Sunrise

Earth & Space Science | Lesson Guide

4th Grade

Photo Description

This image shows a sunrise over a flat landscape with a straight road stretching toward the horizon. The sun is low on the eastern horizon, creating brilliant orange and pink colors in the sky that fade to blue higher up. The road, fields, and trees are still mostly dark because the sun hasn't fully risen yet, showing how light from the sun gradually brightens our world each morning.

Scientific Phenomena

Anchoring Phenomenon: Why does the sun appear to move across the sky and create a sunrise?

Scientific Explanation: The sun doesn't actually move—Earth does! Earth rotates (spins) on its axis like a spinning top, completing one full rotation every 24 hours. When your location on Earth rotates toward the sun, you experience sunrise. As the sun's light reaches Earth's atmosphere at a low angle during sunrise, it scatters off air particles, creating the distinctive red, orange, and pink colors we see. This is called the "scattering of light" and happens because shorter blue wavelengths scatter more easily than longer red and orange wavelengths when the sun is near the horizon.

Core Science Concepts

1. Earth's Rotation: Earth spins on an invisible axis (an imaginary line through the North and South Poles). This rotation causes the sun to appear to rise in the east and set in the west, though the sun isn't actually moving—we are!

2. Light and Atmosphere: Sunlight travels in straight lines through space, but when it enters Earth's atmosphere (especially at sunrise and sunset), it interacts with air molecules and particles. This causes the light to scatter, which is why we see brilliant colors instead of just a bright sun.

3. Day and Night: As Earth rotates, different parts of the planet face toward or away from the sun. The part facing the sun experiences day (sunlight), while the part facing away experiences night (darkness).

4. Patterns in the Sky: Sunrise occurs at predictable times and in predictable directions (east), allowing us to recognize patterns and use the sun's position to navigate and tell time.

Pedagogical Tip:

Help students understand that Earth's rotation is difficult to "feel" because we're moving smoothly at a constant speed. Use an analogy: When you're in a car moving at steady highway speed, you don't feel the movement—only changes in speed feel noticeable. Similarly, Earth's constant rotation is imperceptible to us, which is why ancient people thought the sun moved instead!

UDL Suggestions:

To support diverse learners: (1) Provide a physical model (globe with a flashlight) so kinesthetic and visual learners can see how rotation creates sunrise/sunset; (2) Use videos showing time-lapse sunrises so students can observe the phenomenon at different speeds; (3) Create a "sunrise observation journal" where students can draw and write about what they observe, supporting varied forms of expression beyond verbal participation.

Zoom In / Zoom Out

Zoom In: Light Scattering at the Atomic Level

When we zoom in to a microscopic level, we can see what's actually happening during a sunrise. Sunlight is made of tiny waves of energy called photons. As sunlight enters Earth's atmosphere, it collides with incredibly small particles—individual air molecules like nitrogen and oxygen, and tiny dust particles. When a red or orange photon hits one of these molecules, it bounces off (scatters) and travels in a new direction. Blue photons scatter even more easily, but during sunrise, most of the blue light scatters upward and sideways away from our eyes, while the red and orange light reaches us directly. This atomic-level interaction is invisible to us, but it's the reason we see brilliant colors instead of white light!

Zoom Out: Global Weather Patterns and Climate Systems

When we zoom out to see the bigger picture, we can see how sunrise connects to Earth's entire weather and climate system. The sun's energy doesn't just create pretty colors at sunrise—it powers everything! Sunlight heats Earth's atmosphere, oceans, and land, creating temperature differences that drive wind patterns, ocean currents, and the water cycle. Different parts of Earth receive different amounts of sunlight depending on Earth's rotation and tilt, which creates seasons and climate zones. The sunrise we see in this photo is just one small moment in a 24-hour cycle of heating and cooling that affects weather patterns, plant growth, animal behavior, and ecosystems across the entire planet.

