AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
PHYSICS

F

Foundation Tier Paper 2

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:
- a ruler
- a scientific calculator
- a protractor
- 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.
- Do not write outside the box around each page or on blank pages.
- 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

Information
- The maximum mark for this paper is 100.
- 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.

Answer **all** questions in the spaces provided.

Do not write outside the box

0 1 **Figure 1** shows a water wave.

Figure 1

0 1 . 1 What type of wave is a water wave?

[1 mark]

Tick (✓) **one** box.

Electromagnetic ☐

Longitudinal ☐

Transverse ☑

0 1 . 2 Which statement describes the movement of the water at point **X**?

[1 mark]

Tick (✓) **one** box.

The water at point **X** does **not** move. ☐

The water at point **X** moves to the left and right. ☐

The water at point **X** moves up and down. ☑

Do not write outside the box

0 1 . 3 The wave has a frequency of 2.0 hertz.

The wavelength is 0.032 metres.

Calculate the wave speed.

Use the equation:

wave speed = frequency × wavelength

Choose the unit from the box.

[3 marks]

m^2/s	m/s	s^2

$v = 2.0 \times 0.032$

$v = 0.064$ (m/s)

Wave speed = 0.064 Unit m/s

0 1 . 4 What is transferred by all waves?

[1 mark]

Tick (✓) **one** box.

- Energy ✓
- Information
- Water

Question 1 continues on the next page

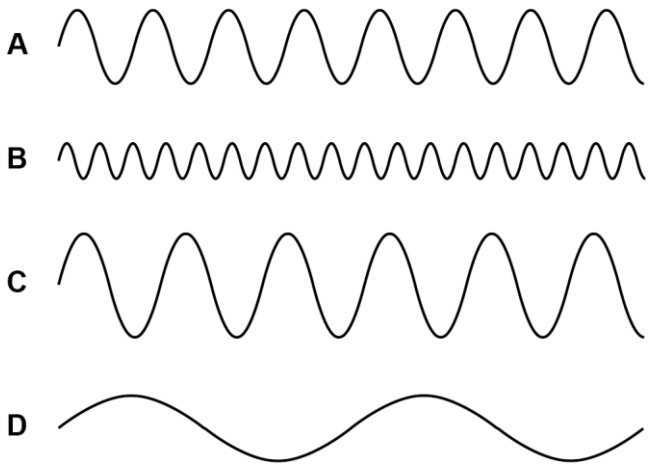
Do not write outside the box

Figure 2 shows four water waves.

The waves are all drawn to the same scale.

The waves all travel at the same speed.

Figure 2



0 1 . 5 Which wave has the longest wavelength?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☑

0 1 . 6 Which wave has the highest frequency?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☑ **C** ☐ **D** ☐

8

Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

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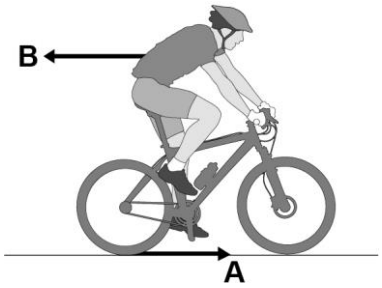
0 2 **Figure 3** shows a cyclist on a bicycle.

The cyclist is moving at a constant velocity.

Arrows **A** and **B** represent the horizontal forces acting on the bicycle and cyclist.

Figure 3



0 2 . 1 What is force **A**?

[1 mark]

Tick (✓) **one** box.

Air resistance ☐

Friction ☑

Tension ☐

Upthrust ☐

Do not write outside the box

0 2 . 2 What is force **B**?

[1 mark]

Tick (✓) **one** box.

- Air resistance ☑
- Magnetic ☐
- Tension ☐
- Upthrust ☐

0 2 . 3 What is the relationship between force **A** and force **B** when the cyclist travels at a constant velocity?

[1 mark]

Tick (✓) **one** box.

- **A** = **B** ☑
- **A** > **B** ☐
- **A** < **B** ☐

Question 2 continues on the next page

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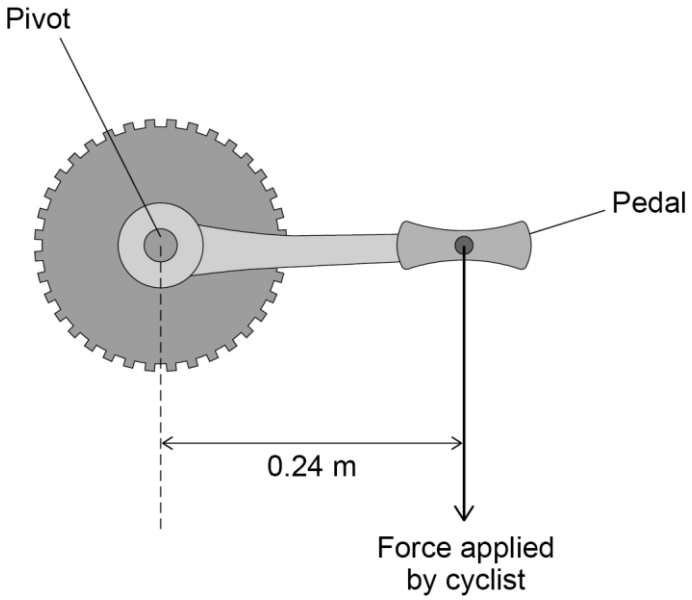
0 2 . 4 The cyclist applies a force of 150 N to one of the bicycle pedals.

