Sunrise

Earth & Space Science | Lesson Guide

4th Grade

Photo Description

This image shows tall buildings in a city during sunset or sunrise. The sun appears as a bright light between the buildings, creating shadows and making some buildings look dark while others reflect light. Trees and a pathway can be seen in the front of the picture.

Scientific Phenomena

The anchoring phenomenon here is shadows and light patterns created by Earth's rotation and the sun's position. As Earth rotates on its axis, the sun appears to move across our sky, creating different angles of sunlight throughout the day. When sunlight hits tall objects like buildings, it creates shadows on the opposite side. The bright light we see is direct sunlight, while the dark silhouettes are buildings blocking that light from reaching our viewpoint.

Core Science Concepts

1. Shadow Formation: Objects block light to create shadows, and shadow size and direction change based on the light source's position
2. Earth's Rotation: Our planet spins on its axis, making the sun appear to move across the sky and creating day/night cycles
3. Light Travel: Light travels in straight lines, which is why shadows have defined edges and shapes
4. Reflection: Some building surfaces reflect sunlight, making them appear brighter than others

Pedagogical Tip:

Use a flashlight and classroom objects to demonstrate how shadows change when you move the light source to different positions. This hands-on experience helps students understand the sun-Earth relationship.

UDL Suggestions:

Provide multiple ways for students to explore shadows: kinesthetic learners can use their bodies to make shadows, visual learners can draw shadow patterns, and auditory learners can describe what they observe aloud to partners.

Zoom In / Zoom Out

1. Zoom In: Light is made up of tiny particles called photons that travel in straight lines. When these photons hit an object, they cannot pass through solid materials, creating the dark area we call a shadow.

2. Zoom Out: This shadow pattern is part of Earth's larger day/night cycle system. As our planet rotates, different parts of Earth face the sun, creating daylight for some regions while others experience nighttime.

Discussion Questions

1. What do you notice about the shadows in this picture and how might they look different at noon? (Bloom's: Analyze | DOK: 2)

2. If you were standing in this same spot tomorrow at the same time, would the shadows look exactly the same? Why or why not? (Bloom's: Evaluate | DOK: 3)

3. How could you use shadows to tell what time of day it is? (Bloom's: Apply | DOK: 2)

4. What would happen to these shadows if there were clouds covering the sun? (Bloom's: Predict | DOK: 2)

Potential Student Misconceptions

1. Misconception: The sun moves around Earth during the day
   Clarification: Earth rotates on its axis, making the sun appear to move across our sky

2. Misconception: Shadows are always the same size as the object making them
   Clarification: Shadow size depends on the distance and angle of the light source

3. Misconception: All shadows are completely black
   Clarification: Shadows can have different shades because some light reflects off nearby surfaces

Cross-Curricular Ideas

1. Math - Measurement & Graphing: Have students measure shadow lengths at different times of day (every hour) and create a line graph showing how shadows change. They can calculate the ratio of object height to shadow length, introducing proportional relationships in a concrete way.

2. ELA - Descriptive Writing: Ask students to write a paragraph describing what they see in this photo using vivid adjectives and sensory details. Challenge them to write from the perspective of a shadow ("A Day in the Life of a Building's Shadow") or create a poem about light and darkness.

3. Art - Light & Shadow Techniques: Students can create their own silhouette artwork using black paper and a light source. They can also practice drawing techniques that show how light creates highlights and shadows on objects, learning about value (light to dark) in visual art.

4. Social Studies - City Planning: Discuss how architects and city planners think about sunlight when designing buildings and cities. Students can explore why buildings are positioned certain ways and how sunlight affects where people work and play in urban spaces.

STEM Career Connection

1. Astronomer: Astronomers study the sun, moon, stars, and how they move in our sky. They use telescopes and cameras to observe space and help us understand Earth's place in the universe. This photo relates to their work because understanding shadows helps us understand how Earth and the sun interact. Average annual salary: $105,000

2. Architect: Architects design buildings and plan how they look and function. They think carefully about where sunlight will hit buildings throughout the day and year. This helps them design buildings that are bright, comfortable, and energy-efficient. The tall buildings in this photo were designed by architects who considered how light and shadows would affect the city. Average annual salary: $88,000

3. Urban Planner: Urban planners decide how cities should be organized and developed. They think about where buildings should go, how parks fit into cities, and how sunlight reaches streets and public spaces. They use their knowledge of shadows and light to make cities healthier and more enjoyable for people to live in. Average annual salary: $78,000

NGSS Connections

- Performance Expectation: 5-ESS1-2 - Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky
- Disciplinary Core Ideas: 5-ESS1.B
- Crosscutting Concepts: Patterns
- Science Practices: [[NGSS:SEP:Analyzing and Interpreting Data]]

Science Vocabulary

* Shadow: A dark area created when an object blocks light from reaching a surface
* Rotation: The spinning motion of Earth on its axis that creates day and night
* Light source: An object that gives off light, like the sun or a flashlight
* Reflection: When light bounces off a surface, like sunlight bouncing off building windows
* Silhouette: The dark outline of an object seen against a bright background

External Resources

Children's Books:
- Shadows and Reflections by Tana Hoban
- What Makes a Shadow? by Clyde Robert Bulla
- Day Light, Night Light by Franklyn Branley