



Solar Ovens

Solar Ovens Lesson 12: Reflecting Sunlight

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DESCRIPTION: Students will see a demonstration and conduct a simple experiment on reflecting sunlight. During this demonstration, they will determine the purpose of the reflectors on a solar oven's design and make observations about their functionality. They will use what they learn to build their solar ovens.

GRADE LEVEL(S): 4 and 5

SUBJECT AREA(S): Science

ACTIVITY LENGTH: 00 hours, 45 minutes

LEARNING GOAL(S): Students will learn that reflectors can be used to increase solar oven temperatures by concentrating solar energy. Students will use their observations from the prior lesson to make claims based on the concepts of reflection and absorption within a solar oven system. Students will use their observations from reflection and absorption experiments to determine how to best capture reflected solar energy.

STANDARDS MET:

Next Generation Science Standards:

4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

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Student Background:

Previous observations about the design of solar ovens.

Educator Background:

Have a general understanding of how solar cookers work and solar energy concepts.

Materials List:

- Day with full sun
- Sun Oven
- 6 mini parabolic ovens (tin foil, glue, poster paper, string, hole punch)
- small Styrofoam bowls (two per group of 4)
- ice-cubes (2 per group of 4. As close to the same size as possible.)
- Plastic trash bag or black construction paper (enough to cover the Sun Ovens' reflectors.)

Vocabulary:

- Albedo: the ability to reflect light
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Lesson Details:

- **STEP 1:** Set up the Sun Oven in the sun. Like a conventional oven, the Sun Oven needs to preheat. (SAFETY REMINDER: The Sun Oven becomes very hot and should be either placed in a location that students do not have access to and make sure the oven is supervised by an adult at all times.)
- **STEP 2:** Point out the reflectors on the Sun Oven and ask the students if they think they really make a difference. Ask them how much of a difference they think they make. How many degrees? Are they really worth the time?
- **STEP 2:** Explain the 2 experiments to them. First, you will be setting up the solar oven with the reflectors. Once it has reached a fairly stable temperature for about 20 minutes, you will cover the reflectors with white paper so that they do not reflect as much light. Second, the students will be doing an experiment with ice-cubes. Have them look at page 17 in their student workbooks. In groups of 4, they will be placing one ice-cube in a Styrofoam bowl and one ice-cube in a Styrofoam bowl in the middle of the parabola. Make sure both Styrofoam bowls are placed on the same type of surface. Placing them on different surfaces, for example one on cement and one on grass, may change the experiment.

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However, if you have different groups of students try different surfaces, you may allow for a meaningful discussion of reflection/conduction from these surfaces.

- **STEP 3:** Go outside and do the experiments. (SAFETY REMINDER: The Sun Oven becomes very hot. Students should not be allowed to be near or come into contact with the oven. Make sure the oven is in a location that students do not have access to and that an adult is supervising the oven at all times.)
- **STEP 4:** Have students record their results on page 17 in their student workbooks.
- **STEP 5:** Have a whole group discussion about the experiments.

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