Reflective Solar Cooker

This activity will take you 30 minutes to build and about 45 more minutes to complete, depending on how many experimental trials you conduct.

This reflective solar cooker uses the Sun's energy to cook marshmallows. The target cooking area is the space where the light concentration is greatest.

Never look directly at the Sun! It could damage your eyes. Don't allow the cooker to reflect sunlight into your eyes.

Activity

You will need these items to complete this activity:

- shoebox
- aluminum foil
- string
- tape
- straws
- manila folder
- marshmallows (white and chocolate, or other color)

Preparation

1. Cut out slots of equal length down the short sides of the shoebox opposite each other. Draw a scale, beginning with zero at the top, along each slot. Then cut diagonal slits at the corners of the box for the string.
2. Cut a manila folder in half along the fold. Place one half inside the shoebox, so that the folder bows into a curved, half-pipe shape resting on the bottom of the box. Fasten with tape in this shape to the box.
3. Lay a sheet of aluminum foil, shiny-side up, along the curved folder. Tape it to the box, fitting it to the folder shape.
4. Cut two 20-inch lengths of string. Knot each at one end. Floss the knotted ends into slits A and B. Drape the string inside the box, and insert the other end into slits C and D.
5. Discuss the term "cook" with the class.

Experiment

1. Place one white marshmallow onto a straw near the end, and a colored marshmallow (or more, if you have several colors) on a second straw.
2. Snip a slit at one end of the second straw, and then join the slit end to the other straw. Space the two marshmallows an inch or two apart from each other.
3. Lay the straw into the slot so that the marshmallows are near the center of the box. The straws should rest on the string at both ends.
4. Pull on both strings to bring the straw to the first level from the bottom.
5. Direct the box toward the Sun; prop it up. Allow the marshmallows to cook for a specified time (e.g., 4 minutes).
6. Repeat with another set of marshmallows at a different height for the same length of time.
7. ***Option***. After discussion, when the best height is discussed, repeat the experiment with different cooking times.

Analysis

1. Why is the shiny surface curved? Would this work if it were straight?
2. Did the color of the marshmallow make a difference? Why?
3. Did the height of the straws make a difference? Why?
4. Did the student definitions of "cook" change?

Answers

1. It is curved to focus the sunlight. A straight surface will reflect but not focus light.
2. The darker color marshmallows should cook faster, since white reflects rather than absorbs energy. (This is the reason you are cooler when you wear white clothes in the sunlight than when you wear dark colors.)
3. When the straws bring the marshmallows closest to where the Sun's energy is concentrated, the marshmallows will cook fastest. Imagine that the reflecting surface is part of a circular pipe; depending on the shape of your box, it may not be perfectly circular. The focus is one half of the radius of this pipe.
Hint: Students may notice the marshmallows are brightest when they are near the focus.
4. Most students expect "campfire" results before the experiment.

National Science Education Standards

Earth Science (5-8): The Sun is the major source of energy for phenomena on Earth's surface.
Science and Technology (5-8): Students should develop abilities of technological design.