AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname ____________________

Forename(s) ____________________

Candidate signature ____________________
I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Physics Paper 2F

Friday 16 June 2023 Morning Time allowed: 1 hour 15 minutes

Materials
For this paper you must have:
- a protractor
- a ruler
- a scientific calculator
- the Physics Equations Sheet (enclosed).

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information
- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

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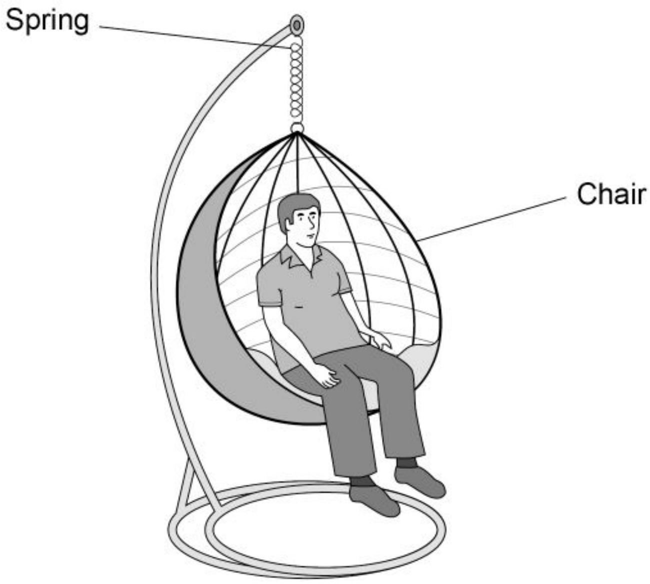
0 1 **Figure 1** shows a garden chair hanging from a spring.

Figure 1



The weight of the person causes the spring to extend.

0 1 . 1 Why does the weight of the person cause the spring to extend?

[1 mark]

Tick (✓) **one** box.

Weight acts downwards ☐

Weight acts in all directions ☐

Weight acts upwards ☐

0 1 . 2 Complete the sentence.

Choose the answer from the box.

[1 mark]

a gravitational	**a frictional**	**an electrostatic**

The weight of the person in **Figure 1** is ________________________________ force.

Question 1 continues on the next page

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The weight of the person causes an extension in the spring of 0.070 m.

The spring constant of the spring is 12 000 N/m.

0 1 . 3 Calculate the weight of the person.

Use the equation:

weight = spring constant × extension

[2 marks]

Weight = ______________________ N

0 1 . 4 Calculate the elastic potential energy stored in the extended spring.

Use the equation:

elastic potential energy = 0.5 × spring constant × $(\text{extension})^2$

[2 marks]

Elastic potential energy = ______________________ J

0 1 . 5 If there is more than one person on the chair, the spring could become inelastically deformed.

What is meant by 'inelastically deformed'?

[1 mark]

Tick (✓) **one** box.

