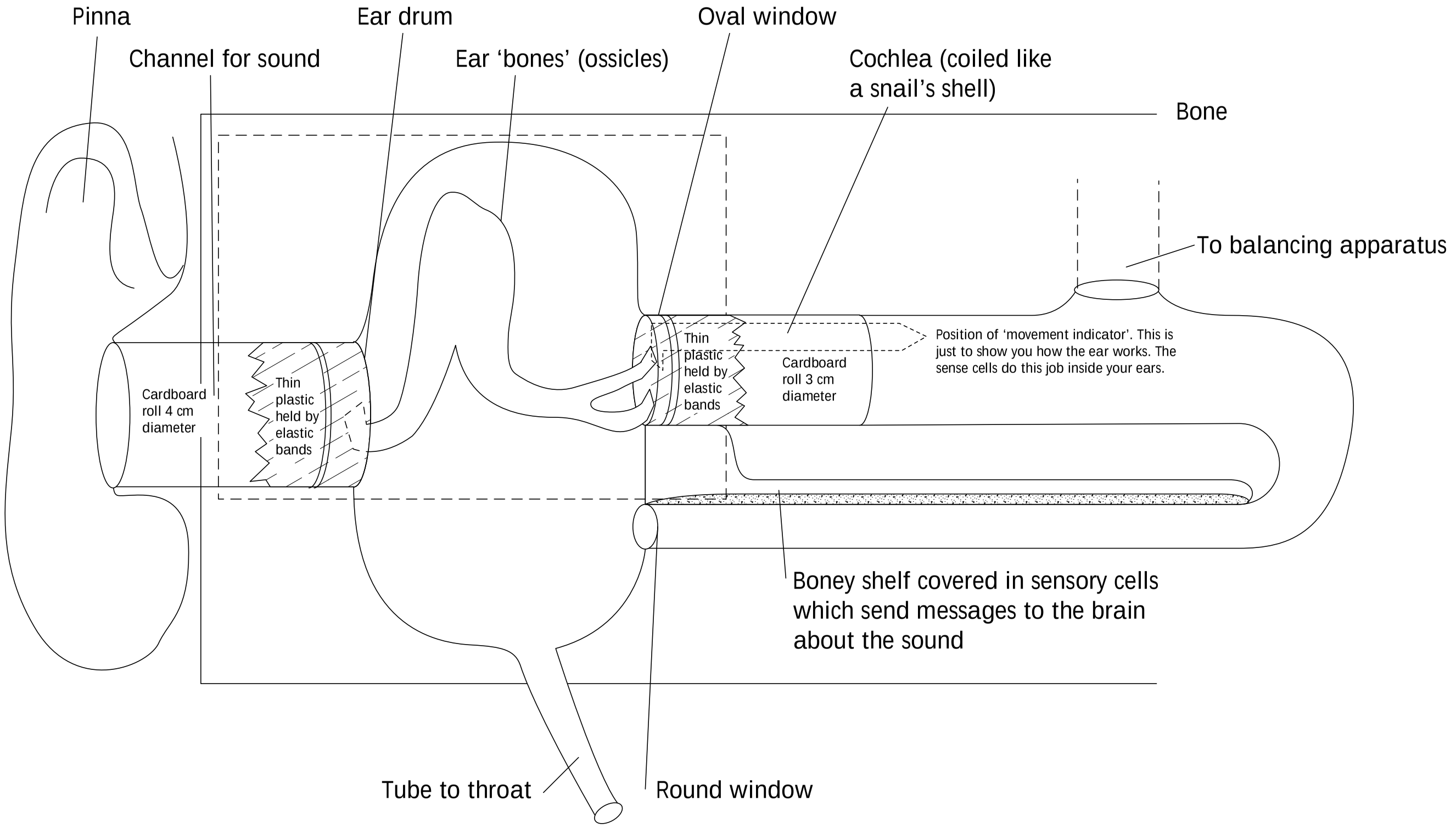
Name .....

Hearing and Sound

Class .....



