

Build Your Own Solar Oven

Background: Cooking with the Sun

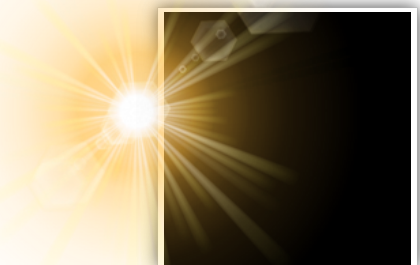
Our sun is a constant source of energy. Each day, the sun bathes the Earth in unimaginable amounts of solar energy, most of which comes in the form of visible light. All over planet Earth, sunlight is by far the most important source of energy for all living things. Without it, Earth would be lifeless.



The sun is the earth's most important source of energy.

Sunlight can be a practical source of energy for such everyday jobs as cooking, heating water, or warming up homes. The challenge is to find ways to transform sunlight into useable heat. The most efficient way to use heat from sunlight transform sunlight into heat is to shine lots of sunlight onto a dark surface. Dark surfaces absorb most of the visible light that falls upon them, and reflect very little. Visible light that is absorbed this way usually causes the dark-coloured surface to warm up. Of all colours, black can absorb the most light, and produce the most heat.

You are familiar with what happens to a dark-colored surface when sunlight strikes it: it will get warm. But without a little help, there is not usually not enough heat produced to cook foods. To produce enough heat for cooking, it is necessary to shine additional sunlight from a wider area onto the black surface. This is easy to do with mirrors or other reflective surfaces, or with glass or plastic lenses.



The solar oven you will be building from this plan uses aluminum foil to gather sunlight. The foil-covered panels of the oven reflect sunlight into the cooking chamber, which is painted black. Heat is produced when the concentrated sunlight is absorbed by the black surface of the cooking chamber. The heat is contained inside the chamber with the help of insulation, and a clear plastic oven bag. The result is a great solar cooker and yummy food!

Materials Required

- Cardboard
- Duct tape
- Black paint
- White glue
- Aluminum foil
- 1 large aluminum foil cake tin
- 1 large Ziplock bag
- Shredded newspaper
- Cardboard box

Tools

Gather together the following tools:

- Oven thermometer
- Scissors
- Paint brush
- Marker or pencil
- Measuring tape or meter stick



Solar Oven Safety (Optional Materials)

- Use sunglasses when working with shiny materials in sunlight.
- Solar ovens can get very hot! Use oven mitts or gloves to prevent burns.



Construction Plan: Building Your Solar Oven

Part A: Prepare the Reflective Panels

Before you begin:

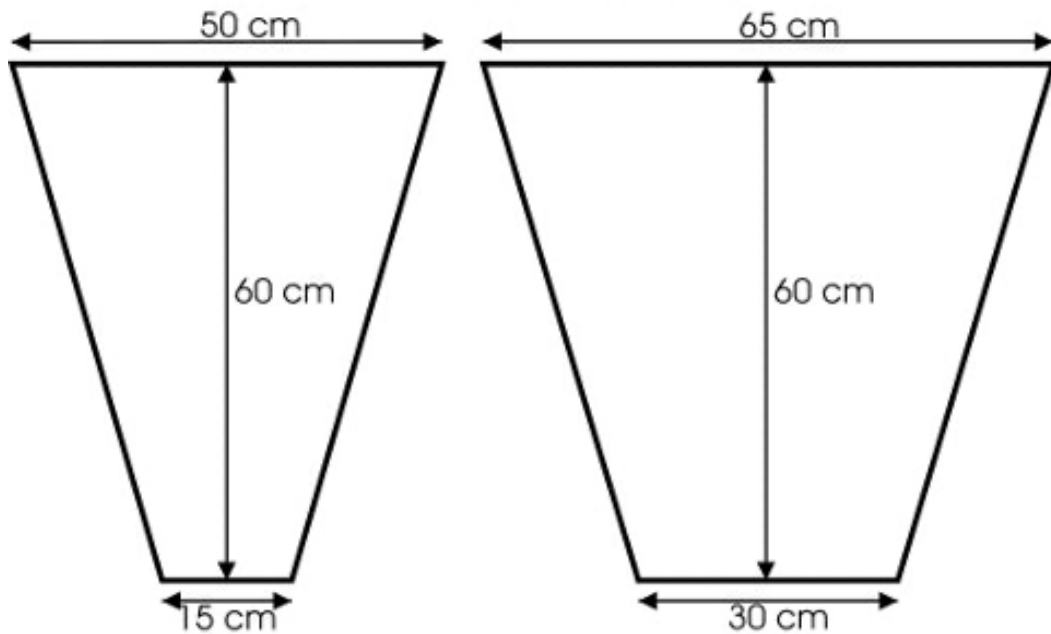
Organize your workspace. You will need a large tabletop to work on. It is very helpful to have a sink nearby for cleaning up. Arrange your materials and tools so you can get to them conveniently.

