LESSON 2: SNOW GOGGLES AND LIMITING SUNLIGHT

LESSON OVERVIEW

LESSON SUMMARY

Although different kinds of radiation are helpful to human activities, too much of it can be harmful. The purpose of this lesson is to illustrate the use of the scientific method to solve problems of too much radiation. By studying ancient solutions to the issue of excessive sunlight on human vision, we can better understand the process of designing solutions to similar problems for spacecraft, such as the MESSENGER mission to Mercury. Students build snow goggles similar to those used by the Inuit people. The goggles are designed to block unwanted light, while increasing the viewer's ability to see in a bright region. Students also create their own version of the goggles to improve upon existing designs. Students compare the process used to invent snow goggles with that employed by the MESSENGER mission designers. As a result, they discover that the basic principles of using the scientific method for solving problems are the same, regardless of whether the exact solution to the problem is the same.

GRADE LEVEL
5 - 8

DURATION
1-2 hours

ESSENTIAL QUESTION

How can the scientific method be used to solve different kinds of problems?

OBJECTIVES

Students will be able to:

- Construct snow goggles to examine an ancient solution to the problem of excess sunlight.
- Explain how the scientific method can be used to solve different kinds of problems.
- Explain why excessive sunlight is a concern for the MESSENGER spacecraft.

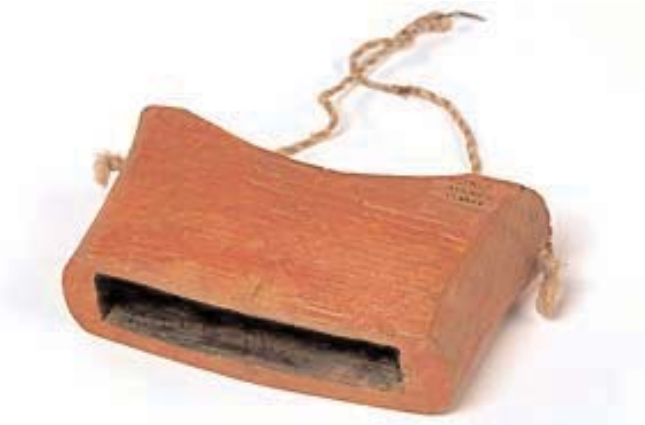

Figure 1. Snow goggles were used by ancient hunters as eye protection while they looked across snowy landscapes in bright sunlight in search of food. Snow goggles consisted of an opaque eye-covering made of materials such as wood, leather, whalebone or ivory, and were attached by a string. Narrow slits or holes limited the hunters' field of view, but reduced bright sunlight so that their visibility on ice and snow was greatly improved. Today's hunters wear modern sunglasses or snow goggles often made of Polaroid lenses, which are quite effective in reducing excessive amounts of light. (Picture credit: Arctic Studies Center, National Museum of Natural History, Smithsonian Institution: http://www.mnh.si.edu/lookingbothways; photograph by Carl C. Hansen.)

Concepts

- The scientific method can be used to solve a variety of problems.

- Sunlight is necessary for many different purposes (such as hunting or observing the properties of planets), but too much of it can be dangerous.

MESSENGER Mission Connection

We need some sunlight to see, but too much may be harmful to our eyes. In a similar way, the MESSENGER spacecraft needs some sunlight to operate and to observe Mercury, but too much of it can heat it up and cause damage.

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

Standard A1 Abilities necessary to do scientific inquiry

Identify questions that can be answered through scientific investigations: Students should develop the ability to refine and refocus broad and ill-defined questions. An important aspect of this ability consists of students' ability to clarify questions and inquiries and direct them toward objects and phenomena that can be described, explained, or predicted by scientific investigations. Students should develop the ability to identify their questions with scientific ideas, concepts, and quantitative relationships that guide investigation.

Standard A2 Understandings about scientific inquiry

Different kinds of questions suggest different kinds of scientific investigations. Some investigations involve observing and describing objects, organisms, or events; some involve collecting specimens; some involve experiments; some involve seeking more information; some involve discovery of new objects and phenomena; and some involve making models.

Related Standards

Standard E1 Abilities of technological design

Students should develop their abilities by identifying a specified need, considering its various aspects, and talking to different potential users or beneficiaries. They should appreciate that for some needs, the cultural backgrounds and beliefs of different groups can affect the criteria for a suitable product.

Standard E2 Understandings about science and technology

Many different people in different cultures have made and continue to make contributions to science and technology.

American Association for the Advancement of Science, Project 2061

Benchmark 4F2: Something can be "seen" when light waves emitted or reflected by it enter the eye – just as something can be "heard" when sound waves from it enter the ear.

Benchmark 11B3: Different models can be used to represent the same thing. What kind of a model to use and how complex it should be depends on its purpose. The usefulness of a model may be limited if it is too simple or if it is needlessly complicated. Choosing a useful model is one of the instances in which intuition and creativity come into play in science, mathematics, and engineering.

Benchmark 12C5: Inspect, disassemble, and reassemble simple mechanical devices and describe what the various parts are for; estimate the effect that making a change in one part of the system is likely to have on the system as a whole.