The spring extends more when two or more forces act on it. ☐

The spring will not go back to its original length when the force is removed. ☐

The spring extends so that it is twice as long as its original length. ☐

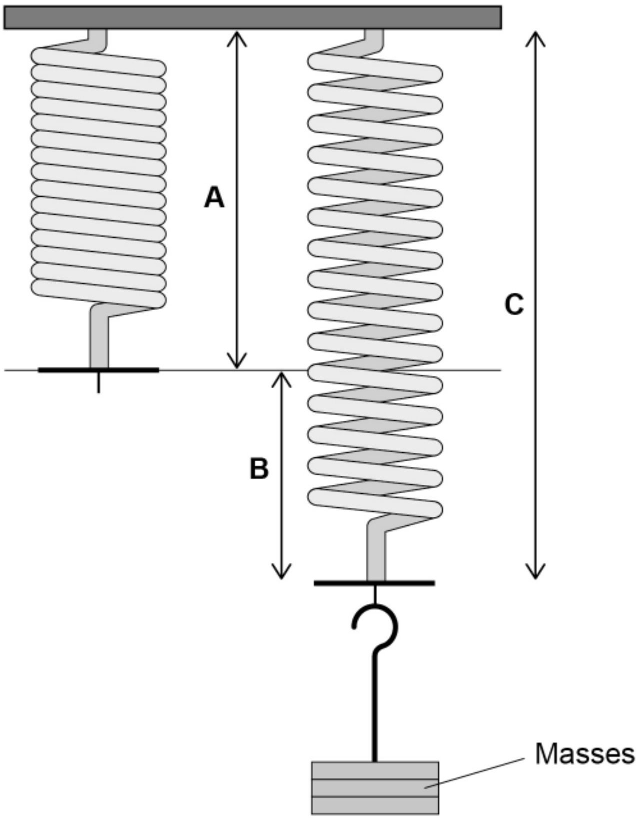
Question 1 continues on the next page

The manufacturer of the chair investigated the extension of a new spring.

0 1 . 6 **Figure 2** shows slotted masses hanging from the spring.

The weight of the masses extends the spring.

Figure 2



Which length in **Figure 2** represents the extension of the spring?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐

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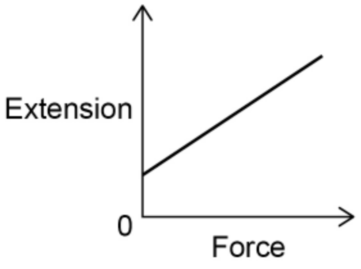
0 1 . 7 Which graph shows that the extension of the spring is directly proportional to the force applied to the spring?

[1 mark]

Tick (✓) **one** box.

A



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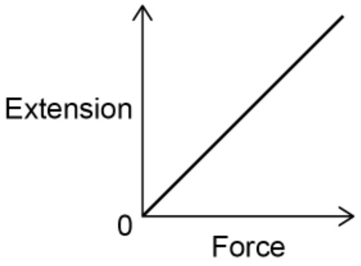
B



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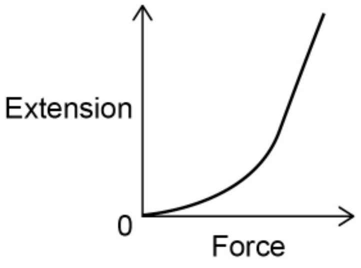
C



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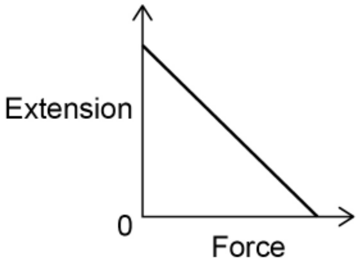
D



☐

Question 1 continues on the next page

Turn over ►

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0 1 . 8 **Table 1** shows the results of the manufacturer's investigation.

Table 1

Force in newtons	**Extension in metres**
100	0.008
200	0.016

Suggest **two** improvements to the investigation.

[2 marks]

1 ____

____

2 ____

____

11

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Turn over for the next question

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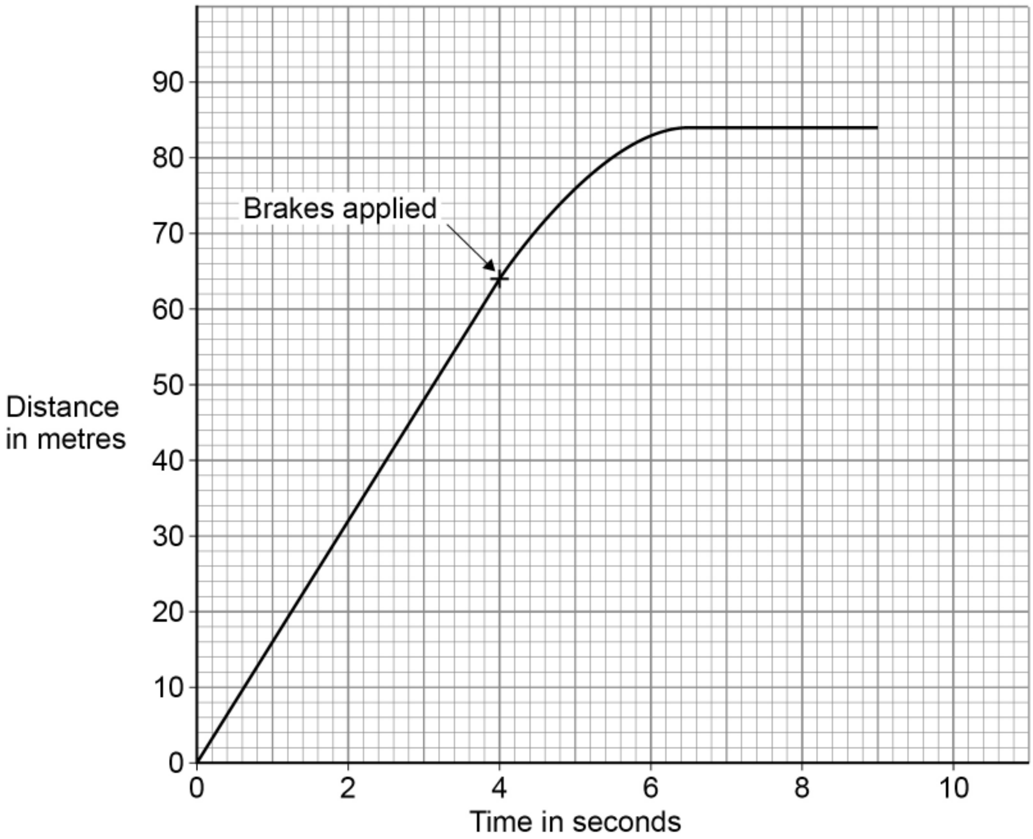
ANSWER IN THE SPACES PROVIDED

