GCSE Physics Trilogy



Required Practical Question Book

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| **Name:** | **Class:** | **Teacher:** |

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| **Practical 4**  **Density** | **/ 13** | **Practical 8**  **Radiation and absorption** | **/ 16** |

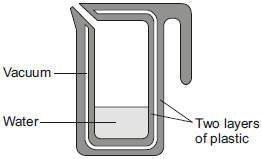
**Required Practical 1: Specific Heat Capacity**

**An investigation to determine the specific heat capacity of one or more materials.**

1. A new design for a kettle is made from two layers of plastic separated by a vacuum.

After the water in the kettle has boiled, the water stays hot for at least 2 hours.

The new kettle is shown below.



(a)     The energy transferred from the water in the kettle to the surroundings in 2 hours is   
46 200 J.

The mass of water in the kettle is 0.50 kg.

The specific heat capacity of water is 4200 J/kg °C.

The initial temperature of the water is 100 °C.

Calculate the temperature of the water in the kettle after 2 hours.

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Temperature after 2 hours = \_\_\_\_\_\_\_\_\_\_\_ °C

**(3)**

(b)     Calculate the average power output from the water in the kettle to the surroundings in 2 hours.

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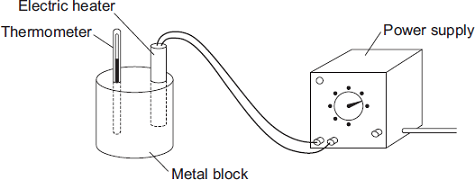
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Average power output = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ W

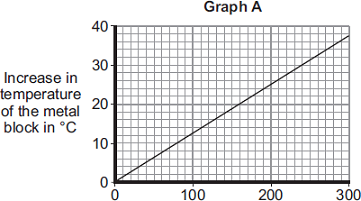
**(2)**

1. (a) A student used the apparatus drawn below to investigate the heating effect of an electric heater.



(i)      Before starting the experiment, the student drew **Graph A**.

**Graph A** shows how the student expected the temperature of the metal block to change after the heater was switched on.



Describe the pattern shown in **Graph A**.

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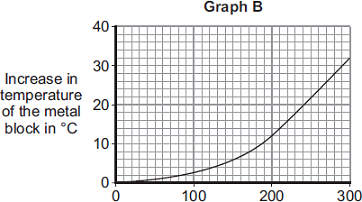
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**(2)**

(ii)     The student measured the room temperature. He then switched the heater on and measured the temperature of the metal block every 50 seconds.

The student calculated the increase in temperature of the metal block and plotted **Graph B**.



After 300 seconds, **Graph B** shows the increase in temperature of the metal block is lower than the increase in temperature expected from **Graph A**.

Suggest **one** reason why.

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(iii)    The power of the electric heater is 50 watts.

Calculate the energy transferred to the heater from the electricity supply in 300 seconds.

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Energy transferred = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ J

**(2)**

(b)     The student uses the same heater to heat blocks of different metals. Each time the heater is switched on for 300 seconds.

Each block of metal has the same mass but a different specific heat capacity.

|  |  |
| --- | --- |
| **Metal** | **Specific heat capacity in J/kg°C** |
| Aluminium | 900 |
| Iron | 450 |
| Lead | 130 |

Which **one** of the metals will heat up the most?

Draw a ring around the correct answer.

|  |  |  |
| --- | --- | --- |
| **aluminium** | **iron** | **lead** |

Give, in terms of the amount of energy needed to heat the metal blocks, a reason for your answer.

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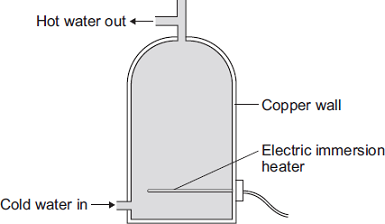
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**(2)**

1. An electric immersion heater is used to heat the water in a domestic hot water tank.  
   When the immersion heater is switched on the water at the bottom of the tank gets hot.



(a)     Complete the following sentence.