Set 3: Sc4 Poster 2: Hearing and Sound

TEACHER'S NOTES

National Curriculum

Programme of study Sc4 (iv)
Pupils should learn that sounds are heard because they travel to the ear and that they can do so via a variety of materials

Sc4 (5f)
Know that sound is produced by a vibrating object and travels as a wave

Sc2 (5a)
Be able to name and outline the functions of the major organs and organ systems in mammals

Activities

This poster consists of a diagram of the internal structure of part of the ear and templates so that the middle portion of the poster can be turned into a working model.

Pupils will need a postcard or record card, a card roll from inside a kitchen towel roll (diameter 4 cm), a card roll from an aluminium foil dispenser (diameter 3 cm), two elastic bands, two pieces of thin plastic sheet (from a carrier bag), a small bead, a paper fastener, sticky tape, and card from which to cut out the ossicles and the movement indicator. Templates for these are provided on the right for the teacher to copy as needed. Construct the 'ear' as follows:

1 Fasten pieces of plastic sheeting securely around one end of each cardboard roll.
2 Cut out the ear ossicles ('bones'), and fold in the places marked.
3 Punch a hole through the card and the 'bones' and rotate so that the hole becomes slightly enlarged. Locate the small bead through the fastener behind the 'bones' and rotate so that the hole becomes slightly enlarged. Locate the small bead through the fastener behind the 'bones' and then secure on to the postcard. Make sure that the 'bones' can move quite freely.
4 Tape the card rolls into position and then glue the flaps on the 'bones' to the plastic, arranging them as shown in the poster. It can be glued into position, or just held carefully in place.

Pupils can either blow the membrane or use the blunt end of a pencil to push the plastic sheet from inside the left-hand card roll so that it moves the 'bones'. Repeated pushing behind the flap attached to the sheet works most effectively. The bones should vibrate and push against the second plastic sheet. This should vibrate gently and cause the indicator to move.

Background information

Pupils should appreciate that the model of the ear imitates how we hear most sounds. Imagine a loud bang made as a door is slammed. The noise sets off vibrations or sound waves which travel through the air in all directions. Very quickly some of these reach the ear, and the pinna directs them into the channel which ends in the eardrum. The vibrating air causes the eardrum to vibrate, the ear ossicles move backwards and forwards thus causing the membrane on the oval window to vibrate. This is the movement that pupils will see in their model. This vibrating membrane makes the liquid inside the cochlea move (like ripples on a pond) and this stimulates the sensory cells which send messages to the brain which interprets the sensory information and we 'hear' the sound.

The poster shows the cochlea as a straight tube so that it is easier to understand how it works. It is actually coiled up. The balancing apparatus is joined to the cochlea, but this has been left off. The Eustachian tube is shown as this is important in relation to our ability to hear. It is connected to the throat, and allows the pressure inside the ear to be the same as the air outside. This helps stop the eardrum from being displaced or even bursting. A complete diagram with full labelling is provided on the right to help with any questions which may arise from these omissions.

Extension activities

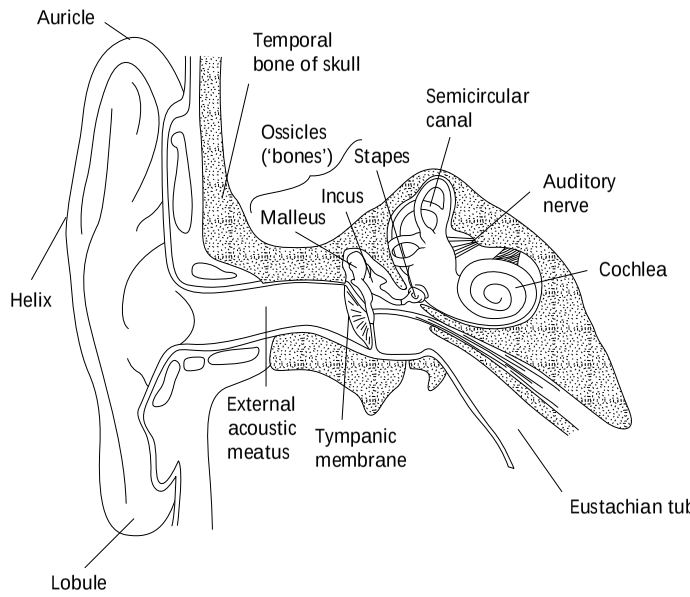
The whole ear is embedded in the temporal bone which makes up the side of the skull, and sounds can be transmitted directly through the bone to the hearing mechanism. Pupils might like to investigate this. Hold a ticking watch near to one ear and move it slowly away until the sound cannot be heard. (Quartz and battery watches usually do not tick.) Place earplugs or cotton wool into both ears and check that the ticking sound cannot be heard. Place the watch firmly against the bone immediately in front of the ear, and see if the ticking can be heard. Try different parts of the skull. Sounds can be transmitted through a range of materials. Pupils might like to investigate this by making model telephones of different materials (eg yogurt pots, plastic bottles, chocolate boxes) and transmitting gentle sounds along different solid or hollow tubes. Quiet sounds are essential for this to work, otherwise the sound will also be transmitted through the air.

