

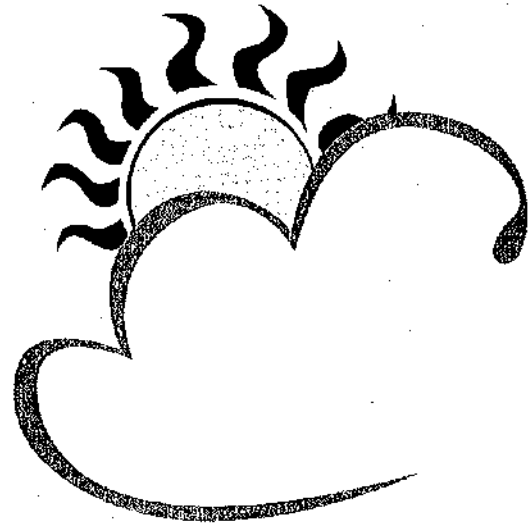
Objects in the Sky

Different things can be seen in the sky.

Put a **D** next to the things that are seen **only** in the daylight.

Put an **N** next to the things that can be seen **only** at night.

Put a **B** next to the things that can be seen in **both** day and night.



___ the Sun

___ the Moon

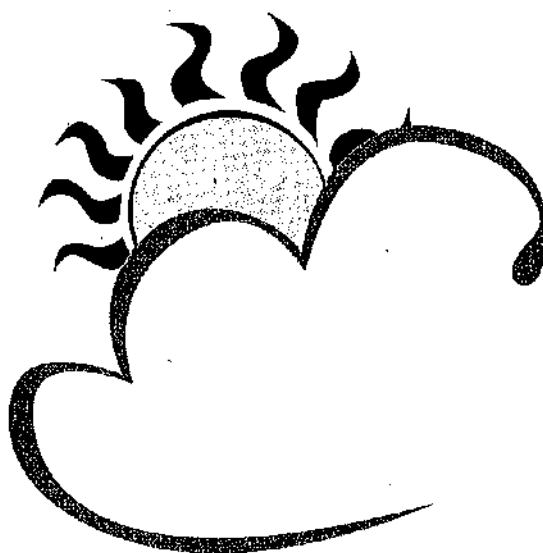
___ the next-nearest star to our Sun

___ constellations

Explain your thinking. How did you decide when you could see different things in the sky?

Objects in the Sky

Teacher Notes



Purpose

The purpose of this assessment probe is to elicit students' ideas about when objects can be seen in the sky. Students' explanations reveal their thinking about the role of light and distance in seeing sky objects.

Related Concepts

Earth's axis, light reflection, light source, scale size and distance in the universe, stars

Explanation

The best response is D for the Sun, N for the next-nearest star to our Sun and constellations, and B for the Moon. Much to some people's surprise, the Moon can be quite visible in the blue sky when it is at a place in its orbit that

puts it above the Earth's horizon during the daytime. The Moon's visibility during a bright day is due to its relative proximity to the Earth and its reflection of sunlight. A nearby star and constellations (groupings of stars) can only be seen at night because they are so far away. The only star visible to us in the daytime sky is the Sun. Venus has been called "the morning star" because of its visibility in the morning, but it is not a star. It is a nearby planet that reflects light from the sun.

Curricular and Instructional Considerations

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Elementary Students

In the elementary years, students make regular observations of the sky, taking inventory of the familiar objects and their locations as seen during the day and night, including the Sun, Moon, and stars. They are encouraged to draw what they see. The emphasis at this level should be on observing and describing. Observations and descriptions of the day and night sky should begin in early elementary years with the Earth-Moon-Sun system.

In later elementary grades, students expand their observations and descriptions to include stars and planets. They also develop ideas about light reflection and light sources to explain why some things can be seen in the dark. The idea that the Moon can be seen during the daytime is a grade-level expectation in the national standards.

Middle School Students

Students at this level begin to add details to their growing conception of the solar system and the universe, moving beyond the sky overhead to the vastness of space. They develop a working knowledge of the size, distances, and movement of objects in the sky, including the planets and the effect of light reflection at a distance. They construct and use models to explain distances from the Earth and the Sun. Their growing knowledge about the motion of the Moon moves them beyond the observation that the Moon can be seen during the daytime to understanding why it can be seen based on its motion relative to the Earth and the Sun.

