



CHEDD-ANGIER



SCIENTIFIC AMERICAN

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Hot Planet – Cold Comfort

Activity 1: Grades 5-8

Light Absorption

As global temperatures rise, ice melts and glaciers retreat. In Alaska, the retreating glaciers expose the ground below. Unlike ice and snow cover, the exposed land surface is not highly reflective. Instead, the ground absorbs much of the sunshine that falls upon its surface. This energy is transformed into heat. The heat adds to global warming and leads to increased melting.

This activity page will offer:

- A hands-on experience in the transfer of energy
- An arena in which to observe temperature rise associated with absorbed sunlight
- The opportunity to compare and contrast how color affects energy absorption

In the Pocket

The amount of light energy that an object absorbs depends upon its appearance. The brighter an object is, the more light it reflects. The reflecting leaves less light for absorption. The darker the object, the less light it reflects. This results in more light energy being absorbed. In this activity, you'll compare light and dark objects and see how they respond to light absorption and heat generation.

Materials

- Two thermometers
- Construction paper (half sheets of black and white paper)
- Stapler
- Scissors

Procedure

1. Work in groups of two. Start with a half sheet of black and white

- construction paper.
2. Fold each sheet in half lengthwise to form a pocket.
 3. Use a stapler to secure the shape of these two pockets.
 4. Place a thermometer in each pocket. Make sure that each thermometer fits completely within its sleeve.
 5. Place the pockets the shade. Wait 10 minutes. Quickly observe and record the temperature shown by each thermometer. Return them to their appropriate pockets.
 6. Place both pockets in direct sunlight.
 7. Every five minutes, observe and record the temperature displayed by each thermometer. Make a table to display your results.

Questions

1. Which of the three pockets reflected the most light?
2. Which of the three pockets absorbed the most light?
3. Which pocket showed the fastest temperature rise? Why?
4. Which pocket showed the slowest temperature rise? Why?

Critical Thinking

Suppose each sleeve was placed in a separate clear, sealed container. How might this affect the observed temperature values?

Albedo

The term albedo (al-BEE-dough) is a measure of the amount of light reflected by a surface. Snow has an albedo of almost 1. Sand has an albedo of about 0.35. Coal has an albedo of about 0.05. Based only on their albedo values, which of these materials heats up first when placed in the sun? Explain.

Painted Black

Take two shoeboxes. Paint the inside of one black. Paint the inside of the other white. Tape a lab thermometer to the inside wall of each box. Cover the boxes with clear plastic wrap. Place the boxes in direct sunlight, but position them so the thermometers remain in the shade. Compare and contrast the temperature rise in both boxes.

Greenhouse on Wheels

Develop a strategy for inquiry that would explore whether tinted car windows influence the greenhouse effect inside a closed automobile. Share your experimental design with your instructor. With his or her approval, perform your investigation. Report your results back to the class in an oral presentation.

Web Connection

Global Warming Links

<http://www.autobahn.mb.ca/~het/globalwarming.html>

The site presents a library of hyperlinks to global warming URLs.

Albedo

<http://www.arcticice.org/albedo.htm>

The site offers a brief presentation of reflected sunlight and its relationship to the arctic environment.

EPA: Global Warming: Impacts: State Impacts

<http://yosemite.epa.gov/oar/globalwarming.nsf/content/ImpactsStateImpacts.html>

This site hosted by the U.S. Environmental Protection Agency offers a state-by-state overview of the impact of climatic change and global warming.

Academic Advisors for this Guide:

Suzanne Panico, Science Teacher Mentor, Cambridge Public Schools, Cambridge, MA

Anne E. Jones, Science Department, Wayland Middle School, Wayland, MA

Gary Pinkall, Middle School Science Teacher, Great Bend Public Schools, Great Bend, KS

Cam Bennet Physics/Math Instructor Dauphin Regional Comprehensive Secondary School
Dauphin, MB Canada



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Light Absorbption

Questions

1. Which of the three pockets reflected the most light?
(White.)
2. Which of the three pockets absorbed the most light?
(Black.)
3. Which pocket showed the fastest temperature rise?
(Black.)
Why?
(It absorbed more of the light energy that fell upon its surface.)
4. Which pocket showed the slowest temperature rise?
(White.)
Why?
(It reflected more of the light energy that fell upon its surface.)

Critical Thinking

Suppose each sleeve was placed in a separate clear, sealed container. How might this affect the observed temperature values?

(They would be higher due to the greenhouse effect.)

Albedo

The term albedo (al-BEE-dough) is a measure of the amount of light reflected by a surface. Snow has an albedo of almost 1. Sand has an albedo of about 0.35. Coal has an albedo of about 0.05. Based only on their albedo values, which of these materials heats up first when placed in the sun? Explain.

(Coal. With a low albedo value, it absorbs more light. This light is changed into heat and generates a greater temperature increase.)