Cross-curricular links

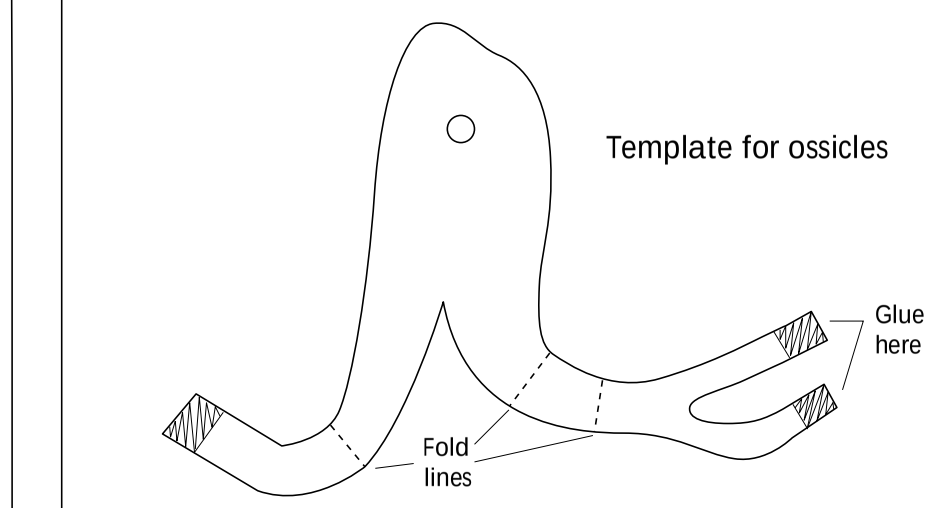
Music
Look at how different musical instruments generate sounds. Investigate the instruments used in different cultures and countries.

Technology
Construct musical instruments from recyclable materials.