0 2 A car contains a device called a black box. The black box records the distance travelled and the time taken for each journey.

Figure 3 shows the distance–time graph for part of a journey.

Figure 3



0 2 . 1 Which feature of **Figure 3** shows that the car travels at a constant speed for the first 4 seconds?

[1 mark]

Tick (✓) **one** box.

The line becomes horizontal. ☐

The line goes through the origin. ☐

The line is straight. ☐

0 2 . 2 After 4 seconds the driver applied the brakes and the car slowed down and stopped.

The distance the car travelled after the brakes were applied is called the braking distance.

Determine the braking distance of the car.

Use **Figure 3**.

[2 marks]

Braking distance = ______________________ m

The black box also records the deceleration of the car.

0 2 . 3 As the car decelerates, the velocity of the car changes by 16 m/s.

The car decelerates for 2.5 seconds.

Calculate the deceleration of the car.

Use the equation:

$$\text{deceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

[2 marks]

Deceleration = ______________________ m/s^2

0 2 . 4 If the black box records large decelerations, it identifies that the driving may be dangerous.

Why can large decelerations be dangerous?

[2 marks]

Tick (✓) **two** boxes.

The brakes on the car can overheat. ☐

The driver may lose control of the car. ☐

The force applied by the brakes is very small. ☐

The reaction time of the driver increases. ☐

The thinking distance is very short. ☐

0 2 . 5 The black box monitors the speed of the car.

Describe how speed affects braking distance.

[1 mark]

____

____

8

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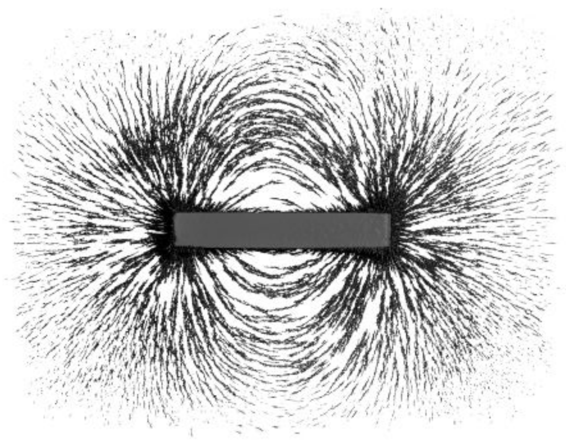
0 3 **Figure 4** shows iron filings sprinkled around a bar magnet.

Figure 4



0 3 . 1 Why are the iron filings attracted to the bar magnet?

[1 mark]

Tick (✓) **one** box.

Iron is a metal. ☐

Iron is charged. ☐

Iron is heavy. ☐

Iron is magnetic. ☐

Question 3 continues on the next page

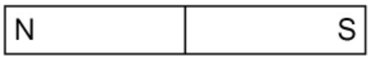
0 3 . 2 **Figure 5** shows a bar magnet.

Draw magnetic field lines to show the magnetic field pattern around the bar magnet.

You should add arrows to the field lines to show the direction of the magnetic field.

[2 marks]

Figure 5



0 3 . 3 **Figure 6** shows two bar magnets.

Figure 6

The magnets attract each other.

What conclusion can be made about the two poles marked **X** and **Y**?

[1 mark]

Tick (✓) **one** box.

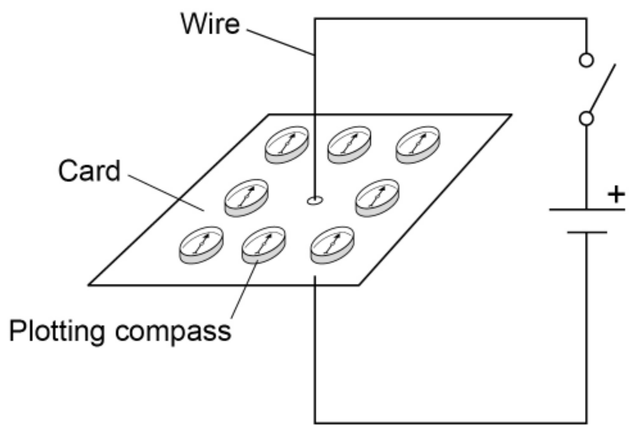
They are both north poles. ☐

They are both south poles. ☐

They are opposite poles. ☐

Figure 7 shows some plotting compasses around a wire. There is no current in the wire.

Figure 7



0 3 . 4 Why do the plotting compasses all point in the same direction?

[1 mark]

____

____

0 3 . 5 When the switch is closed there is a current in the wire.

The current creates a magnetic field.

What shape are the magnetic field lines around the wire?

[1 mark]

Tick (✓) **one** box.

Circular ☐

Rectangular ☐

Square ☐

Triangular ☐

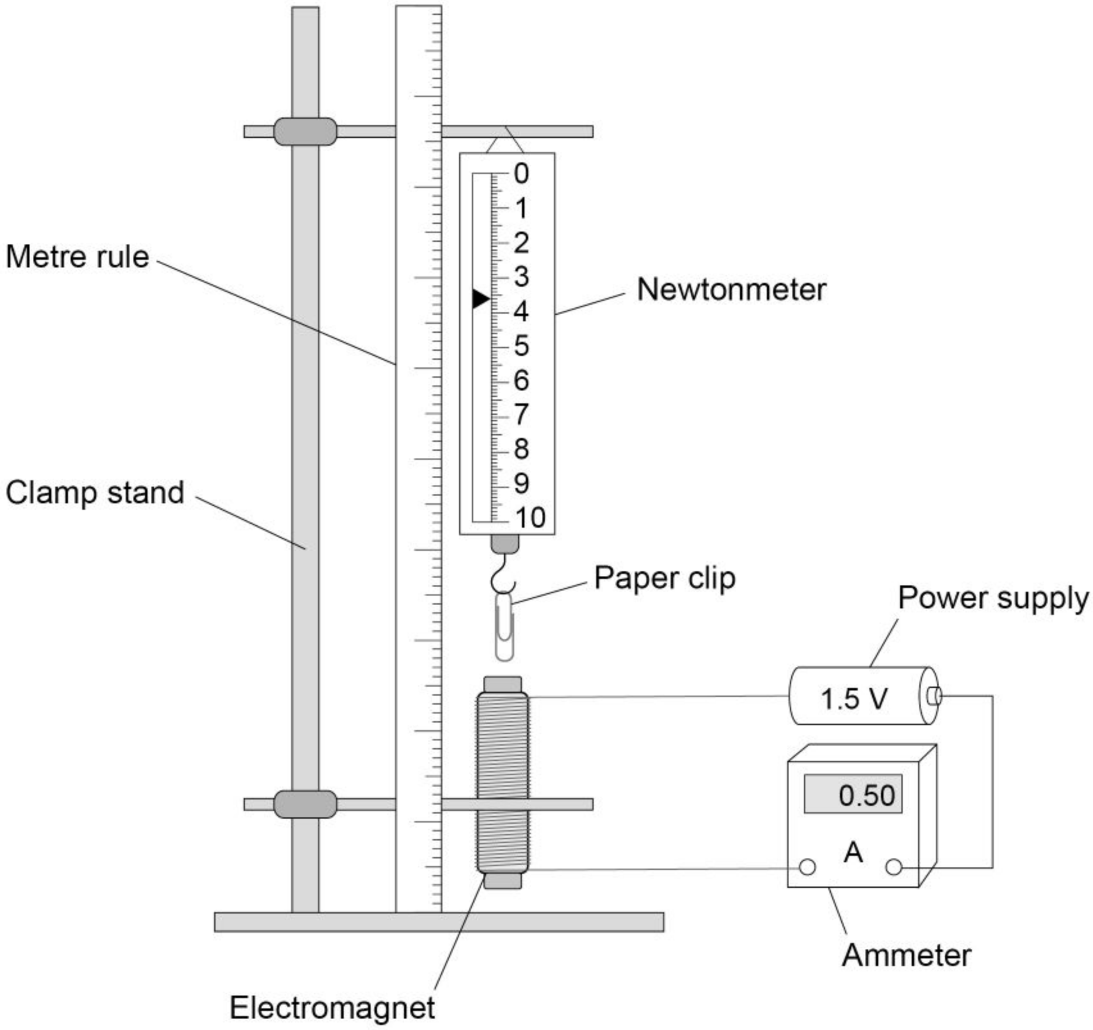
Turn over ►

A student investigated the force exerted by an electromagnet on a paper clip.

The student varied the distance between the paper clip and the electromagnet.

Figure 8 shows the equipment used.

Figure 8



The student recorded the reading on the newtonmeter for several different distances.

Do not write outside the box

0 3 . 6 The current in the electromagnet was the same for each distance.

Complete the sentence.

Choose the answer from the box.

[1 mark]

a control	**the dependent**	**the independent**

In the investigation, the current was ______________________________ variable.

0 3 . 7 What is the size of the downward force on the paper clip in **Figure 8**?

[1 mark]

Force = ________________________ N

0 3 . 8 The distance between the paper clip and the electromagnet is **increased**.

What happens to the size of the downward force?

[1 mark]

____

9

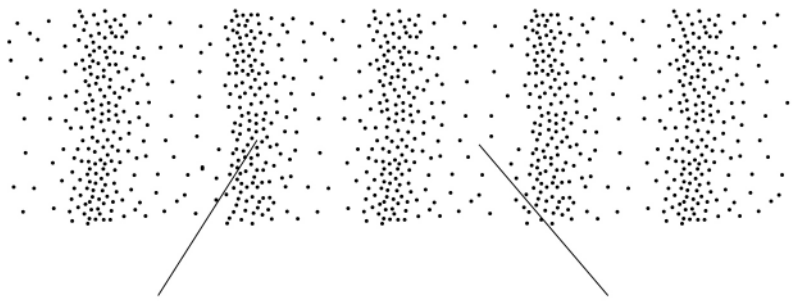
Turn over for the next question

Do not write outside the box

0 4 Sound waves are longitudinal waves.

0 4 . 1 **Figure 9** shows a sound wave.

Figure 9



____________________ ____________________

Complete the labels on **Figure 9**.

Choose answers from the box.

[2 marks]

compression	**extension**	**rarefaction**
reflection		**resistance**

Do not write outside the box

0 4 . 2 Which of the following is true for longitudinal waves?

[1 mark]

Tick (✓) **one** box.

Longitudinal waves transfer charge. ☐

Longitudinal waves transfer energy. ☐

Longitudinal waves transfer matter. ☐

Question 4 continues on the next page

Figure 10 shows a device a farmer uses to scare away birds.

Figure 10

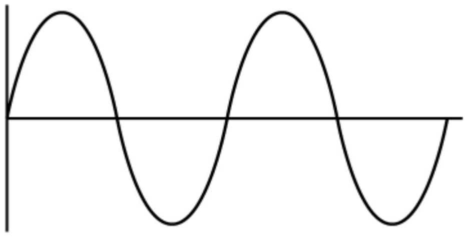
The device emits a very loud sound.

The farmer measures the sound emitted by the device at different distances from the device.

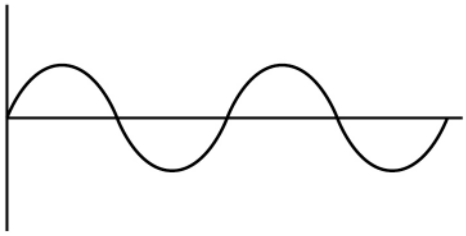
0 4 . 3 **Figure 11** shows a visual display of the sound waves at different distances from the device.

Both waves are drawn to the same scale.

Figure 11



At a distance of 80 m



At a distance of 200 m

Which property of the wave changes between 80 m and 200 m?

[1 mark]

Tick (✓) **one** box.

Amplitude ☐

Frequency ☐

Period ☐

Wavelength ☐

Question 4 continues on the next page

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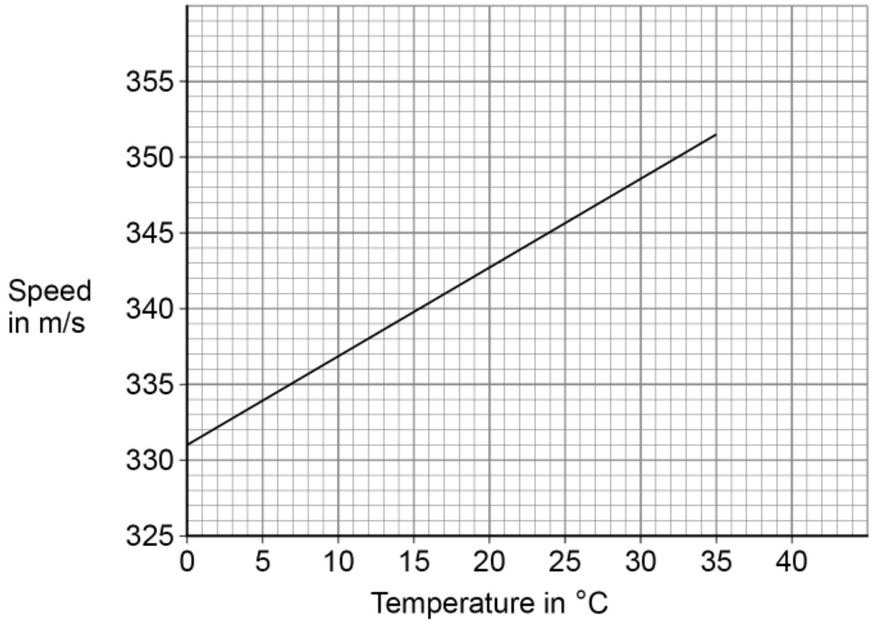
Figure 12 shows how the speed of the sound emitted by the device is affected by the temperature of the air.

Figure 12



0 4 . 4 The farmer tests the device on a day when the temperature of the air is 15 °C.

What is the speed of the sound emitted by the device when the temperature of the air is 15 °C?

[1 mark]

Speed = ________________________ m/s

Do not write outside the box

0 4 . 5 The farmer stands a safe distance from the device.

It takes a time of 0.20 s for the sound to travel from the device to the farmer.

Calculate the distance between the device and the farmer.

Use your answer to Question **04.4** and the equation:

distance = speed × time

[2 marks]

Distance = ____________________ m

0 4 . 6 Explain how the time taken for the sound to reach the farmer is affected by the temperature of the air.

Use **Figure 12**.

