1st Grade: Light

Standards Bundle

Standards are listed within the bundle. Bundles are created with potential instructional use in mind, based upon potential for related phenomena that can be used throughout a unit.

1-PS4-1 Plan and carry out an investigation to provide evidence that vibrating materials can make sound and that sound can make materials vibrate. (SEP: 3; DCI: PS4.A; CCC: Cause/Effect). [Clarification Statement: Examples of vibrating materials that make sound could include tuning forks and plucking a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.]

1-PS4-2 Construct an evidence-based account for how objects can be seen only when illuminated. (SEP: 6; DCI: PS4.B; CCC: Cause/Effect) [Clarification Statement: Examples of observations could include those made in a completely dark room, a pinhole box, and a video of a cave explorer with a flashlight. Illumination could be from an external light source or by an object giving off its own light.]

1-PS4-3 Plan and carry out an investigation to determine the effect of placing objects made with different materials in the path of a beam of light. (SEP: 3; DCI: PS4.B; CCC: Cause/Effect) [Clarification Statement: Examples of materials could include those that are transparent (such as clear plastic), translucent (such as wax paper), opaque (such as cardboard), and reflective (such as a mirror).] [Assessment Boundary: Assessment does not include the speed of light.]

1-PS4-4 Design and build a device that uses light or sound to solve the problem of communicating over a distance.* (SEP: 6; DCI: PS4.C; CCC: Technology) [Clarification Statement: Examples of devices could include a light source to send signals, paper cup and string "telephones," and a pattern of drum beats.] [Assessment Boundary: Assessment does not include technological details for how communication devices work.]

Content Overview

This section provides a generic overview of the content or disciplinary core ideas as an entry point to the standards.

Light is necessary for objects to be seen. Light can come from external or internal sources. Different materials respond to light in different ways. Some allow light to pass through, others only allow some light through, and others block light completely, creating shadows where light cannot reach. Mirrors can be used to redirect light.

When materials vibrate, they can make a sound. Sounds can also make materials vibrate.

People can use a variety of devices to communicate over long distances. These devices can use both light and/or sound to send and receive information.

Phenomena

Phenomena can be used at varying levels of instruction. One could be used to anchor an entire unit, while another might be more supplemental for anchoring

just a unit. Please remember that phenomena should allow students to engage in the SEP and use the CCC/DCI to understand and explain the phenomenon.

- Sounds of different pitches (high and low) can be produced by swinging a flexible tube overhead.
- The appearance of a rainbow after it rains.
- The Northern Lights (Aurora borealis) in the northern sky.
- A sun dog in the sky around the sun.
- When a glass breaks from the playing of a certain high pitched/frequency note.
- The use of sonar devices to get a picture of the ocean floor, locate marine animals and now to even possibly communicate with dolphins is a use of sound wave in technology.
- Fiber optics cables transmit messages via light waves. Telecommunication companies use fiber optics to transmit telephone, internet and TV signals to your home.

Storyline

This section aims to decode not only the DCI connections, but also the SEP and CCC in a detailed account of how they possibly fit together in a progression for student learning, including both rationale and context for the bundle.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations ● Plan and conduct investigations collaboratively to produce evidence to answer a question **Constructing Explanations and Designing Solutions** ● Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena ● Use tools and materials provided	**PS4.A: Wave Properties** ● Sound can make matter vibrate, and vibrating matter can make sound. **PS4.B: Electromagnetic Radiation** ● Objects can be seen if light is available to illuminate them or if they give off their own light. ● Some materials allow light to pass through them, others allow only some light through and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach. Mirrors can be used to redirect a light beam. (Boundary: The idea that light travels from place to place is developed through experiences with light sources, mirrors, and shadows, but no attempt is made to discuss the speed of light.)	**Cause and Effect** ● Simple tests can be designed to gather evidence to support or refute student ideas about causes.

to design a device that solves a specific problem.	**PS4.C: Information Technologies and Instrumentation** ● People also use a variety of devices to communicate (send and receive information) over long distances.	