The parts of the ear



Template for movement indicator



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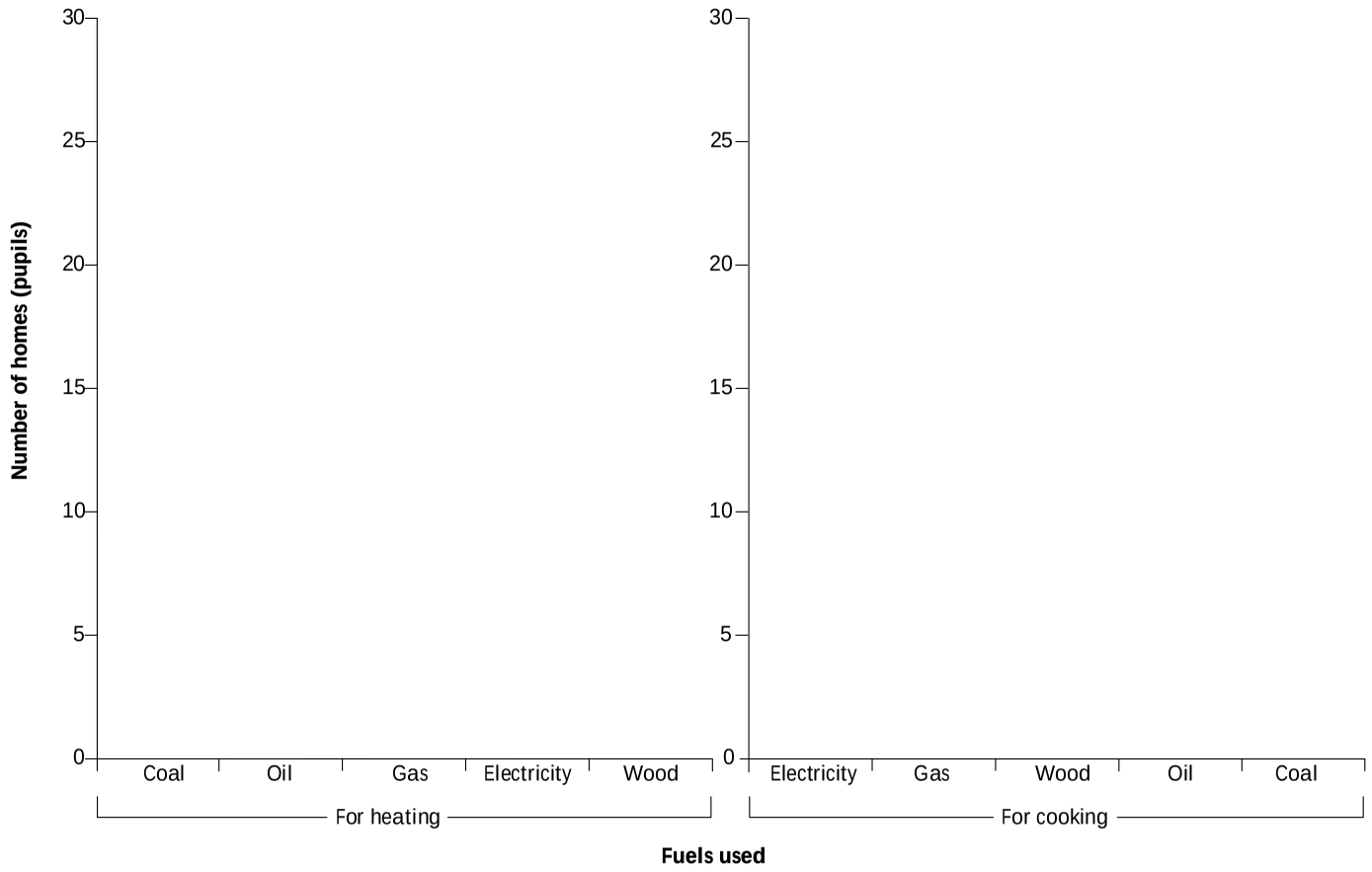
Name .....