The main way the energy is transferred through the copper wall of the water tank is

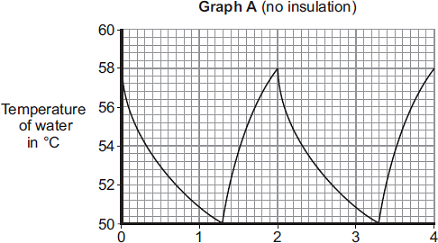
by the process of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**(1)**

(b)     The immersion heater has a thermostat to control the water temperature.

When the temperature of the water inside the tank reaches 58°C the thermostat switches the heater off. The thermostat switches the heater back on when the temperature of the water falls to 50°C.

**Graph A** shows how the temperature of the water inside a hot water tank changes with time. The tank is **not** insulated.



Time in hours

(i)      The temperature of the water falls at the fastest rate just after the heater switches off.

Explain why.

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**(2)**

(ii)     To heat the water in the tank from 50°C to 58°C the immersion heater transfers 4032 kJ of energy to the water.

Calculate the mass of water in the tank.

Specific heat capacity of water = 4200 J/kg°C

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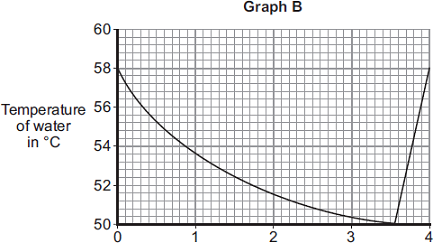
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Mass = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ kg

**(3)**

(iii)    An insulating jacket is fitted to the hot water tank.

**Graph B** shows how the temperature of the water inside the insulated hot water tank changes with time.



Time in hours

An insulating jacket only costs £12.

By comparing **Graph A** with **Graph B**, explain why fitting an insulating jacket to a hot water tank saves money.

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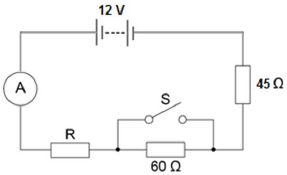
**(3)**

**Required Practical 2: Resistance**

**Use circuit diagrams to set up and check appropriate circuits to investigate the factors affecting the**

**resistance of electrical circuits.**

1. A student set up the electrical circuit shown in the figure below.



(a)     The ammeter displays a reading of 0.10 A.

Calculate the potential difference across the 45 Ω resistor.

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Potential difference = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ V

**(2)**

(b)     Calculate the resistance of the resistor labelled **R**.

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Resistance = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Ω

**(3)**

(c)     State what happens to the total resistance of the circuit and the current through the circuit when switch **S** is closed.

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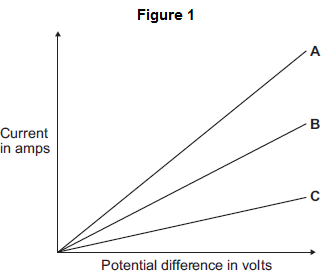
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**(2)**

1. (a)     **Figure 1** shows the current−potential difference graph for three wires, **A**, **B** and **C**.



(i)      Using **Figure 1**, how can you tell that the temperature of each wire is constant?

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**(1)**

(ii)     Which **one** of the wires, **A**, **B** or **C**, has the greatest resistance?

|  |  |
| --- | --- |
| Write the correct answer in the box. | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q15S2F07_files/img02.png |

Give a reason for your answer.

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**(2)**

(b)     A student measured the resistance of four wires.

The table below shows the resistance of, and other data about, each of the four wires, **J**, **K**, **L** and **M**.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Wire** | **Type of metal** | **Length in cm** | **Diameter in mm** | **Resistance in …….** |
| **J** | copper | 50 | 0.17 | 0.36 |
| **K** | copper | 50 | 0.30 | 0.12 |
| **L** | copper | 100 | 0.30 | 0.24 |
| **M** | constantan | 100 | 0.30 | 7.00 |

(i)      The last column of the table should include the unit of resistance.

