

Light and Shadows

Strand	Interrelationships in Earth/Space Systems
Topic	Investigating light and shadows
Primary SOL	K.8 The student will investigate and understand that shadows occur when light is blocked by an object. Key concepts include a) shadows occur in nature when sunlight is blocked by an object; b) shadows can be produced by blocking artificial light sources.
Related SOL	K.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which a) basic characteristics or properties of objects are identified by direct observation; b) observations are made from multiple positions to achieve different perspectives; e) nonstandard units are used to measure the length, mass, and volume of common objects; h) observations are recorded; k) objects are described both pictorially and verbally.

Background Information

A shadow is an area where direct light from a light source cannot reach because that area is being blocked by an object that the light cannot shine through. The shadow is a dark area or image that is created when light is blocked by an object. Shadows are created on the opposite side of an object than the light source. Shadows change when the object or light source moves.

Materials

- Strong source of light (e.g., overhead projector)
- Objects with which to create shadows (e.g., scissors, tape, pencil)
- Chalk
- Pictures of objects and their shadows
- Digital camera
- Presentation software

Vocabulary

shadow, light source, sun, block, darkness, trace, compare

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

Introduction

1. Have students sit in front of a strong source of light (e.g., overhead projector) so they can see the projection screen but not the back of the projector. Make a short “wall” around the front and the two sides of the projector with a manila folder so that students cannot see the mystery objects as they are placed on the projector. Project a variety of solid objects,

and have students discuss the shadows they make. Materials to use include scissors, tape, book, pencil, and fork. Have students guess what is making the shadow.

2. Talk about what is seen on the screen. Ask, “Do we see the object? Its colors? No, we see darkness.” Talk about how the shadow is made. Place your hand on the overhead, and have students discuss what they see. Ask, “What are we seeing? What is blocked?” Your hand blocks the light. Let students hold up fingers to make a shadow on the screen. Talk about what is displayed on the screen.

Procedure

1. Discuss what is needed to make a shadow—i.e., light and an object to block it. Talk about where you see shadows: outside on the playground, when you use a flashlight, at day’s end as the sun is going down, and behind a lamp in your house are a few that may come up.
2. Tell students that they are going to be scientists today and they are going to conduct an experiment about shadows. Ask them if they are outside all day in the sun on a sunny day, are their shadows always the same? Ask them what they think will happen if they stand in the same place at three different times during a sunny day. With students’ input, create a hypothesis (e.g., If I stand in the same place in the morning and in the afternoon, my shadow will remain the same.) Write the statement on the whiteboard or chalkboard.
3. Tell students that they are now going to conduct an experiment to see if they are correct or not. On a sunny day, take students on a shadow walk outside in the morning. Divide students into pairs. Give each pair a piece of chalk to trace their shadows. In a defined area, have each pair of students pick a place to watch their shadows. Have each student stand on the sidewalk or blacktop and find his/her shadow. Have his/her partner take chalk and draw around his/her feet and around his/her shadow. Have them write their names and that the shadow was made in the morning.
4. Around noon, have them go back outside to the same location, trace their shadows again with their feet in the same positions, and compare. Talk about the changes. At about 2:00 p.m., have them return to their spot one more time. Again, have them measure their shadows.
5. Have them discuss with each other the changes or lack of changes that they see. Ask them what the answer is now to their questions: “If they are outside all day in the sun on a sunny day, are their shadows always the same? Did they have the same answer as they predicted, or was it different?” Remind students that it is fine if what they predicted is different from what they proved with their experiment. That is how scientists’ work is done. Ask them why their answer was the same or why it was different.
6. Have students draw pictures in their student journals that show what their shadows looked like each of the three observation times.
7. Using a digital camera, have each student take a picture of a shadow (either one that is outside or a shadow that is created inside the classroom) and the object that made the shadow. Use presentation software to compile these pictures and make a “Mystery Shadow” show. First show the shadow and then the object that made the shadow. Students can share the presentation with another class to see if they can guess what object is making each shadow. A shadow can also be shown, and students could choose from several objects to guess which object created the shadow.

Assessment

- Match pictures of objects and their shadows.
- Have students draw pictures of themselves and their shadows on a bright sunny day. Tell them to think about where to draw the sun and what their shadow might look like. Check that they have each item in the correct alignment.

Extensions and Connections (for all students)

- Have students move around outside on a sunny day and see how their shadow changes. Direct them to stand with a friend and compare shadows.
- Have students create a picture book of objects and their shadows.
- Have students make shadow puppets and perform a puppet show. Videotape the show to enjoy at a later date.
- Have students play shadow tag.

Strategies for Differentiation

- Use interactive software to match objects to their shadows.
- Give students a limited amount of objects to match to shadows. Differentiate objects according to readiness, i.e., give more difficult objects to identify for students who are ready for a challenge.
- In groups of two to three students, allow students to explore shadows using a flashlight as a light source and objects to cast shadows onto paper.