

Questacon at HOME

Energy Activity Sheet

Solar Oven S'mores

BACKGROUND

Have you ever cooked food outside? Maybe you've cooked food over a fire while camping, or had a barbeque? But have you ever thought about cooking with the heat energy from the sun? This can be done using a solar oven, which is a low-cost, ecologically-friendly technology. In the winter time, the sun does sit lower in the sky and we are prone to cloudy days; however, with a small amount of heat, plus some good insulation to keep the heat in the box, you can experiment with some simple cooking!

MATERIALS

- Clean pizza box or a shoe box
- Pencil
- Ruler
- Aluminium foil
- A sheet of black construction paper
- Cling wrap
- Sticky tape
- Utility knife
- Newspaper

SAFETY

A utility knife is a sharp object and should only be used by an adult.

This solar oven should not get hot enough to burn but care should be taken if being used under a hot summer sun. Avoid attempting to cook foods that could be problematic if undercooked like raw meats

Supervision is recommended for young experimenters.

PROCEDURE

On the outside of the lid of the box draw a square that is about 2cm inward from each edge. Adults will then use a utility knife and a ruler (as a straightedge) to carefully cut along the front and two sides of the square you just drew. Do not cut the side that runs along the hinge of the box (this will become the reflective 'flap'), instead fold back along the attached side, so it can open and shut.

Cover the inside of the cardboard flap with aluminium foil; fold the foil over the cardboard flap and tape it in place (try and keep the foil as smooth as possible).

Open the box lid and cover the opening made by the flap with a layer of cling wrap, using tape to secure. Make sure all the edges are sealed.

Line the inside of the box with aluminium foil – the bottom, sides and the inside part of the lid (going around the plastic covered opening). Centre and tape the piece of black construction paper to the bottom of the box.



Your oven is now ready for cooking! Simply place your food on the black paper (think of it like a cooking tray) and close the box lid. Use your ruler to prop open the flap, make sure you face your solar oven towards the sun! Depending on how much sun you have on the day, you may have to leave it for a while, but make sure you check on it every so often so you can keep it pointed towards the sun.



TIPS AND TRICKS

- Start with simple recipes, for example, you could try cooking s'mores (plain digestive biscuit, a marshmallow and a piece of milk chocolate)
- If the weather is gloomy, place your solar oven on a windowsill inside facing the direction of the sun
- Place a thermometer inside the box with your food, and see what the temperature reaches it

WHAT'S THE SCIENCE?

The process of cooking food in the solar oven utilises several scientific phenomena. Solar ovens use thermal (heat) and light energy from the sun to cook food. However, that heat and light needs to be redirected into the oven, and this is why the flap of the box lid is covered with foil and tilted at an angle. The shininess of the foil reflects the heat from the sun into the box in a process called **reflection**. It is important to adjust the flap and the position of the box to reflect all the heat you can as the sun moves across the sky.

The heat from the sun then acts to heat up the air inside the box. With the air particles gaining energy and generating heat, the next step is to keep them in the box. The cling wrap acts as a transparent, airtight barrier – allowing the sunlight in, but stopping the warm air from rising and escaping. The black paper also acts to **absorb** the heat energy (opposite to the reflective foil). This absorption of energy keeps the heat inside the box and assists with the cooking process. The **insulation** of the box is also important in trapping heat inside the box; multiple layers will help this.

WHAT QUESTIONS COULD I ASK?

- How do we know that the foil is reflective? What other materials could we use if we didn't have foil?
- Why did we use a black sheet of paper? Would the oven work as well without it? What if we used a plate instead?
- How do the seasons impact on how well our oven works? What about the weather? Can you still cook food when it is overcast outside?

WHAT'S NEXT?

Improving your design: What could you change to improve the effectiveness of your oven? Think about the materials used, amount of insulation, the angle of the reflector flap, and how well the foil reflects the sunlight.

When experimenting, saying "I don't know" is ok - solving problems is about curiosity and finding things out. If we always knew the answer we would never learn anything new!