What is the unit of resistance?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     The resistance of a wire depends on many factors.

Look at the table. Which **two** wires from **J**, **K**, **L** and **M** show that the resistance of a wire depends on the **length** of the wire?

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Give a reason for your answer.

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**(2)**

(iii)    A student looked at the data in the table and wrote this conclusion:

‘The resistance of a wire depends on the type of metal from which the wire is made.’

The student could **not** be certain that her conclusion is true for **all** types of metal.

Suggest what extra data is needed for the student to be more certain that the conclusion is correct

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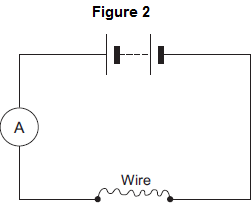
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**(1)**

(c)     The resistance of a wire can be calculated using the readings from an ammeter and a voltmeter.

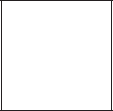
(i)      Complete **Figure 2** by drawing a voltmeter in the correct position in the circuit. Use the correct circuit symbol for a voltmeter.



**(1)**

(ii)     In a circuit diagram, a wire can be represented by the symbol for a resistor.

In the box below, draw the circuit symbol for a resistor.

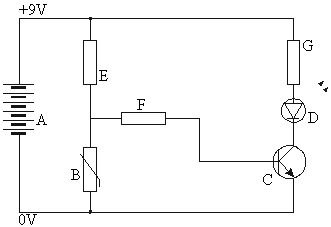


**(1)**

**Required Practical 3: I-V Characteristics**

**Use circuit diagrams to construct appropriate circuits to investigate the I–V characteristics of a variety of circuit elements, including a filament lamp, a diode and a resistor at constant temperature.**

1. The diagram shows an electronic circuit.



(a)     Write down the names of the components in the list below.

A                     =        \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

B                     =        \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

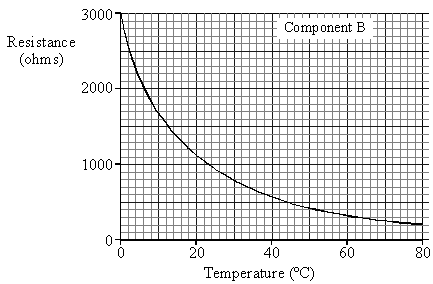
C                     =        \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

D                     =        \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

E, F and G      =        \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(5)**

(b)     The graph shows how the resistance of component B depends on its temperature.



Describe, in as much detail as you can, how the resistance of component B changes as its temperature rises from 0ºC to 80ºC.

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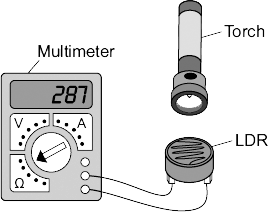
**(4)**

(c)     At what temperature does component B have a resistance of 1000 ohms?

*Answer* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ °C .

**(2)**

1. A student used the apparatus below to find out how the resistance of a light-dependent resistor (LDR) depends on light intensity.



The resistance of the LDR was measured directly using a multimeter.

(a)    (i)       Which **one** of the following is the correct circuit symbol for a LDR?

Draw a ring around your answer.

https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q12S2F04_files/7_img02.png

**(1)**

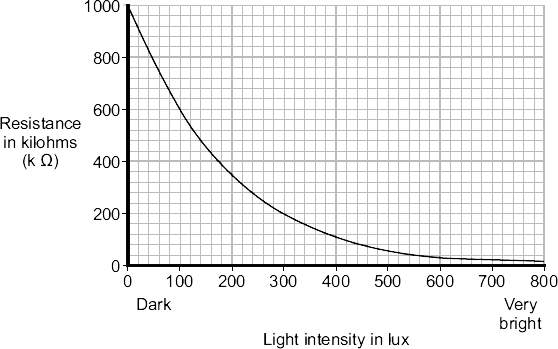
(ii)     Name **one** factor that will affect the intensity of the light hitting the LDR.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

(b)     The manufacturer of the LDR provides data for the LDR in the form of a graph.



Describe how the resistance of the LDR changes when the light intensity increases from 100 lux to 300 lux.

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**(2)**

(c)     The student only obtained three results. These are given in the table.

|  |  |
| --- | --- |
| **Light intensity** | **Resistance in kilohms** |
| Dark | 750 |
| Bright | 100 |
| Very bright | 1 |

(i)      The student could **not** use the results to draw a line graph.  
Why not?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

(ii)     Do the student’s results agree with the data the manufacturer provided?

|  |  |  |
| --- | --- | --- |
| Draw a ring around your answer. | YES | NO |

Give a reason for your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(1)**

(d)     Which **one** of the following circuits probably includes a LDR?

Tick (https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q12S2F04_files/5_img01.png) **one** box.

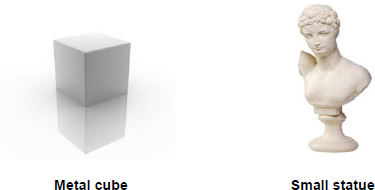
|  |  |
| --- | --- |
| A circuit that automatically switches outside lights on when it gets dark. | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q12S2F04_files/8_img02.png |
| A circuit that automatically switches central heating on and off. | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q12S2F04_files/8_img02.png |
| A circuit that automatically turns lights off when no one is in the room. | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q12S2F04_files/8_img02.png |

**(1)**

**Required Practical 4: Density**

**Use appropriate apparatus to make and record the measurements needed to determine the densities of regular and irregular solid objects and liquids.**

1. A student wants to calculate the density of the two objects shown in the figure below.



© Whitehoune/iStock/Thinkstock,      © Marc Dietrich/Hemera/Thinkstock

Describe the methods that the student should use to calculate the densities of the two objects.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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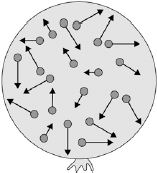
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**(6)**

1. The figure below shows a balloon filled with helium gas.



(a)     Describe the movement of the particles of helium gas inside the balloon.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(b)     What name is given to the total kinetic energy and potential energy of all the particles of helium gas in the balloon?

|  |  |
| --- | --- |
| Tick **one** box. |  |
| External energy | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP181F09_files/img02.png |
| Internal energy | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP181F09_files/img02.png |
| Movement energy | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP181F09_files/img02.png |

**(1)**

(c)     Write down the equation which links density, mass and volume.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(d)     The helium in the balloon has a mass of 0.00254 kg.

The balloon has a volume of 0.0141 m3.

Calculate the density of helium. Choose the correct unit from the box.

|  |
| --- |
| **m3 / kg**                              **kg / m3**                              **kg m3** |

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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       Density = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Unit \_\_\_\_\_\_\_\_\_

**(3)**

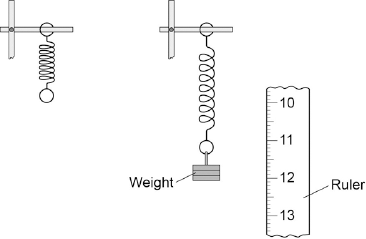
**Required Practical 5: Force and Extension**

**Investigate the relationship between force and extension for a spring.**

1. A student suspended a spring from a laboratory stand and then hung a weight from the spring.

**Figure 1** shows the spring before and after the weight is added.

**Figure 1**



(a)     Measure the extension of the spring shown in **Figure 1**.

Extension = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ mm

**(1)**

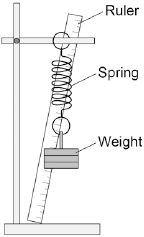
(b)     The student used the spring, a set of weights and a ruler to investigate how the extension of the spring depended on the weight hanging from the spring.

Before starting the investigation the student wrote the following prediction:

The extension of the spring will be directly proportional to the weight hanging from the spring.

**Figure 2** shows how the student arranged the apparatus.

**Figure 2**



Before taking any measurements, the student adjusted the ruler to make it vertical.

Explain why adjusting the ruler was important.

