

SPOTLIGHT ON LIGHT

BENCHMARK and TASKS

SC.B.1.2.2 The student recognizes various forms of energy (e.g., heat, light, and electricity).

- The student recognizes that energy comes in many different forms: (e.g., **mechanical**, energy of position and motion; **electrical**, energy of moving electrons; **chemical**, energy stored in chemical bonds; **thermal**, heat energy - the energy of moving and vibrating molecules; **nuclear**, energy contained in the nuclei of atoms; and **radiant**, energy that travels in waves like sunlight).
- The student demonstrates that light travels very rapidly in straight lines. When it strikes an object, light is reflected, absorbed, or it passes through, causing it to be refracted.

KEY QUESTION

Does light travel in a straight line?

BACKGROUND INFORMATION

Light, a form of radiant **energy**, is necessary in order for us to see. What the human eye sees as light, such as the glow from a candle, is actually radiant energy, also referred to as electromagnetic radiation. Light radiates outward in straight lines in all directions from a source, such as the **sun** or a lamp, to an object, such as a tree. The light is **reflected** to our eyes, where it stimulates special nerve receptors on the retina at the back of the eyeball, which then transmit information through the optic nerve to the brain. When light strikes an object, it is not reflected in just a certain direction, but is scattered in all directions. This allows the object to be seen from different viewing positions.

Light always travels in straight lines until it strikes an object or surface. Evidence that light travels in straight lines is provided by the fact that shadows are the same shape as the objects that cast them. When light strikes an object, the direction of its straight-line path may change. The fact that a beam of light can be reflected from a mirror or converged by a lens are examples of how light may change its direction upon striking an object or surface. Light may also bend around the edges of an object or as it passes through a small opening.

When light passes from one medium to another, light changes direction slightly. This is called **refraction**. Refraction occurs because light travels at different speeds through different materials.

MATERIALS

Teacher

1 flashlight
2 dusty chalkboard erasers
1 ruler
scissors
The Wonder of Light, Jan Adkins, Ranger Rick

Per group

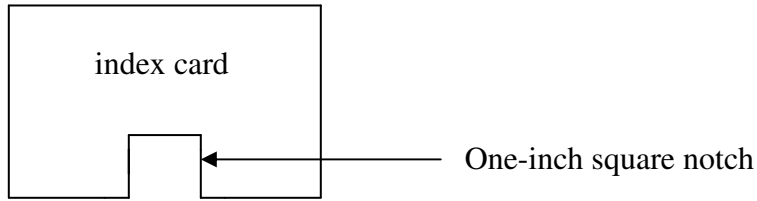
3 prepared index cards
1 plain index card for the screen
1 flashlight
clay
1 metric ruler

Per student

science journal

TEACHING TIP

Prepare index cards ahead of time. (See illustration.)

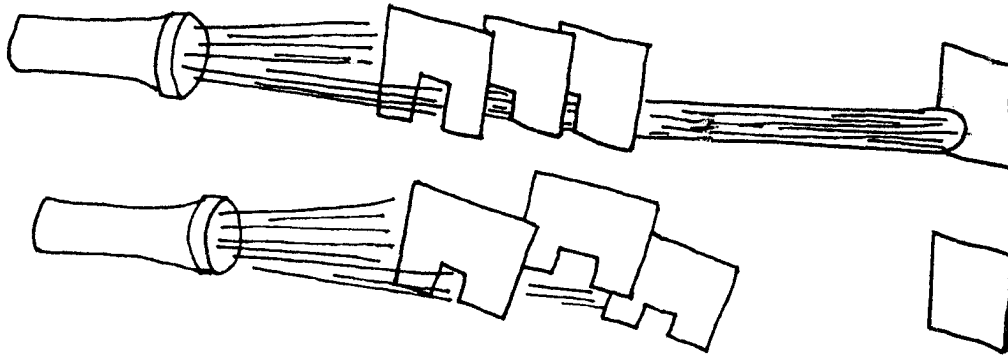


ENGAGE

1. Have students watch as you aim a flashlight at the chalkboard from about six feet away. Darken the room as much as possible and turn on the flashlight. Clap dusty erasers in front of the light so students can see the light rays clearly. Have a student outline the spot of light on the board with chalk.
2. Ask:
What did you see?
What made the spot on the board?
What can we do to show the path that the light rays took?

EXPLORE

1. Tell students that they are going to be investigating the path in which light rays travel. Ask for ideas on how they could conduct such an investigation. (Try some of the ideas, if possible.)
2. Organize the students into groups.
3. Show students how to use clay to anchor the index cards to the table about 10 cm apart with the square notches aligned in a straight line.
4. The student holding the flashlight should lay it on the table behind the notch of one of the end cards.
5. Have the students use clay to anchor an index card screen at the end opposite the flashlight.



6. Darken the room so students can observe any light pattern on the index card screens.
7. Have students record observations in their science journals.
8. Next, tell students to move the index cards so the notches are not in a straight line and then observe any light patterns on the screen.
9. Students should record observations in their science journals.

EXPLAIN

How were the index cards arranged when the light rays reached the screen?

Why did the light rays reach the screen when the notches were aligned?

What happened when the notches were not aligned? (When the notches were in a straight line, the rays were able to pass through the openings, but the rays were blocked by the card when the notches were unaligned.)

EXTEND/APPLY

1. Periscopes are used for seeing around corners. Allow students to make periscope models.
2. Ask students to reflect on this idea: *How would shadows be affected if light did not travel in a straight line?* (If light could go around corners, there would be no shadows. Objects could not block light; the light would just travel on around the object.)
3. Read *The Wonder of Light* by Jan Adkins.

ASSESSMENT

Ask students to reflect on why we cannot see around corners. (Light only travels in straight lines. It cannot travel around a corner without the help of a reflector.)