KS3 Lesson Plan

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Lesson 10	Solar Thermal Insulation		
Level	Key Stage 3	**Time required**	30 minutes

National Curriculum Links

Science, Maths (view scheme of work for full details of links)

Aims

- The students will learn how insulation can improve the efficiency of a solar thermal heating system
- They will experiment with the Solar Water Heater Kit both with and without insulation

Resources required

Solar Water Heater Kit, timer, optional: lamp (with incandescent bulb)

Web search keywords

Solar thermal energy insulation, solar water heater insulation

Solar Water Heater Kit

Ensure the students are familiar with the Solar Water Heater Kit and how it works before starting the experiments.

Instructions are included with the Solar Water Heater Kit. These can be downloaded in PDF format: http://www.ecostyle.co.uk/products/solar_water_heater_kit/solar_water_heater_kit_activity_sheets_v2.15.pdf

The digital thermometer is originally designed to monitor refrigerator temperatures. The instruction booklet contains further details including setting a minimum/maximum temperature alarm.

Risk assessment

The aluminium heating fin, copper heating tube and the water inside the tube may become very hot during use. Avoid leaving the kits in direct sunlight when not in use. Allow the kits to cool down before handling. Stop the experiment when the temperature exceeds 50°.

Task 1

Remove the black solar collector fin, copper tube and digital thermometer from the plastic case. Remove the white foam insulating block from inside the case and put it to one side.

Remove the solid orange bung and fill the copper heating tube with cold tap water. Replace the bung.

Put the solar collector fin, copper tube and digital thermometer back into the plastic case. Feed the digital thermometer through the slot in the case so that the thermometer is outside the case. Close the case and fasten the catches.

Place the case on a windowsill or outside in the sun. Record the ambient temperature and the temperature inside the copper heating tube by toggling the 'Room-Fridge' button. When the display shows 'Room' this is the ambient temperature, and 'Fridge' is the temperature inside the heating tube.

After 5 minutes have elapsed on the timer, record both the ambient temperature and the temperature inside the copper heating tube by toggling the 'Room-Fridge' button.

Record the weather conditions, e.g. the sun was behind thin cloud etc.

Task 2

Remove the black solar collector fin, copper tube and digital thermometer from the plastic case. Put the white foam insulating block back inside the case.

Remove the solid orange bung and fill the copper heating tube with cold tap water. Replace the bung.

Put the solar collector fin, copper tube and digital thermometer back into the plastic case on top of the white foam insulating block. Feed the digital thermometer through the slot in the case so that the thermometer is outside the case. Close the case and fasten the catches.

Place the case on a windowsill or outside in the sun. Record the ambient temperature and the temperature inside the copper heating tube by toggling the 'Room-Fridge' button. When the display shows 'Room' this is the ambient temperature, and 'Fridge' is the temperature inside the heating tube.

After 5 minutes have elapsed on the timer, record both the ambient temperature and the temperature inside the copper heating tube by toggling the 'Room-Fridge' button.

Record the weather conditions, e.g. the sun was behind thin cloud etc.

What happens to the temperature?

Plot a graph comparing both sets of results.

Ask the students to consider why the temperature has risen more rapidly when the foam block is in place. This is due to the insulating properties of the foam.