Students can work in small groups to conduct investigations about light. At this age, investigations are conducted in collaboration with peers and serve to produce data to use as evidence. Students can use information from their first-hand observations with light to discover that objects can only be seen if light is available to illuminate them, or if they give off their own light. Students should be given an opportunity to see that this occurs in a variety of situations so they can identify it as a pattern. Students can also observe the behavior of light when it is reflected in a mirror. However, students are not expected to explain why this happens, but simply to observe it as a behavior of light. Through investigations students can also see that some materials allow light to pass through them, others allow only some light to pass through, and others block light completely. This too is a pattern students can identify through first-hand experiences, if they are given an opportunity to investigate lights impact on different materials (clear plastic, waxed paper, cardboard, etc.). At this age, students should be encouraged to develop explanations for why these patterns exist. They should also be given an opportunity to evaluate their own explanations as well as other students' explanations for this.

Students can design a device using light or sound to communicate over a distance. In order to begin designing a device, students should be given opportunities to investigate how sound works. Investigations should include first-hand experiences and observations with any object that makes sound when it vibrates (guitars, rulers, etc.). Students can work in small groups to plan and conduct multiple investigations to collect data that will allow them to determine that: (1) vibrating materials produce sound, (2) sound can make materials vibrate and (3) that when the vibrations stop so does the sound. This will allow students to make claims, supported by observational evidence, that vibration and sound are directly related. Students can use the data they collect as evidence to explain what causes sound. The students can use the evidence to identify that causing an item to vibrate has an effect of producing a sound, and conversely, sound causes materials to vibrate.

Once students are familiar with how sound and light works, they can then use tools and materials to design and build a device to communicate over a distance. Students can begin by raising questions about how people communicate with others who are far away. Students can then work in small groups to construct a device using sound or light based on their prior experiences and observations (both first-hand and from media). Example devices could include: using a light source to send signals, paper cup string telephones, and using a drum to create beat patterns. Once they have completed the design and construction process, they will engage in constructing an explanation for why they think their device does or doesn't work to communicate using light or sound.

Formative Assessment

Formative assessment is crucial because all learners benefit from timely and focused feedback from others. It promotes self-reflection, self-explanation, and social learning. It can also make learning more relevant. Each of the questions below might be used throughout the formative assessment process. Specific prompts may focus on individual practices, core ideas, or crosscutting concepts, but, together, the components need to support inferences about students' three-dimensional science learning as described in a given bundle, standard or lesson-level performance expectation.

Resources to inform your formative assessment.

http://stemteachingtools.org/brief/30

http://stemteachingtools.org/brief/41
http://stemteachingtools.org/pd/sessionb

SEP Planning and Carrying Out Investigations

- Plan and carry out an investigation observing different vibrations and what type of sound is produced from that vibration.
- Plan and carry out an investigation observing how light waves behave when they hit different materials.

Constructing Explanations and Designing Solutions

- Construct an explanation using evidence from sound observations as to how Native Americans were able to predict that a group of people were approaching their camp.

CCC Cause and Effect

- What causes the change in the oobleck when it sits on top of a speaker that is giving off sound?
- After gathering data from an investigation, what patterns do you notice between the type of material the sound is traveling through and the pitch of the sound?

Performance Outcomes

These are statements of how students use knowledge and are similar to the standards in how they blend DCI, SEP, and CCC, but at a smaller grain-size. These are potential outcomes for instruction as it plays out in lessons and activities in the classroom. It is important to also think of these as smaller outcomes that build toward the larger goal of mastering the standards.

- **Gather observational evidence** that shows that sound can *cause* matter *vibrate*.
- **Gather observational evidence** that shows a *change* in the vibration of matter can *make changes* to the sound produced.
- **Raise questions using my observations** to get *compare and contrast* how people *communicate* with others who are *far away*.
- **Communicate using evidence** *why and how people* use a variety of devices to send and receive information over *long distances*.
- **Communicate** that we use technology every day and *life would be hard without it.*
- **Design and build** a *device to communicate* with other people using sound or light.