Figure 4 shows the distance between the force applied and the pivot.

Figure 4



Calculate the moment about the pivot caused by the force applied to the pedal in **Figure 4**.

Use the equation:

moment of a force = force × distance

[2 marks]

M = 150 × 0.24

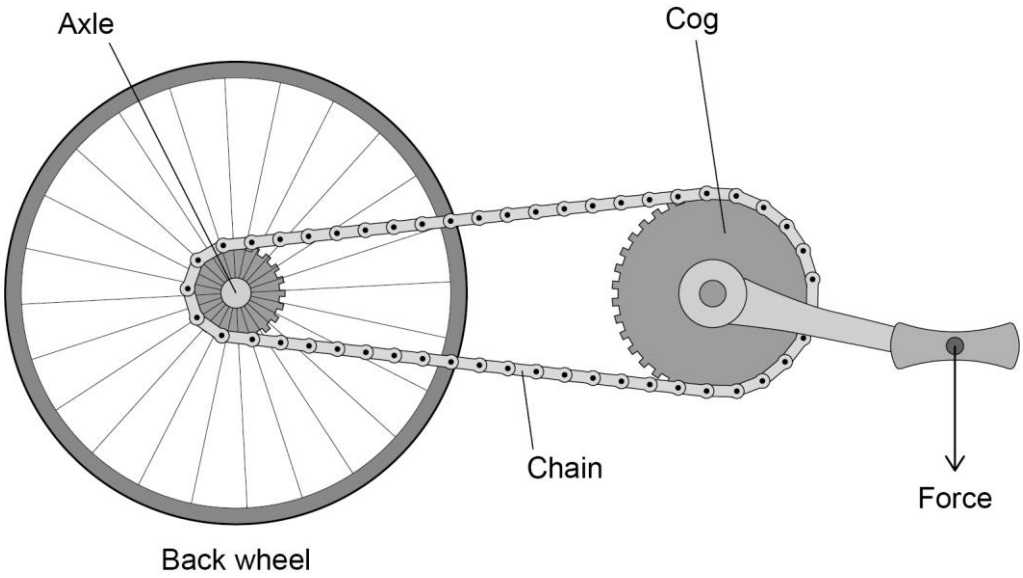
M = 36 (Nm)

Moment = 36 (Nm) N m

Do not write outside the box

0 2 . 5 **Figure 5** shows how the pedal is connected to the back wheel of the bicycle.

Figure 5



Complete the sentence.

Choose the answer from the box.

[1 mark]

axle	**chain**	**cog**

The force from the cyclist pushing down on the pedal is transmitted to the back wheel by the chain .

Question 2 continues on the next page

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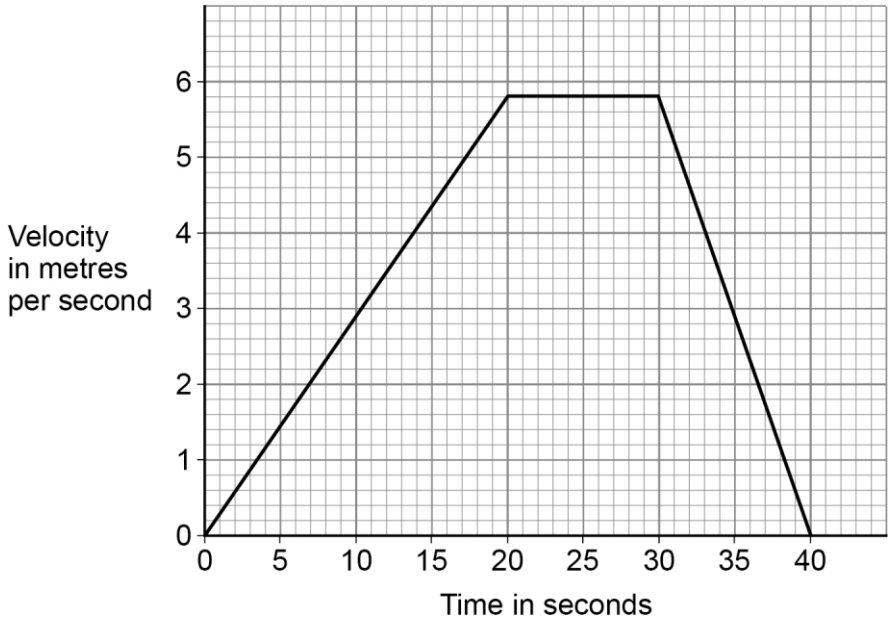
Figure 6 shows how the velocity of the cyclist changes during a journey.

Figure 6



0 2 . 6 What is the change in velocity of the cyclist in the first 20 seconds of the journey?

[1 mark]

Tick (✓) **one** box.

5.2 m/s ☐

5.4 m/s ☐

5.6 m/s ☐

5.8 m/s ☑

Do not write outside the box

0 2 . 7 Determine the acceleration of the cyclist during the first 20 seconds of the journey.

Use your answer from Question **02.6**

Use the equation:

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

[2 marks]

a = 5.8/20

a = 0.29 (m/s²)

Acceleration of the cyclist = 0.29 m/s²

0 2 . 8 Complete the sentence.

Choose the answer from the box.

[1 mark]

deceleration	**speed**	**velocity**

Between 30 and 40 seconds the cyclist moves with

a constant deceleration .

