

# WJEC Wales Physics GCSE

## SP1.3a: Methods of Heat Transfer

### Practical Notes



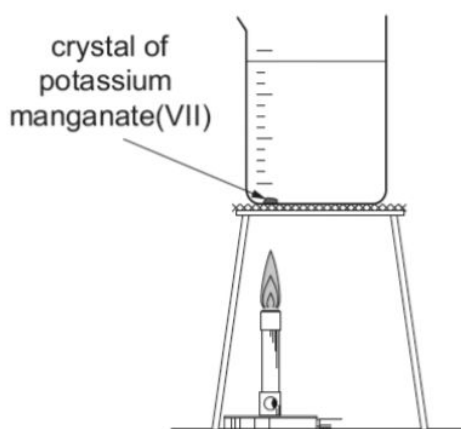
## Investigation of the methods of heat transfer

### Convection

#### Equipment

- 2x 250 cm<sup>3</sup> beakers
- 1 crystal of potassium manganate
- 10 cm<sup>3</sup> glass tube
- Tripod and gauze
- Heatproof mat
- Bunsen burner
- Forceps

#### Diagram



*Image: WJEC*

#### Method

1. Fill the beaker with water until it is three-quarters full and place it on top of the tripod and gauze.
2. Using the forceps, pick up the crystal and drop it through the glass tube to one side of the bottom of the beaker.
3. Cover the top of the tube with your finger and remove the tube carefully.
4. Heat the beaker using the bunsen burner and record observations.

#### Safety Precautions

- Ensure hair is tied back and no loose clothing is hanging near the flame when dealing with the bunsen burner.
  - Blazers, lanyards and ties should be removed.
  - Sleeves should be rolled up to the elbow.
- Ensure the safety (orange) flame is on when you are not heating anything with the bunsen burner. Do not leave the flame lit for longer than necessary so as to reduce the risk of causing a fire.
- Gas taps must be off when not connected to a lit bunsen burner.

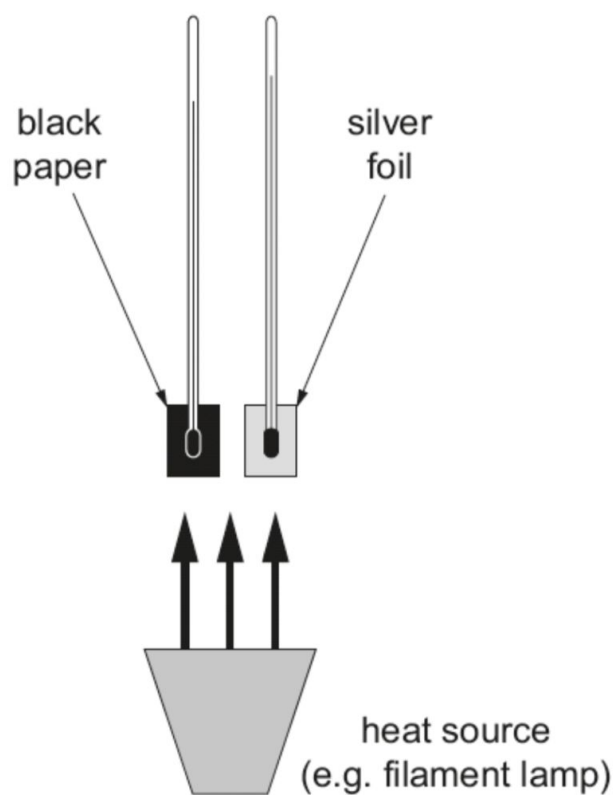


## Radiation

### Equipment

- Filament lamp
- 2x thermometers
- 2 cm piece of black paper
- 2 cm piece of silver foil
- Tape
- Stopwatch
- 2x clamp stands, clamp and boss

### Diagram



*[Image: WJEC](#)*



## Method

1. Using the tape, attach the piece of black paper to the bottom of one thermometer and the silver foil to the bottom of the other thermometer.
2. Clamp the two thermometers the same distance away from a filament lamp.
  - This should be about 10 cm away.
3. Record the initial temperatures of the two thermometers.
4. Turn on the lamp and leave it for 10 minutes.
5. Record the temperatures again.
  - The thermometer with the greatest change in temperature will tell you which material is the best absorber of radiation.

## Tips

- Avoid handling the thermometers too much before taking the initial temperatures.
  - Allow them to cool to room temperature for more accurate results.
- Do not touch the thermometers during heating as you will transfer heat energy to them and skew the results.

## Safety Precautions

- Avoid touching the lamp during or after it has been on as it may cause a burn.



## Conduction

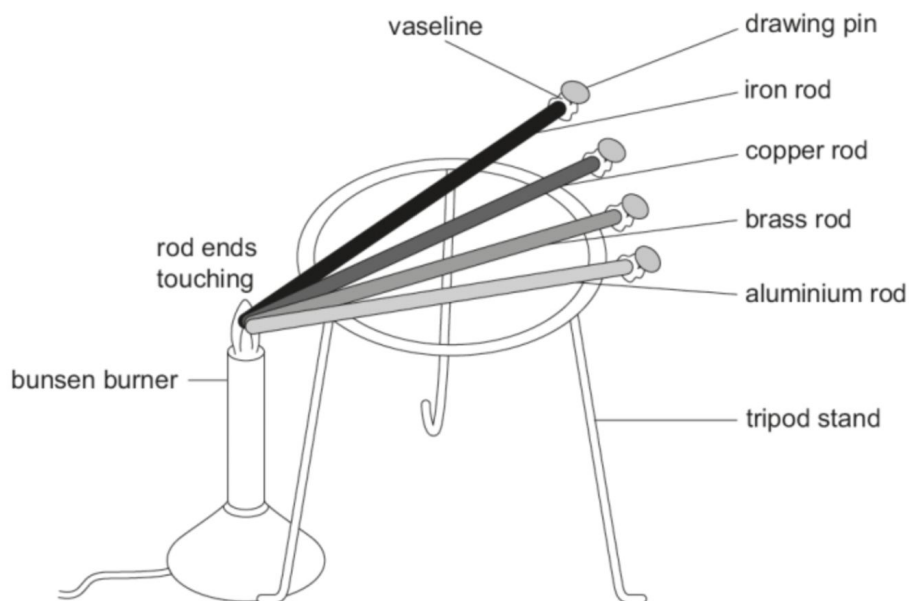
There are two ways of investigating conduction in this practical: using metal rods or a conduction ring.

