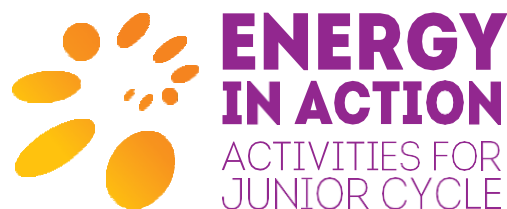


Strand B

Heat Energy

B5: HEAT ENERGY BY RADIATION



B5 ACTIVITY 3: SOLAR HOUSE HEATING

Background

This activity provides students with some experimental evidence of the **greenhouse effect**, as well as introducing them to **convection currents** as a means of heating houses using the Sun's heat. Again, use is made of the **thermofilm** and the **calibration chart** from **B1 ACTIVITY 3 (II): CALIBRATING THERMOFILM**.

Dark coloured materials absorb **infrared radiation** and **emit** the radiation readily. However, **glass is opaque to infrared radiation**.

During the investigation thermofilm, fixed onto black card which is inside a boiling tube, registers a rise in temperature. As it is the infrared radiation that, emitting heat energy, causes a change in temperature, students may ask why the temperature rises in the boiling tube.

The light energy from the lamp will pass through the glass tube. The black card will transform this visible light into infrared (heat). This in turn raises the temperature of the card as seen by the colour change of the thermofilm.

Students will now need to **explain** the rise in temperature. Because glass is opaque to infrared radiation, the air inside the tube is heated, so it rises to the top. This is why adding layers of glass to the outside of a building can result in heat gain inside.

Suggested approaches:

- Start with a short brainstorming session to learn what the students know about the greenhouse effect. Some key terms can be suggested.
 - ① *Is global warming a problem or not?*
 - ① *What if the Earth's surface was minus 20°C, the same temperature as the moon?*
 - ① *There is a current focus on climate change and sustainability – why is there a focus on these issues now and what has using energy from the Sun got to do with it?*
 - Let the students' ideas stand, and come back to them after the activity.
-

Equipment required (per group):

- Boiling tube
- Bung to fit boiling tube
- Test tube rack
- Two strips of thermofilm (10 cm x 5 cm) each on black card
- Lamp (an incandescent lamp is best)
- An energy efficient bulb
- Calibration chart for the thermofilm from **B1 ACTIVITY 3 (II): CALIBRATING THERMOFILM**

Strand B

Heat Energy

B5: HEAT ENERGY BY RADIATION

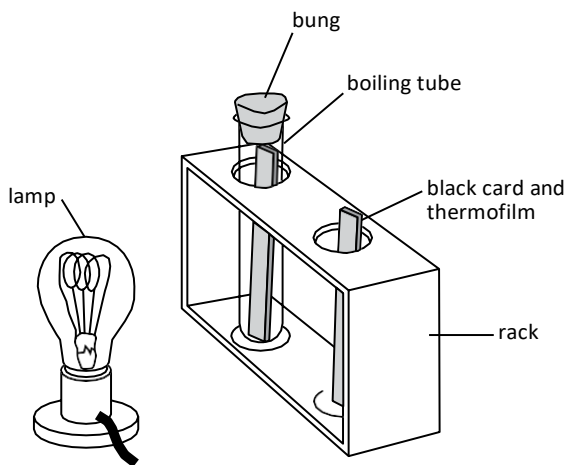


Figure 33

What to do:

1. Put one of the black strips with thermofilm into the boiling tube. Bung it and place it in the rack as shown in Figure 33, making sure that the thermofilm is facing the lamp.
2. Place the second strip in the rack near the boiling tube as shown in Figure 33 making sure this thermofilm is also facing the lamp.
3. Place the lamp about 40 cm from each strip.
4. Switch on the lamp.

Observe and **record** any colour changes on the strips.

5. Using the calibration chart, relate the colour changes to the appropriate temperature.

❓ *If there are changes, are they surprising ones?*

❓ *Why?*

❓ *Do you think we would obtain the same result if we used an energy efficient bulb?*

6. Repeat the experiment using an energy efficient bulb and compare your predictions with the outcome.

Resource:

- [Click here](#) to view this activity online from the National Stem Centre, UK.