# Shadow

Physical Science | Lesson Guide

Kindergarten

## Photo Description

A large rock sits on the ground covered with moss and surrounded by green grass. You can see a dark shadow stretching out from the rock on one side. The shadow shows the rock's shape on the ground, made by sunlight coming from the opposite direction.

## Scientific Phenomena

Anchoring Phenomenon: Shadow formation caused by light blocking.

When sunlight hits an object like this rock, the light cannot pass through it. This creates a dark area on the ground called a shadow. The shadow appears on the side of the rock opposite the direction the sun is shining from. This happens because light travels in straight lines—when the rock blocks the light, a shadow forms behind it. The position and length of the shadow change throughout the day as the sun moves across the sky.

## Core Science Concepts

* Light travels in straight lines – Sunlight comes from one direction and creates shadows when blocked by objects.
* Objects block light – Solid objects like rocks stop light from passing through, creating shadows.
* Shadows change position – As the sun moves, shadows move and change shape and length.
* Light and dark are related – Shadows exist because some areas receive direct light while others do not.

**Pedagogical Tip:**

For Kindergarten students, use the phrase "light gets blocked" rather than technical terms like "opacity." Have students trace their own shadows on paper outdoors at different times of day to concretely observe how shadows change. This kinesthetic experience anchors the abstract concept of light behavior.

**UDL Suggestions:**

Multiple Means of Representation: Use both real shadows (outdoors) and shadow puppet activities indoors with a flashlight so students experience shadows in different contexts. Some learners benefit from tactile exploration (feeling the rock's texture) alongside visual observation of the shadow.

Multiple Means of Action and Expression: Allow students to show understanding through drawing shadows, creating shadow puppets, or physically positioning themselves to make shadows—not just verbal responses.

## Zoom In / Zoom Out

Zoom In (Microscopic Level):

Light is made of tiny particles called photons that travel very, very fast. When these photons hit the rock, they bounce off or get absorbed by the rock's surface. The photons that would have continued past the rock are blocked, leaving an empty space with no light—the shadow. Even though we see shadows as smooth dark shapes, they're actually made of billions of blocked light particles.

Zoom Out (Larger System):
Shadows are part of Earth's day-night cycle. The sun's position in the sky changes throughout the day, which means all shadows on Earth are constantly moving and changing. This shadow pattern helps plants know when it's daytime, helps animals navigate, and even helps us tell time using sundials. Shadows are a visible clue about where the sun is in the sky and what time of day it is.

## Discussion Questions

1. "Why do you think the shadow is dark?" (Bloom's: Understand | DOK: 1)

2. "What would happen if we moved the rock to a different spot in the sun? Where do you think the shadow would go?" (Bloom's: Predict | DOK: 2)

3. "How is the shadow like the rock? How is it different?" (Bloom's: Analyze | DOK: 2)

4. "If the sun moved to the other side of the rock, what would change about the shadow?" (Bloom's: Evaluate | DOK: 3)

## Potential Student Misconceptions

* Misconception: "Shadows are things you can pick up or touch like objects."
  - Clarification: Shadows are not real objects—they're the absence of light. They're the dark area created when something blocks sunlight. You can see a shadow, but you cannot hold it.

* Misconception: "Shadows stay in the same place all day."
  - Clarification: Shadows move as the sun moves across the sky. A shadow in the morning points one direction, but by afternoon, it points a different way and is a different length.

* Misconception: "Only dark objects make shadows."
  - Clarification: Any object—light colored or dark—can make a shadow if sunlight hits it. The color of the object doesn't matter; what matters is that the object blocks the light.

## Extension Activities

1. Shadow Tracing Outdoors: On a sunny day, have students stand or place objects in sunlight and trace their shadows with chalk on the ground. Revisit the same spot 1-2 hours later and trace again. Compare the two tracings. Discuss how the shadow moved and changed shape.

2. Flashlight Shadow Puppets: Dim the classroom lights and use a flashlight to create shadows on a white sheet or wall. Let students create shadow shapes with their hands, objects, or stuffed animals. Explore how moving the light source or object changes the shadow.

3. Rock Shadow Hunt: Take students on a nature walk to find rocks with shadows. Have them point to where the sun must be based on the shadow's position. Use this as informal assessment of their understanding.

## Cross-Curricular Ideas

* Math: Measure shadow lengths at different times of day using string or rulers. Create a simple chart or graph showing how shadow length changes (introduces data collection and measurement).

* ELA/Literacy: Read "Bear Shadow" by Frank Asch or similar shadow-themed picture books. Discuss how the character in the story interacts with their shadow.

* Social Studies/Geography: Discuss how shadows help us know what time of day it is. Connect to how people long ago used shadows on sundials to tell time.

* Art: Create shadow art by arranging objects and shining light on them to make interesting shadow patterns. Have students draw or paint their favorite shadow designs.

## STEM Career Connection

* Astronomer: Astronomers study the sun and stars. They understand how light from the sun creates shadows on Earth and use this knowledge to learn about space. They use shadows and light to figure out where objects are in the sky. Average Annual Salary: $120,000 USD

* Geologist: Geologists study rocks and Earth. This geologist might study the moss-covered rock in our photo to learn about the environment and weather. They understand how rocks interact with sunlight and weather. Average Annual Salary: $95,000 USD

* Photographer: Photographers use light and shadows to create beautiful pictures. They understand how light moves and where shadows fall to make their photos interesting and artistic. Average Annual Salary: $65,000 USD

## NGSS Connections

Kindergarten (Undefined Level):
- Performance Expectation: K-PS3-1 Plan and conduct investigations to provide evidence that vibrations make sound and that light is needed to see objects.
  - This image connects to the light component of this standard—students can investigate how light is needed to see the rock, and how light creates shadows.

Relevant Crosscutting Concepts:
- Cause and Effect – Light (cause) creates shadows (effect)
- Patterns – Shadows follow predictable patterns as the sun moves throughout the day

Relevant Disciplinary Core Ideas (implicit connection):
- Light interactions and observable phenomena related to Energy and Matter

## Science Vocabulary

* Shadow: A dark shape made when something blocks sunlight (the light cannot get past the object).
* Light: Bright energy that comes from the sun and helps us see things.
* Block: To stop something from moving past (the rock blocks the light).
* Object: A thing you can see and touch, like a rock, toy, or person.

## External Resources

Children's Books:

Bear Shadow* by Frank Asch

Shadows and Light* by Tana Hoban

What Makes a Shadow?* by Clyde Robert Bulla