

Chapter 4: Energy on the Move

Aim

The aim of this chapter is to explore how energy can be transferred from one object or medium to another. Energy can be transferred through solids (conduction), through water/air (convection) and from the sun (radiation).

Overview of Chapter

There are three lessons in this chapter. The first investigates conduction, the second convection and the third radiation.

Working Scientifically Skills

The children will be applying and developing the following working scientifically skills:

- Observing
- Predicting
- Investigating and experimenting
- Estimating and measuring
- Recording and communicating



Lesson link

3rd and 4th Class Programme Chapter 4: all lessons

Lesson 1 – Conduction**Resources****IWB 5 / PowerPoint 5: Energy on the move - Conduction, convection and radiation**

1 long metal spoon, bowl or tray, hot water (or packet soup), butter, pea or plastic bead

Activity type: Teacher led investigation

Use **IWB 5 activities/PowerPoint 5:** to find out and develop the children's ideas about conduction.

Questions to promote discussion

- 1 What equipment is used for cooking food? (*saucepans, frying pan, wooden spoons, plastic spoons etc.*).
- 2 What materials are these made from?
- 3 Why do you think different utensils are made from different materials?
- 4 Why do you think saucepans are made from metal?

Investigation question: "Can heat move through metals?"

Place a pea on a blob of butter half way up the long metal spoon and a second pea on a blob of butter towards the top of the metal spoon (See illustration on **IWB 5 / PowerPoint 5**). Ask the children to predict what they think will happen to the peas if you place the spoon in a bowl of hot water. Encourage them to give a reason for their predictions. Pour hot water into a bowl. Place the round end of the spoon in hot water. Observe which pea falls off first. Discuss the investigation with the children.

Questions to promote discussion

- 1 What did you predict would happen?
- 2 What happened?
- 3 Which pea fell first?
- 4 Why do you think this happened?
- 5 What does this tell us about metal and heat? (*this shows that heat travels up through the spoon*).

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Lesson 2 – Convection

Resources

IWB 6 / PowerPoint 6: Energy on the move - Conduction, convection and radiation

Small plastic bottle with lid (yogurt drink/travel bottle), needle (to make a small hole), thread, food colouring, beaker or glass (must be transparent), hot water, cold water, blu-Tack

Activity type: Teacher led investigation

Teacher note: This investigation could also be conducted in groups but care is required when handling hot water.

Put a small hole in the lid of the bottle and place a thread through it. Tie a knot in the thread. Place a pebble or a piece of blu-tack inside the bottle to weigh it down. Fill the bottle with hot water as near to the top as possible so that there is no air bubble. Add 2 or 3 drops of food colouring to the water. Ask the children what they think will happen if you submerge the bottle of coloured water into a beaker of cold water. Ask them to give a reason for their predictions. Ask each child to draw a diagram of what they think will happen. Drop the bottle of hot coloured water into the beaker of cold water and observe. Discuss their observations.

Questions to promote discussion

- 1 What did you see? (*food colouring comes out of the bottle and rises into the beaker*).
- 2 Why do you think this happened? (*the hot coloured water is less dense than the cold water and therefore it rises*).
- 3 What happened to the clear water? (*it changes colour starting from the top of the beaker*).

Lesson 3 – Radiation

Resources

IWB 7 / PowerPoint 7: Solar oven

PCM 14: Planning your investigation

PCM 15: Recording your investigation

3 different sized pizza boxes, stiff black paper, aluminium foil, clear plastic (plastic cellophane works well), glue, cellotape, scissors, rulers, markers, small bar of chocolate, 3 small paper plates (to fit inside the oven), lollipop sticks or dowel, blu-tack

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Activity type: Design and make

Teacher note: This lesson is divided into two parts. In the first part the children make a pizza box solar oven which demonstrates radiation (energy from the sun) and in the second part they use the solar oven to carry out a fair test investigation. Ideally the investigation should be carried out on a sunny day. Three solar ovens per class are required to conduct the investigation.

Show the children the materials that are available to make the solar oven (see resource list). Discuss the properties of these materials for example foil is a reflector of light, black paper absorbs light. Explain that they are going to make 3 solar powered ovens by attaching these materials to the inside of the pizza boxes (see image on **IWB 7/ PowerPoint 7**). Children make 3 ovens per class. More ovens can be made depending on the availability of resources.

Further directions for making the pizza box solar oven are available from **The Energy File: The pizza box solar oven (page 32)**. Make sure to cover the inside of the box with foil.

Now use your ovens to investigate the question below.

Activity type: Investigation

Teacher note: This lesson investigates heat transfer and looks at one method of using the sun's radiation as a renewable source of energy. For further information on solar energy please visit: www.seai.ie/Renewables/Solar_Energy/

Brief explanation

Heat from the sun gets trapped inside the solar oven, which starts to get very hot. How does it happen? The foil reflects rays of sunlight into the box. Rays pass through the plastic cellophane and heat up the air that is trapped inside. The black paper absorbs the heat at the bottom of the oven.

Investigation question: "Which oven will melt a square of chocolate first?"

Present the investigation question to the children and ask them to think about how they could carry out this investigation. Each group records their ideas on **PCM 14 (Planning your investigation)**. Discuss their ideas.

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Questions to promote discussion

- 1 How are you going to carry out the investigation?
- 2 How will you make it a fair test?
- 3 What will you change? (*size of the pizza box*)
- 4 What will you keep the same? (*position in the sun, size of the piece of chocolate*)
- 5 What do you predict will happen? Why?
- 6 What are you going to observe? (*the chocolate melting*)
- 7 How are you going to measure this? (*how long it takes the chocolate to melt*)

Conduct the investigation by placing an equal amount of chocolate in each solar oven. Then place the three solar ovens in a sunny location. Discuss the results of the investigation and record on **PCM 15** (Recording your investigation). The investigation can be conducted as a whole class or group investigation, depending on how many pizza solar ovens have been made.

