

## Physics – Core Practical's

AQA Topics	AQA Chapter	Core Practical	Year Taught	Exam Paper
Conservation & Dissipation Energy	P1 Chapter 1		10	1
Energy transfer by heating	P1 Chapter 2	1 and 2	9	1
Energy Resources	P1 Chapter 3		10	1
Electric Circuits	P2 Chapter 4	3 and 4	10	1
Electricity in the Home	P2 Chapter 5		10	1
Molecules and Matter	P2 Chapter 6	5	10	1
Radioactivity	P3 Chapter 7		11	1
Forces	P3 Chapter 8		10	2
Motion	P3 Chapter 9		9	2
Force and Motion	P3 Chapter 10	6 and 7	10	2
<i>Forces and Pressure (Triple Only)</i>	P3 Chapter 11		11	2
Wave Properties	P4 Chapter 12	8	9	2
Electromagnetic Waves	P4 Chapter 13	10	9	2
<i>Light (Triple Only)</i>	P4 Chapter 14	9 (T)	11	2
Electromagnetism	P4 Chapter 15		11	2
<i>Space (Triple Only)</i>	P4 Chapter 16		11	2

Required practicals		Topic
1	<b>Determining specific heat capacity.</b> Determine the specific heat capacity of a metal block of known mass by measuring the energy transferred to the block and its temperature rise, and using the equation for specific heat capacity.	P2.4
2	<b>Investigating thermal insulators.</b> Use different materials and different thicknesses of the same material to insulate identical beakers of hot water, and measure the change in temperature of the water at regular intervals.	P2.1
3	<b>Investigating resistance.</b> Set up circuits and investigate the resistance of a wire, and of resistors in series and parallel.	P4.3 P4.6
4	<b>Investigating electrical components.</b> Correctly assemble a circuit and investigate the potential difference-current characteristics of circuit components.	P4.4
5	<b>Calculating densities.</b> Measure the mass and volume of objects and liquids and calculate their densities using the density equation.	P6.1
6	<b>Investigate the relationship between force and extension for a spring.</b> Hang weights of known mass from a spring and, using the correct apparatus, measure the resulting extension. Use the results to plot a force-extension graph.	P10.8
7	<b>Investigate the relationship between force and acceleration.</b> Using a newton-metre, investigate the effect on the acceleration of an object of varying the force on it and of varying its mass.	P10.1
8	<b>Investigating plane waves in a ripple tank and waves in a solid.</b> Determine which apparatus are the most suitable for measuring the frequency, speed, and wavelength of waves in a ripple tank, and investigate waves on a stretched string.	P12.4
9	<b>Investigate the reflection and refraction of light.</b> Use different substances and surfaces to investigate the refraction and reflection of light.	P14.2 P14.3
10	<b>Investigating infrared radiation.</b> Determine how the properties of a surface affect the amount of infrared radiation absorbed or radiated by the surface.	P13.2

## CP1- P2.4 Determining Specific Heat Capacity



### Aims

In this experiment, you will make measurements of energy transferred and temperature change and use these to find the specific heat capacity of aluminium.

### Equipment and materials

- 12 V, 24 W low-voltage heater
- 12 V power supply for heater
- joulemeter
- two connecting leads
- aluminium block with holes for a heater and a thermometer
- insulation for block (including a thick insulating mat to place under it)
- rubber bands or tape to fix insulation around block
- thermometer

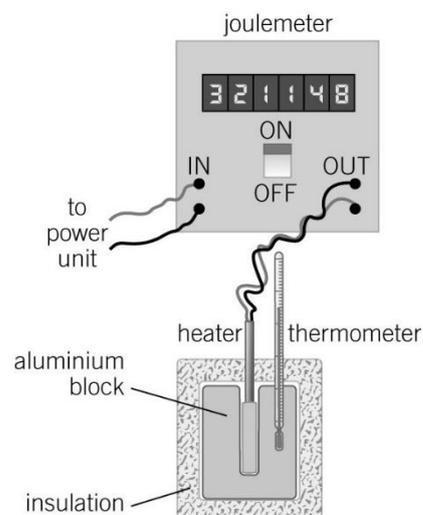
### Equation Given in Exam

change in thermal energy = mass  $\times$  specific heat capacity  
 $\times$  temperature change

$$\Delta E = m c \Delta \theta$$

### Method

1. Check the mass of the aluminium block (it may be written on the block, or your teacher will be able to tell you).
2. Wrap the insulation securely around the block, and place it on an insulating mat.
3. With the power supply switched off, set up the apparatus as shown in the diagram.
4. Check with your teacher that the joulemeter is correctly connected to the heater and the power supply.
5. Place the thermometer in the aluminium block and measure the temperature of the block. Record this as the 'starting temperature' of the block.
6. Switch the joulemeter on and record the 'starting' reading of the joulemeter.
7. Switch the power supply on.
8. Watch the reading on the thermometer, and when it reaches about 15°C above the starting temperature, switch off the power supply.



9. Record the joulemeter reading and the thermometer reading.
10. The thermometer reading might continue to increase for up to a few minutes after the heater has been switched off. Measure and record the highest reading of the thermometer after the heater was switched off.

### Results

<b>Mass of aluminium block in kg</b>	
<b>Starting temperature of block in °C</b>	
<b>Temperature when heater was switched off in °C</b>	
<b>Highest temperature of block in °C</b>	
<b>Starting reading on joulemeter in J</b>	
<b>Final reading on joulemeter in J</b>	

## CP2- P2.1 Investigating Thermal Insulators



### Aims

You are going to compare the effectiveness of different thermal insulators in slowing down the cooling of hot water. You will take measurements as accurately as possible, and present your results. In the follow up activity you will analyse a set of results and plan an investigation into the effect of changing the thickness of an insulator.

### Equipment and materials

- eye protection
- four identical containers (beakers, boiling tubes, or metal cans)
- measuring cylinder
- four thermometers
- stopwatch
- elastic bands or tape
- four materials to test as insulators
- aluminium foil or cling film (if needed for lids)
- access to hot water
- graph paper

### Method

11. Set up your containers: leave one unwrapped, and wrap each of the others in a different material, using elastic bands or tape to hold the material in place. Try to make the different wrappings roughly the same thickness.
12. Prepare lids for the containers, made out of the same material as the wrapping if possible, otherwise made from aluminium foil or cling film.
13. Make a hole in each lid which is just big enough for the thermometer to fit through.
14. Use the measuring cylinder to pour equal amounts of hot water into each container.
15. Put the lids onto the containers, with a thermometer fitted through each lid so that it rests near the bottom of the water.
16. Start the stopwatch, and measure the starting temperature of the water.
17. After 15 minutes, use the thermometer to gently stir and then measure the temperature of the water in each beaker.

## CP3- P4.3 & P4.6 Investigating Resistance



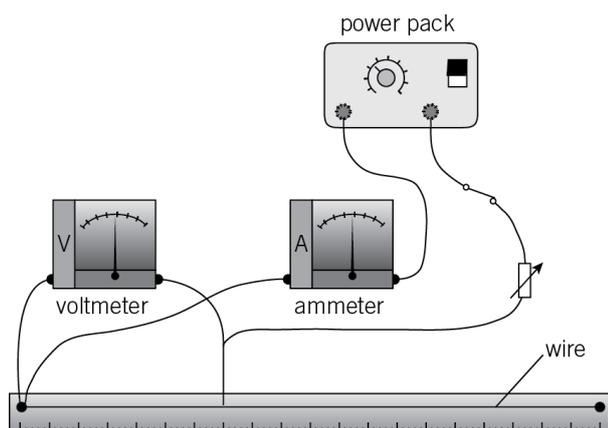
### Aims

Different wires have different resistances. You are going to follow a method to investigate how a wire's length affects its resistance.

### Equipment

- Piece of wire to test
- Low-voltage power supply, or battery pack
- Variable resistor
- Switch
- 7 connecting leads
- 2 crocodile clips
- Heat-resistant mat(s) – enough to stop piece of wire from touching table
- Ammeter
- Voltmeter
- Metre ruler

### Method



- 1 Tape the ends of the wire to the heat-resistance mat(s) and set up the circuit as shown in the diagram.
- 2 Set the length of the test wire in the circuit to be 20 cm, by adjusting the positions of the crocodile clips.
- 3 Set the power supply to either 1 V or 1.5 V and then switch it on.
- 4 Turn on the switch in your circuit.
- 5 If the ammeter reading is higher than 1 A, adjust the variable resistor until the reading goes below 1 A.
- 6 Record the readings on the meters.
- 7 Turn off the switch.
- 8 Repeat steps 2 to 7, increasing the test wire's length by 10 cm each time, up to at least 70 cm.

## CP4- P4.4 Investigating Electrical Components



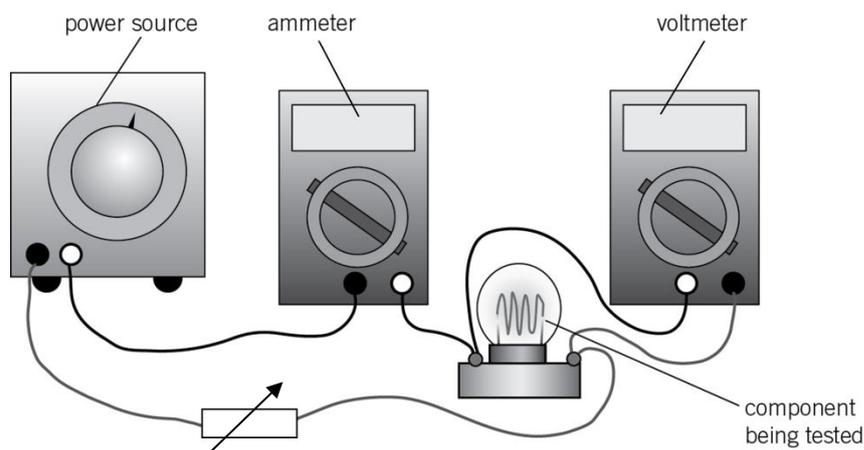
### Aims

You are going to investigate the relationship between current and potential difference for a component. You will follow a method to take measurements and plot a graph of current versus potential difference. You will see that different types of component have graphs which look different.

### Equipment

- Power supply or battery pack
- Component to test, with holder or crocodile clips
- Variable resistor
- Ammeter
- Voltmeter
- 6 connecting leads

### Method



- 1 Draw a circuit diagram of the circuit shown in the picture, using the correct symbol for the component you have been given to test.
- 2 With the power supply switched off, set up the circuit.
- 3 You will adjust the variable resistor and measure the current and potential difference for your component. Find out from your teacher what supply potential difference to use. Do not allow the current to go above 1.0 A.
- 4 Starting with the variable resistor at its lowest resistance (so that the current is at its highest), measure the current and potential difference for your component.
- 5 Switch off the power supply.
- 6 Increase the resistance of the variable resistor in about six steps between the minimum and maximum resistances, and each time measure the current and potential difference for the component. Switch off the power supply between readings.

## CP5- P6.1 Calculating Densities

### Aims

In this activity you will plan and carry out an experiment to measure the mass and volume of given solids and liquids shaped as regular and irregular three-dimensional bodies. You will use your measurements to calculate the densities of the materials. You write a report about your experiment.

### Equipment

- Regular-shaped solid material
- Irregular-shaped solid material
- Liquid in a regular-shaped container
- Balance
- Ruler (30 cm is long enough)
- Measuring cylinder

### Method

Density of a solid (in the shape of a cube or cuboid)

**1** In your table for solids, write the material from which the solid is made.

**2** Measure and record the mass of the solid.

**3** Measure and record the length, width, and height of the solid.

Density of a solid (irregular-shaped sample)

**4** Measure and record the mass of the sample.

**5** Fill a measuring cylinder half-full with water. (There needs to be enough water so that when you put the solid into the water, the water will cover the solid but will not rise above the top of the measuring scale.)

**6** With your eye level with the water's surface, measure the volume of water and record it.

**7** Carefully place the solid material into the container.

**8** Measure and record the new volume of the water.

Density of a liquid

**9** In your table for liquids, write the type of liquid whose density you are measuring.

**10** Measure and record the mass of an empty measuring cylinder.

**11** Pour the liquid into the measuring cylinder, making sure it does not go above the top of the cylinder's measuring scale.

**12** Measure and record the mass of the cylinder with the liquid in it.

**13** Measure and record the volume of liquid in the cylinder.

## CP6- P10.8 Investigate Extension for a Spring



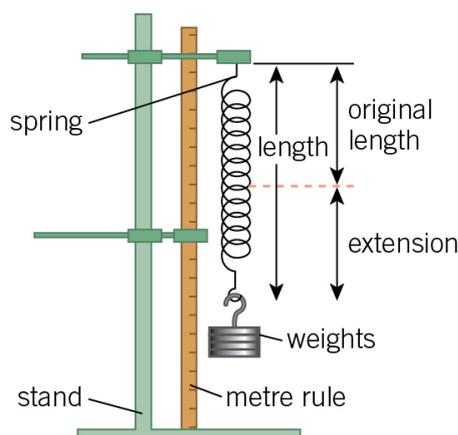
### Aims

After completing the practical you should be able to: make measurements of force and extension for a spring, plot a graph of the results, interpret force–extension graphs. Springs have many uses, for example in newtonmeters, toys, pens, mattresses, and car and bike suspension.

### Equipment and materials

- Eye protection
- Spring
- Set of 50 g (0.5 N) masses
- Mass holder
- 1 m ruler
- Clamp stand with three clamps
- G-clamp

### Method



1. Attach the spring to the clamp stand by hanging it off a clamp, and let the spring hang freely over the side of the bench.
2. Use the G-clamp to fix the clamp stand to the bench.
3. Use the other two clamps to hold the ruler vertically, near but not touching the spring. You will use this to measure the length of the spring.
4. Measure the length of the spring with no force acting on it.
5. Hang the mass holder from the spring. Check the mass of the holder, and measure the new length of the spring. Record the length of the spring and the mass suspended from it.
6. Add a 0.5 N (50 g) weight and measure the length of the spring.
7. Repeat step 6 until a total of 250 g (including the mass holder) is hanging from the spring. Each time, record the length of the spring and the total mass suspended from the spring.
8. Record all your results in a table.

### Equation Given in Exam

elastic potential energy =  $0.5 \times \text{spring constant} \times \text{extension}^2$

$$E_e = \frac{1}{2} k e^2$$

## CP7- P10.1 Investigate Force and Acceleration

### Aims

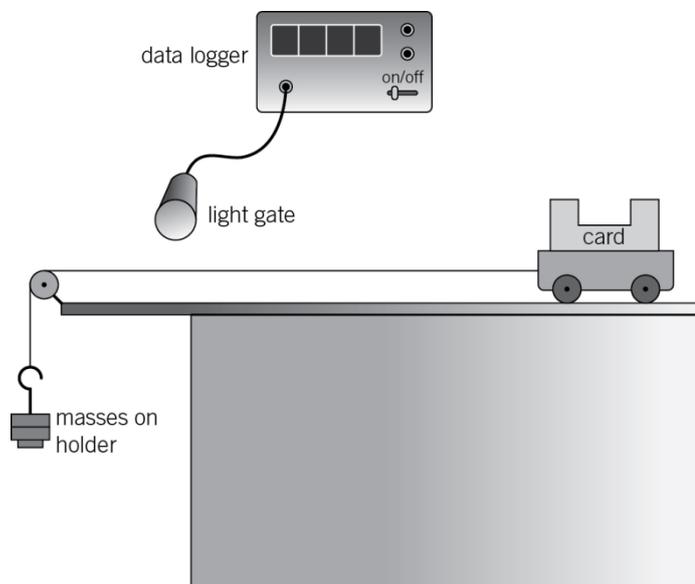
After completing the practical you should be able to, measure the acceleration of an object, draw and interpret graphs of acceleration against force, and of acceleration against mass and recall and use the relationship between acceleration, resultant force, and mass.

### Equipment and materials

- Trolley
- Piece of card shaped like this: 
- Ruler (30 cm is long enough)
- Sticky tape or tack
- Pulley with clamp
- Mass holder and 50 g masses
- Wooden block, or lump of modelling clay (if needed to protect pulley)
- String or strong thread
- Data logger
- Light gate, with connecting lead
- Clamp stand and clamp for light gate

### Method

1. Measure the length of each card segment, and make a note of it.
2. Set up the apparatus as shown in the diagram below. When the trolley is as close to the pulley as it can get, the bottom of the mass holder should be between 0.5 cm and 1 cm above the floor.



3. During this experiment the trolley will travel towards the pulley. If you need to, place a lump of modelling clay or a block in front of the pulley to stop the trolley from hitting the pulley.
4. Set up the data logger. You will use its measurements to find the trolley's acceleration. There are different ways of doing this, depending on the data logger and the method your teacher asks you to use. Below are three of the possible methods.
  - a If your data logger will calculate the acceleration of the trolley, you will only need to input the lengths of the two card segments.

- b** If your data logger will calculate the speeds of the trolley as each card segment passes through the light gate, you will need to input the lengths of the segments. Calculate acceleration (change in speed  $\div$  time). The time is from the middle of one segment's time in the gate to the middle of the other's time in the gate.
  - c** If you will not be using your data logger to do calculations, then you will need to get information about the card's position versus time from the data logger's graph.
    - i** From the graph, find out how long it took for each of the card segments to pass through the light gate.
    - ii** Work out the speed (length of card  $\div$  time) at which each card segment passed the light gate.
    - iii** Calculate the card's acceleration using the method described in **b**.
- 5.** Add masses to the mass holder so that the total mass, including the holder, is 250 g.
  - 6.** Pull back the trolley, set the data logger to record, and then let the trolley run to the pulley. Collect the necessary measurements from the data logger.
  - 7.** Take 50 g off the mass holder and place it onto the trolley. You may need to use a small amount of tape or sticky tack to hold the mass securely in place. Repeat step 6.
  - 8.** Repeat steps **6–7** until there is 200 g on the trolley – this will be your fifth and final run.

## CP8- P12.4 Investigation Plane Waves

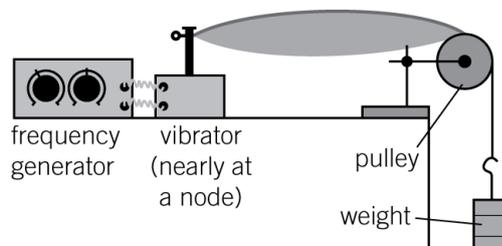


### Aims

In this required practical, you will measure the speed of waves passing through a liquid (water) and the speed of waves passing through a solid (a vibrating string or wire). This will allow you to evaluate the equipment used and decide whether it is suitable for the experiment.

### Equipment

- signal generator
- vibration generator
- masses on a mass holder
- length of string
- tape measure.



### Method

1 Assemble the apparatus as shown in the diagram below. Attach the string to the top of the vibration generator, pass it over the pulley and keep it fairly taut with a mass hanging from the end.

2 Measure the length of string ( $L$ ) between the vibration generator and the pulley.

3 Turn on the signal generator. This will produce vibrations in the string.

4 Increase the frequency of the vibration from zero until you can see a wave pattern in the string, as shown in the diagram below, with one complete wave on the string.



5 Record the frequency of the signal generator in the first row of the results table below.

6 Continue to increase the frequency until you see a second wave pattern, as shown in the diagram below, with two complete waves.