Discussion Questions

1. "Why do you think we see an orange and red sunrise instead of a white or blue sunrise?" (Bloom's: Analyze | DOK: 2)

2. "If you traveled west on an airplane very, very fast, could you 'chase' the sunrise and make it stay in the sky longer? Why or why not?" (Bloom's: Evaluate | DOK: 3)

3. "What evidence from this photo tells you that Earth is rotating rather than the sun moving toward Earth?" (Bloom's: Evaluate | DOK: 3)

4. "Predict what the sky would look like 30 minutes after this photo was taken, and explain your thinking." (Bloom's: Create | DOK: 3)

Potential Student Misconceptions

Misconception 1: "The sun moves around Earth."
Why students think this: From our perspective on Earth, it looks like the sun is moving across the sky. This is what ancient people observed, and it feels natural to think that what we see is what's actually happening. Students have not yet developed the ability to think about reference frames (perspective matters!).

Scientific Clarification: The sun doesn't move—Earth does! Earth is rotating like a spinning top. When your location on Earth rotates toward the sun, the sun appears to rise in the east. When your location rotates away from the sun, the sun appears to set in the west. It's similar to sitting in a spinning chair: if you spin slowly, it looks like the room is moving around you, but really, you're the one moving. Use the globe-and-flashlight model to help students experience this perspective shift.

Misconception 2: "Sunrises and sunsets happen at the same time everywhere on Earth."
Why students think this: Fourth graders often have limited geographic awareness and may assume that if it's sunrise where they live, it's sunrise everywhere. They haven't yet integrated the concept of time zones or Earth's size into their thinking.

Scientific Clarification: Different places on Earth experience sunrise and sunset at different times because Earth is round and rotates continuously. When it's sunrise on the east coast of the United States, it's already mid-morning on the west coast (because the west coast has already rotated into the sun's light earlier). On the other side of Earth, people are experiencing sunset or nighttime. You can demonstrate this with a globe: place small stickers representing cities, then shine a flashlight to show that only certain areas are in "sunrise" at any given moment.

Misconception 3: "The sunrise colors are actually colored light coming from the sun."
Why students think this: Students may think the sun itself is changing colors—that it's red or orange at sunrise and yellow later. They don't yet understand that the sun is always the same color (white/yellow); the colors we see are created by how light interacts with Earth's atmosphere.

Scientific Clarification: The sun is actually always white/yellowish—the same color all day long. The colors we see at sunrise are created because sunlight has to travel through more atmosphere when the sun is low on the horizon. The atmosphere scatters (bounces around) the blue light away from our eyes, leaving mostly red, orange, and yellow light to reach us. You can simulate this by shining a white flashlight through progressively thicker layers of translucent colored plastic or tissue paper: as the light passes through more material, it changes color, just like sunlight passing through more atmosphere.

Extension Activities

1. Sunrise Observation Journal (5-7 days): Have students observe and sketch the sunrise from the same location each morning before school or with a family member. Ask them to record the time, colors, cloud patterns, and any changes they notice. After one week, discuss patterns: Does the sunrise time change? Does the location on the horizon change slightly? This builds observation skills and reveals the patterns in Earth's rotation.

2. Day-Night Globe Demonstration: Using a globe and a flashlight in a darkened classroom, have students take turns rotating the globe while the flashlight represents the sun. Students can identify where it's sunrise, sunset, and night, and predict what will happen as they continue rotating. This kinesthetic activity makes the abstract concept of rotation concrete and memorable.

3. Sunrise Colors Investigation: Provide students with watercolor paints or colored pencils and have them create their own sunrise artwork. First, discuss why the colors change from red/orange near the horizon to yellow to blue higher up. Then, as they paint or draw, ask them to think about which colors represent which parts of the sky and why light scatters differently at different angles. Display artwork and have a gallery walk where students explain their color choices using scientific reasoning.

Cross-Curricular Ideas

ELA Connection: Sunrise Poetry and Descriptive Writing
Have students write acrostic poems or haikus about sunrise using vivid descriptive language. First, show them the photo and discuss sensory words: What colors do you see? If you were there, what sounds might you hear? What would the air feel like? Students can write poems using their observations, then share them aloud. This combines science observation with creative expression and vocabulary development. Students could also write a narrative story from the perspective of someone driving down this road at sunrise, incorporating scientific facts about what's happening in the sky.

