Shadow

Physical Science | Lesson Guide

1st Grade

Photo Description

In this image, you can see a large rock sitting on the ground surrounded by green moss and plants. The rock has a dark shadow cast on top of it because the sun is shining on it from one side. The shadow shows us where the light from the sun is blocked by the rock.

Scientific Phenomena

Anchoring Phenomenon: Shadow Formation from Light Blocking

Why It's Happening: Shadows occur when an object blocks light from traveling in a straight line. The sun produces light that travels in straight paths. When the rock gets in the way of that light, the light cannot pass through the rock (because rocks are opaque), so a dark area—a shadow—appears on the rock's surface and on the ground around it. The position and darkness of the shadow change throughout the day as the sun moves across the sky. This is a direct result of how light travels and interacts with solid objects.

Core Science Concepts

* Light travels in straight lines: When nothing blocks light from the sun, it reaches objects in a straight path. When an object is in the way, it creates a shadow.

* Shadows show us where light is blocked: A shadow is the dark area created when light cannot pass through or around an object. Different objects create different shadow shapes.

* Shadows change throughout the day: As the sun moves across the sky from morning to evening, the direction and length of shadows change. This happens because light is coming from a different angle.

* Objects can be opaque, transparent, or translucent: The rock in this photo is opaque (light cannot pass through it), which is why it creates a dark shadow. This is different from transparent objects like clear glass.

Pedagogical Tip:

When teaching about shadows in First Grade, always start with direct observation outdoors on a sunny day. Have students trace or observe their own shadows at different times (morning, midday, afternoon) before introducing the concept abstractly. This concrete, kinesthetic experience makes the phenomenon tangible and memorable for young learners.

UDL Suggestions:

To support diverse learners: (1) Provide tactile exploration by letting students feel the cool shadow area versus the warm sunny area; (2) Use visual supports like photos or drawings showing shadows at different times; (3) Allow students to act out shadow formation by having one student be the "light source" (sun), one be the "object," and one be the "shadow" as others observe; (4) Offer pre-recorded sound descriptions for students with visual impairments describing where shadows fall.

Zoom In / Zoom Out

Zoom In (Microscopic):
At the microscopic level, light is made of tiny particles called photons. When photons hit the rock, they are absorbed (taken in) or reflected (bounced off) rather than passing through. The absorbed energy heats up the rock's surface slightly. Different colored surfaces absorb different amounts of light—darker surfaces absorb more light energy than lighter surfaces, which is why the shadow area looks cooler than sun-exposed areas.

Zoom Out (Larger System):
On a planetary scale, Earth's rotation around the sun causes all shadows on Earth to move and change length throughout the day and throughout the year. In summer, the sun is higher in the sky, so shadows are shorter. In winter, the sun is lower, creating longer shadows. This shadow cycle is connected to seasons, which affect ecosystems, animal behavior, and plant growth. The rock's position relative to the sun's daily and yearly movement creates predictable shadow patterns that ancient peoples used to track time and seasons.

Discussion Questions

* "What do you think would happen to this rock's shadow if we looked at it again in two hours?" (Bloom's: Predict | DOK: 2)

* "Why do you think the shadow is darker than the ground around it?" (Bloom's: Analyze | DOK: 2)

* "Can you find the shadow's shape? What does it tell us about the rock's shape?" (Bloom's: Understand | DOK: 1)

* "If we moved the rock to a shadier place (under a tree), what do you think would happen to its shadow?" (Bloom's: Analyze | DOK: 2)

Potential Student Misconceptions

* Misconception: "Shadows are things; they can move around by themselves."
  - Clarification: Shadows are not objects—they are the absence of light. Shadows move because the sun moves across the sky and the light is coming from a different direction, not because the shadow itself is moving.

* Misconception: "All shadows are the same color—they're all just black."
  - Clarification: Shadows can be different shades of gray or blue depending on the light around them and what surfaces they fall on. The shadow on this rock appears darker in some areas because less light is reaching those spots.

* Misconception: "Shadows only happen on sunny days; they disappear when it's cloudy."
  - Clarification: Shadows happen whenever light is blocked by an object, even on cloudy days. On cloudy days, shadows are much lighter (fainter) because the clouds scatter the light so it comes from many directions instead of one direction like the sun.

Extension Activities

* Shadow Tracing Walk: On a sunny day, take students outside. Have them stand in a sunny spot and trace around their own shadow on the pavement with chalk at different times (9 a.m., 12 p.m., 3 p.m. if possible). Compare the tracings to observe how shadows change length and direction. Discuss why their shadows look different at different times.

