two individuals, events, ideas, or pieces of information in a text.
LA.RF.1.3	Know and apply grade-level phonics and word analysis skills in decoding words.

MA.1.G.A.3	Partition circles and rectangles into two and four equal shares, describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.
VPA.1.3.2.B	Music
VPA.1.3.2.D	Visual Art

Resources

- URL: FOSSWEB.com
  - Description: This site will lead you to the additional resources for non-fiction books to share with your students.
- URL: https://www.fossweb.com/foss-content?htmlContentID=G3898595
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  - Description: This site will lead you to the Smartboard documents to use during your lessons.
- URL: www.phys.unsw.edu.au
  - Description: This website includes text and images showing the processes involved in making sound with a flute.
- URL: science.howstuffworks.com
  - Description: Check out this How Stuff Works web page to find out what causes a sonic boom. Young students may require adult assistance.

- URL: www.tryscience.org
  - Description: Find out about more than 400 science and technology centers and museums worldwide. Use an interactive map of the world to find and explore a science and technology center or museum near you. You can also find online adventures and field trips, ideas for experiments at home, plus live webcams. TryScience.org is your gateway to experience the excitement of contemporary science and technology through on and offline interactivity with science and technology centers worldwide. TryScience is brought to you through a partnership between IBM Corporation, the New York Hall of Science (NYHOS), the Association of Science-Technology Centers (ASTC), and science centers worldwide.

- URL: electronics.howstuffworks.com
  - Description: Find out how a speaker (or headphone) translates electrical signals and translates them back into physical vibrations to create sound waves that you can hear. Young students may need adult assistance.
- URL: wonderwise.unl.edu
  - Description: Introduces you to women who have made science their career. You can take several field trips, including space geology, African plant exploration, and urban ecology.

- URL: littleshop.physics.colostate.edu

- Description: The Little Shop of Physics includes a couple of interactive activities at its Shockwave link dealing with auditory illusions and finding out what happens when you mix different sounds.

- URL: www.iknowthat.com
  - Description: This is a great site for activities, animations, simulations and other resources related to the human body, sounds, matter the solar system, weather and other science topics to supplement sound.

- URL: www.att.com
  - Description: Time line of technologies pioneered at AT&T's Bell Laboratories, beginning with the telephone in 1876 and continuing through 1993. Covers such innovations as electronic recording, sound motion pictures, transatlantic telephone services, stereo recording, transistors, the solar cell, and cellular phones.

21st Century Skills

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.