

## Photo Description



A large rock sits on the ground surrounded by grass and small plants on a sunny day. The rock casts a dark shadow on the ground beside it. You can see where the sun makes the shadow appear, showing how light from the sun creates the dark shape.

## Scientific Phenomena

Anchoring Phenomenon: Shadow formation caused by light blocking

When sunlight hits an object like this rock, the light cannot pass through it. The light bounces off the rock and spreads around it, but the area directly behind the rock (away from the sun) receives no direct light. This creates a darker area called a shadow. The shadow's position and size change throughout the day as the sun moves across the sky.

## Core Science Concepts

- \* Light travels in straight lines — Sunlight moves in a straight path until it hits an object. When something blocks the light, it creates a shadow.
- \* Shadows are created by blocking light — Objects that are opaque (you cannot see through them) block light and make shadows. Transparent objects like glass do not make dark shadows.
- \* Shadows change with the sun's position — As the sun moves during the day, shadows move and change shape and size.
- \* Shadows need light to exist — Without a light source like the sun, there would be no shadows.

### Pedagogical Tip:

Have students predict where a shadow will appear before observing it. This encourages them to think about light direction before you explain it. Use think-pair-share: students think individually, discuss with a partner, then share with the class. This builds confidence and deepens understanding.

### UDL Suggestions:

Provide multiple means of representation: Use a diagram showing light rays hitting an object to create a shadow (visual), describe shadows using simple language (verbal), and have students trace shadows with chalk (kinesthetic). Allow students to explore shadows outdoors on a sunny day, in a darkened classroom with a flashlight, and through picture cards —different modalities help all learners access the concept.

## Zoom In / Zoom Out

Zoom In — Atomic Level:

At the smallest level, shadows happen because light is made of tiny particles of energy called photons. When photons hit the rock, they bounce off or get absorbed, but they cannot pass through the rock's solid atoms and molecules. This blockage is what our eyes see as a shadow.

**Zoom Out — Daily Earth System:**

Shadows are part of Earth's daily cycle caused by our planet's rotation. As Earth rotates, different parts receive direct sunlight, creating daytime, and other parts are in shadow, creating nighttime. This same principle—light and shadow—affects where plants grow, when animals are active, and the temperature in different locations throughout the day.

### Discussion Questions

1. What do you think would happen to the shadow if it were a cloudy day instead of sunny? (Bloom's: Analyze | DOK: 2)
2. Why do you see a shadow behind the rock but not in front of it? (Bloom's: Understand | DOK: 2)
3. If we looked at this same rock in the morning, at noon, and in the afternoon, how do you think the shadows would be different? (Bloom's: Evaluate | DOK: 3)
4. Can you find something in our classroom that does NOT make a shadow? What makes it different from the rock? (Bloom's: Analyze | DOK: 2)

### Potential Student Misconceptions

- \* Misconception: "Shadows are things you can pick up or touch like real objects."
  - Clarification: Shadows are just areas where light is blocked. They are not solid objects—they are the absence of light. You cannot grab a shadow because it is not made of matter.
- \* Misconception: "Shadows stay in the same place all day."
  - Clarification: Shadows move throughout the day as the sun moves across the sky. In the morning, shadows point one direction; at noon they are short; and in the afternoon they point the opposite direction.
- \* Misconception: "All dark areas are shadows."
  - Clarification: True shadows are created when light is blocked by an object. A dark corner in a room might be a shadow, or it might just be an area with less light. A real shadow follows the shape of the object blocking the light.

### Extension Activities

1. Shadow Tracing Hunt: On a sunny day, take students outside with chalk. Have them find different objects (tree, fence post, playground equipment) and trace the shadows on the pavement with chalk. Return to the same spots 2–3 hours later and trace the shadows again. Compare how the shapes and positions changed. Discuss why the shadows moved.
2. Flashlight Shadow Theater: In a darkened classroom, use a flashlight as a light source and have students hold objects (ball, stuffed animal, book) between the light and a white sheet or wall. Ask them to predict the shadow shape before they make it. Experiment moving the object closer and farther from the light to see how shadows change size.
3. Shadow Length Measurement: Place a stick or pencil upright in the sun at different times of the day (morning, noon, afternoon). Measure the shadow's length each time using a ruler or string. Record the measurements on a chart and create a simple bar graph together. Discuss patterns: when is the shadow longest? Shortest? Why?

## Cross-Curricular Ideas

- \* Math: Measure and compare shadow lengths at different times of day using non-standard units (paperclips, hand spans) or standard units (inches, centimeters). Create a simple bar graph showing shadow length changes. This connects to measurement and data representation standards.
- \* ELA/Literacy: Read picture books about shadows (see resources below). Write or dictate simple sentences describing what they observed about shadows. Create a class "Shadow Observation Journal" where students draw and label shadows they find in their daily lives.
- \* Art: Create shadow art by arranging small objects on paper, placing them in sunlight, and tracing the shadows with markers or crayons. Students can create shadow art displays. Discuss how artists use light and shadow to make pictures more interesting.
- \* Social Studies: Discuss how shadows and sunlight affect communities—why we build playgrounds in sunny spots, why some buildings have shade, and how shadows helped people tell time long ago with sundials. Connect to how different places on Earth get different amounts of sunlight.

## STEM Career Connection

- \* Photographer: Photographers use light and shadows to create beautiful pictures. They think carefully about where the sun is so shadows make their photos look interesting. Some photographers use shadows as the main part of their artwork.  
Average Salary: \$65,000/year
- \* Architect: Architects design buildings and outdoor spaces. They think about how sunlight and shadows will look on a building throughout the day and year. They make sure buildings have good light and shade in the right places. Average Salary: \$82,000/year
- \* Astronomer: Astronomers study space and how light from stars and planets travels to Earth. They understand how shadows and light work to learn about distant objects in space. Average Salary: \$104,000/year

## NGSS Connections

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

Disciplinary Core Ideas:

- K-PS3.B — Energy can be moved from place to place by light, sound, and electric currents. (Relevant at primary level understanding)

Crosscutting Concepts:

- Cause and Effect — Sunlight (cause) creates shadows (effect) when it is blocked by objects.
- Patterns — Shadows follow patterns based on the sun's position in the sky throughout the day.

## Science Vocabulary

- \* Shadow: A dark area created when something blocks light from reaching the ground or another surface.
- \* Light: Energy from the sun or a lamp that lets us see things; light travels in straight lines.
- \* Opaque: When something is so thick or solid that light cannot pass through it (like wood, metal, or stone).
- \* Transparent: When something is clear and you can see right through it, like glass or clean water.

\* Block: To stop something from moving forward; in shadows, objects block light.

### External Resources

Children's Books:

- My Shadow by Robert Louis Stevenson
- Shadows and Light by Roma Gans (Illustrated by Paul Mirocha)
- The Shadow Book by Beatrice Schenk de Regniers (Illustrated by Isabel Estrada)