Math Connection: Time and Patterns

Challenge students to track sunrise times over several weeks using a calendar or data table. They can research (or collect) sunrise times for your city and graph the data to see patterns. Questions might include: "Does the sunrise time change every day? By how much? What's the pattern?" Students can use addition and subtraction to calculate time differences between sunrise times on different days. This connects to measurement, data collection, and pattern recognition while reinforcing the scientific concept that sunrise follows predictable patterns due to Earth's rotation and orbit.

Social Studies Connection: Navigation and Geography
Throughout human history, people have used the sun's position for navigation and telling time. Discuss how the sunrise always occurs in the east, making it a reliable directional marker. Students can use a compass to identify east, west, north, and south in their schoolyard or neighborhood, then predict where the sun will appear the next morning. They can also research how different cultures and ancient civilizations used the sun for timekeeping and navigation (sundials, solstices, celestial navigation). This bridges science with human geography and cultural practices.

Art Connection: Color Theory and Atmospheric Perspective
Build on the "Sunrise Colors Investigation" extension by diving deeper into color mixing and perspective. Students can experiment with watercolors or pastels to explore how colors appear to fade and change with distance (atmospheric perspective—a key art technique). They can practice the gradient from warm colors (red, orange, yellow) near the horizon to cool colors (blue, purple) higher in the sky. Display finished artwork and discuss why artists use these color transitions. This develops fine motor skills, color theory understanding, and reinforces the scientific concept of light scattering while celebrating art as a mode of scientific expression.

STEM Career Connection

Meteorologist (Weather Scientist)
Meteorologists study weather and atmosphere. They use information about the sun, clouds, wind, and temperature to predict weather and understand climate. A meteorologist might track how sunrise colors indicate different weather patterns or study how the sun's energy creates storms and wind. Meteorologists work for weather services, airlines, farms, and environmental organizations. They help keep people safe by predicting dangerous weather like tornadoes and hurricanes.

Average Annual Salary: $97,000 USD

Astronomer
Astronomers study the sun, stars, planets, and everything in space. Some astronomers research how the sun works and how its energy affects Earth. Others study how light travels from distant stars through space and Earth's atmosphere. Astronomers use telescopes and computers to make discoveries about the universe. They work at universities, observatories, and space agencies like NASA.

Average Annual Salary: $119,000 USD

Pilot or Flight Navigator

Pilots fly airplanes and need to understand many things about Earth and the sun, including how to use the sun's position and shadows for navigation, how sunrise and sunset times affect flight schedules, and how atmospheric conditions (like the colorful sunrise shown in this photo) indicate weather changes. Pilots use instruments and their knowledge of Earth's rotation to navigate safely across the world. They work for airlines, cargo companies, or government agencies.

Average Annual Salary: $121,000 USD

NGSS Connections

Performance Expectation:
4-ESS1-1: Identify evidence from patterns in local geological records that Earth has changed over time.

Disciplinary Core Ideas:
- 4-ESS1.A The Universe and Its Stars: Patterns of the sun, moon, and stars observed from Earth can be predicted and described; differences in these patterns are due to Earth's rotation and orbit.
- 4-ESS2.E Earth's Systems: Maps show where things are located; one can determine distances between places using maps.

Crosscutting Concepts:
- Patterns The predictable patterns of sunrise and sunset result from regular motion (Earth's rotation).
- Cause and Effect Earth's rotation causes the observed motion of celestial objects and creates day-night cycles.

Science Vocabulary

* Sunrise: The moment when the sun appears above the eastern horizon at the beginning of the day.

* Rotation: When Earth spins like a top on an imaginary line called an axis, completing one full spin every 24 hours.

* Atmosphere: The layer of air that surrounds Earth.

* Scatter (or Light Scattering): When light bounces off tiny particles in the air, spreading out in different directions and creating colors we see at sunrise and sunset.

* Horizon: The line where the sky meets the land (or water) in the distance.

* Axis: An imaginary line through Earth's center that runs from the North Pole to the South Pole, around which Earth rotates.

External Resources

Children's Books:
- The Sun: Our Nearest Star by Franklyn M. Branley, illustrated by Don Madden – A classic explanation of how the sun creates day and night through Earth's rotation.
- Me and My Amazing Body by Joan Sweeney – Includes sections on how our bodies respond to sunrise and the Earth's daily cycle.
- Sunrise by Barney Saltzberg – A picture book exploring what happens at sunrise with beautiful illustrations.