Background Information for Activity Leaders

Overview

Children will build and use a solar oven to explore the uses of solar energy.

Key Concepts

- **Solar energy** is light or heat energy that comes from the Sun. The Sun gives off more energy in one second than humans have used since the beginning of time.

- Humans in early civilizations used simple magnifying glasses to concentrate the light of the Sun into beams to start wood fires.

- Over 2,000 years ago, the Greeks built their homes so that the Sun's rays entered during the winter, but not during the summer. They designed entire cities this way.

- The Romans were the first to place glass in windows. The glass allowed the Sun's light to pass through into the room and trap its heat. They also built glass greenhouses so they could grow fruit and vegetables all winter.

- In the 1700s, Europeans began to use solar energy to collect the Sun's heat in what was called a hot box. The bottom of the box was lined with black cork and the top was made of three layers of glass. The inside of the box reached a temperature of 228°F (109°C).

- By the 1830's improvements in the design of the solar oven lead to its use by the French Foreign Legion.

- From the early 1920s to just before World War II, most people in Florida heated their water with solar water heaters.

- Many parts of the world use simple solar collectors as their only source of hot water. The collectors boil water to make it safe to drink, to sterilize doctors' tools, to heat water to wash clothes, dishes, or even people!

- Today, millions of homes use state-of-the-art solar equipment to heat water for household use.

- There are many different ways to use solar energy. The Sun's energy can be used to heat things, like homes, water, and food.

Background Information for Activity Leaders

- The sun's energy can also be harnessed by solar panels that convert light from the sun into electricity. This is called **photovoltaic energy**.

- Thermal means heat, so **solar thermal energy** means heat energy from the Sun. Thermal energy can be captured using solar panels to heat water for use in homes.

- Insulation traps energy inside and doesn't let it escape.

What to Expect

- Children will expect to see an immediate result in the solar oven. Plan for an intermediary activity in order to give the solar oven time to bake the food (marshmallows, bread, etc.) .

- The best time of year to conduct this investigation is during sunny days in late spring, summer, and early fall. During the summer months, the top of the solar oven box should be pointing straight up. During the winter months, it should be at a 60-degree angle to trap the most sunlight.

Common Misconceptions

- *Children may think: "Solar energy can only be used during the day."*

  Solar heating systems have ways to store the heat that is collected on sunny days to keep people warm at night or on cloudy days. One way is to collect and store hot water in insulated tanks.

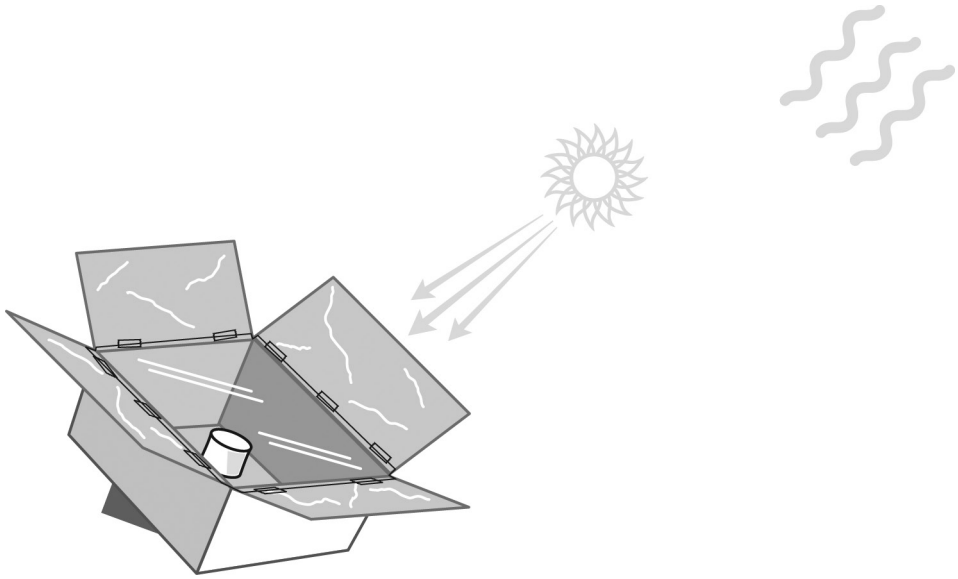
Demonstration Solar Cooker

1. Use glue or tape to line a medium box with insulating materials such as foam core poster board or foam food trays.

2. Tape the corners of the four lid sections of the box to each other so that they form a funnel shape into the box. Do not cut the lids.

3. Line the entire inside of the box including the lids with aluminum foil. Make sure the aluminum is as smooth as possible. The smoother the aluminum foil, the better the sunlight will be focused into the center of the cooker.

4. Tape a removable flap of clear plastic wrap to the box below the lids, so that it can be lifted and taped back to place and remove the food.



WHAT'S COOKING?

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Data Collection Sheet

Name:_____ **Date:**_____

WONDER How do you think solar energy might be used for cooking?

RECORD Start time: _____ End time: _____

time cooking	observations and drawings
before cooking	
after 10 minutes	
after 20 minutes	

CONCLUDE What did you discover about solar cooking?

_____

_____

WHAT'S COOKING?