Question 2 continues on the next page

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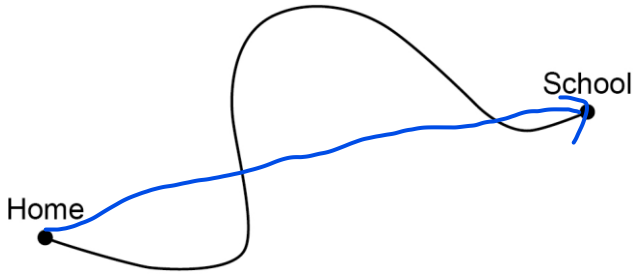
0 2 . 9 The cyclist travels from home to school.

Figure 7 shows the route the cyclist followed.

Figure 7



Draw an arrow on **Figure 7** to show the displacement of the cyclist.

[1 mark]

11

straight arrow drawn between home and school pointing towards school.

0 3 There are different groups of waves in the electromagnetic spectrum.

0 3 . 1 **Figure 8** shows the position of three groups of the waves.

Figure 8

A	Microwaves	**B**	Visible light	**C**	**D**	Gamma rays

Which letter shows the position of infrared?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☑ **C** ☐ **D** ☐

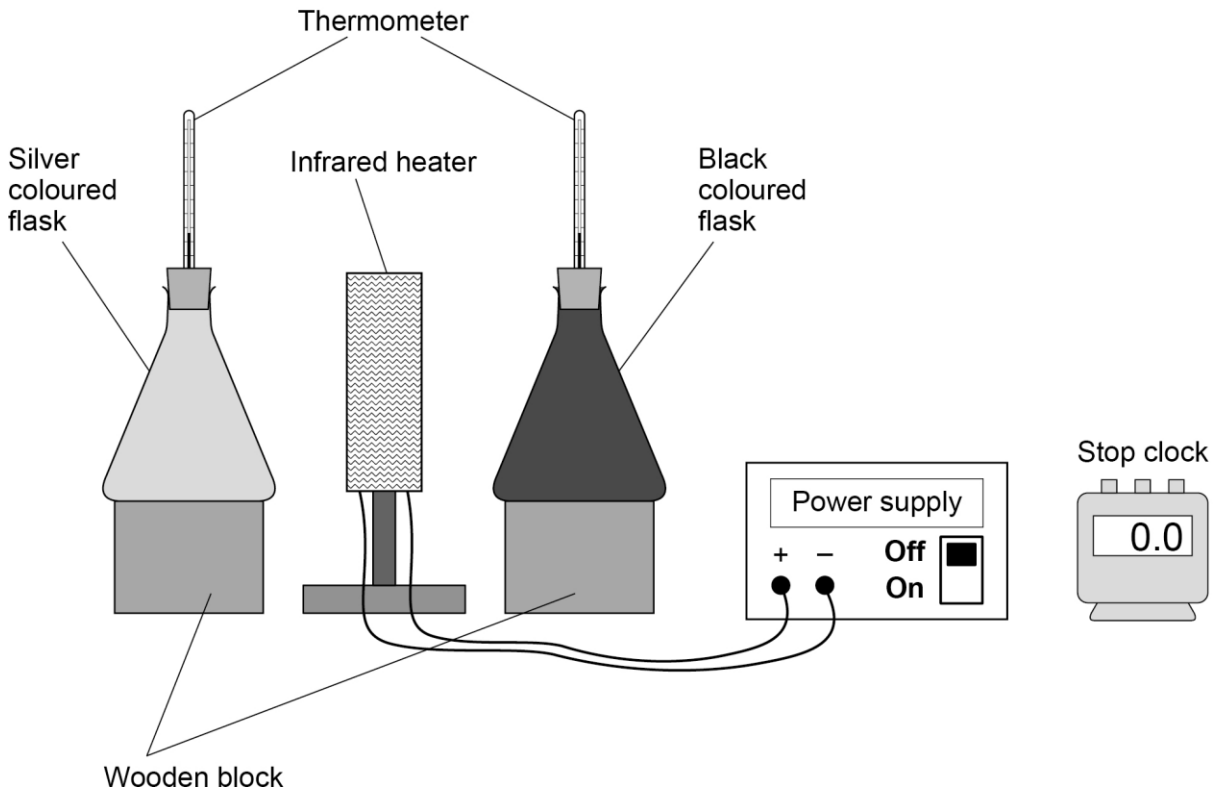
Question 3 continues on the next page

Do not write outside the box

A student investigated how the colour of a surface affects the amount of infrared the surface absorbs.

Figure 9 shows the equipment used.

Figure 9



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0 3 . 2 Complete the sentence.

Choose the answer from the box.

[1 mark]

a control	the dependent	the independent

In this investigation the distance between each flask and the infrared heater is a control variable.

0 3 . 3 The student wrote the hypothesis:

'Surface colour of the flask affects the amount of infrared absorbed when the heater is switched on for five minutes.'

Describe how the equipment in **Figure 9** could be used to test this hypothesis.

[4 marks]

record the initial temperature of the two thermometers in each flask switch the infrared heater on and start the stop clock (at the same time) after five minutes record the (final) temperature from both flasks see / check if the temperature inside the flasks had increased by different amounts

Question 3 continues on the next page

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Table 1 shows the results.

Table 1

Colour of flask	Temperature increase in °C		
	Test 1	Test 2	Test 3
Black	19	17	27
Silver	10	12	11

0 3 . 4 Which **one** of the results for the black flask is anomalous?

