First Grade: Physical Science

CAN YOU SEE IT? Light and Its Properties

Background Information

Light is needed for humans to see. Light may also be used to communicate. As with sound, the type of medium used for passing the light through will be determined by the function of the communication. For example materials used in stoplights, stained glass windows, flashlights, and frosted glass all affect the output of light. When light strikes an object, many actions may occur. Two factors involved in this interaction are the type of light and the object itself. The light may bounce or reflect off of an object or pass through it. The quality of light transmission may determine the use of a material.

If the light passes through an object, the object is said to be transparent. These materials absorb one or more frequencies of light and transmit what is not absorbed. Examples of transparent items include plastic wrap, soap bubbles, clear glass, and some plastics.

Objects that do not allow light to pass through them are called opaque. Opaque objects cannot be seen through. Opaque objects absorb one or more frequencies of light and reflect what is not absorbed. Quarters, rubber, and bricks block light, thus they are opaque.

Translucent objects allow light to pass through them; however, the light is scattered as it passes through the objects. The details of translucent objects cannot be clearly seen. Translucent items include wax paper, frosted glass, some plastics, and tissue paper.

Engineering calls for children to apply what they know about science and math—and their learning is enhanced as a result. At the same time, because engineering activities are based on real-world technologies and problems, they help children see how disciplines like math and science are relevant to their lives. Research also shows that when engineering is part of elementary instruction, students become more aware of the diverse opportunities for engineering, science, and technical careers—and they are more likely to see these careers as options they could choose.
https://www.eie.org/overview/engineering-children

Performance Expectation

1-PS4-3 Waves and Their Applications in Technologies for Information Transfer

Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.
https://www.nextgenscience.org/pe/1-ps4-3-waves-and-their-applications-technologies-information-transfer

K-2-ETS1-1 Engineering Design

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.
https://www.nextgenscience.org/dci-arrangement/k-2-ets1-engineering-design

Disciplinary Core Ideas

PS4.B: Electromagnetic Radiation

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. (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.)

ETS1.B: Developing Possible Solutions

Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.

Science and Engineering Practices

Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

Plan and conduct investigations collaboratively to produce evidence to answer a question.

Crosscutting Concepts

Cause and Effect: Simple tests can be designed to gather evidence to support or refute student ideas about causes.

Structure and Function: The shape and stability of structures of natural and designed objects are related to their function(s).

Influence of Engineering, Technology, and Science, on Society and the Natural World: People depend on various technologies in their lives; human life would be very different without technology.

Objectives

- Students will explore the quality of light transmission of various objects.
- Students will use design and build a kaleidoscope based on material's attributes of light transmission.
- With guidance, students describe the scientific information they use to design the solution.
- Students will explain why the chosen materials are used in the construction process.
- Students will follow a series of steps.
- Students will work collaboratively to diagram how a kaleidoscope works.

Materials (Students will work in 3 groups for the initial investigation of the kaleidoscopes.)

- Kaleidoscopes
- Flashlights
- Origami Paper, Assorted Colors

- Tissue Paper, Assorted Colors
- Aluminum Foil
- Transparencies
- Translucent Beads (About 10 per student)
- Cups
- Transparent Tape
- Cardstock
- Glue Stick (optional)

Advanced Preparation

- Cut tissue paper, aluminum foil, transparencies, and any other materials into squares.
- Determine how materials will be distributed.

Suggested Implementation

Part I. Begin by distributing one kaleidoscope per group. Allow ample time for students to use the kaleidoscopes, make observations, and share ideas within their groups. As a large group, elicit observations, comments, and ideas students wish to share. You may wish to record these for reference through the rest of the lesson.

Share with students that they will continue to explore light. Provide students with flashlights and samples of solid color paper (origami paper), tissue paper, transparencies, and aluminum foil. Pose a question such as, "What happens when you shine the flashlight at the papers?" Explain to students that this is the question they need to investigate. Have student groups of four investigate light transmission through the various samples. Assist student groups as needed.
Based on their observations, students now group the papers into categories.