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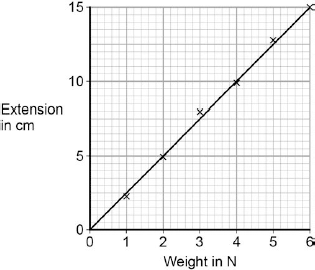
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(c)     The student measured the extension of the spring using a range of weights.

The student’s data is shown plotted as a graph in **Figure 3**.

**Figure 3**



What range of weight did the student use?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(d)     Why does the data plotted in **Figure 3** support the student’s prediction?

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**(1)**

(e)     Describe **one** technique that you could have used to improve the accuracy of the measurements taken by the student.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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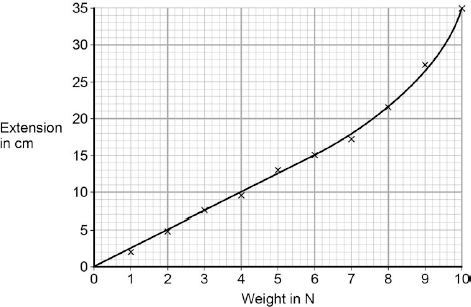
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

(f)     The student continued the investigation by increasing the range of weights added to the spring.

All of the data is shown plotted as a graph in **Figure 4**.

**Figure 4**



At the end of the investigation, all of the weights were removed from the spring.

What can you conclude from **Figure 4** about the deformation of the spring?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Give the reason for your conclusion.

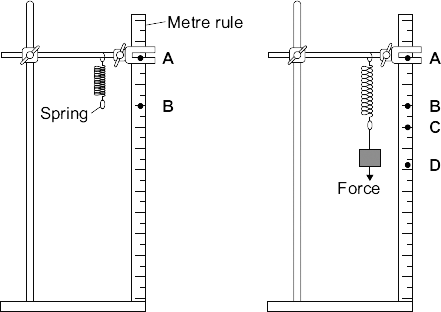
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

1. A student investigated how the extension of a spring depends on the force applied to the spring.

The diagram shows the spring before and after a force had been applied.



(a)      (i)     Complete the following sentence using letters, **A**, **B**, **C** or **D**, from the diagram.

The extension of the spring is the distance between the positions labelled

\_\_\_\_\_\_\_\_\_\_\_and \_\_\_\_\_\_\_\_\_\_\_ on the metre rule.

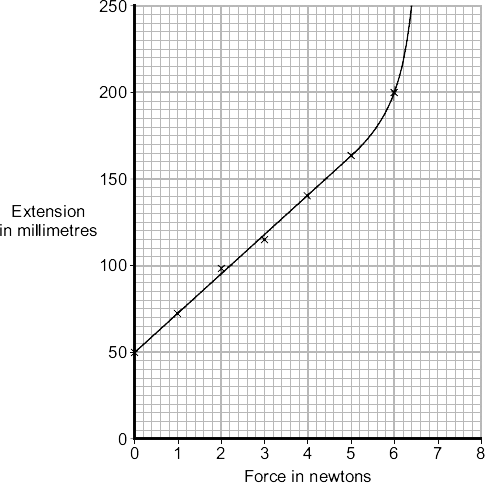
**(1)**

(ii)     What form of energy is stored in the stretched spring?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(b)     The results from the investigation are plotted on the following graph.



(i)     The graph shows that the student has made an error throughout the investigation.

What error has the student made?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Give the reason for your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(ii)     The student has loaded the spring beyond its *limit of proportionality*.

Mark on the graph line the *limit of proportionality* of the spring. Label the point **P**.

Give the reason for choosing your point **P**.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

(c)     The student uses a different spring as a spring balance. When the student hangs a stone from this spring, its extension is 72 mm.

The spring does not go past the limit of proportionality.