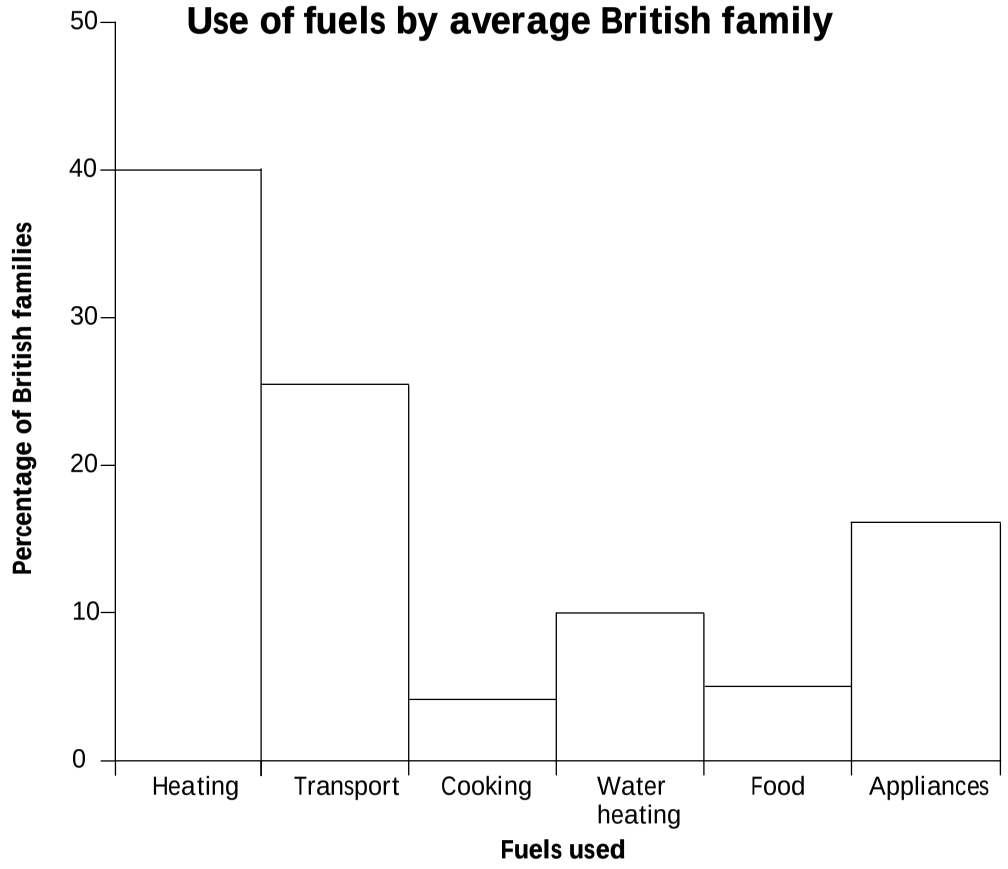
Fuels and the Home

Class .....