7 Record the frequency on the signal generator in the second row of the results table.

8 Continue this process to find the frequencies which form three and four complete waves on the string.

## CP9-P14.2 Investigating Refraction (Triple) Part 1



### Aims

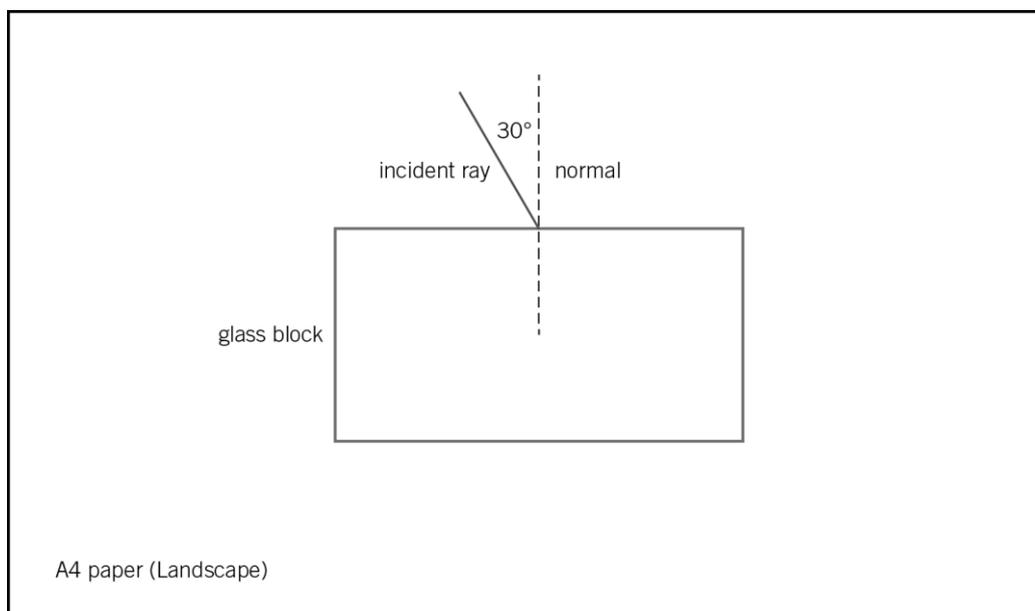
In this required practical, you will investigate how light bends as it passes from air into a glass or Perspex block. This effect is called refraction. You then plan an investigation to compare the refraction of light in other materials.

### Equipment

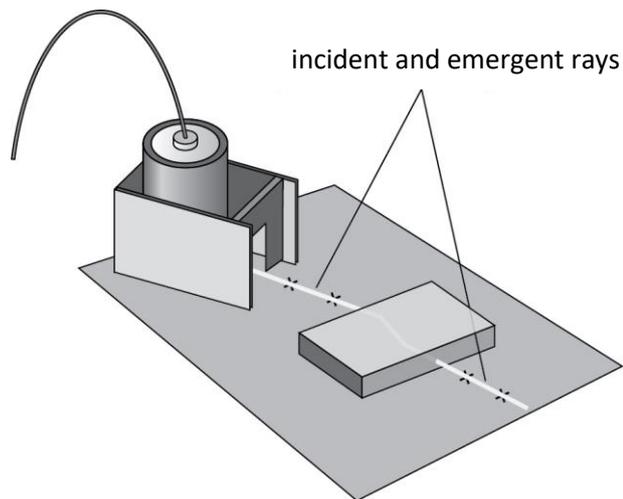
- glass or Perspex block
- ray box, narrow slit, power supply
- sheet of plain white paper
- pencil, ruler, and rubber
- protractor
- other transparent materials.

### Method

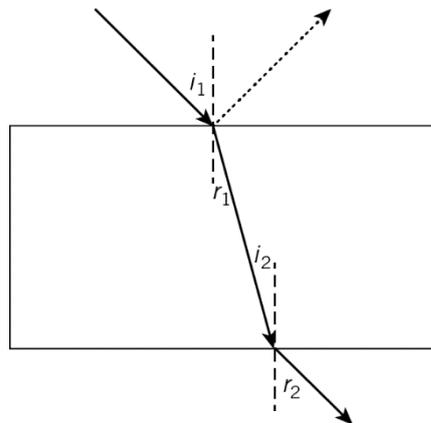
- 1 Place the glass or Perspex block in the centre of the piece of paper (landscape view) and draw around its edges.
- 2 Remove the block and draw a dotted normal line at right angles to the edge of one long side of the block, about half way along.
- 3 Draw a line to represent the incident ray at  $30^\circ$  to the normal.