[1 mark]

27°C

0 3 . 5 The anomalous result was caused by reading the thermometer incorrectly.

What should the student do with the anomalous result?

[1 mark]

ignore (the result)

0 3 . 6 Calculate the mean temperature increase for the silver flask.

[1 mark]

(33/3 =) 11

Mean temperature increase = 11 °C

Do not write outside the box

0 3 . 7 What conclusion can be made from **Table 1?**

[1 mark]

Tick (✓) **one** box.

Both flasks absorbed the same amount of infrared during the five minutes. ☐

The black flask absorbed the most infrared during the five minutes. ☑

The silver flask absorbed the most infrared during the five minutes. ☐

10

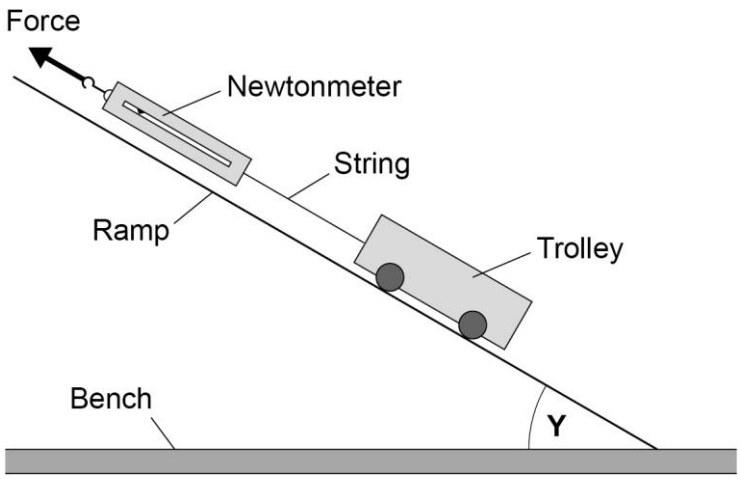
Turn over for the next question

Do not write outside the box

0 4 A student investigated how the angle of a ramp affects the force required to hold a trolley stationary on the ramp.

Figure 10 shows the equipment used.

Figure 10



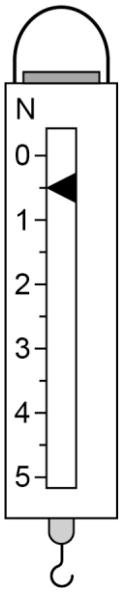
0 4 . 1 Measure the angle **Y** in **Figure 10**

[1 mark]

Angle **Y** = 30° degrees

Figure 11 shows the newtonmeter before the investigation started.

Figure 11



0 4 . 2 What type of error is shown on the newtonmeter in **Figure 11**?

[1 mark]

Tick (✓) **one** box.

Human error ☐

Random error ☐

Zero error ☑

0 4 . 3 How can this error be corrected after the measurements have been taken?

[1 mark]

Tick (✓) **one** box.

Add 0.5 N to each measurement ☐

Multiply each measurement by 0.5 N ☐

Subtract 0.5 N from each measurement ☑

Do not write outside the box

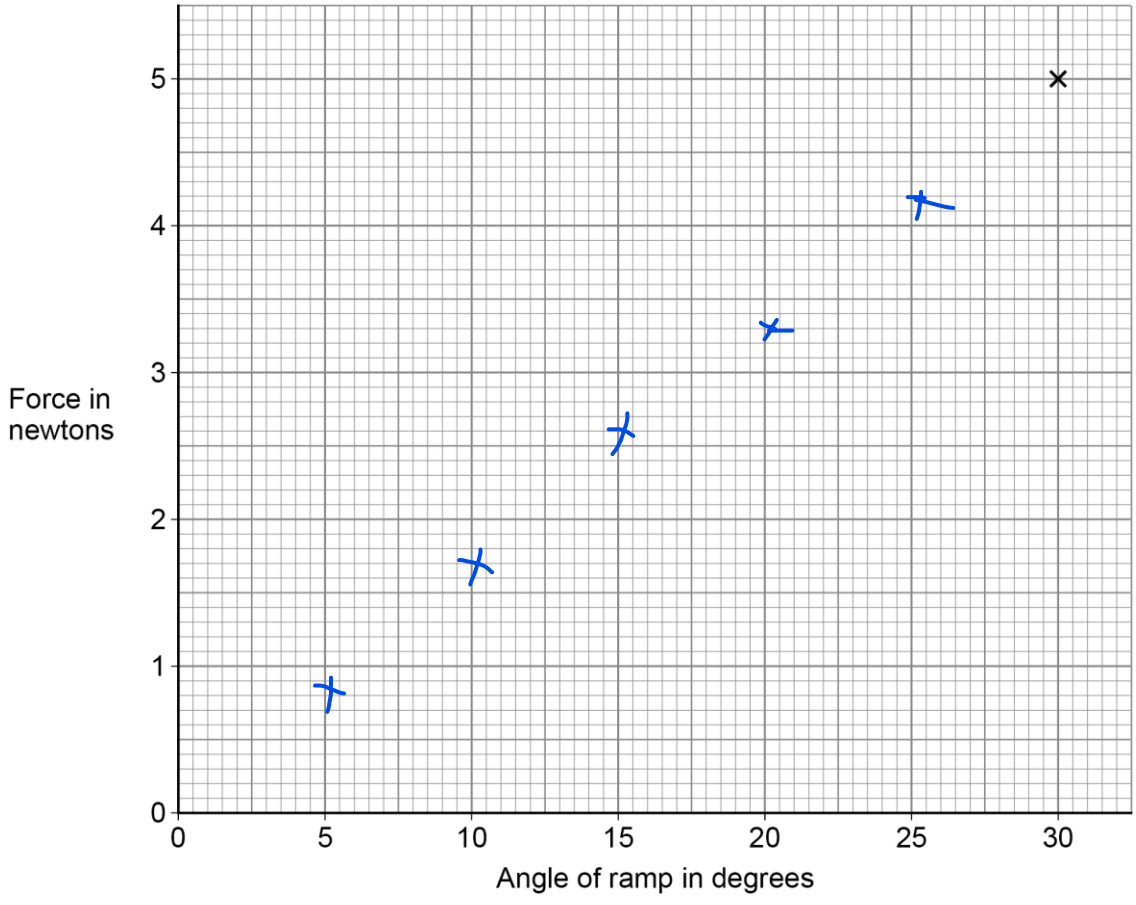
Table 2 shows the corrected results.

Table 2

Angle of ramp in degrees	Force in newtons
5	0.9
10	1.7
15	2.6
20	3.4
25	4.2
30	5.0

Figure 12 is an incomplete graph of the results

Figure 12



subtract 0.5 N from each measurement

Do not write outside the box

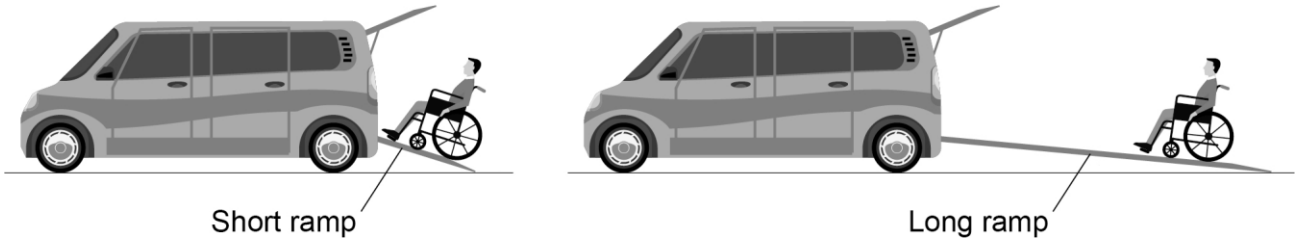
0 4 . 4 Plot the missing results from **Table 2** on **Figure 12**.

[2 marks]

points plotted correctly

0 4 . 5 **Figure 13** shows a person in a wheelchair using two different ramps to enter a van.

Figure 13



The ramps are at different angles to the ground.

Explain **one** advantage of using the long ramp compared with using the short ramp.

[2 marks]

the long ramp has a smaller angle so less force is needed (to hold the wheelchair stationary on the ramp)

0 4 . 6 A force of 160 N is used to move the wheelchair up the long ramp.

The ramp is 2.5 m long.

Calculate the work done to move the wheelchair up the ramp.

Use the equation:

work done = force × distance

[2 marks]

W = 160 × 2.5
W = 400 (J)

Work done = 400 J

9

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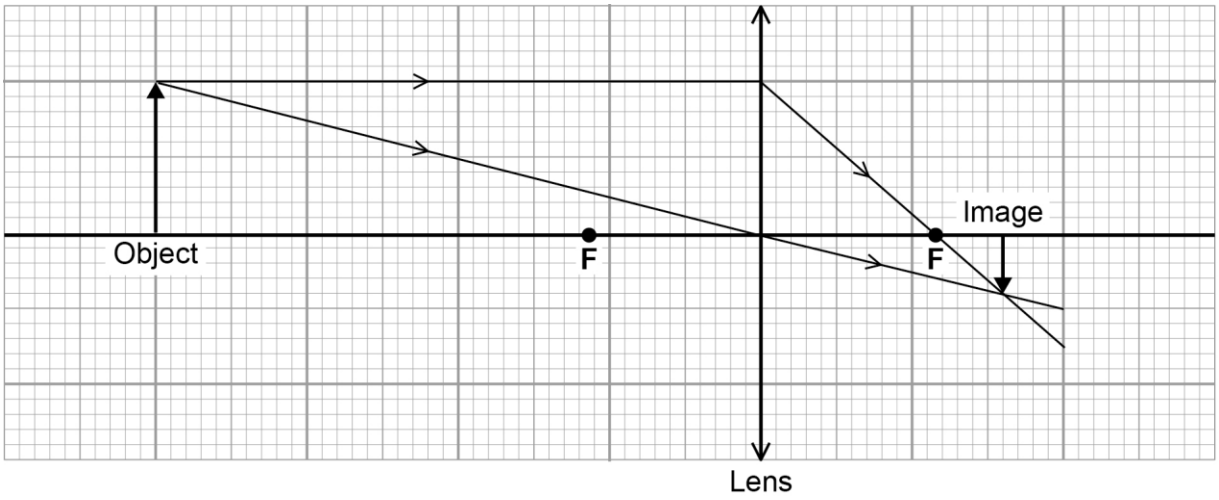
0 5 **Figure 14** shows how a lens forms an image of an object.

Figure 14



0 5 . 1 What type of lens is represented in **Figure 14**?

[1 mark]

Tick (✓) **one** box.

Concave ☐

Convex ☑

Diverging ☐

0 5 . 2 Measure the image height and the object height in **Figure 14**.

[1 mark]

Image height = 0.8 cm

Object height = 2.0 cm

Do not write outside the box

0 5 . 3 Calculate the magnification produced by the lens.

Use the equation:

$$\text{magnification} = \frac{\text{image height}}{\text{object height}}$$

[2 marks]

magnification = 0.8/ 2.0

magnification = 0.4(cm)

Magnification = 0.4

0 5 . 4 Which **two** words describe the image in **Figure 14**?

[2 marks]

Tick (✓) **two** boxes.

- Enlarged ☐
- Inverted ☑
- Real ☑
- Upright ☐
- Virtual ☐

Question 5 continues on the next page

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0 5 . 5 The object was blue.

A student looked at the blue object through a green filter.

Complete the sentences.

Choose answers from the box.

[2 marks]

black	**blue**	**green**	**red**	**white**

Looking at the blue object through a green filter makes the object appear

black .

This is because the green filter only transmits the light that is green .

8

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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0 6 The Sun is the closest star to the Earth.

0 6 . 1 A 2.5 kg mass would have a weight of 750 N at the surface of the Sun.

Calculate the gravitational field strength at the surface of the Sun.

Use the equation:

$$\text{gravitational field strength} = \frac{\text{weight}}{\text{mass}}$$

[2 marks]

g = 750/2.5

g = 300.0 (N/kg)

Gravitational field strength = 300 N/kg

0 6 . 2 Gravity is a non-contact force.

Which of the following is also a non-contact force?

[1 mark]

Tick (✓) **one** box.

- Air resistance ☐
- Electrostatic ☑
- Friction ☐
- Tension ☐

Do not write outside the box

0 6 . 3 All stars have a life cycle.

Figure 15 shows part of the life cycle of a star that becomes a black dwarf.

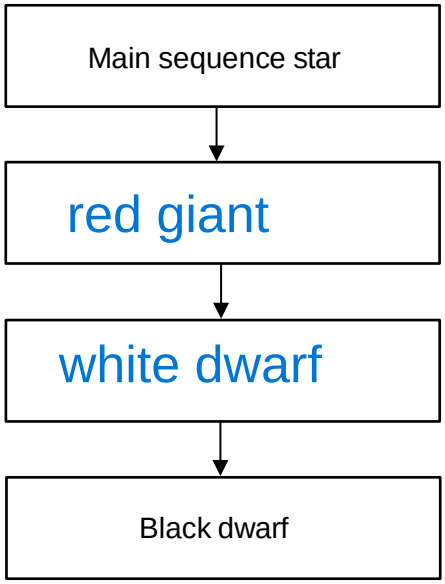
Complete **Figure 15**.

Choose answers from the box.

[2 marks]

Black hole		**Neutron star**
Red giant	**Supernova**	**White dwarf**

Figure 15



Question 6 continues on the next page

Table 3 gives the mass of three stars compared to the mass of the Sun.

Table 3

Star	Mass compared to the mass of the Sun
X	× 25.0
Y	× 15.0
Z	× 0.9

0 6 . 4 Which letter represents the star most likely to become a black dwarf?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

X ☐ **Y** ☐ **Z** ☑

Reason only stars about the same/smaller size/mass as the Sun become Black dwarfs

0 6 . 5 In which stage of the life cycle of a star are elements heavier than iron produced?

[1 mark]

Tick (✓) **one** box.

Nebula ☐

Protostar ☐

Supernova ☑

8

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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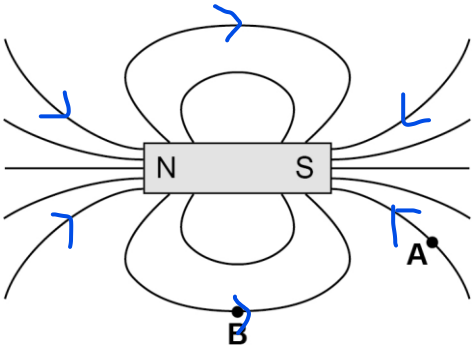
0 7 **Figure 16** shows the magnetic field pattern around a bar magnet.

Figure 16



0 7 . 1 Draw an arrow at point **A** and point **B** to show the direction of the magnetic field at each point.

[1 mark]

0 7 . 2 A bar magnet produces its own magnetic field.

Complete the sentence.

Choose the answer from the box.

[1 mark]

an electromagnet	**an induced magnet**	**a permanent magnet**

A bar magnet is an example of a permanent magnet .

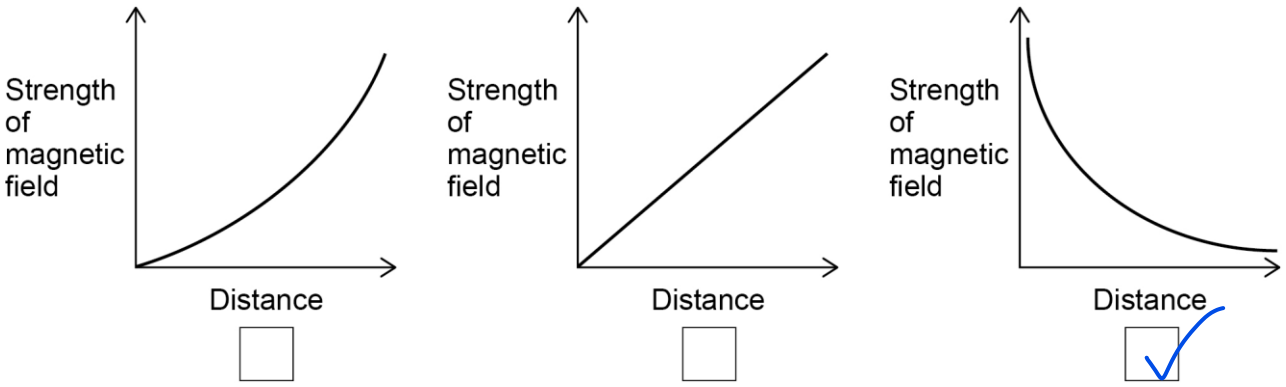
Do not write outside the box

0 7 . 3 Which graph shows how the strength of the magnetic field varies with distance from the bar magnet?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.



☐ ☐ ☑

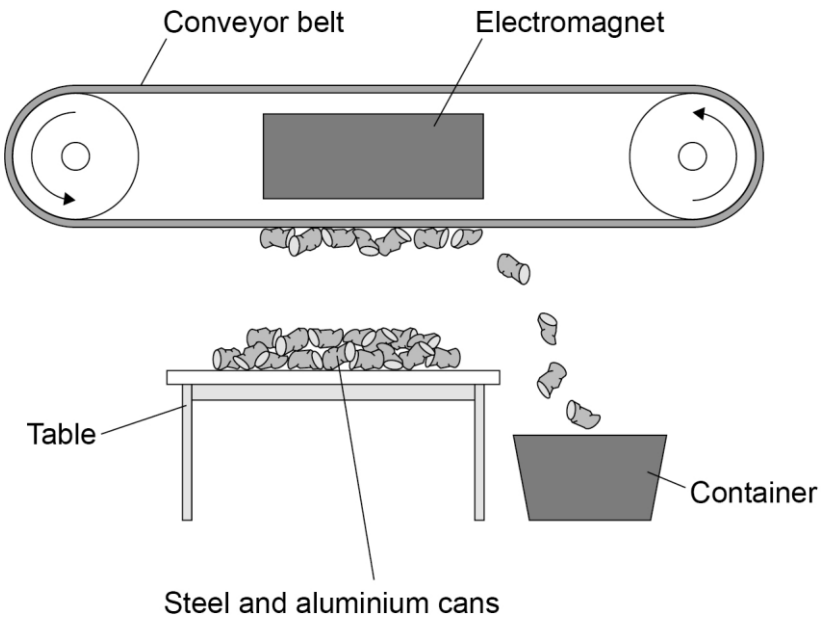
Reason (the only graph) that shows the magnetic field getting weaker (as distance increases) both other graphs show the magnetic field getting stronger (as the distance increases)

Question 7 continues on the next page

Do not write outside the box

Figure 17 shows an electromagnet being used to separate aluminium cans from steel cans.

Figure 17



0 7 . **4** Explain how the electromagnet and conveyor belt are used to separate the steel cans from the aluminium cans.

[2 marks]

steel cans are attracted to the electromagnet and are transferred to the container (by the conveyor belt) aluminium cans are not attracted to the electromagnet and are left behind on the table

Do not write outside the box

0 7 . 5 At the top of the table the strength of the magnetic field is only just enough to pick the cans up.

Describe **two** ways to increase the strength of magnetic field at the top of the table.

[2 marks]

1 use a larger potential difference / current

2 use a stronger electromagnet

0 7 . 6 Write down the equation which links distance travelled (*s*), speed (*v*) and time (*t*).

[1 mark]

distance travelled = speed × time

0 7 . 7 The conveyor belt moves a can at a speed of 1.7 m/s.

Calculate the time taken to move the can 3.3 m at this speed.

Give your answer to 2 significant figures.

[4 marks]

t = 3.3/1.7

t = 1.941 (s)

t = 1.9 ς

Time taken (2 significant figures) = 1.9 s

13

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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0 8 The thinking distance and braking distance for a car vary with the speed of the car.

0 8 . 1 Explain the effect of **two** other factors on the **braking** distance of a car.

Do **not** refer to speed in your answer.

[4 marks]

Factors
• increased mass of car/passengers
Explanation
• increases kinetic energy of car
• more work needs to be done to stop car
• increases momentum of the car

Question 8 continues on the next page

Do not write outside the box

0 8 . 2 Which equation links acceleration (a), mass (m) and resultant force (F).

[1 mark]

Tick (✓) **one** box.

resultant force = mass × acceleration ✓

resultant force = mass × acceleration^2

resultant force = $\frac{\text{mass}}{\text{acceleration}^2}$

resultant force = $\frac{\text{mass}}{\text{acceleration}}$

0 8 . 3 The mean braking force on a car is 7200 N.

The car has a mass of 1600 kg.

Calculate the deceleration of the car.

