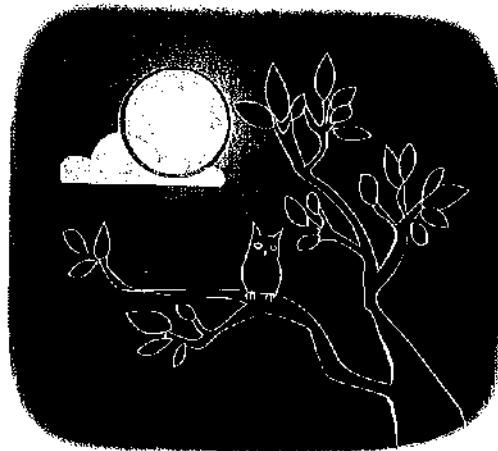


Moonlight

Five friends noticed they could see better at night when there was a full Moon. They wondered where the moonlight came from. This is what they said:



Curtis: "The Moon reflects the light from the Earth."

Chet: "The light from the Sun bounces off the Moon."

Clarence: "The Moon gets its light from distant stars."

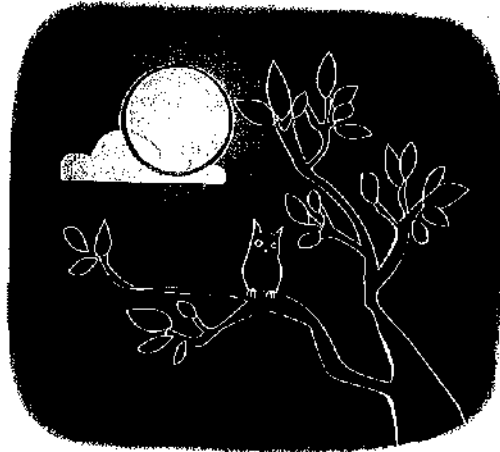
Fallon: "The Moon absorbs light from the Sun during the day."

Deirdre: "There is light inside of the Moon that makes it shine."

Which person do you most agree with? Explain your thinking about moonlight.

Moonlight

Teacher Notes



Purpose

The purpose of this assessment probe is to elicit students' ideas about light and the Moon. The probe is designed to find out what students think is the source of a full Moon's light.

Related Concepts

light reflection, Moon, Moon phases

Explanation

The best answer is Chet's: "The light from the Sun bounces off the Moon." In other words, the Moon reflects sunlight. Even though you do not see the Sun in the evening, it does shine on the surface of the Moon. The light from the Sun reflects off the Moon and travels to Earth. Therefore, during a full Moon, the moonlight that helps us see better during the evening after the Sun has set is actually sunlight that is bounce-

ing off the Moon, striking the Earth, reflecting off objects, and entering our eyes, which allows us to see things at night. When there is no full Moon, there is less light reaching and reflecting off the Earth; therefore, we see better when there is a full Moon. In contrast, stars emit their own light. They are sources of light rather than objects that reflect light.

Curricular and Instructional Considerations

Elementary Students

In the elementary grades, students observe different phases of the Moon over time and describe the monthly pattern. They should also be challenged to think about why we can see the Moon, developing the idea that light from the Sun is reflected by the Moon toward Earth.

Reflection of light is a prerequisite understanding that should be developed before students learn that the Moon reflects light.

Middle School Students

In the middle grades, students develop a more sophisticated understanding of light reflection and the phases of the Moon. Now is the time when they can begin putting together ideas about the Earth, Moon, and Sun system to construct an understanding of what causes the phases of the Moon. By middle school, they should be able to distinguish between stars that give off their own light versus Moons and planets that can be seen by the Sun's reflected light.

High School Students

By high school, students should understand that the light from the Moon comes from reflected sunlight. However, there may be some students who still hold on to early misconceptions that were never challenged.

Administering the Probe

Make sure students understand the context of this probe. Students in urban areas may have never experienced the difference in nighttime darkness during the light of a full Moon.

Related Ideas in National Science Education Standards (NRC 1996)

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K-4 Objects In the Sky

- ★ The Sun, Moon, stars, clouds, birds, and airplanes all have properties, locations,

and movements that can be observed and described.

K-4 Light, Heat, Electricity, and Magnetism

- Light travels in a straight line until it strikes an object. Light can be reflected by a mirror, refracted by a lens, or absorbed by the object.

5-8 Transfer of Energy

- ★ Light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection).

5-8 Earth In the Solar System

- Most objects in the solar system are in regular and predictable motion. Those motions explain such phenomena as the phases of the Moon.

Related Ideas in Benchmarks for Science Literacy (AAAS 1993 and 2008)

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Note: Benchmarks revised in 2008 are indicated by (R). New benchmarks added in 2008 are indicated by (N).

K-2 The Universe

- The Moon looks a little different every day but looks the same again about every four weeks.

★ Indicates a strong match between the ideas elicited by the probe and a national standard's learning goal.

3–5 Motion

- Light travels and tends to maintain its direction of motion until it interacts with an object or material. Light can be absorbed, redirected, bounced back, or allowed to pass through. (N)

6–8 The Earth

- ★ The Moon's orbit around the Earth once in about 28 days changes what part of the Moon is lighted by the Sun and how much of that part can be seen from the Earth—the phases of the Moon.

Related Research

- Understanding the phases of the Moon is very challenging for students. To understand the phases of the Moon they must first master the idea of a spherical Earth and understand the concept of light reflection and how the Moon gets its light from the Sun (AAAS 1993).

Suggestions for Instruction and Assessment

- Compare and contrast objects that emit their own light and objects that reflect light, and connect this to how we see the Moon.
- For students who believe the Moon creates its own light, use a model to confront them with their ideas. Shine a light on a white Styrofoam ball in a dark room. Have students describe what they see. Ask them to examine the ball to decide if there is something in it that caused it to light up. Give students time to revise

their explanation after experiencing the model.

- Model the relationship between the Moon and the Sun at night. Using a model, show how the Sun shines on the Moon, even though we do not see the Sun during the night.

Related NSTA Science Store Publications, NSTA Journal Articles, NSTA SciGuides, NSTA SciPacks, and NSTA Science Objects

- Ansberry, K., and E. Morgan. 2008. Teaching through trade books: Moon phases and models. *Science & Children* (Sept.): 20–22.
- Gilbert, S., and S. Ireton. 2003. *Understanding models in Earth and space science*. Arlington, VA: NSTA Press.
- Young, T., and M. Guy. 2008. The Moon's phases and the self shadow. *Science & Children* (Sept.): 30–35.

Related Curriculum Topic Study Guides

(Keeley 2005)

Earth, Moon, Sun System

Visible Light, Color, and Vision

References

- American Association for the Advancement of Science (AAAS). 1993. *Benchmarks for science literacy*. New York: Oxford University Press.
- American Association for the Advancement of Science (AAAS). 2008. *Benchmarks for science lit-*

★ Indicates a strong match between the ideas elicited by the probe and a national standard's learning goal.

eracy online. www.project2061.org/publications/bsl/online

Keeley, P. 2005. *Science curriculum topic study: Bridging the gap between standards and practice.* Thousand Oaks, CA: Corwin Press.

National Research Council (NRC). 1996. *National science education standards.* Washington, DC: National Academy Press.