Step 1:

Using a meter stick and marker/pencil, draw the outlines of the reflector panels on your cardboard. Use the measurements on the Solar Oven Reflector Plan shown below.

Solar Oven Reflector Plan

Cut two of each of these panels



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Step 2:

Using the scissors carefully cut out the 4 cardboard segments.

TIP: Use a ruler or straight-edge to help guide your cuts.

Step 3:

Carefully unroll enough aluminum to completely cover one panel.

TIP: Keep the foil as smooth and flat as possible. Wrinkles and creases in the foil will reduce the efficiency of the reflector. If the cardboard is wider than the foil, use two pieces of foil and plan to join them near the middle.

Step 4:

Apply a thin layer of white glue over the entire surface of the cardboard.

TIP: Be sure to spread the glue right to the edge of the cardboard. Use the flat edge of a piece of scrap cardboard as a squeegee to spread the glue out evenly.



Spreading glue on the cardboard.

Step 5:

Before the glue dries, place the foil on the cardboard shiny side up, and smooth it down over the entire surface.

TIP: Try to press out any wrinkles, bubbles, or creases in the foil. If your foil gets badly wrinkled during the gluing process, tear it off and try again with fresh glue.



Smooth out the foil carefully, removing any wrinkles or bubbles as you go.

Part B: Join the Panels

Step 1:

Arrange the panels foil side down, wide panels alternating with narrow ones.



Step 2:

Carefully position the first two panels, keeping a slight space (approximately 2mm) for bending between them. Position one of your strips of duct tape over the joint between the panels. Press it onto the joint, being sure it sticks securely to both panels over its full length.

TIP: Keep a piece of cardboard handy for propping up your solar oven later.



Step 3:

Join the third and fourth panels as you did in step 2 above.

Step 4:

Carefully flip the joined panels over on the table. Reinforce the joint between each panel using another strip of duct tape.

Step 5:

Stand your reflector up (foil side in), bringing the edges of the outer two panels together and add a piece of duct tape.



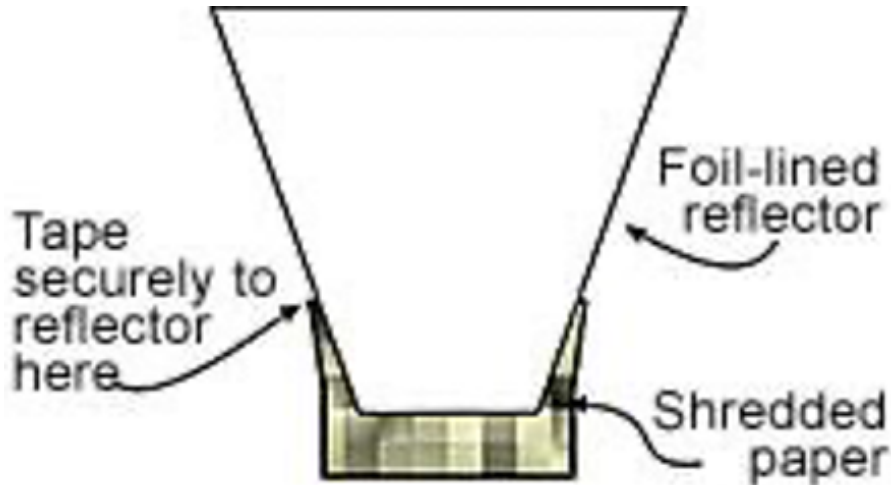
Step 6:

Finish the last joint inside the reflector by applying the remaining piece of duct tape.

Part C: Add the Insulated Box

Step 1:

Shred some newspaper by tearing it lengthwise into thin strips. You can also use paper from a mechanical paper shredder. Stuff shredded paper into the gaps between the box and the reflector. Leave a little of the paper on the bottom of the box, as shown in the illustration.



Insulate the box below the reflector using shredded newsprint.

Step 2:

Using duct tape, fasten the cardboard box securely to the bottom of the reflector by its flaps. Be sure the box is centered. Add a few strips of duct tape to the corners to make the assembly more rigid.



Part D: Prepare the Baking Chamber

Step 1:

Using the paint brush, apply the black paint evenly over the inside of an aluminum foil loaf tin. Set this aside to dry. It may be necessary to apply two coats of the paint to ensure full coverage of the aluminum.



