

### **Activity: Building a solar oven**

Natural Science Senior Phase CAPS (Curriculum and Assessment Policy Statement) relevance

This activity has relevance to two topics in the CAPS at two different grade levels.

These are:

Grade	Topic	Content & Concepts
Grade 7 Term 3	Insulation and energy saving	Insulating materials slows down heat transfer (heat loss or gain) through conduction, convection and radiation
Grade 9 Term 3	Cost of electrical power	Alternative appliances/systems such as solar heating panels for heating water

Although the CAPS suggests designing a 'hotbox' as an activity, the designing, making and testing of a solar oven provides an alternative that incorporates the same principles of insulation, heat conduction, convection and radiation.

### **Background knowledge required before attempting the task**

Learners need to understand:

- That the sun releases energy in the form of electromagnetic radiation, which we experience as heat and light.
- Energy laws.
- That South Africa has one of the highest solar insolation levels in the world.
- That energy can be utilized in different ways e.g. solar thermal power stations.
- That black colour absorbs heat, causing the black material to retain heat and therefore heat up quicker.
- The principle of the greenhouse effect.
- The properties of light, e.g. light travels in straight lines and reflection.

Resources

- Textbooks: Physical Science, Natural Science and/or Life Science – Chapters on Energy, Light and Colour
- Websites: e.g. [www.homemadesolar.net](http://www.homemadesolar.net)
- Encyclopaedias

## Assessment Criteria

Assessment Criteria	Performance indicator levels		
	10-7	6-4	3-0
<b>(Individual) Answer to questions</b>	Shows understanding of task	Shows partial understanding of task	Shows no understanding of task
<b>Group work</b>	Effective group work Everyone participated Good communication	Partial participation Poor communication	No group work
<b>Apparatus</b>	Correctly used	Partially correctly used	Not used correctly
<b>Neatness of Solar Oven</b>	Very tidy	Tidy	Untidy
<b>Functioning oven</b>	Oven heats food up within the allocated time	-	Does not heat up food properly

### Step-by-step instructions on how to build a solar oven (Group work)

Things you'll need:

- Non-toxic glues and sellotape or staplers
- Scissors
- Pencils
- Aluminium foil
- Cardboard
- Large and small cardboard boxes
- Plastic wrap
- Newspaper
- Black construction paper or black paint
- Piece of wire

Step 1

Choose two boxes that fit inside each other with approximately 4-5 cm space on each side.

#### Step 2

Crumple up newspaper and line the bottom of the larger box with it.

#### Step 3

Place the smaller box inside the larger box and make sure that the smaller box sits level with the rim of the larger box.

#### Step 4

Fill the space between the sides of the two boxes with crumpled newspaper.

#### Step 5

Cover the sides of the smaller and larger box with aluminium foil and fix it in place, either by using sellotape or folding the edges of the foil over the top of the box to hold it in place.

#### Step 6

Cover the bottom of the inside of the smaller box with black construction paper or paint aluminium foil black.

#### Step 7

Make the lid. Use a pencil to trace the circumference of the larger box onto a large piece of cardboard. Then add 2 cm around the trace line and cut out. Place the cardboard onto the larger box and cut flaps so that they can be bent down to fit over the outer box. Glue the flaps together, but do not glue the lid onto the box.

#### Step 8

Make a reflector. Place cardboard onto the boxes and trace the outline of the smaller box. Then cut three of the sides so that the inner square can bend up. Cover and glue the foil on the inner side of the cut-out square and make sure that all wrinkles in the foil are smoothed out.

#### Step 9

Secure the reflector with the wire at an angle of approximately 50 degrees.

#### Step 10

Place the oven on an open area with the reflector facing the sun for maximum exposure.

#### Step 11

Place the food into the oven. Situate the oven with the box opening up and the reflector facing the sun for maximum heat. Also place a thermometer in the oven.

#### Step 12

Wrap cling wrap across the top of the larger box. Secure the cling wrap with sellotape around the entire oven to ensure that no heat can escape.

#### Step 13

Measure the temperature of the oven every 10 minutes for an hour and record them in a table.

#### Step 14

Draw a graph of your temperature measurements over an hour.