Host a class discussion with questions such as the following:
☆ *Did all of the paper let the light through?*
☆ *What differences did you notice?*

Students return to their original groups and resort their papers, if they wish, based on the discussion. You may wish to coach them to the categories of light goes all the way through, partly through, not through, and bounces back.

Distribute a set of "Light Student Pages" to each student. Students continue to work with their groups and retest materials as needed. Each group will select a type of paper used and explain how the light interacts with it, as well as a potential use for the paper. It is suggested this is done three to four times, each time with a different type of paper.

Ask each group to complete the following. In your group, think of other objects that use one or more of these properties of light. Once they have completed their discussions, have them share ideas.

You may wish to chart their ideas under the following headings:

Passes Through	Does Not Pass Through	Bounces Off or Reflects

Debrief

- Brainstorm items that purposefully use these traits.
- Explain your ideas.

Part 2: Discuss the results from the previous lesson and the initial investigation of the kaleidoscopes. The following are some questions that may support the conversation:

- *Which material(s) did the light shine through?*
- *What do you think this happened when you used the kaleidoscope? What is your evidence?*
- *Which material(s) did the light not shine through?*
- *Do you think this happened when you used the kaleidoscope? What is your evidence?*
- *Reflection of light was caused by what material(s)?*
- *Do you think this happened when you used the kaleidoscope? What is your evidence?*
- *What is the purpose of a kaleidoscope?*

Share that they will now make a kaleidoscope. Introduce the materials that will be available for students to use. Student groups should plan how to build the kaleidoscope. Once plans have been developed, have students obtain materials. Assist students as needed during the building process.

Once the kaleidoscopes are completed, allow time for students to view theirs as well as other students' creations. Divide students into groups no larger than four. Supply each group with a piece of drawing paper or a whiteboard. Each group now explains how the kaleidoscope works through the use of drawings, labels, arrows, and such. Student groups can then share their ideas with the class. Combine their ideas to arrive at the correct explanation by having a class discussion. Have the groups return to their explanations and redo or revise as needed.

Debrief

- Why were clear cups used?
- Why did we use beads that the light can pass through?
- What happens when light hits aluminum foil?
- How did this help make the kaleidoscope work?
- If someone asked you what light could do when it his (shines on) different materials, what would you tell them?

Resources

http://www.kbs.msu.edu/wp-content/uploads/2017/02/NGSS-Interactive-Read-Alouds.pdf

- Zschock, H. (2005). *Whoo's there? A bedtime shadow book.*
  Use a flashlight (not included) to cast picture shadows on your wall as you read the gentle rhyming tale of winsome animals keeping busy during the night.
- Golding, E. (2011). *Moonlight animals.*
  Do you know what happens in the forest after dark? Now you can with a touch of the magic flashlight that reveals hidden creatures! Each spread appears to be dark, but once the flashlight is pointed, brilliant wildlife illustrations magically illuminate.
- Rocco, J. (2011). *Blackout.*
  One hot summer night in the city, all the power goes out. The TV shuts off and a boy wails, "Mommm!" His sister can no longer use the phone, Mom can't work on her computer, and Dad can't finish cooking dinner. What's a family to do?
- Marino, G. (2015). *Night animals.*
  Animals turn topsy-turvy in fear of things that go bump in the night

Extensions

- If you would like additional study in angles and sunlight, this activity might be useful.
  https://www.nasa.gov/centers/langley/pdf/245895main_MeteorologyTeacherRes- Ch4.r3.pdf

Assessment

The following single point rubric can be used to assess student understanding. For each of the criteria listed below, either circle the proficient description or add notes to a box indicating why the student's performance was either lacking or exceptional.

Areas that need improvement. **Developing Performance**	Criteria for **Proficient Performance**	Evidence of exceeding standards. **Advanced Performance**
	Can explain several ways that light interacts with different substances.	
	Can provide a description or drawing of how light reflections can be used to build a kaleidoscope.	