

Details: Your goal is to build a small solar water heater that will heat 300ml of water inside of a black aluminum soda can to the highest possible temperature in 45 minutes using solar energy as your only heat source.

Time: You will have two periods to build and test an optimal heater design.

Design Constraints:

- You may use the following materials:

2 pieces of cardboard (50cm x 50cm) (you bring)

1 piece of aluminum foil (45cm x 100cm)

2 index cards (5" x 8")

10 popsicle sticks

1 piece of clear, plastic wrap (45cm x 100cm)

1 aluminum soda can painted flat black (cannot be altered)

1 thermometer

20 toothpicks

Tape (scotch, masking, duct)

White glue

Scissors

Single-edge razor blades (be careful!)

Rulers/Meter sticks

- You do not have to use all of the aluminum foil and cardboard in the construction of your water heater, but you cannot have extra so make sure you plan carefully before you cut.
- The soda can with the 300ml of water can be placed anywhere in your solar oven, but no water may leak out the top hole. The can must be easily accessible at the end of the contest so that the water temperature can be measured.
- You must test your design for at least 15 minutes before presentation time

Competition

Each team will receive 300 mL of water at air temperature to place in their can. The team with the greatest water temperature at the end of 45 minutes will be the winner.

Design Questions

What materials are you going to use? Why are you going to use these materials?

After your first test, what modifications did you make? Why did you make these modifications?

Final Design

Draw your basic design:

Ending temperature _____ °C
 Beginning temperature _____ °C
 Change in temperature _____ °C
 X (1255.2) = _____ Joules

Which design seemed to perform the best?

Why do you think this design worked well?

How would you change your design to perform better?

There are many different types of Solar cookers. All solar cookers are based on a small pool of ideas to heat food with the sun's heat and light. The basic principles of solar cookers are:

- * Concentrating sunlight: Some device, usually a mirror, is used to concentrate light and heat from the sun into a small cooking area, making the energy more concentrated and therefore more potent.
- * Converting light to heat: Any black on the inside of a solar cooker, as well as certain materials for pots, will improve the effectiveness of turning light into heat. A black pan will absorb almost all of the sun's light and turn it into heat, substantially improving the effectiveness of the cooker. Also, the better a pan conducts heat, the faster the oven will work.
- * Trapping heat: Isolating the air inside the cooker from the air outside the cooker makes an important difference. Using a clear solid, like a plastic bag or a glass cover, will allow light to enter, but once the light is absorbed and converted to heat, a plastic bag or glass cover will trap the light inside using the Greenhouse Effect. This makes it possible to reach similar temperatures on cold and windy days as on hot days.

Alone, each of these strategies for heating something with the sun is fairly ineffective, but most solar cookers use two or all three of these strategies in combination to get temperatures sufficient for cooking.

Some examples are below:

