

## Investigation of the methods of heat transfer

### Introduction

Heat can be transferred through materials (and indeed empty space) in different ways. This series of experiments explores the methods of heat transfer and aims to develop your understanding of the differences between conduction, convection and radiation.

### Apparatus

#### **Convection:**

2 × 250 cm<sup>3</sup> beaker  
 1 crystal of potassium manganate(VII)  
 10 cm<sup>3</sup> glass tube  
 tripod and gauze  
 heat proof mat  
 Bunsen burner  
 forceps

#### **Radiation:**

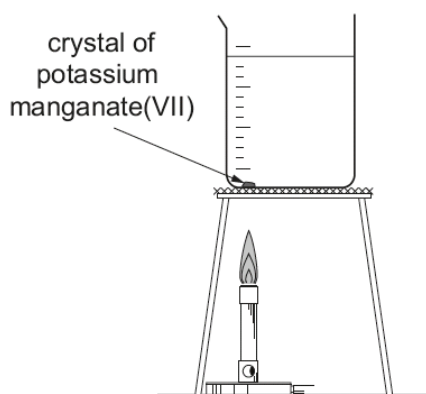
filament lamp  
 2 × thermometers  
 1 small piece of black paper  
 1 small piece of silver foil  
 Sellotape  
 stopwatch  
 2 × clamp stand, clamp and boss

#### **Conduction:**

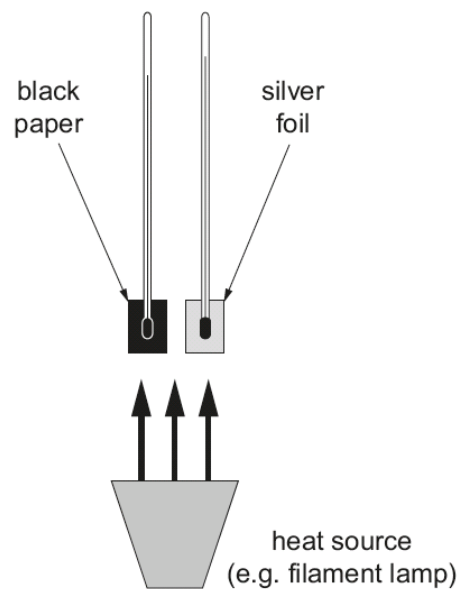
conductive ring  
 (aluminium, brass, copper and iron)  
 4 × wooden matches  
 Vaseline  
 clamp stand, clamp and boss  
 Bunsen burner  
 heat proof mat  
 stopwatch

## Diagram of Apparatus

### Convection Experiment

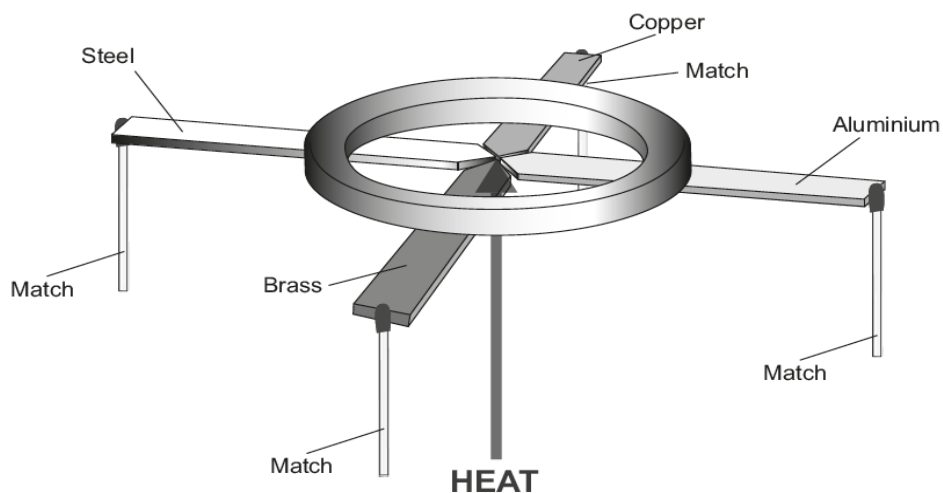


### Radiation Experiment



### Conduction Experiment

#### Conductive Ring Experiment



## Method

### Convection Experiment

1. Fill the beaker to  $\frac{3}{4}$  full of water.
2. Use forceps to pick up a single crystal of potassium manganate(VII) and drop it carefully through the glass tube to one side of the bottom of the beaker.
3. Place your finger on the top of the tube and remove carefully.
4. Light the Bunsen burner well away from the apparatus. Use the gas tap to get the smallest blue flame that you can.
5. Put the small Bunsen flame directly underneath the crystal and record your observations.

### Radiation Experiment

1. Use Sellotape to attach a 2 cm strip of black paper to the bulb of one thermometer.
2. In the same way attach a 2 cm strip of silver foil to the bulb of another thermometer.
3. Clamp the 2 thermometers **the same distance away** (about 10 cm) from a filament lamp.
4. Record the temperatures shown by the two thermometers.
5. Switch on the lamp and record the temperatures again after 10 minutes.

### Conduction Experiment

1. Clamp the conductive ring taking care to keep the clamp away from the mid-point of the ring.
2. Attach a wooden match to the outer end of each metal using a small blob of Vaseline.
3. Heat the centre point of the ring with a blue Bunsen flame.
4. Record how long it takes for each metal to lose its wooden match.

## Analysis

1. Determine which colour is the best absorber of heat.
2. Determine the order of conductivity of the metals.