GCSE Physics Trilogy (F)



Required Practical Question Book

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

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| **Practical 1****Specific Heat Capacity** | **/ 19** | **Practical 5****Force and Extension** | **/ 15** |
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**Required Practical 1: Specific Heat Capacity**

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

1. A student investigated how much energy from the Sun was incident on the Earth’s surface at her location.

She put an insulated pan of water in direct sunlight and measured the time it took for the temperature of the water to increase by 0.6 °C.

The apparatus she used is shown in the figure below.



(a)     Choose the most appropriate resolution for the thermometer used by the student.

|  |  |
| --- | --- |
| Tick **one** box. |   |
| 0.1 °C | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP181F12_files/img02.png  |
| 0.5 °C | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP181F12_files/img02.png  |
| 1.0 °C | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP181F12_files/img02.png  |

**(1)**

(b)     The energy transferred to the water was 1050 J.

The time taken for the water temperature to increase by 0.6 °C was 5 minutes.

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

Write down the equation which links energy transferred, power and time.

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**(1)**

(c)     Calculate the mean power supplied by the Sun to the water in the pan.

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

**(2)**

(d)     Calculate the mass of water the student used in her investigation.

Use the correct equation from the Physics Equation Sheet.

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

**(3)**

(e)     The student’s results can only be used as an estimate of the mean power at her location.

Give **one** reason why.

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**(1)**

1. A student used the apparatus in **Figure 1** to compare the energy needed to heat blocks of different materials.

Each block had the same mass.

Each block had holes for the thermometer and the immersion heater.

Each block had a starting temperature of 20 °C.

**Figure 1**



The student measured the time taken to increase the temperature of each material by 5 °C.

(a)     (i)      State **two** variables the student controlled.

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

2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(2)**

**Figure 2** shows the student’s results.

**Figure 2**


                          Material

(ii)     Why was a bar chart drawn rather than a line graph?

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**(1)**

(iii)    Which material was supplied with the most energy?

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Give the reason for your answer.

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**(2)**

(iv)    The iron block had a mass of 2 kg.

Calculate the energy transferred by the heater to increase the temperature of the iron block by 5 °C.

The specific heat capacity of iron is 450 J / kg °C.

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

**(2)**

(b)     The student used the same apparatus to heat a 1 kg block of aluminium.

He recorded the temperature of the block as it was heated from room temperature.

The results are shown in **Figure 3**.

**Figure 3**


                            Time the immersion heater is switched on for in minutes

(i)      One of the student’s results is anomalous.

Draw a ring around the anomalous result.

**(1)**

(ii)     Draw the line of best fit for the points plotted in **Figure 3**.

**(1)**

(iii)    What was the temperature of the room?

Temperature = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ °C

**(1)**

(iv)     What was the interval of the time values used by the student?

Interval = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ minutes

**(1)**

**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 wants to investigate how the current through a filament lamp affects its resistance.

(a)     Use the circuit symbols in the boxes to draw a circuit diagram that she could use.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **12 V battery** | **variableresistor** | **filamentlamp** | **voltmeter** | **ammeter** |
| https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP181F05_files/img01.png | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP181F05_files/img02.png | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP181F05_files/img03.png | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP181F05_files/img04.png | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP181F05_files/img05.png |

**(2)**

(b)     Describe how the student could use her circuit to investigate how the current through a filament lamp affects its resistance.

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**(4)**

(c)     The student’s results are shown in **Figure 1**.

**Figure 1**



Describe how the resistance of the filament lamp changes as the current through it increases.

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**(1)**

(d)     Use **Figure 1** to estimate the resistance of the filament lamp when a current of 0.10 A passes through the lamp.

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

**(1)**

(e)     The current‑potential difference graphs of three components are shown in **Figure 2**.

Use answers from the box to identify each component.

|  |  |  |
| --- | --- | --- |
| **diode** | **filament lamp** | **light dependent resistor** |
| **resistor at constant temperature** | **thermistor** |

**Figure 2**

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

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

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

**(3)**

1. A resistor is a component that is used in an electric circuit.

 

(i)      Describe how a student would use the circuit to take the readings necessary to determine the resistance of resistor **R**.

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**(6)**

**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.



**(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 () **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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**(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** |

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

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

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

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

       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)     Which distance gives the extension of the spring?

|  |  |
| --- | --- |
| Tick **one** box. |   |
| from **J** to **K** | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F04_files/img02.png  |
| from **K** to **L** | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F04_files/img02.png  |
| from **J** to **L** | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F04_files/img02.png  |

**(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.

**Figure 2** shows that the ruler is in a tilted position and not upright as it should be.

**Figure 2**



How would leaving the ruler tilted affect the weight and extension data to be recorded by the student?

Use answers from the box to complete each sentence.

Each answer may be used once, more than once or not at all.

|  |  |  |
| --- | --- | --- |
| **greater than** | **the same as** | **smaller than** |

The weight recorded by the student would be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the actual weight.

The extension recorded by the student would be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the actual extension of the spring.

**(2)**

(c)     The student moves the ruler so that it is upright and not tilted.

The student then completed the investigation and plotted the data taken in a graph.

The student’s graph is shown in **Figure 3**.

**Figure 3**



Use **Figure 3** to determine the additional force needed to increase the extension of the spring from 5cm to 15cm.

Additional force = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ N

**(1)**

(d)     What can you conclude from **Figure 3** about the limit of proportionality of the spring?

**(1)**

(e)     The student repeated the investigation with three more springs, **K**, **L** and **M**.

