**ACTIVITY: Making a solar oven**

**Activity idea**

In this activity, students will learn about using the Sun’s energy to meet our needs. They will be introduced to concepts around solar energy needed for solar cooking (heat) – dark colours for absorbing sunlight, greenhouse effect, light colours for reflecting sunlight and insulation. Using this science knowledge, they will then construct and use a solar oven.

By the end of this activity, students should be able to:

* explain how solar energy can be used for cooking.
* explain the principles of solar cooking (dark coloured objects absorb sunlight, double glazing traps and helps retain heat (a greenhouse effect), light coloured objects and shiny surfaces reflect sunlight, insulation slows heat energy transfer)
* construct a solar oven
* use the Sun to obtain maximum heating (setting the reflector to reflect sunlight into the oven and positioning the oven to face the Sun throughout the cooking time).

[Introduction/background notes](#Introduction)

[What you need](#need)

[What to do](#do)

[Extension ideas](#extension)

Student worksheet: [How to make a solar oven](#making)

**Introduction/background**

This activity describes how a solar oven can be constructed from a pizza box. It is then up to the teacher to determine how much input (for the construction) is needed for the students.

Obviously the Sun needs to be shining brightly for this activity. For this reason, terms 1 or 4 are probably better times for this activity and for a unit on solar energy.

This is a practical technology activity that can be successfully carried out if scientific concepts around solar energy are understood. Students should have completed the activities in [Using heat energy](http://link.sciencelearn.org.nz/resources/1751-using-heat-energy) to gain a good understanding of the principles involved to successfully complete this activity.

Teachers should also read the article [Using solar energy](http://link.sciencelearn.org.nz/resources/1747-using-solar-energy) for a more complete understanding.

Four concepts students will need to understand:

* Absorption – dark coloured objects (especially black) absorb sunlight and transform it into heat energy.
* The greenhouse effect allows sunlight into an area where it is transformed into heat energy. Heat energy is then trapped for a period of time in that area (it transfers slowly).
* Insulation – materials that insulate help to retain heat by slowing down the transfer of heat.
* Reflection – shiny, smooth surfaces (for example, aluminium) and light coloured objects reflect light. Aluminium is used to reflect light into the oven.

7-year-old students have built these solar ovens and cooked in them. They needed more specific instruction and support with the construction of the ovens than older students. For younger students, show an oven already made and discuss the scientific aspects of its construction and how each part contributes to the cooking.

Both younger and older (9–10 years) students enjoyed discussion around the concepts and why certain aspects of the construction are important.

Questions to encourage thinking:

* How can we get the sunlight into the box?
* How can we trap the sunlight in the box?
* How can we keep the heat in the box?

To reinforce the science concepts and to link understanding of those concepts to the oven (technology) during construction, questions could be asked such as:

* Why do we need to paint the box black?
* Why do we need clear plastic covering the box? Why do we need 2 layers?
* What do we need the rolled up paper for?
* What does the aluminium foil do? (Note: Both sides of the foil reflect sunlight)

More capable students enjoy being able to design their own ovens based on their science learning.

There is also an alternative [solar oven construction activity](http://link.sciencelearn.org.nz/resources/1591-making-a-solar-oven).

**What you need**

* Student worksheet: [How to make a solar oven](#making)
* Pizza boxes
* Black paint (or black paper)
* Sheets of clear plastic or cling film (keeping it as smooth as possible)
* Aluminium foil
* Newspaper
* Craft knife
* Tape
* Nail
* String
* Drawing pin
* Food for cooking, for example, bread, spaghetti, cheese, biscuits, marshmallows, chocolate

**What to do**

1. Discuss what would be needed to make an outdoor (solar) oven. Ideally, students should have already learned about solar energy. Discussion should revolve around how heat energy could be harnessed from the Sun and concentrated in the oven.
2. Discuss as a class how the oven could be constructed using the four science concepts for harnessing heat energy – absorption, greenhouse effect, insulation and reflection.
3. Assist groups of students to select items and construct their ovens. Students will also need to determine when the food is cooked (depending on the strength of the Sun and the food to be cooked). Cooking time could be an hour or more.

**Extension ideas**

Challenge students to improve the efficiency of their oven. Make some modifications (for example, make the flap a concave shape to concentrate the sunlight onto the food; use a firmer, smooth plastic instead of the cling film so the sunlight can go straight through without reflecting off wrinkles in the plastic; set the food on a piece of aluminium that is curved up a little to reflect light back onto the food). Students could compete with other groups to see which oven cooks the fastest after they’ve made their modifications.

**Student worksheet: How to make a solar oven**



1. Paint the whole box black – inside and out and leave to dry (or line the base of the box with black paper).
2. Draw a square on top of the lid about 5 cm in from the outer edge and then use a craft knife to cut along the front and two sides. The hinge of the flap should be on the same side of the box as the lid hinge. Fold the flap back.
3. Tape a layer of clear plastic or cling film over the gap on the outside of the lid. Open the lid and tape another layer of clear plastic or cling film to the inside of the lid (for a double glazing effect). The tape should seal the cling film to the box (one run of tape along each side) so that there are no gaps. The two layers of see-through material let in the sunlight but then help to trap heat energy in the box by slowing heat transfer.
4. Tuck rolled up newspaper around the inside edges of the box to insulate the box and help reduce the rate of heat energy transfer.
5. Line the flap with aluminium foil on the under side. The aluminium-lined flap can be bent back and set at an angle to reflect light into the box. Aluminium is shiny and behaves like a mirror to reflect light.



1. The aluminium-lined flap can be held in place by attaching a piece of string (with a drawing pin) to the front edge (centre) part of the flap. Insert a nail (or stick) into the base of the box at the back. The string can then be wound around the nail to position the flap for the best reflection of sunlight into the box.
2. Make up food to be cooked (bread, spaghetti with cheese on top, or biscuits with marshmallows and chocolate on top).
3. Place your group’s food in the oven.
4. Place the oven in a sunny spot – the aluminium foil should face the Sun and reflect light into the box.
5. During cooking, keep checking the oven to see it is still facing the Sun for the best heat.