Meteorologist: Solar ovens

Time: 45 Minutes **Skill Level:** Elementary (age 6-11), Middle School (age 12-14)

Background

What is Science Inquiry?

Children are natural scientists. From a very early age they explore the world, ask questions and seek answers. This journey of exploration and discovery is Science Inquiry. Science Inquiry helps young people understand their environment, solve problems and gain knowledge about scientific ideas and processes.

Next Generation Science Standards (NGSS)

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
1. Asking questions (for science) and defining problems (for engineering)	**PS3:** Energy	**2.** Cause and effect: Mechanism and explanation
3. Planning and carrying out investigations	**ESS1:** Earth's place in the universe	**3.** Scale, proportion, and quantity
6. Constructing explanations (for science) and designing solutions (for engineering)	**ESS3:** Earth and human activity	**5.** Energy and matter: Flows, cycles, and conservation
8. Obtaining, evaluating, and communicating information	**ETS1:** Engineering design	**6.** Structure and function

Objective

In this activity, students will learn about the sun's energy and effective solar oven design. Students will then build a solar oven and observe the oven's temperature as it cooks s'mores.

About the Scientist

Meteorologists are scientists that study weather and the atmosphere. The word meteorologist comes from the ancient Greek word, metéōros, meaning *high in the sky*. Meteorologists study and predict weather and climate, and identify the relationship with other environmental processes. This is important locally, as well as globally, since weather impacts our daily lives and the economy.

The Science of Solar Ovens

The Sun provides Earth with *energy*, in the form of *heat* and *light*. Heat energy from the sun can be extremely powerful—even enough to cook with! Solar ovens are designed to absorb sunlight and

The Science of Solar Ovens *(continued)*

convert it to heat. Ovens may also trap and hold this heat, to increase the oven's efficiency and reduce cooking times.

Materials List:

Clear sheet protectors	Glue sticks	Thermometers (for ovens)
Black construction paper	Box knife	Indoor & outdoor thermometers
Aluminum foil	Packing tape	Paper plates
Scissors	Duct tape	Graham crackers, chocolate, and marshmallows
Pizza boxes	Wooden skewers	

Discuss…Ask students what they know about solar energy. Use "The Science of Solar Ovens" to explain how solar ovens work. Discuss specific aspects of solar oven design—what's the purpose of each feature? How does the solar oven concentrate the sunlight? How can the inside of the oven be designed to absorb more light to convert to heat? How is heat trapped and stored? What's the purpose of the transparent sheet protectors? How will a pizza box cook a s'more?

Predict…Generate Ideas. Select a Solution

Experience "What to Do"- What is the plan for the investigation? Show students how to do the following:

1. First, create a reflective flap on the pizza box lid to reflect sunlight and concentrate it into the box. To do this, use the box cutter to cut along the three open sides of the lid, approximately 1-2″ from the edge of the lid. Score the remaining side on the underside of the lid, and bend the newly cut flap upward. Line the newly cut flap with foil and glue the foil into place.
2. Line the bottom of the pizza box with foil and glue into place.
3. Cover the foil on the bottom of the pizza box with black construction paper, leaving a small foil border for securing the construction paper with packing tape. The black paper absorbs the light reflected off the foil lid and converts the light to heat. (Remind students about a black t-shirt on a hot day!).
4. Pull the sheet protectors apart to create a single layer of plastic and line the *inside* of the box lid (*not* the flap). The plastic should span the flap opening. If it doesn't, tape plastic sheets together to form a larger sheet. The plastic helps trap and hold the heat.
5. Finish the oven by taping a wooden skewer to the flap, then insert the other end of the skewer into the box lid to prop the flap open.
6. Insert a thermometer into the side of the box so you can determine the oven's temperature.
7. Place your s'mores (open-faced) on the black paper and close the lid. Put the solar oven in direct sun until the s'mores begin melting.

Share …Encourage students to discuss the design while building, and observe the oven's temperature changes while in the sun.

Reflect …**Analyze and interpret the data and results. Discuss among the group.** Observations?

Generalize …**to real world examples. Construct explanations.** Why don't we use solar ovens at home to cook food? What are its benefits and/or limitations?

Apply …**outside the classroom or club meeting.** What other objects act like a solar oven? (e.g., cars)

Additional resources:

- This experiment is based on an activity designed by Steven Spangler, available on his website, **http://www.stevespanglerscience.com/lab/experiments/solar-oven**
- For more information on meteorologists, see American Meteorological Society website, **http://www.ametsoc.org/careercenter/careers.html**
- For more information on the Sun, see NASA's website, **http://solarsystem.nasa.gov/sun**

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