Shadow

Physical Science | Lesson Guide

3rd Grade

Photo Description

This image shows a large rock sitting on the ground surrounded by grass and moss. The rock casts a dark shadow on the ground next to it. You can see where the sunlight is hitting one side of the rock, making that part bright, while the other side is darker because the sun's light is blocked.

Scientific Phenomena

Anchoring Phenomenon: Shadows form when an object blocks sunlight.

When sunlight tries to travel in a straight line and hits an object (like the rock), the light cannot pass through it. This creates a dark area on the ground called a shadow. The shadow appears on the opposite side of where the light is coming from. The position and size of the shadow change throughout the day as the sun moves across the sky.

Core Science Concepts

* Light travels in straight lines: Sunlight moves directly from the sun toward Earth in straight paths until something blocks it.

* Objects block light and create shadows: Any solid object can stop light from reaching the ground, creating a shadow shape.

* Shadows change throughout the day: As the sun's position changes in the sky, shadows move and their sizes change.

* Shadow characteristics reflect the object's shape: The shadow's outline tells us about the object blocking the light.

Pedagogical Tip:

When introducing shadows to Third Graders, have students predict where a shadow will appear BEFORE looking at it. This activates prior knowledge and makes the phenomenon more memorable. Use the phrase "the sun is blocked" rather than more complex language about light rays to keep it concrete and observable.

UDL Suggestions:

Provide multiple means of engagement by allowing students to explore shadows indoors (using flashlights) and outdoors (using sunlight). Some students may have limited outdoor time or light sensitivity—offering both options ensures all learners can participate safely and meaningfully. Consider pairing visual observations with tactile explorations (feeling the warmth difference between shadowed and sunny areas).

Zoom In / Zoom Out

Zoom In (Microscopic/Invisible Process):
At the atomic level, light is made of tiny particles called photons that travel extremely fast. When photons hit the rock, they either bounce off (which is why we see the rock) or are absorbed into the rock's material. The photons never reach the ground directly beneath the rock, which is why we see a shadow—it's the absence of photons in that space.

Zoom Out (Larger System Connection):
The rock's shadow is part of Earth's larger relationship with the sun. Throughout the day, as Earth rotates and the sun appears to move across the sky, all objects on Earth cast changing shadows. This pattern of changing shadows helped ancient humans and animals understand time—the sun's movement created natural clocks. Today, we use the sun's position and shadows to tell time and navigate, and solar panels are designed to capture maximum sunlight by minimizing shadows.

Discussion Questions

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

2. If we looked at this rock's shadow in the morning, at noon, and at 3 p.m., how do you predict it would be different? (Bloom's: Predict | DOK: 3)

3. What would happen to the shadow if we moved the rock to a different spot? (Bloom's: Apply | DOK: 2)

4. Can you think of other places in your neighborhood where you see shadows, and why those shadows appear there? (Bloom's: Create | DOK: 3)

Potential Student Misconceptions

* Misconception: "Shadows are things that follow us around and stick to us."
  - Clarification: Shadows are simply dark spots created when light is blocked. They're not physical objects that can touch us or move independently; they appear wherever the sun's light cannot reach an object.

* Misconception: "Shadows are always the same size."
  - Clarification: Shadows change size and direction depending on where the sun is in the sky. Early morning shadows are long, noon shadows are short, and evening shadows are long again.

* Misconception: "Only people and animals make shadows."
  - Clarification: Any object—rocks, buildings, trees, cars, or cups—can make a shadow whenever it blocks sunlight.

Extension Activities

Activity 1: Shadow Stick Measurement
On a sunny day, have students place a stick in the ground and trace its shadow with chalk at three different times: early morning, noon, and late afternoon. Students measure and record the shadow lengths, then compare the data. This builds measurement skills while reinforcing that shadows change throughout the day.

Activity 2: Shadow Puppet Theater
In a darkened classroom, set up a bright flashlight or lamp as a light source. Have students use their hands, small objects, and puppets to create shadows on a white sheet or wall. Encourage experimenting with how moving objects closer or farther from the light changes shadow size—a foundational understanding of how light works.

Activity 3: Shadow Hunt and Sketch
Take students on a "shadow hunt" around the school grounds. Have them find three different shadows and sketch them in their science notebooks, labeling what object made each shadow. They can return to the same spots later in the day to see how shadows have moved.

Cross-Curricular Ideas

* Math: Measure and compare shadow lengths at different times of day using rulers and centimeters. Create a bar graph showing how shadow length changes throughout the day.

ELA: Write descriptive paragraphs about a shadow using sensory words (dark, cool, moving, dancing). Read and discuss shadow-themed picture books like Bear Shadow* by Frank Asch.

* Social Studies: Research how ancient civilizations (Egyptians, Greeks) used shadows and the sun to tell time and build calendars. Discuss how sundials work.

* Art: Create shadow artwork by arranging objects on dark construction paper in sunlight and tracing their outlines, or make shadow paintings using watercolors with shadow shapes.

STEM Career Connection

* Geologist: Geologists study rocks and Earth. They observe rocks like the one in the photo to learn about Earth's history and what materials Earth is made of. They might use shadows to help them map or document rocks in different lighting. Average Salary: $95,000 USD

* Astronomer: Astronomers study the sun, moon, and stars. They understand how light from the sun creates shadows on Earth and how celestial bodies move in patterns. This knowledge helps them predict eclipses and understand planetary motion. Average Salary: $119,000 USD

* Landscape Designer: Landscape designers plan outdoor spaces and gardens. They think carefully about where shadows fall throughout the day when placing trees, buildings, and plants—ensuring some areas get sunlight and others stay shaded. Average Salary: $71,000 USD

NGSS Connections

Performance Expectation:
1-PS4-3: Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light. *

Disciplinary Core Ideas:
- 1-PS4-3

Crosscutting Concepts:
- Cause and Effect - The sun's light is blocked by the rock, causing a shadow to form on the ground.
- Patterns - Shadows follow predictable patterns based on the sun's position throughout the day.

Teacher Note: For Third Grade, you may also reference the underlying concept of light energy and how it interacts with matter, even though formal NGSS standards for light are introduced in later grades. This activity builds foundational understanding for future physics learning.

Science Vocabulary

* Shadow: A dark area that appears when an object blocks sunlight from reaching the ground.

* Sunlight: The light that comes from the sun and travels to Earth.

* Block: To stop something from moving forward (like when the rock blocks light).

* Light: A form of energy that helps us see things and travels in straight lines from the sun.

* Object: Any thing or item that takes up space (like a rock, tree, or person).

External Resources

Children's Books:

My Shadow* by Robert Louis Stevenson (illustrated editions available)

Bear Shadow* by Frank Asch

Shadows* by Manya Stojic