Calculate the force exerted by the stone on the spring.

|  |
| --- |
| spring constant = 25 N/m |

Show clearly how you work out your answer.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Force = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ N

**(2)**

**Required Practical 6: Acceleration**

**Investigate the effect of varying the force on the acceleration of an object of constant mass, and the effect of varying the mass of an object on the acceleration produced by a constant force.**

1. The figure below shows the horizontal forces acting on a car.

https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F10_files/img01.png

(a)     Which **one** of the statements describes the motion of the car?

|  |  |
| --- | --- |
| Tick **one** box. |  |
| It will be slowing down. | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F10_files/img02.png |
| It will be stationary. | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F10_files/img02.png |
| It will have a constant speed. | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F10_files/img02.png |
| It will be speeding up. | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F10_files/img02.png |

**(1)**

(b)     During part of the journey the car is driven at a constant speed for five minutes.

Which one of the equations links distance travelled, speed and time?

|  |  |
| --- | --- |
| Tick **one** box. |  |
| distance travelled = speed + time | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F10_files/img02.png |
| distance travelled = speed × time | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F10_files/img02.png |
| distance travelled = speed − time | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F10_files/img02.png |
| distance travelled = speed ÷ time | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F10_files/img02.png |

**(1)**

(c)     During a different part of the journey the car accelerates from 9m / s to 18m / s in 6 s.

Use the following equation to calculate the acceleration of the car.

   acceleration=https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F10_files/img03.png

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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acceleration = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ m / s2

**(2)**

(d)     Which equation links acceleration, mass and resultant force?

|  |  |
| --- | --- |
| Tick **one** box. |  |
| resultant force = mass + acceleration | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F10_files/img02.png |
| resultant force = mass × acceleration | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F10_files/img02.png |
| resultant force = mass − acceleration | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F10_files/img02.png |
| resultant force = mass ÷ acceleration | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F10_files/img02.png |

**(1)**

(e)     The mass of the car is 1120 kg. The mass of the driver is 80 kg.

Calculate the resultant force acting on the car and driver while accelerating.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Resultant force = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ N

**(2)**

(f)     Calculate the distance travelled while the car is accelerating.

Use the correct equation from the Physics Equation Sheet.

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Distance = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ m

**(3)**

(g)     A car driver sees a fallen tree lying across the road ahead and makes an emergency stop.

The braking distance of the car depends on the speed of the car.

For the same braking force, explain what happens to the braking distance if the speed doubles.

You should refer to kinetic energy in your answer.

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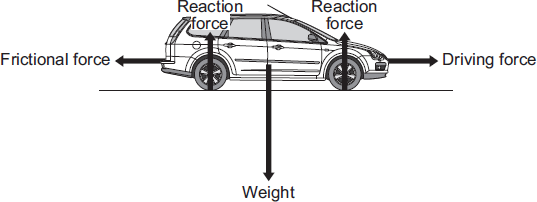
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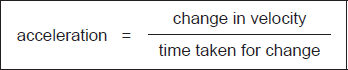
**(4)**

1. The diagram shows the forces acting on a car. The car is being driven along a straight, level road at a constant speed of 12 m/s.



(a)     The driver then accelerates the car to 23 m/s in 4 seconds.

Use the equation in the box to calculate the acceleration of the car.



Show clearly how you work out your answer and give the unit.

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Acceleration = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(3)**

(b)     Describe how the horizontal forces acting on the car change during the first **two** seconds of the acceleration.

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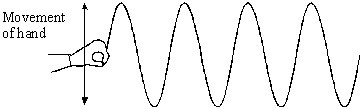
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**(3)**

**Required Practical 7: Waves**

**Make observations to identify the suitability of apparatus to measure the frequency, wavelength and speed of waves in a ripple tank and waves in a solid and take appropriate measurements.**

1. The diagram shows a wave travelling along a rope.



(a)     On the diagram:

(i)      show the wavelength and label it **W**;

(ii)     show the amplitude and label it **A**.

**(2)**

(b)     The wavelength of the wave is 0. I m. Its frequency is 2 Hz.

Calculate the speed of the wave. Show clearly how you work out your answer and give the unit.

