



COOLER IN THE SHADOWS

DESIGNING TO STAY COOL

LESSON OVERVIEW

LESSON SUMMARY

Students will make inferences about the cause of shadows, by observing and making their own shadows in the sun. Many properties of shadows (such as heat and brightness of light) will also be identified firsthand as the students conduct simple experiments to observe changes that are comparable to those experienced by the MESSENGER spacecraft in its voyage to and around Mercury.

OBJECTIVES

Students will be able to:

- discover patterns in the behavior of sunlight, temperature, and shadows
- gain an understanding of how shadows form and the factors that influence the shape and size of a shadow
- explain the difference between a shadow and a reflection
- understand that light travels in a straight line
- begin to understand why shadows outdoors are different at different times of the year

GRADE LEVEL
Pre-K - 1

DURATION
1-2 hours

ESSENTIAL QUESTION

How does the amount of sunlight and heat change in areas that are shaded?



CONCEPTS

- Sunlight and other types of light form shadows.
- Shadows form because light travels in straight lines.
- Light cannot pass through some materials and this leads to the formation of shadows.
- Shadows can change position and shape and size depending on the position of the object in relation to the position of the light source.
- Darkness is the absence of light.

MESSENGER MISSION CONNECTION

The generation of heat by sunlight is also why shadows are important for the MESSENGER mission to Mercury. Because the spacecraft will be very close to the Sun, it will receive much more intense sunlight than we get on Earth. To reduce the temperatures in the probes, a sunshade is included on the craft. The spacecraft is oriented so that the shade always faces the Sun, and the sensitive instruments used to make observations of Mercury are always in shadow.

WARNING

Do *not* look directly at the Sun!

This lesson is about the Sun and sunlight, but be sure to remind students frequently ***never to look directly at the Sun!*** Looking for even a few seconds can cause permanent damage to the eyes, and longer exposure can cause blindness. Note that sunglasses do *not* provide an adequate safeguard against looking directly at the Sun.





STANDARDS & BENCHMARKS

NATIONAL SCIENCE EDUCATION STANDARDS

K-4 Standard D2b Objects in the Sky

- The sun provides the light and heat necessary to maintain the temperature of the Earth.
(From the narrative: "As they [students] observe changes, such as the movement of an object's shadow during the course of a day, and the positions of the sun and moon, they will find patterns in these movements.")

K-4 Standard B31 Light, Heat, Electricity, and Magnetism

- Light travels in a straight line until it strikes an object.

BENCHMARKS FOR SCIENTIFIC LITERACY (AAAS PROJECT 2061)

4E (K-2)

The sun warms the land, air and water.