### **Metal Rods Method**

#### **Equipment**

- 4x metal rods of different types of metal
  - Aluminium, brass, copper and iron
- 4x drawing pins
- Petroleum jelly
- Tripod
- Bunsen burner
- Heatproof mat
- Stopwatch

#### **Diagram**



[Image: WJEC](#)

#### **Method**

1. Set up the equipment as shown in the diagram.
2. Using a small amount of petroleum jelly, attach a drawing pin to the end of each of the rods.
  - Try to make this the same amount of petroleum jelly for each rod.
3. Bring together the other ends of the rods (without the pins) so that they can each be heated the same amount.
4. Using the bunsen burner, begin heating the ends of the rods without the pins and start the stopwatch.
5. Record the time taken for the pins to fall off the end of each rod and use this to determine the order of conductivity of the metals.
  - The first pin to fall will be from the rod that is the best conductor.



## Tips

- Try to avoid handling the rods and the jelly too much before heating.
- Allow the rods to cool to room temperature before heating so that they all begin at the same temperature and the results are more accurate.

## Safety Precautions

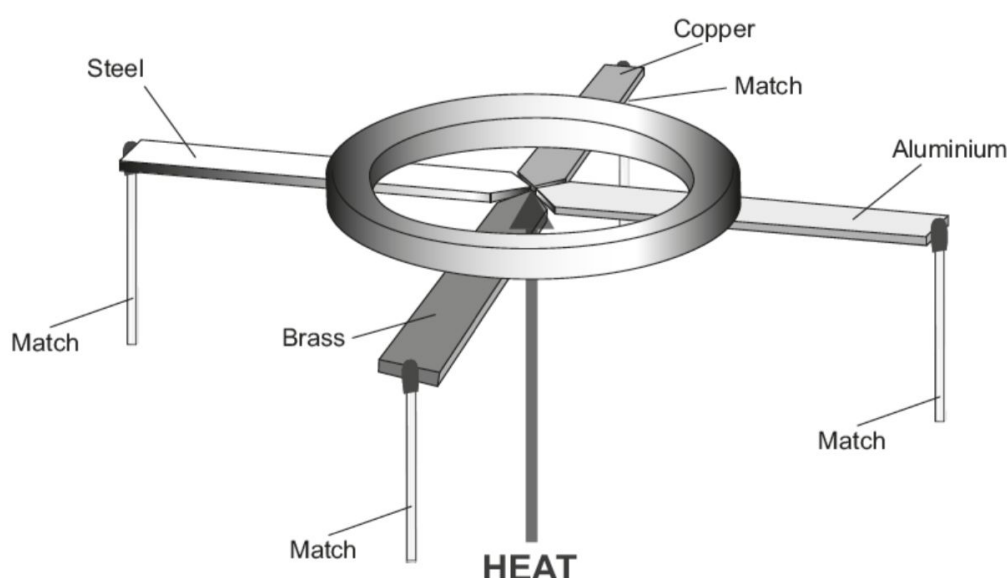
- Ensure hair is tied back and no loose clothing is hanging near the flame when dealing with the bunsen burner.
  - Blazers, lanyards and ties should be removed.
  - Sleeves should be rolled up to the elbow.
- Ensure the safety (orange) flame is on when you are not heating anything with the bunsen burner. Do not leave the flame lit for longer than necessary so as to reduce the risk of causing a fire.
- Gas taps must be off when not connected to a lit bunsen burner.

## Conduction Ring Method

### Equipment

- Conductive ring
  - Aluminium, brass, copper and steel
- 4x wooden matches
- Petroleum jelly
- Clamp stand, clamp and boss
- Bunsen burner
- Heatproof mat
- Stopwatch

### Diagram



*Image: WJEC*



## Method

1. Clamp the conductive ring in position.
  - Ensure the clamp is away from the centre of the ring.
2. Using a small amount of petroleum jelly, attach a wooden match to the outer end of each of the metals.
3. Use the bunsen burner to begin heating the centre point of the ring and start the stopwatch.
4. Record the time taken for the match to fall from each piece of metal, as with the rods method (above), and use this to determine the order of conductivity of each of the metals.
  - The first match to fall will be from the metal that is the best conductor.

## Tips

- Try to avoid handling the metals and the jelly too much before heating.
- Allow the metals to cool to room temperature before heating so that they all begin at the same temperature and the results are more accurate.

## Safety Precautions

- Ensure hair is tied back and no loose clothing is hanging near the flame when dealing with the bunsen burner.
  - Blazers, lanyards and ties should be removed.
  - Sleeves should be rolled up to the elbow.
- Ensure the safety (orange) flame is on when you are not heating anything with the bunsen burner. Do not leave the flame lit for longer than necessary so as to reduce the risk of causing a fire.
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