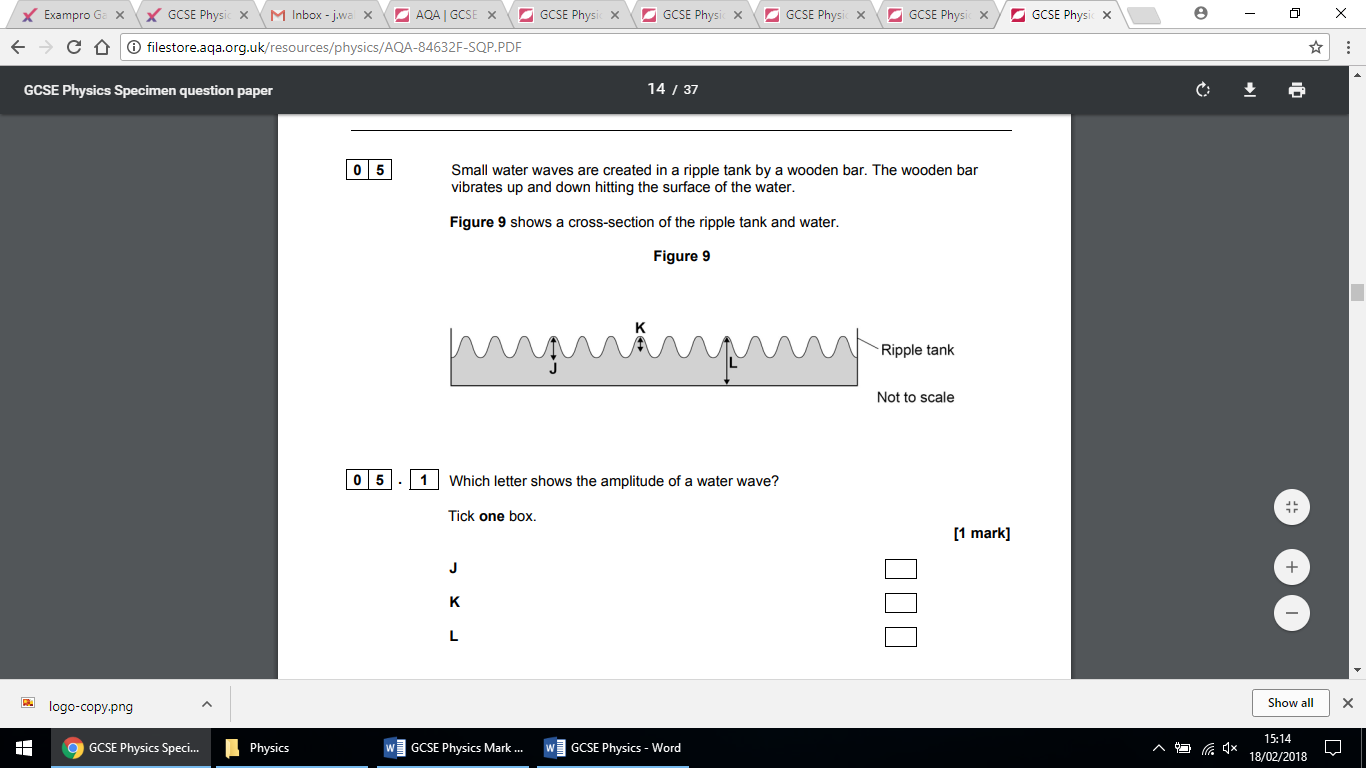
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Speed of wave \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(3)**

1. Small water waves are created in a ripple tank by a wooden bar. The wooden bar vibrates up and down hitting the surface of the water. Figure 9 shows a cross-section of the ripple tank and water.



1. Which letter shows the amplitude of a water wave? Circle one letter.

**J K L**

**(1)**

(b) Describe how the wavelength of the water waves in a ripple tank can be measured accurately.

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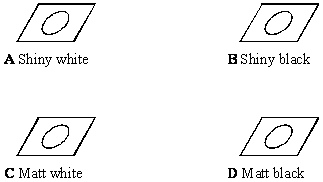
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**Required Practical 8: Radiation and Absorption**

**Investigate how the amount of infrared radiation absorbed or radiated by a surface depends on the nature of that surface.**

1. The diagram shows four identical pieces of aluminium. Each had been painted with a different type of paint. A drop of water was placed on each and they were then heated by a radiant heater held about one metre above them.



