

SECTION 1 ACTIVITIES

Activity 1: Solar Cookers

ACTIVITY TYPE: Science-Kit Lab

OVERVIEW: This is a two-part activity. In Part I, students work with the Sun Oven to cook food and purify water using solar energy. In Part II, students make their own solar cookers using common household materials.

GOAL: Students learn the basic principles of solar-thermal and passive-solar heating.

SUBJECTS: Science, Art, and Language

TIME FOR PART I: 30 minutes to 1 hour

TIME FOR PART II: 2 1-hour class periods

SETTING FOR PART I: Outside on a sunny day.

SETTING FOR PART II: Classroom for solar cooker construction and outside on a sunny day for testing ovens and cooking.

MATERIALS FOR PART I: The Sun Oven and Sun Oven Manual are in your science kit. You'll also need a pot to hold water, water, and food to warm up in the oven (e.g., 1-2 student lunches).

MATERIALS FOR PART II: How to Build a Solar Cooker Worksheet, cardboard, heavy tin foil (18 inches wide), glue (white glue or spray adhesive), black paint, scissors, and something to cook (see ideas listed in the activity).

KEY VOCABULARY: Energy, heat, passive solar, pasteurization, photon, renewable resource, solar energy, and solar thermal.

CORRELATIONS TO STANDARDS	
NATIONAL	Physical Science – 3a: Energy is a property of many substances and is associated with heat, light, electricity, mechanical motion, sound, nuclei, and the nature of a chemical.
IDAHO	Science – Goal 1.2: Understand concepts and processes of evidence, models, and explanations.
OREGON	Science – Energy: Describe and explain various energy transfers and resulting transformations.
WASHINGTON	Science – Systems 1.3 Changes: Understand how interactions within and among systems cause changes in matter and energy.

ABOUT THE AUTHORS: Founded in 1998, Bonneville Environmental Foundation (BEF) is essentially a non-profit business. Through the sales and marketing of green power products (known as carbon offsets) BEF gives individuals and businesses a way to participate in solving our most pressing environmental issues. All of the net revenues, or “profits,” that the organization makes are reinvested in projects that restore damaged watersheds and support the development and understanding of renewable energy technologies such as solar, wind, and biomass.



☀️ **ACTIVITY 1: SOLAR COOKERS**

source: *Bonneville Environmental Foundation (BEF)*

Homemade Solar Cookers: Teacher Guide

PART I: Use the Sun Oven and the Sun Oven manual to cook food and pasteurize water in the oven. The oven has a built-in temperature gauge so the process can be monitored.

PART II: Construct homemade solar cooker. Depending on class size, students can work in groups of 3-5.

The sun's energy can be harnessed to heat water and cook food. This activity demonstrates a simple method of constructing a solar cooker. Solar cookers can be built in a variety of ways, but there are three important elements necessary in building any solar cooker:

- 1. Directing sunlight:** in this design sunlight is directed with reflectors, which help focus a wide area of light on a small space.
- 2. Absorbing sunlight:** this design uses black paint to help gather and absorb sunlight.
- 3. Providing insulation:** plastic wrap, a jar, or a plastic bag can be used to provide an isolative barrier between the food you are cooking and the air.

How to Build the Solar Cooker Worksheet

STEP 1: Gather Materials

For each solar cooker, you'll need the following:

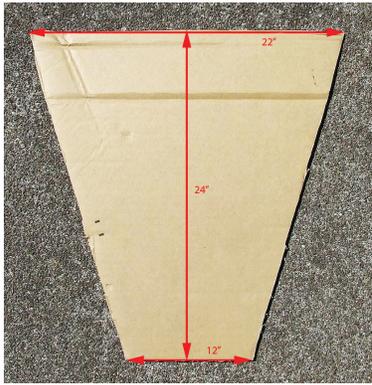
- Cardboard (4 2 x 3 feet pieces per cooker)
- A roll of heavy tin foil (18 inches wide)
- Glue (white glue or spray adhesive)
- Black paint
- Paint brush
- Scissors
- Duct tape



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source: Bonneville Environmental Foundation (BEF)

STEP 2: Construct the Reflectors



1. Cut four pieces of cardboard with the dimensions 22 x 24 x 12, as shown in the photo. When the pieces are assembled, these dimensions will create a 67° angle, which will maximize the focus of light at the base of your solar cooker.



2. Apply glue to one side of the cardboard pieces you've cut out and cover the glued side with tin foil.



3. Cover all four pieces of cardboard in tin foil.



4. Tape the four pieces of cardboard together with duct tape or another heavy, durable tape. Then connect the far ends to complete the reflector.



5. To create the base of the solar cooker, cut a piece of cardboard that will fit the opening at the base of the solar cooker. Paint one side of this piece of cardboard black. Let the square dry. When the square has sufficiently dried, tape the square to the base of the reflectors with the black side facing up.

STEP 2: Continued



6. Once the solar cooker is assembled, place it outside in the sun on a low-wind day. Shift the cooker until there are no shadows within the reflector area. You'll notice that the reflector starts to heat up almost immediately.

STEP 3: Cooking with the Sun



Now you are ready to cook. To help speed up the cooking process, you can add an isolative barrier between the food and the air. In this photo, we have placed an egg in a small cooking dish and covered the dish with plastic for insulation.

To boil and steam food in your solar cooker, you can also place food in a jar or pot with a lid for insulation. The sealed containers act as a strong isolative barrier and helps foods heat faster and reach higher temperatures.

If you are using a jar, select one that is no larger than a half gallon. Painting the jar black will further reduce cooking time, but leave a clear strip on the jar for monitoring food. If using a pot, select a dark-colored pot and seal the pot in a large zip-lock bag for additional insulation.

When cooking, don't overfill jars or pots, as food expands over time. You can poke a hole in the lid or leave it on loose to avoid pressure buildup. If food is actively boiling, open jars and pots slowly to release any built-up pressure. If a lid sticks, tap it around the edges or pry up under it to release any vacuum pressure.

Here are some solar cooking ideas you might want to try:

Vegetables: Vegetables and fruits cook well in jars with little or no water, or they can be added to things like pastas and grains. Lightly oiled potatoes cook well on a rack in the solar oven. Corn on the cob can be cooked in its own sheath.

Bread: Bread cooks well in one-pound coffee cans that are painted black. Oil the cans. Let dough rise in the cooker without collectors attached, then add the collectors when you're ready to bake. Bread shrinks, so it will come out of the cans with a gentle tapping when it is done.

Pizza: Bake the crust first. Then add toppings and cover the pizza with a clear lid to contain heat.



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source: *Bonneville Environmental Foundation (BEF)*

Adaptation: Oven Box Design



(Photo Courtesy of the Solar Cooker Archives)

One adaptation to this solar cooker design is to add a deeper box for cooking larger dishes. An oven-box design also allows for more insulation options. This design utilizes two boxes as the base of the solar cooker. One of the boxes needs to be slightly smaller than the other. Place the smaller box inside the larger box and fill the space between the boxes with insulative materials like rags, newspaper, or cut-up cardboard boxes. The smaller, inner box can be covered with Plexiglas or glass to add additional insulation when cooking.

The inside of the inner box should be painted black to aid in capturing sunlight. The reflectors for this model should be designed to meet the dimensions of the inner box. When the food is cooked, you can fold the collectors down over the glass. This provides good insulation, so the food stays hot until you are ready to eat.

You can find dozens of designs and recipes for solar ovens, learn how to pasteurize water for safe consumption, and read in-depth articles about the science of solar cookers at <http://solarcooking.org/>.