

Activity Investigations into heat transfer by convection

Introduction: We have seen in previous activity that heat cannot travel very well through liquids and gases via conduction. In liquids and gases, heat can travel through convection. Convection is the transfer of heat by the movement of molecules in the material.

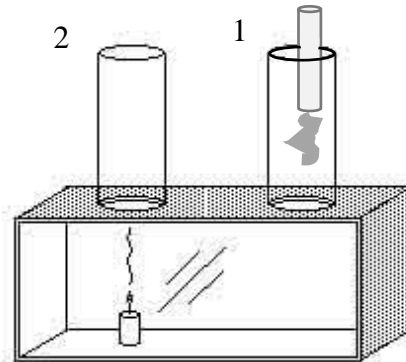
Section 1: Convection in air

Practical 1: The chimney experiment

Instructions: use a piece of smouldering paper to create smoke and we hold it above the chimney before and after lighting the candle.

Materials:

- Small box made from cardboard or wood
- Scissors and tape
- Piece of rolled up paper
- 1 sheet of hard clear plastic
- Small Candle



Procedure:

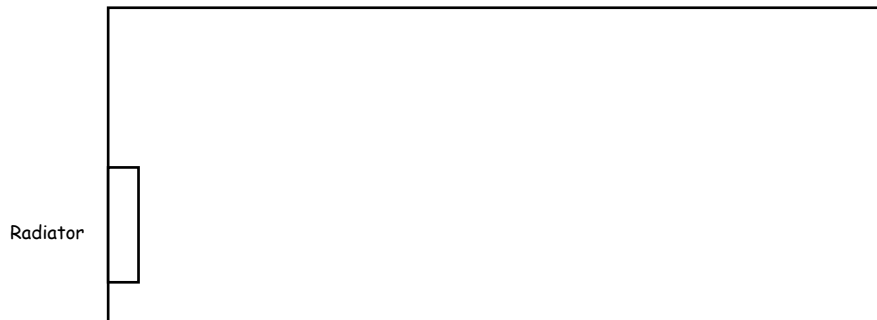
1. Cut a large window into one side of your box
2. Cover the window with half of your plastic sheet using tape.
3. Cut a small closable door into one side of the box
4. Cut two equal sized holes onto the side of the box that is above the window
5. Using your remaining plastic cut and tape two identical openended cylinders
6. Set up the apparatus as shown in the diagram.
7. Light the candle and place it inside the box under tube 2. Let the candle burn for a minute or two.
8. Light the piece of paper on fire and quickly extinguish it to the point of smoulder.
9. Insert the smouldering paper roll into tube 1.
10. Draw arrows on the diagram to show how the smoke moves.

Discussion Questions:

1. Convection happens when molecules of a gas or a liquid are _____. This gives them _____ energy than cooler regions and so they can move faster. This hotter molecules move to a _____ region, taking their heat energy with them.
2. Convection only happens in _____ and _____. This is because the atoms or molecules in a _____ or _____ are _____ to move from place to place, whereas the atoms or molecules in a solid are not.

Convection is the method of heat transfer that heats our homes from radiators. The radiator is made very hot so that it gives heat energy to the air around it. These air particles will then start to move and spread the heat around the room. Think back to the way the water moved when it was heated.

3. Add arrows to the room below to show how the hot air would circulate.



4. Can you think of three other things which are heated using convection?

5. Describe how the heating element in a kettle heats all the water.

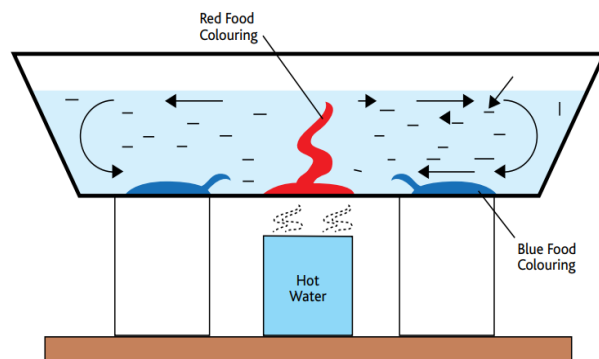
Section 2: Convection in liquids

Experiment 3: Modelling ocean currents

Instructions: Observe a beautiful demonstration of heat convection.

Materials:

- Shallow glass trough or clear lunch box
- Two different food colourings
- Supports for the trough
- Hot and cold tap water
- Beaker, glass or cup to fit snugly under trough



Procedure:

1. Place the trough on supports.
2. Pour cold water into the trough until it is three-quarters full and allow the water to settle.

Why is this settling important?



3. Using a straw or long dropper, carefully place two drops of one of the food colourings at the bottom of the trough in the middle. This is shown as red food colouring.
4. Using a different straw carefully place two drops of the other food colouring at each of the two extreme ends of the container. This is shown as dark blue food colouring

What do you expect to happen when hot water is placed underneath the trough?

5. Place a beaker of hot water under trough just below the location of the first food colouring as shown

Discussion Questions:

1. What did you observe?

2. Can you explain why this happened?

Discussion Questions:

1. Describe what happened when the water was heated.

2. Can you explain why this happened?