* Shadow Art Creation: Provide students with flashlights (or use natural sunlight through a window), large paper, and various opaque objects (blocks, toys, books). Have students arrange objects on paper and shine light on them to create shadow pictures. They can trace the shadows or paint over them to create artwork. This reinforces that different object shapes make different shadow shapes.

* Shadow Hunt Scavenger Hunt: Create a simple checklist or picture cards showing different types of shadows (long shadows, short shadows, shadows on walls, shadows on the ground, etc.). Take students on a nature walk to find and point to examples of each. This builds observation skills and pattern recognition about how shadows vary in different contexts.

Cross-Curricular Ideas

* Math Connection: Measure and compare shadow lengths at different times using non-standard units (hand spans, blocks, or string). Create a bar graph showing "long shadows" vs. "short shadows" found around the playground. This integrates measurement and data representation.

* ELA Connection: Read books about shadows (see resources below) and create a class "shadow" word bank. Have students dictate or write simple sentences like "My shadow is long" or "The rock makes a dark shadow." Create a class big book called "Our Shadow Discovery" with student drawings and sentences.

* Art Connection: Use the shadow images as inspiration for a silhouette art project. Students can cut out shapes from black paper to create their own shadow pictures, or trace shadows in chalk on the playground to create temporary shadow art installations.

* Social Studies/Science Connection: Discuss how shadows helped people long ago tell time (like sundials) and understand seasons. Show pictures of ancient shadow-tracking tools. Explain that farmers used to watch shadows to know when to plant and harvest crops.

STEM Career Connection

Astronomer: Astronomers are scientists who study the sun, moon, stars, and planets. They learn about how light from stars travels to Earth and how shadows form in space. Astronomers use telescopes and cameras to explore the night sky and understand how objects in space create shadows. Average Salary: $104,740 USD*

Photographer: Photographers use light and shadows to create beautiful pictures. They understand how light falls on objects to create interesting shadow effects in their photos. Photographers think carefully about where the sun or light is positioned to make their pictures look just right. Average Salary: $64,790 USD*

Civil Engineer: Civil engineers design buildings, parks, and outdoor spaces. They need to understand how shadows work so they can plan where to put buildings, trees, and walkways in cities. They make sure parks have sunny spots and shady spots for people to enjoy. Average Salary: $99,680 USD*

NGSS Connections

Disciplinary Core Ideas:
- K-PS3.B: Objects can reflect light; the way an object looks depends on the light that shines on it.

Crosscutting Concepts:
- Cause and Effect: Light blocked by an object causes a shadow to form.
- Patterns: Shadows follow predictable patterns as the sun moves across the sky.

Performance Expectation:

- K-PS4-1: Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate. (Note: While not a perfect match, this relates to observable phenomena in nature. A more aligned PE for shadow study would be foundational work leading to grade 3-5 light standards.)

Clarification: First Grade students are building foundational understanding of light and shadows through observation. These concepts directly support later NGSS performance expectations in grades 3-5 that formally address light properties and energy.

Science Vocabulary

* Shadow: The dark area made when something blocks light from reaching a surface.

* Light: Energy from the sun or a lamp that lets us see things and creates brightness.

* Block: To get in the way of something so it cannot pass through.

* Opaque: A word that describes something light cannot pass through, like a rock or a book.

* Reflect: When light bounces off a surface instead of passing through it.

* Sun: The big ball of hot light in the sky that gives us light and warmth.

External Resources

Children's Books:
* My Shadow by Robert Louis Stevenson (classic poem, available in many picture book editions)
* Shadow by Marcia Brown (Caldecott-winning picture book exploring shadows through art and storytelling)
* Shadows and Light by Tana Hoban (photography book showing real-world shadows in everyday settings)

Summary for Teacher Implementation:
This rock-and-shadow photograph provides an excellent anchor for First Grade exploration of light and shadow concepts. It is concrete, observable, and connects directly to students' lived experiences. By starting with outdoor observation of their own shadows and the rock's shadow, you'll build genuine curiosity before introducing the science vocabulary. The hands-on extension activities ensure kinesthetic and visual learners stay engaged, while discussion questions scaffold higher-order thinking. Remember to revisit this image at different times of day or in different seasons to show the dynamic, ever-changing nature of shadows—this reinforces the cause-and-effect relationship between light position and shadow formation.