Shadow

Physical Science | Lesson Guide

2nd Grade

Photo Description

This image shows a large rock on the ground surrounded by moss and grass. The rock has a dark shadow cast on it from the sunlight shining from one side. You can see where the sun is making a dark shape on the ground and on the rock itself, showing how light and shadows work in nature.

Scientific Phenomena

Anchoring Phenomenon: Why does the rock have a dark shadow on one side?

When sunlight hits an object like a rock, the light cannot pass through it. The rock blocks the sunlight and creates a dark area called a shadow on the opposite side where the sun is shining from. Shadows form because objects are opaque (solid) and do not let light pass through them. The position and length of shadows change throughout the day as the sun moves across the sky.

Core Science Concepts

* Light and Shadows: Objects block light, creating dark shadows on the opposite side. Shadows show us where light is coming from.

* Light Source Direction: The position of the shadow tells us where the light source (the sun) is located. If a shadow falls to the right, the light is coming from the left.

* How Shadows Change: Shadows get longer or shorter and move their position depending on the time of day and where the sun is in the sky.

* Opaque vs. Transparent Materials: Opaque objects (rocks, trees, people) create shadows because light cannot pass through them. Clear materials like glass let light pass through and do not make shadows.

Pedagogical Tip:

Use the phrase "light blocker" when teaching shadows to Second Graders. Help students understand that shadows are NOT things, but the ABSENCE of light. Demonstrate this with a flashlight and simple objects in a darkened area so students can see the direct cause-and-effect relationship between a light source, an object, and a shadow.

UDL Suggestions:

To support all learners, provide multiple means of representation: (1) Use physical objects and direct observation with flashlights rather than only pictures, (2) Create shadow puppets on a white wall so kinesthetic learners can explore how moving objects changes shadows, and (3) Offer audio descriptions or peer explanations for students who need clarification about what they're observing.

Zoom In / Zoom Out

Zoom In (Microscopic): Light travels in straight lines as tiny particles called photons. When these photons hit the rock, they bounce off or are absorbed, but they cannot pass through the solid stone. This is happening at a scale too small to see with your eyes, but it's what causes the shadow to form.

Zoom Out (Ecosystem/Larger System): In nature, shadows are important for many living things. Plants and animals in forests use shadows to stay cool during hot days. The shadow from this rock provides shelter for small insects, moss, and fungi that need shade to survive. Shadows also help animals find food and stay safe from predators.

Discussion Questions

1. If you stand in front of a bright lamp, where does your shadow appear? (Bloom's: Understand | DOK: 1)

2. Why do you think the shadow of this rock is darker on one side than the other? (Bloom's: Analyze | DOK: 2)

3. If the sun moved to a different place in the sky, what would happen to this rock's shadow? (Bloom's: Apply | DOK: 2)

4. What would happen if this rock was made of clear glass instead of solid stone? Would it still have a shadow? (Bloom's: Evaluate | DOK: 3)

Potential Student Misconceptions

* Misconception: "Shadows are dark things that move around."
  - Clarification: Shadows are not objects—they are the absence of light. They form when something blocks light from reaching a surface. Shadows don't move by themselves; they move when the light source moves or the object moves.

* Misconception: "Shadows only happen outside on sunny days."
  - Clarification: Shadows can form anytime there is a light source and an object that blocks light. You can make shadows indoors with a flashlight, lamp, or window light.

* Misconception: "All shadows are black."
  - Clarification: Shadows are usually dark, but they are not always completely black. Some shadows are dark gray or blue-gray depending on how much light reaches them and what surfaces are nearby.

Extension Activities

1. Shadow Hunt Around School: Take students outside on a sunny day to find and observe shadows made by trees, buildings, playground equipment, and other objects. Have students draw or photograph shadows at different times of day (morning, midday, afternoon) to observe how shadows change. Discuss why the shadows look different.

2. Make Shadows with a Flashlight: In a dimly lit classroom, provide students with flashlights and various objects (stuffed animals, blocks, toys, books). Let them experiment with making shadows on a white wall or paper. Ask them to predict what will happen if they move the flashlight closer or farther away, or if they move the object. Test their predictions and record observations.

3. Shadow Puppet Show: Students create simple shadow puppets using their hands, paper cutouts, or craft materials. Shine a light source behind the puppets to create shadows on a white sheet or wall. Students can perform stories or create their own shadow narratives, deepening their understanding of how objects block light.

Cross-Curricular Ideas

* Math: Measure shadows using non-standard units (paper clips, blocks) and standard units (inches, centimeters). Create a graph showing how shadow length changes at different times of day. Introduce concepts of longer/shorter and compare shadow sizes.

ELA: Read shadow-themed books like Bear Shadow by Frank Asch or My Shadow* by Robert Louis Stevenson. Write descriptive sentences about shadows students observe. Create a class book titled "Our Shadow Discoveries" with illustrations and simple sentences.

* Art: Create shadow art projects such as silhouettes, shadow drawings on colored paper, or mixed-media art using light and dark contrasts. Use black construction paper to cut shadow shapes of familiar objects and animals.

* Social Studies/Physical Education: Play shadow tag or shadow games at recess. Discuss how shadows help us understand the position of the sun and time of day—connecting to Earth science and directional awareness.

STEM Career Connection

Photographer: Photographers use light and shadows to make beautiful pictures. They position objects and lights in special ways to create interesting shadows in their photos. They understand how light works to take amazing pictures of people, nature, and buildings. Average annual salary: $65,000 USD*

Astronomer: Astronomers study the sun, moon, stars, and planets. They use shadows to understand how sunlight reaches Earth and how the Earth's position creates day and night. Shadows help them measure distances in space. Average annual salary: $104,000 USD*

Landscape Architect: Landscape architects design outdoor spaces like parks and gardens. They think about shadows from trees and buildings to decide where to plant flowers, place benches, and create shade for people to rest. They understand how shadows change throughout the day. Average annual salary: $72,000 USD*

NGSS Connections

Performance Expectation: K-PS3-1 Make observations to determine the effect of sunlight on Earth's surface.

Disciplinary Core Ideas:
- K-PS3.A

Crosscutting Concepts:
- Cause and Effect
- Patterns

Science and Engineering Practice: Obtaining, Evaluating, and Communicating Information

Science Vocabulary

* Shadow: A dark area created when something blocks light from reaching a surface.

* Light: Energy that we can see and that helps us see things around us.

* Light source: Something that makes or gives off light, like the sun, a lamp, or a flashlight.

* Block: To stop something from passing through; to get in the way.

* Opaque: Something that is solid and does not let light pass through it.

External Resources

Children's Books:

Bear Shadow* by Frank Asch

My Shadow* by Robert Louis Stevenson

Shadows* by Henry Pluckrose (Explorers series)