Use two coats of black paint to coat the inside of the baking chamber.

Part E: Test and Prepare the Solar Oven for Use

The solar oven is now ready to be tested. If the glue and paint are all dry and it is a sunny day, you can warm up your oven in preparation for its first cooking job.

Step 1:

Place the oven thermometer inside the painted baking tin.

Step 2:

Slip the baking tin into the transparent plastic oven bag. Arrange the bag so that the plastic forms a smooth, unwrinkled window over the baking chamber.



Place the baking tin inside the oven bag.

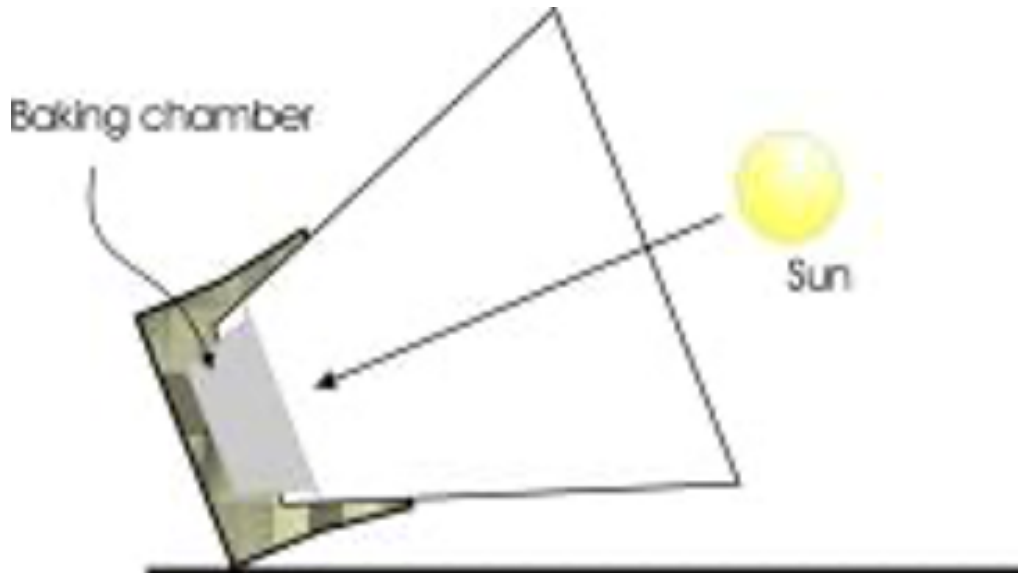
Step 3:

Press the baking chamber tightly into the bottom of the reflector.

Step 4:

Outside, arrange your cooker so that the cooking chamber is fully illuminated by the sun. The diagram below shows you how to orient the reflector to get the most heat from the sun.

TIP: You can use the cardboard you saved in Step 2 of *Joining the Panels* to prop the reflector up to keep it at the right angle. You can also use books, bricks, or other objects. Position the oven so that the baking chamber faces the sun squarely and the shadow of the reflector is minimized.



Step 5:

Allow the cooker to reach its maximum temperature (about 200 degrees C or higher) and maintain that for an hour or more. This will burn off any unwanted substances inside the baking chamber.

Warming and Cooking Food with The Sun

- If your cooker reaches 100 degrees C, you can use it for heating foods. If it gets to temperatures of 175 degrees C or higher, you can actually use it for baking.
- The plastic oven bag is extremely fragile and easily torn. Handle it carefully, especially when the cooking chamber is hot.
- For cooking and baking, you will need to find small baking tins that fit easily into your baking chamber. To improve the baking efficiency, paint the OUTSIDE of any small baking tins you want to use with the same paint and glue mixture you used to blacken the inside of the baking chamber. Be sure to heat your painted tins in the oven without food to burn off any impurities before cooking with them.
- You can use your oven to bake brownies, cookies, muffins, bread, and other foods. You can also use your oven to warm soups, stews, pizza, and pastries using your cooker. You can also bake “veggie packs” of mixed vegetables such as carrots, broccoli, onions, and potatoes.
- You may need to support the pot or tin using small stones or metal jar lids to keep them level inside the baking chamber. Whatever you use in the baking chamber, make sure it is oven-safe and free from paints, solvents, plastics, and other substances that you do not want mixing with your food. If you are not sure whether something is oven-safe, ask a teacher, parent, or adult supervisor.

Questions:

1. How could you increase the efficiency of this cooker? Describe 2 or 3 design changes that would help this cooker get hotter faster, and keep its heat better.
2. What is the purpose of having insulation (shredded paper) around the baking chamber?
3. What would happen if you painted the inside of the baking chamber white instead of black?