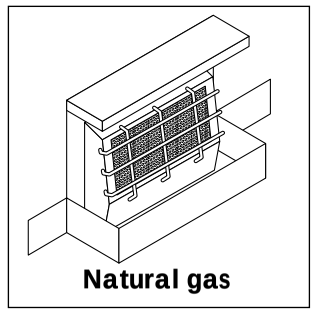
Fuel use

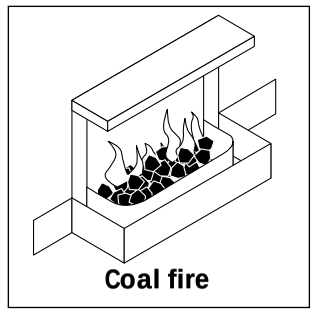


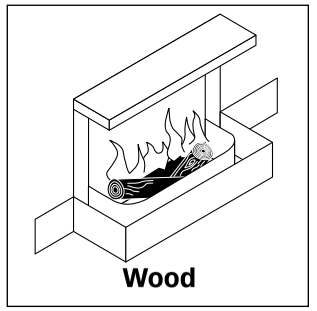
Use of fuels by average British family

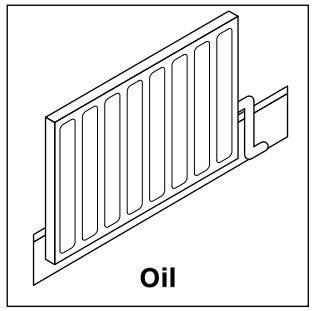


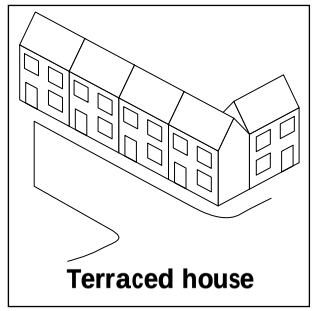
Mix and match pictures

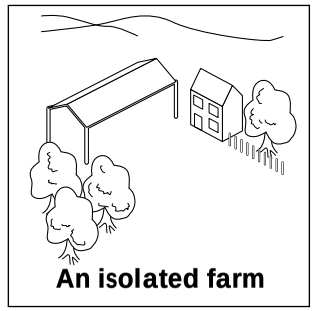

Natural gas

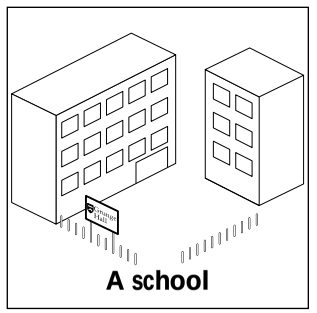

Coal fire

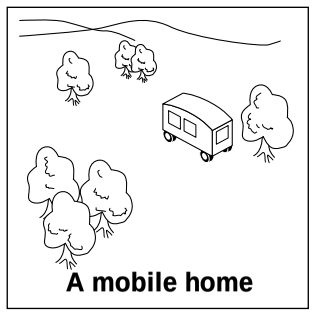

Wood

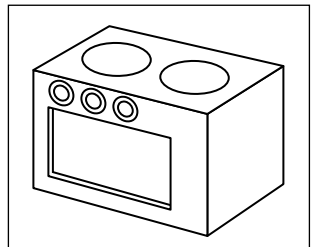

Oil

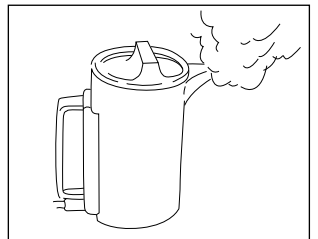

Terraced house

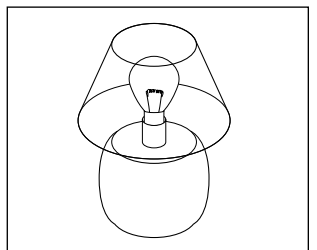

An isolated farm

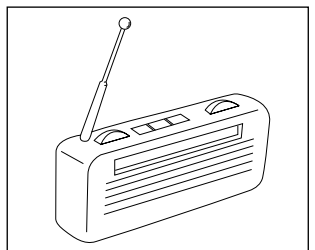

A school

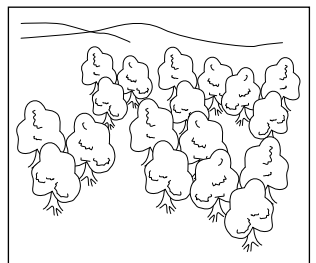

A mobile home

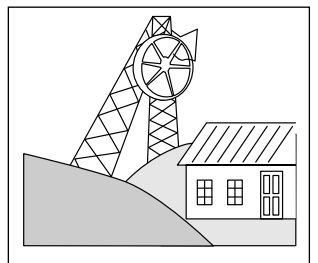

Baking a cake

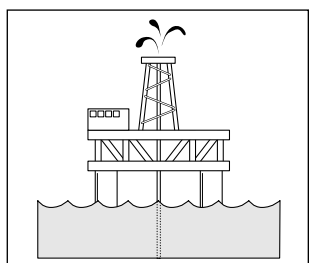

Boiling a kettle

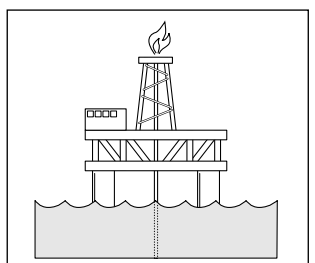

Lighting a lamp


Listening to music


Forests


Coal mine


Oil field


Gas field

Power transferred in watts
(energy transferred each second)
3000 W

Power transferred in watts
(energy transferred each second)
1500 W

Power transferred in watts
(energy transferred each second)
60 W

Power transferred in watts
(energy transferred each second)
16 W

Set 3: Sc4 Poster 6: Fuels and the Home

TEACHER'S NOTES

National Curriculum

Sc4 (3b)
Know that there is a range of fuels used in the home

Sc4 (4b)
Understand that an energy transfer is needed to make things work

Programme of study Sc4 (ii)
They should survey, including the use of secondary sources, the range of fuels used in the home and at school, their efficient use and their origins

Activities

Pupils could begin this topic by finding out which fuels are used in their homes. It is surprising how many will be unaware of this, especially those with central heating where the fuel used is less obvious. This information can be collated by the teacher and recorded by pupils on the poster. Grouping the information – fuels used for space heating, those used for cooking helps to make the bar chart easier to use. Some pupils will use several different fuels, generally fossil fuels. Pupils might like to consider how their chart would be different if they lived in a developing country instead of one with readily available supplies of fossil fuels.