(i)      Suggest in which order the pieces of aluminium would become dry.

first \_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_    \_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_ last

**(1)**

(ii)      Explain why you chose your order.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(2)**

1. A student investigated the effect of shape and colour on heat transfer.

The student used metal containers with the same volume but with different shapes and outside colour. The containers were each filled with water at 100 °C.  
After 20 minutes the temperature of the water inside each container was measured.

|  |  |  |  |
| --- | --- | --- | --- |
| https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q11WY1H05_files/14_img01.png **A** | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q11WY1H05_files/14_img02.png **B** | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q11WY1H05_files/14_img03.png **C** | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q11WY1H05_files/14_img04.png **D** |

The results from the investigation are given in the table.

|  |  |  |  |
| --- | --- | --- | --- |
| **Container** | **Colour** | **Temperature after 20 minutes in °C** | **Temperature fall in °C** |
| **A** | White | 86 | 14 |
| **B** | Black | 86 | 14 |
| **C** | White | 73 | 27 |
| **D** | Black | 60 | 40 |

(i)      The student uses the results in the table to see if shape has affected heat transfer.

Which containers should the student compare to do this?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Give a reason for your answer.

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\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(1)**

(ii)     Explain why the temperature of the water in both containers **A** and **B** fell by the same amount.

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**(2)**

(iii)    A central heating system has several radiators joined together. The hot water goes from the boiler, through each radiator in turn and then back to the boiler for reheating.

Give **one** reason, other than appearance, why it might **not** be a good idea to paint radiators black.

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**(1)**

1. All objects emit and absorb infrared radiation.

(a)     Use the correct answer from the box to complete each sentence.

|  |  |  |  |
| --- | --- | --- | --- |
| **dark matt** | **dark shiny** | **light matt** | **light shiny** |

The best emitters of infrared radiation have

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ surfaces.

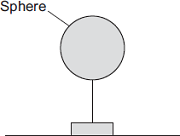
The worst emitters of infrared radiation have

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ surfaces.

**(2)**

(b)     **Diagram 1** shows a sphere which is at a much higher temperature than its surroundings.

**Diagram 1**



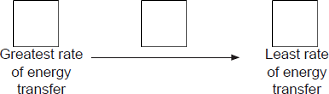
Energy is transferred from the sphere to the surroundings.

The table shows readings for the sphere in three different conditions, **A**, **B** and **C**.

|  |  |  |
| --- | --- | --- |
| **Condition** | **Temperature of sphere in °C** | **Temperature of surroundings in °C** |
| **A** | 70 | 5 |
| **B** | 80 | 0 |
| **C** | 90 | 30 |

In each of the conditions, **A**, **B** and **C**, the sphere transfers energy to the surroundings at a different rate.

Put conditions **A**, **B** and **C** in the correct order.



Give a reason for your answer.

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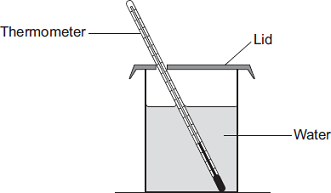
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**(2)**

(c)     **Diagram 2** shows a can containing water.

A student investigates how quickly a can of water heats up when it is cooler than room temperature.

**Diagram 2**



The student has four cans, each made of the same material, with the following outer surfaces.

|  |  |  |  |
| --- | --- | --- | --- |
| **dark matt** | **dark shiny** | **light matt** | **light shiny** |

The student times how long it takes the water in each can to reach room temperature.

Each can contains the same mass of water at the same starting temperature.

(i)      Which can of water will reach room temperature the quickest?

Give a reason for your answer.

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**(2)**

(ii)     Apart from material of the can, mass of water and starting temperature, suggest **three** control variables for the student’s investigation.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**(3)**