Activity Leader's Guide

Group Size: 4-6 children
Time: 45 minutes

Set Up the Expedition

Materials:

For the activity leader:
- (1) medium-sized box
- (1) empty coffee can
- (1) bottle black tempra paint
- (1) medium paint brush
- (1) can frozen bread dough
- enough insulation material, such as foam core poster board or foam food trays to line the inside of the medium-sized box

For each group:
- ***What's Cooking?*** Learning Cards
- (1) roll of aluminum foil
- (1) bottle of glue
- (1) roll of tape
- (1) roll of plastic wrap
- (1) shoe box with lid
- (4-5) foam trays
- (1) stop watch
- drawing paper
- crayons

For each child:
- (1) ***What's Cooking?*** Data Collection Sheet
- (1) large marshmallow
- (1) popsicle stick

Prepare the demonstration:
1. Follow the directions in this lesson to construct the demonstration solar cooker.
2. Paint the outside of coffee can black, and allow it to dry.
3. A few hours before the children gather to do the activity, place a 5 cm cube of defrosted bread dough in the coffee can.
4. Place the coffee can with the dough into the solar oven. Cooking time varies depending on weather, location, altitude, and time of year.

Prepare the exploration:
1. Place the materials needed for each group where children can access them.

Engage

1 Gather the children together.

Say:
"What kinds of energy are used to cook meals?"
Allow children time to share what types of energy sources they have observed being used at home, school, picnics and restaurants. Answers may include natural gas, propane in gas barbecues, electricity, wood and charcoal.

Ask:
"Have you ever cooked using solar energy?"
They will probably say "no." Act surprised.

2 **Say:**
"The Sun has produced energy for billions of years. But here on Earth we can only use a very small part of its energy.

Ask
"Can you think of two types of energy that we receive from the Sun?" All children time to think and discuss with one another. Lead them to light and heat energy.

Say
"We call the energy from the Sun solar radiation." The sun's energy makes it possible for plants to grow and for the Earth to be warm enough to support life.

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Say:
"In fact, the Sun's energy has been cooking this bread for us while I was preparing for this activity. Would you like to take a look?" Take children outside to see the progress the bread is making. If it is not done, let it continue to bake as the children complete the investigation.

Explore/Expand

3 If you are working with more than 4-6 children, divide them into groups. Distribute the Data Collection Sheets and the Learning Cards.

Say:
"Today you will get the opportunity to build your own solar oven. Follow the instructions on your Learning Card."

4 Allow children enough time to complete the WONDER, EXPLORE, RECORD, EXPAND and CONCLUDE sections of their Learning Card.

Encourage children to complete the EXPAND and CONCLUDE sections while their marshmallows are cooking.

Conclude

5 Gather the children together and ask the following questions:

"Why was the aluminum foil necessary?" The aluminum foil reflects the Sun's energy into the cooking area.

"Why do you think the coffee can I built was painted black?" The bread cooks faster in a dark-colored can.

Note: In the "Hot Colors" investigation in this unit, children will explore the concept that dark objects absorb more heat than lighter objects. If they have not done that investigation, allow them to make suggestions. They might want to try another investigation with a light-colored can.

"How can you use solar energy in your home?" Allow children to make suggestions.

6 **Say:**
"Congratulations! You have earned your 'Ask Me About Solar Energy' stamp. You are ready to tell people about solar energy."

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WHAT'S COOKING?

Expedition Learning Card

How can you the Sun's energy to heat or cook food?

solar radiation
convection
insulation

Explore how the Sun can be used as a source of energy.

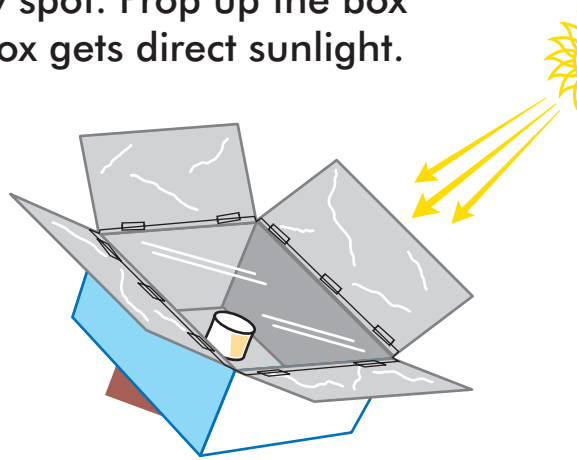
1 WONDER How do you think solar energy might be used for cooking?

Record your ideas on your Data Collection Sheet.

2 EXPLORE Make your own solar oven.

1. Line a shoe box with foam trays. The foam will insulate the box to keep heat in. You may need to use scissors to cut the trays so they fit in the box. Use tape to fasten the trays in place.
2. Line the inside of the box with aluminum foil. Use tape to fasten the aluminum foil to the box.
3. Place the marshmallows for your group in the center of the box and tape a piece of plastic wrap over the top of the box.
4. Take your oven out to a sunny spot. Prop up the box to adjust it so the top of the box gets direct sunlight.

Watch the marshmallows through the plastic wrap, but be sure your shadow doesn't block the sunlight.



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WHAT'S COOKING?

Expedition Learning Card

3 RECORD Notice the appearance of the food before you place it in the oven, and record how the appearance changes as it cooks for 20 minutes.

Draw or write on your Data Collection Sheet what you observe.

4 EXPAND In what other ways can the Sun's energy be used

On a separate piece of drawing paper, draw a diagram of another way in which you could use solar energy.

5 CONCLUDE What did you discover about the Sun's energy?

Record your discoveries on your Data Collection Sheet.

Discovery

Why did we do that?

- Solar energy is useful to humans.
- Solar energy can be used to heat food in solar ovens.

Congratulations!

You have earned your "Ask Me About Solar Energy" stamp! Now you are ready to tell people about solar energy!

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