The second activity is probably best set out by glueing the pictures onto thin card and mixing them up. For simplicity, each of the five groups of pictures could be copied onto a different colour of card. Pupils should then colour the pictures and use them for several tasks: Which of the four fuels would they use in the terraced house? Which fuel is best for the other types of homes (they may need extra copies of the pictures)? Match the fuels to the correct raw material. Match the household appliances to their power ratings (see Background information).

Each of these questions could be used as the basis for discussion and research.

For example, reasons for selection of fuels in the homes – availability, cost and convenience. Environmental effects. How were coal, oil and gas formed? Why is electricity used in so many household appliances? Which machines use most energy?

The following scenario could be put to pupils for them to investigate: Imagine that grandma lives in a terraced house in a town. It takes 50 000 kJ to warm a room for 24 hours. All the different types of fuel are available but can grandma afford them, given that she has £1.40 to spend on heating the room for a week?

Fuel	Energy kJ	Approximate cost per day (pence)
Coal	50 000 from 1.6 kg	20
Wood	50 000 from 3.5 kg	15
Natural gas	50 000 from 1.25 m^3	21
Oil	50 000 from 1.16 l	15

Possible answers:
Terraced house: Grandma probably requires instant heat so oil and gas are good. Coal could be used but she may not be able to carry it and it does not provide instant heat. As cost is also a consideration for grandma, gas is not an option as it is too expensive.

An isolated farm: a wood fire is most likely or they may be able to get oil or coal delivered.

A school: gas or oil are most suitable.

A mobile home: gas cylinders are most suitable. Oil or wood fuelled stoves could also be used.

Background information

Until about 300 years ago wood was the major source of energy. This was replaced by coal partly because coal transfers more energy for the same mass.

Fossil fuels contain more energy per unit mass than wood because the plant material has been concentrated as compression etc has occurred.

The most important factor in selecting a fuel must be availability – hence developing countries use different fuels in differing amounts. Cost and convenience depend on the situation and location of the home.

When fuels are burned the energy is transferred as heat. In cars this takes place in an enclosed space so that kinetic energy can be obtained. (See Poster 6.) Electricity is a convenient way of transferring energy generated from a fossil fuel (or nuclear power.) This is readily available, hence its use in household appliances.

Power ratings indicate the transfer rate in Joules per second (J/s) per second or watts (W) used by a machine (1W = $1Js^{-1}$).

Oven 3000 W, Kettle 1500 W, Lamp 60 W, TV 120 W, Radio 16 W, Vacuum cleaner 600 W.

To find out which machines use most energy the wattage and the time in use needs to be known.

	Watts	Time	Energy used
Bake a cake	3000	40 mins	7200 kJ
Boil a kettle	1500	5 mins	450 kJ
Use a lamp	60	2 hrs	43.2 kJ
Listen to music	16	1 hr	25.2 kJ

Extension activities

The oil, gas and coal industries are very extensive and provide much scope for project work. There are resource packages available from the industries, and many excellent science and geography books on these subjects. Pupils could find out about the energy exchanges that we do not want to happen eg loss of heat from homes and factories. Estimates for a home suggest that heat loss is divided amongst the following areas: walls 35%, roof 25%, floor 20%, windows 10%, draughts 5%, chimneys 5%.

They could look at the most popular methods of energy conservation, how they work and the cost involved.

Cavity wall insulation	Saving £60 - £80
Loft insulation	Saving £50 - £60
Thermostats on radiators	Saving £15 - £30 for 1°C reduction
Double glazing	Saving £20 - £30
Draught proofing	Saving £20 - £30
Buy energy efficient machines	Saving on a fridge freezer £20
Low energy bulbs	Saving up to £8 per light bulb

Figures based on an average size gas centrally heated, semi-detached house for one year but does not include costs of materials. (From Department of Environment booklet.)

Cross-curricular links

Mathematics
Many of the figures could be presented as bar charts or pie charts. Pupils could calculate energy used by different appliances.

Technology
Older pupils could make a model house from a shoe box. Using a bulb lit by a battery to provide heat they could monitor heat loss when different types of insulation are used. (Care should be taken against fire and /or using flammable materials next to the bulb.)

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