- 4 Place the block back on the rectangle you have drawn.
- 5 Switch on the ray box with a narrow slit in front of the bulb and shine the ray along the incident ray you have drawn.
- 6 Observe the path of the light through the block and out of the other side.



- 7 Mark the path of the emergent light ray on the other side with a pencil line. Also mark any other ray you can see.
- 8 Remove the glass block. Draw a normal at the point where the light emerged from the glass block.
- 9 Draw a line to join the incident and emergent ray through the rectangle representing the glass block to give the refracted ray.
- 10 Your drawing should now look like this diagram. Measure the angles shown in the diagram using the protractor. Record your results in the table below.



- 11 Repeat for an angle of incidence of  $50^\circ$ .

## CP9-P14.3 Investigating Reflection (Triple)- Part2



### Aims

In this required practical, you will investigate how light is reflected by different surfaces and how coloured objects appear in coloured light.

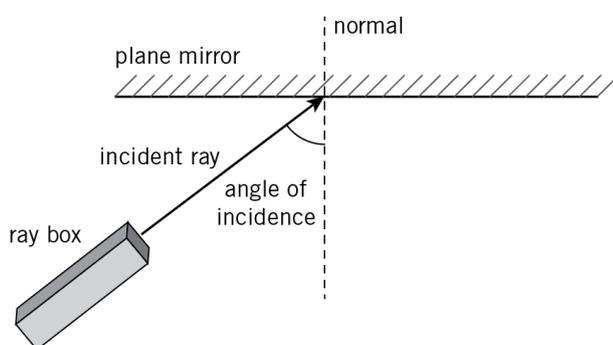
### Equipment

- ray box, narrow slit, power supply
- plane mirror
- sheet of plain white paper
- protractor and ruler
- aluminium foil
- small coloured objects or pieces of card
- red filter.

### Method

You have previously investigated how white light is reflected by a plane mirror in using the method sheet P14.1 *Mirror, mirror*.

1. Set up the mirror and ray box in the same way as in P14.1 *Mirror, mirror*. Draw a line to represent the mirror on a piece of paper and a dotted line to represent the normal at  $90^\circ$  to the first line.
2. Draw an incident ray at  $30^\circ$  to the normal.
3. Place a mirror on the mirror line. Place a narrow slit at the front of the ray box and shine a ray of light along the incident ray line.



4. Mark the reflected ray on the paper.
5. Now place a red filter in the slot at the front of the ray box and repeat your investigation of reflection from the mirror.
6. Remove the mirror and ray box, fully draw in all the reflected rays and measure the angles of reflection (between the ray and the normal).
7. Next, wrap the mirror in a sheet of aluminium foil and repeat the experiment with white light.
8. Place a red filter in front of the slot and repeat the experiment.
9. Scrunch up some aluminium foil and roughly flatten it out again. Wrap the mirror in this foil and repeat the experiment with white light.
10. Using the red filter, remove the narrow slit from the ray box, so that you illuminate the scrunched foil reflector with red light.

## CP10- P13.2 Investigating Infrared Radiation



### Aims

In this practical you will investigate whether infrared radiation is emitted at different rates by a hot shiny object and a hot matt black object.

### Equipment

- Two beakers or drink cans (one painted silver and one painted matt black)
- Two thermometers
- Aluminium foil
- Measuring cylinder
- Stopwatch
- Hot water

### Setting the scene

You are going to prepare two containers of hot water, which cool mainly by emitting infrared radiation. The containers are identical except for the colours of their outer surfaces. You will investigate whether the colours affect how quickly the containers of hot water emit infrared radiation.

### Method

- 1 If you are using beakers, use the aluminium foil to make lids for them. Make a hole in each lid so that a thermometer will be able to go through it into the container.
- 2 Carefully pour 150 ml of hot water into each of the two containers using a measuring cylinder.
- 3 If you are using beakers, place the lids onto the beakers.
- 4 Put a thermometer into the water in each beaker.
- 5 Start the stopwatch, and record the temperature of the water in the two containers every 30 s for 10 minutes.