The results for these springs are given in **Figure 4**.

**Figure 4**



All three springs show the same relationship between the weight and extension.

What is that relationship?

|  |  |
| --- | --- |
| Tick **one** box. |   |
| The extension increases non-linearly with the increasing weight. | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F04_files/img02.png  |
| The extension is inversely proportional to the weight. | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F04_files/img02.png  |
| The extension is directly proportional to the weight. | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/QSP182F04_files/img02.png  |

**(1)**

(f)     Which statement, **A**, **B** or **C**, should be used to complete the sentence?

Write the correct letter, **A**, **B** or **C**, in the box below.

**A**         a lower spring constant than

**B**         the same spring constant as

**C**         a greater spring constant than

From **Figure 4** it can be concluded that spring **M** has      the other two springs.

**(1)**

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.

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

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

**(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**.

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

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

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

**(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.

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

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

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.



(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=

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

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

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.

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

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

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

**(2)**

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

Use the correct equation from the Physics Equation Sheet.

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

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

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

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.

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

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

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

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

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

**(4)**

1. A high-speed train accelerates at a constant rate in a straight line.

The velocity of the train increases from 30 m/s to 42 m/s in 60 seconds.

(a)     (i)      Calculate the change in the velocity of the train.

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

Change in velocity = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ m/s

**(1)**

(ii)     Use the equation in the box to calculate the acceleration of the train.



Show clearly how you work out your answer and give the unit.
Choose the unit from the list below.

|  |  |  |  |
| --- | --- | --- | --- |
| **m/s** | **m/s2** | **N/kg** | **Nm** |

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

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

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

**(2)**

(b)     Which **one** of the graphs, **A**, **B** or **C**, shows how the velocity of the train changes as it accelerates?

Write your answer, **A**, **B** or **C**, in the box.

|  |  |  |
| --- | --- | --- |
| https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q11WY2F03_files/6_img02.png **A** | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q11WY2F03_files/6_img03.png **B** | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q11WY2F03_files/6_img04.png **C** |

Graph    **(1)**

**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.

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

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

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.

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

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

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

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

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **(2)**

**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. A student did two experiments on radiation. The apparatus he used is shown in the diagram.



**Experiment 1**

•        The student put the same volume of cold water into the two cans.

•        He then switched on the heater.

•        Ten minutes later the water in the can with the dull black surface was much hotter than the water in the other can.

**Experiment 2**

•        The student filled both cans with boiling water.

•        This time he left the heater off.

•        Ten minutes later the water in the can with the dull black surface was much cooler than the water in the other can.

          Use words from the box to complete the sentences.

|  |
| --- |
| absorber            conductor            emitter            reflector |

**Experiment 1** shows that the dull black surface is a good \_\_\_\_\_\_\_\_\_\_\_\_\_\_ of radiation

and that the shiny silver surface is a good \_\_\_\_\_\_\_\_\_\_\_\_\_ of radiation.

**Experiment 2** shows that the dull black surface is a good \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of radiation.

**(3)**

1. (a) Use the words from the box to complete the following sentences.

|  |  |  |
| --- | --- | --- |
| **conduction** | **convection** | **radiation** |

(i)      The transfer of thermal energy (heat) by the movement of hot liquids

is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**(1)**

(ii)     The transfer of thermal energy (heat) from one particle to another

is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ .

**(1)**

(b)     A student set up the following equipment. The 3 metal plates are the same distance from the heater. The surfaces of each of the 3 metal plates are different colours.



The student switched the heater on for 10 minutes. The thermometers were read before the heater was switched on. The thermometers were read again just after the heaters were switched off.
The readings are shown in the table.

|  |  |  |
| --- | --- | --- |
|  | **Temperature beforeswitching on in °C** | **Temperature afterswitching on in °C** |
| **1** | 19 | 21 |
| **2** | 19 | 29 |
| **3** | 19 | 23 |

(i)     Which set of readings, **1**, **2** or **3**, is most likely to have been taken from the thermometer labelled **L**?

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

Give a reason for your answer.

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

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

**(2)**

(ii)     Which **one** of the following was **not** a control variable in this experiment?

Put a tick () in the box next to your answer.

|  |  |
| --- | --- |
| the distance between the heater and the metal plates | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q11WY1F04_files/box.png  |

|  |  |
| --- | --- |
| the power of the heater | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q11WY1F04_files/box.png  |

|  |  |
| --- | --- |
| the temperature before the heater was switched on | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q11WY1F04_files/box.png  |

|  |  |
| --- | --- |
| the colour of the metal plates | https://app.doublestruck.eu/content/AG_PHS/HTML/Q/Q11WY1F04_files/box.png  |

**(1)**

(iii)    Suggest **one** advantage of using a temperature sensor, data logger and computer, rather than a thermometer to carry out this experiment.

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

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

**(1)**

(c)     The picture shows a fire fighter putting out a forest fire. The fire fighter’s clothing has thick thermal padding inside and a light coloured, fire proof, shiny layer outside.



(i)      What is the main way that heat is transferred through the air from the fire to the fire fighter?

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

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

**(1)**

(ii)     Why is the outside layer of the clothing shiny?

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

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

**(1)**

(d)     The graph shows the result of a laboratory test on two types of thermal padding. Each type of padding was put onto a very hot metal surface and the temperature inside the padding was taken every minute.



Which type of padding, **M** or **N**, would it be best to use inside the fire fighter’s clothing?

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

Give a reason for your answer.

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

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

**(1)**