

Photo Description



A large rock sits on the ground surrounded by grass and moss. The rock has a dark shadow on one side, created by the sun shining on it. You can see different colors on the rock, including tan, brown, and reddish spots. The shadow shows us where the sunlight is blocking and where it is not.

Scientific Phenomena

Anchoring Phenomenon: Shadows form when light from the sun is blocked by an object.

When sunlight hits the rock, the light cannot pass through it. The rock is opaque, which means light cannot go through it. This causes a dark area (shadow) to appear on the side of the rock opposite the light source. The position and size of the shadow change throughout the day as the sun moves across the sky. This is a fundamental concept in understanding how light travels in straight lines and interacts with objects in our environment.

Core Science Concepts

- * Light travels in straight lines: When sunlight encounters an object like this rock, the light cannot bend around it, so it creates a dark shadow on the opposite side.
- * Objects can be opaque, translucent, or transparent: This rock is opaque, meaning light cannot pass through it at all. Different materials allow light to pass through them in different ways.
- * Shadows change based on light source position: The shadow's location, size, and shape depend on where the sun is in the sky and the angle of the light hitting the object.
- * Heat from the sun: The sunlit side of the rock absorbs energy from the sun, which is why weathering and lichen growth appear differently on various parts of the rock.

Pedagogical Tip:

Start with students' own shadows on a sunny day! Have them trace their shadows on paper or observe how shadows change when they move. This concrete experience helps them understand that shadows are created by blocking light, making the abstract concept of light rays tangible and observable.

UDL Suggestions:

Provide multiple means of engagement by offering shadow exploration through kinesthetic activities (moving to create different shadow sizes), visual observation (shadow pictures), and tactile experiences (feeling the temperature difference between sunny and shaded sides of objects). Allow students to document shadows through drawing, photography, or verbal description based on their learning preferences.

Zoom In / Zoom Out

Zoom In: At the microscopic level, the surface of the rock is made of tiny mineral crystals and particles. These crystals have different colors (we can see tan, brown, and red), which absorb different amounts of light. Lichens and moss growing on the rock are made of tiny living cells that thrive in the shaded, moist areas where less direct sunlight reaches.

Zoom Out: At the ecosystem level, this rock is part of a larger landscape where shadows create microclimates—small areas with different temperature and moisture conditions. The shaded side of the rock supports different plant and animal life than the sunny side. Over geological time scales, rocks like this one are weathered by sunlight, water, and wind, gradually breaking down into soil that supports plant growth.

Discussion Questions

- * What do you think would happen to this shadow if we came back at a different time of day? (Bloom's: Predict | DOK: 2)
- * Why do you think the moss and lichen are growing more on the shaded side of the rock than on the sunny side? (Bloom's: Analyze | DOK: 3)
- * If we moved this rock to a different spot, what would happen to the shadow? (Bloom's: Apply | DOK: 2)
- * How is your shadow different from this rock's shadow? How is it the same? (Bloom's: Compare | DOK: 2)

Potential Student Misconceptions

- * Misconception: "Shadows are things that move on their own" or "Shadows follow me."
 - Clarification: Shadows don't move independently. They form because light is blocked by an object. When YOU move, the position of the light hitting you changes, so your shadow appears to move with you.
- * Misconception: "Shadows are dark paint or dirt on the ground."
 - Clarification: A shadow is not a solid thing. It's the absence of light. It's the area where light cannot reach because an object is in the way. You can move the object, and the shadow disappears!
- * Misconception: "Shadows are always the same size and shape."
 - Clarification: Shadows change size and shape depending on where the light source is. When the sun is high in the sky, shadows are short. When the sun is low (morning or afternoon), shadows are long and stretched out.

Extension Activities

- * **Shadow Tracing Walk:** Take students outside on a sunny day. Have them stand still and trace their own shadows on the ground with chalk. Then have them move to different locations (near a tree, by a wall) and trace new shadows. Compare how the shadows look different based on the light position.
- * **Shadow Puppet Theater:** Provide a light source (flashlight or window light) and let students create shadow puppets with their hands, objects, and toys. Experiment with moving objects closer and farther from the light to see how shadow size changes.
- * **Sunny Side vs. Shady Side:** Set up a science table with objects like a rock, a plant, and a thermometer. Place them half in sunlight and half in shade for 30 minutes. Have students feel the difference in temperature and observe differences in how fast ice melts on each side, or how plant leaves respond to light.

Cross-Curricular Ideas

- * Math: Measure and compare the length of shadows at different times of day. Create a simple chart or graph showing how shadow length changes. Students can practice estimation ("Is the shadow longer or shorter than the rock?").
- * ELA & Art: Write or draw descriptive stories about "Shadow Friends" or illustrate how shadows look at different times of day. Students could create a comic strip showing the same object and its shadow in morning, noon, and afternoon.
- * Social Studies & Science: Explore how different cultures use shadows (sundials, shadow puppets in Indonesian theater). Discuss how people long ago used shadows to tell time before clocks existed.
- * Physical Education: Play shadow tag or freeze dance with shadows. Students move to music and must "freeze" when their shadow touches another person's shadow, integrating light concepts with movement and play.

STEM Career Connection

- * Park Ranger or Geologist: These scientists study rocks, soil, and landscapes. They observe how rocks weather over time, learn about lichens and moss, and help protect natural areas. They sometimes teach visitors about nature. Average Salary: \$42,000–\$58,000/year
- * Lighting Designer: These professionals design lighting for theaters, buildings, and events. They use light and shadows to create special effects and make spaces look beautiful or safe. They understand how light travels and creates shadows. Average Salary: \$55,000–\$75,000/year
- * Botanist (Plant Scientist): Botanists study plants, including mosses and lichens. They investigate where different plants grow best—some in shade, some in sun. They understand how light affects plant growth and help protect endangered plant species. Average Salary: \$48,000–\$68,000/year

NGSS Connections

Grade Band: K–2 (First Grade uses performance expectations from Kindergarten and Grade 2 frameworks)

Relevant Performance Expectation:

- 2-PS1-1: Plan and conduct investigations to provide evidence that heating and cooling physical materials causes changes to the size of objects. (Note: The sun's heat visible in this photo connects to energy concepts)

Disciplinary Core Ideas:

- K-PS3.B (Energy can be used in many ways)
- 2-PS1.A (Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature)

Crosscutting Concepts:

- Cause and Effect (The position of the light source causes the shadow to form)
- Patterns (Shadows follow patterns based on light position)
- Energy and Matter (Light energy is blocked by matter to create shadows)

Science Vocabulary

- * Shadow: A dark area created when an object blocks light from reaching the ground or a surface.
- * Sunlight: Light energy that comes from the sun; it travels in straight lines and makes things warm and bright.
- * Opaque: Something that light cannot pass through, so it creates a shadow (like this rock, a book, or a wall).

- * Lichen: Tiny living things that grow on rocks and other surfaces; they like cool, moist, shaded places.
- * Moss: Soft, green plant-like living things that grow in wet, shady areas and don't have roots like bigger plants.

External Resources

Children's Books:

- * My Shadow by Robert Louis Stevenson (Classic poem beautifully illustrated in multiple editions)
- * Shadows and Light by Tana Hoban (Nonfiction photo exploration book)
- * The Shadow by Nan Parson Rossiter (Story-based picture book about shadows)