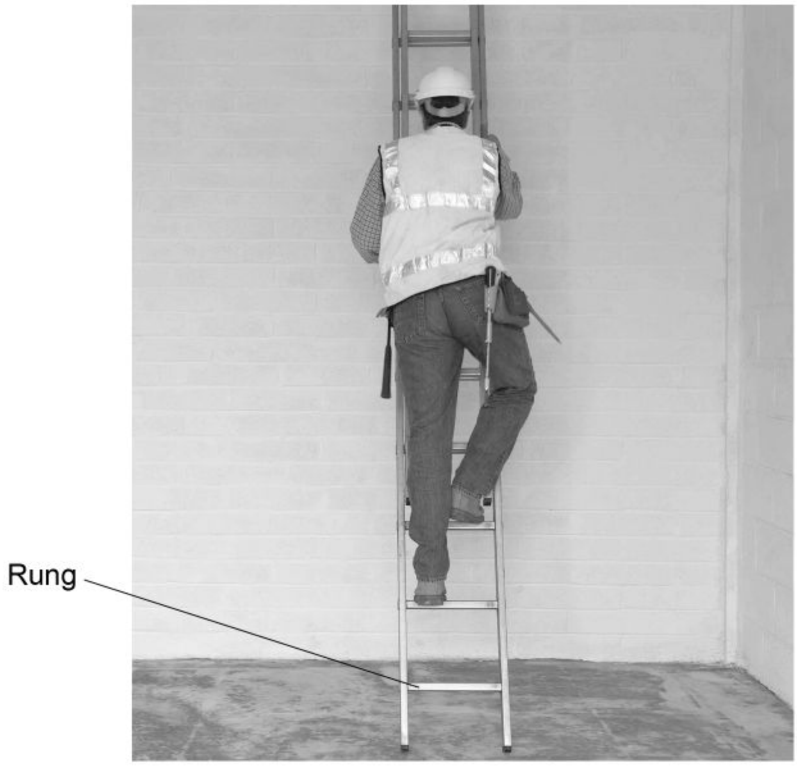
[2 marks]

9

Turn over for the next question

0 5 **Figure 13** shows an engineer climbing up a ladder.

Figure 13



The distance between each rung on the ladder is 30 cm.

0 5 . 1 What is 30 cm in metres?

[1 mark]

Tick (✓) **one** box.

0.030 m ☐ 0.30 m ☐ 3.0 m ☐ 30 m ☐

Do not write outside the box

0 5 . 2 The engineer has a weight of 710 N.

Calculate the work done when climbing up one rung of the ladder.

Use your answer to Question **05.1** and the equation:

work done = force × distance

[2 marks]

Work done = ____________________ Nm

0 5 . 3 The engineer climbs the ladder carrying some equipment.

Give the reason why carrying equipment increases the work done by the engineer when climbing the ladder.

[1 mark]

Question 5 continues on the next page

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0 5 . 4 The engineer is stationary at the top of the ladder.

Which energy stores of the engineer increase due to the engineer climbing the ladder?

[2 marks]

Tick (✓) **two** boxes.

Chemical ☐

Elastic potential ☐

Gravitational potential ☐

Kinetic ☐

Thermal ☐

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Use the Physics Equations Sheet to answer questions **05.5** and **05.6**.

0 5 . 5 Write down the equation that links gravitational field strength (g), mass (m) and weight (W).

[1 mark]

0 5 . 6 The engineer has a weight of 710 N.

gravitational field strength = 9.8 N/kg

Calculate the mass of the engineer.

Give your answer to 2 significant figures.

[4 marks]

Mass (2 significant figures) = ____________________ kg

11

Turn over for the next question

Do not write outside the box

0 6 The Sun emits a continuous spectrum of electromagnetic waves.

Figure 14 names some of the groups of waves in the electromagnetic spectrum.

Figure 14

A	**B**	Infrared	Visible light	Ultraviolet	**C**	Gamma rays

0 6 . 1 Name groups **A**, **B** and **C** in **Figure 14**.

[2 marks]

A ______________________________

B ______________________________

C ______________________________

0 6 . 2 Give **one** similarity and **one** difference between the properties of ultraviolet waves and gamma rays.

[2 marks]