High School Students

High school is the time when a more complete picture of the vast universe develops and students have a more sophisticated understanding of the nature and behavior of light. Nevertheless this probe may be useful in determining whether high school students still retain early ideas about what can be seen in the sky, especially since students rarely take the time to observe these phenomena.

Administering the Probe

Listen carefully to students' ideas. You may want to probe further to ask students where they think the Moon and stars go during the daytime and where the Sun goes at night. As the inventory of celestial objects and phenomena increases for older students, you can add items to the list such as different planets, satellites, the space shuttle, the International Space Station, quasars, black holes, other moons, comets, aurora, asteroids, meteors, and meteorites.

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.

5-8 Earth in the Solar System

- The Earth is the third planet from the Sun

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

in a system that includes the Moon, the Sun, eight other planets and their moons, and smaller objects such as asteroids and comets. The Sun, an average star, is the central and largest body in the solar system. *[Note: This standard was written before scientists decided Pluto was not a planet.]*

Related Ideas in Benchmarks for Science Literacy (AAAS 1993)

K-2 The Universe

- ★ The Sun can be seen only in the daytime, but the Moon can be seen sometimes at night and sometimes during the day. The Sun, Moon, and stars all appear to move slowly across the sky.

3-5 The Earth

- The patterns of stars in the sky stay the same, although they appear to move across the sky nightly, and different stars can be seen in different seasons.
- Planets change their positions against the background of stars.

6-8 The Earth

- ★ The Sun is a medium-sized star located near the edge of a disk-shaped galaxy of stars, part of which can be seen as a glowing band of light that spans the sky on a very clear night. The universe contains many billions of galaxies, and each galaxy contains many billions of stars. To the naked eye, even the closest

of these galaxies is no more than a dim, fuzzy spot.

Related Research

- Students in an astronomy class did not seem to have correct views about some astronomy-related ideas any more than students who did not have a class in astronomy. However, the students who took astronomy did use many more scientific terms in their explanations (Sadler 1987).
- The following ideas identified by Baxter (1989) may help explain where students think some sky objects are during the day or the night and why we cannot see them: the Sun goes behind hills, clouds cover the Sun, the Moon covers the Sun, the Sun goes behind the Earth once a day, the Earth goes around the Sun once a day, and the Earth spins on its axis once a day. It appears that at ages 15-16 many still hold covering and orbital theories of day and night (Driver et al. 1994).

Suggestions for Instruction and Assessment

- Provide opportunities for elementary students to observe and draw the sky at various times of the day during school hours, and encourage them to do this at night and early in the morning when they are home. Going outside and looking at the Moon during the daytime will help students see that the Moon can be visible during the day.
- Before students can discern planets in the night sky, it is necessary to help them dis-

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

tinguish between planets and stars in terms of both how they are seen in the sky and the difference between emitting light and reflecting it.

- Use concrete objects for models such as a ball and light. Let students observe and record how the ball looks in various locations around the light to learn how reflected light allows us to see the Moon and other planets.
- Take photographs of the sky during the day and at night or use available photographs on the internet to look at differences in the sky depending on time and season.
- Introduce students to the various types of technologies, including space telescopes, that enable us to see farther into our universe than we could with our naked eyes or land-based telescopes.
- Today's students are not personally connected to the sky as people in the past were. The sheer wonder of the sky has "inspired the expressive powers of poets, musicians, and artists" (AAAS 1993, p. 61). Help students realize that knowing the sky and what it holds is a tribute to human curiosity and our zest for understanding our place in the cosmos.

Related NSTA Science Store Publications and NSTA Journal Articles

- American Association for the Advancement of Science (AAAS). 1993. *Benchmarks for science literacy*. New York: Oxford University Press.
- Driver, R., A. Squires, P. Rushworth, and V. Wood

Robinson. 1994. *Making sense of secondary science: Research into children's ideas*. London: RoutledgeFalmer.

Gilbert, S., and S. Iretton. 2003. *Understanding models in Earth and space science*. Arlington, VA: NSTA Press.

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Phillips, W. 1991. Earth science misconceptions. *The Science Teacher* 58 (2): 21-23.

Smith, S. 1992. *Project Earth science: Astronomy*. Arlington, VA: NSTA Press.

Related Curriculum Topic Study Guides

(Keeley 2005)

"Earth, Moon, and Sun System"

"Scale Size and Distance in the Universe"

"Solar System"

"The Universe"

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