Similarity ______________________________

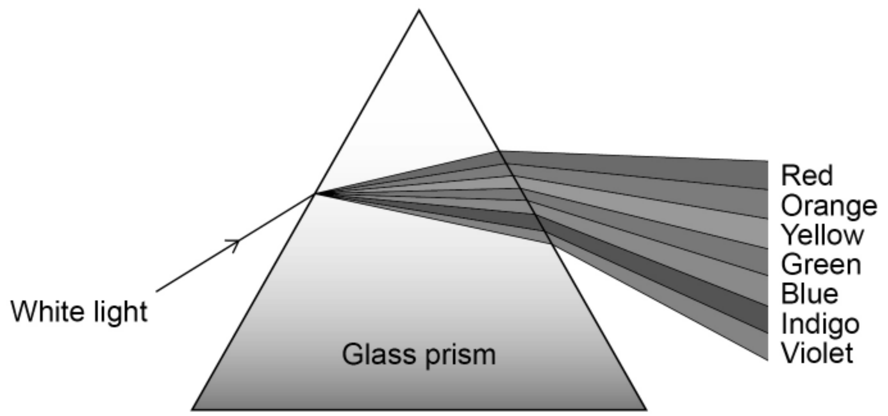
____

Difference ______________________________

____

Figure 15 shows white light split into a spectrum of different colours by a glass prism.

Figure 15



0 6 . 3 Light changes direction when it enters the glass prism.

What name is given to this process?

[1 mark]

Question 6 continues on the next page

Do not write outside the box

Use the Physics Equations Sheet to answer questions **06.4** and **06.5**.

0 6 . 4 Write down the equation that links frequency (f), wavelength (λ) and wave speed (v).

[1 mark]

0 6 . 5 The wave in the middle of the spectrum has a wavelength of 5.0×10^{-7} m.

wave speed of light = 3.0×10^{8} m/s

Calculate the frequency of the wave.

[3 marks]

Frequency = ____________________ Hz

9

Turn over for the next question

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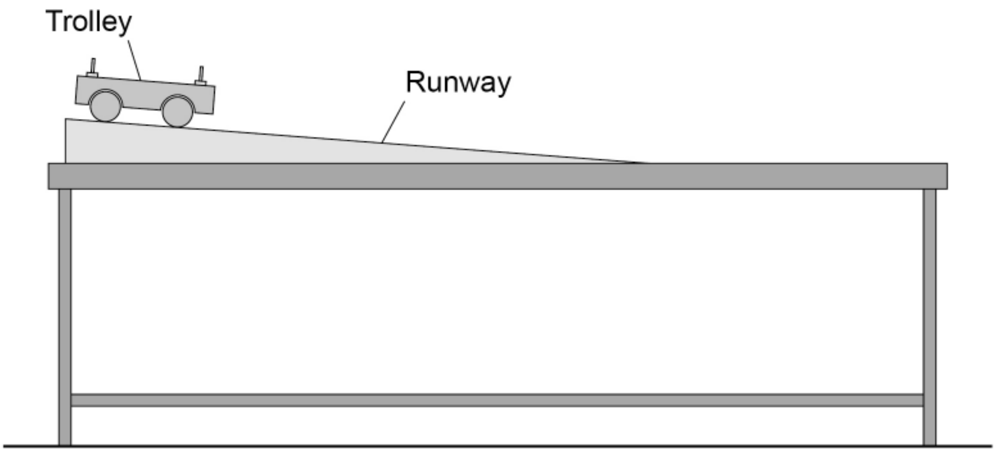
0 7 A student investigated how the acceleration of a trolley is affected by the force acting on the trolley.

Figure 16 shows some of the equipment used.

Figure 16



0 7 . 1 Describe a method the student could use.

Your answer should include any extra equipment needed.

[6 marks]

Question 7 continues on the next page

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Table 2 shows one set of results for a similar investigation.

Table 2

Resultant force in newtons	**Acceleration in m/s^2**
1.2	1.6

0 7 . 2 Which of Newton's laws predicts that the acceleration of the trolley is proportional to the resultant force on the trolley?

[1 mark]

Tick (✓) **one** box.

First law ☐

Second law ☐

Third law ☐

0 7 . 3 Determine the acceleration of the trolley when the resultant force is 3.6 N.

Use **Table 2**.

[2 marks]

____

____

____

Acceleration = ______________________ m/s^2

Use the Physics Equations Sheet to answer questions **07.4** and **07.5**.

0 7 . 4 Write down the equation that links acceleration (*a*), mass (*m*) and resultant force (*F*).

[1 mark]

____

____

0 7 . 5 A resultant force of 0.42 N acts on a different trolley.

The acceleration of the trolley is 1.2 m/s^2.

Calculate the mass of the trolley.

[3 marks]

____

____

____

____

____

Mass of trolley = ____________________ kg

13

END OF QUESTIONS

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