[3 marks]

$7200 = 1600 \times a$

$a = 7200 / 1600$

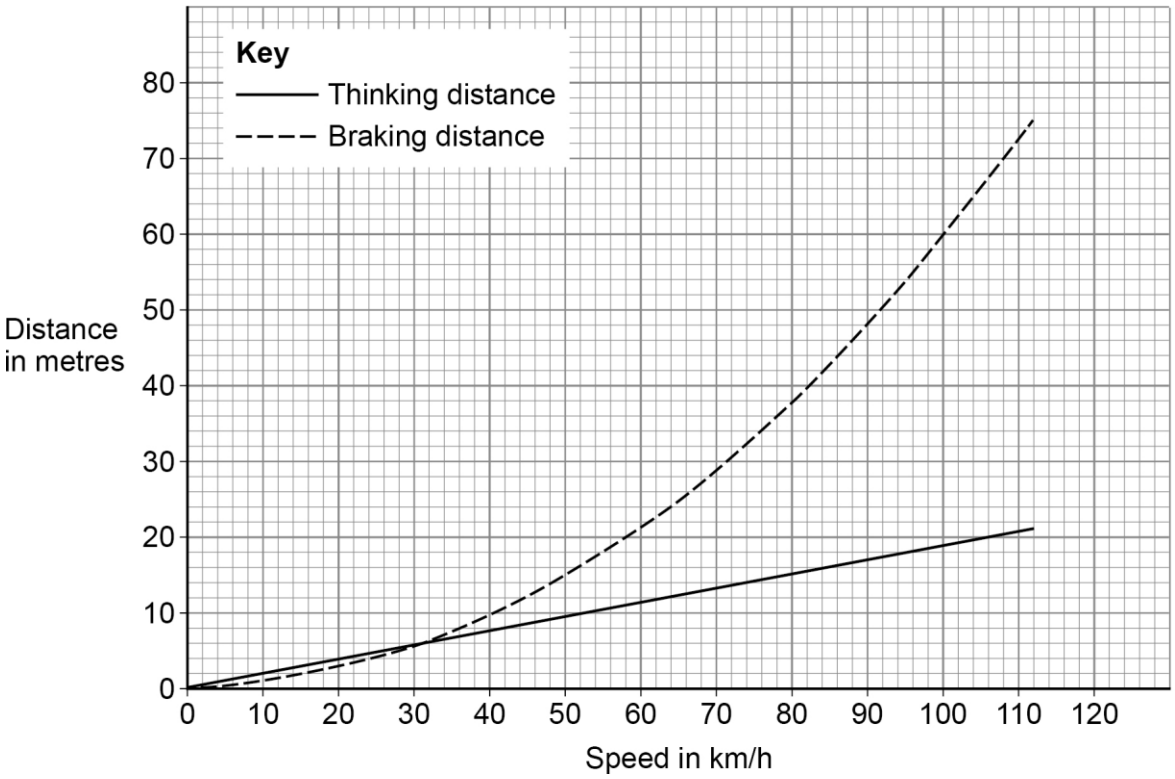
$a = 4.5$ (m/s^2)

Deceleration = 4.5 m/s^2

Do not write outside the box

0 8 . 4 **Figure 18** shows how the thinking distance and braking distance for a car vary with the speed of the car.

Figure 18



Determine the stopping distance when the car is travelling at 80 km/h.

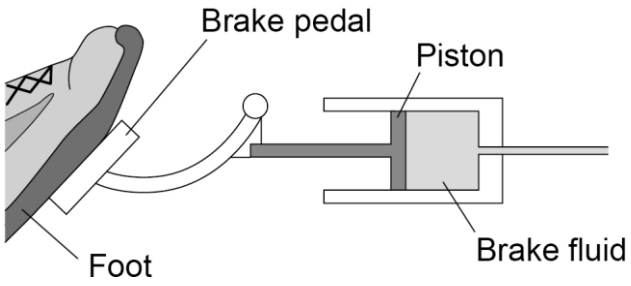
[2 marks]

Stopping distance = 53 m

Question 8 continues on the next page

Figure 19 shows part of the braking system for a car.

Figure 19



0 8 . 5 Which equation links area of a surface (A), the force normal to that surface (F) and pressure (p)?

[1 mark]

Tick (✓) **one** box.

$p = F \times A$ ☐

$p = F \times A^2$ ☐

$p = \frac{F}{A}$ ✓

$p = \frac{A}{F}$ ☐

Do not write outside the box

0 8 . 6 When the brake pedal is pressed, a force of 60 N is applied to the piston.

The pressure in the brake fluid is 120 000 Pa.

Calculate the surface area of the piston.

Give your answer in standard form.

Give the unit.

[5 marks]

120 000 = 60/ A

A = 60 /120 000

A = 0.0005

A = $5 \times 10^{-4} m^2$

Surface area (in standard form) = _____ Unit m^2

16

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ANSWER IN THE SPACES PROVIDED

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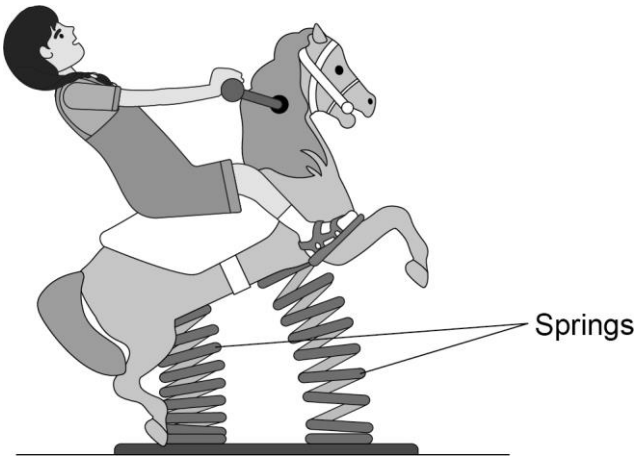
0 9 **Figure 20** shows a child on a playground toy.

Figure 20



0 9 . 1 The springs have been elastically deformed.

Explain what is meant by 'elastically deformed'.

[2 marks]

will return to its original shape/length when the force is removed

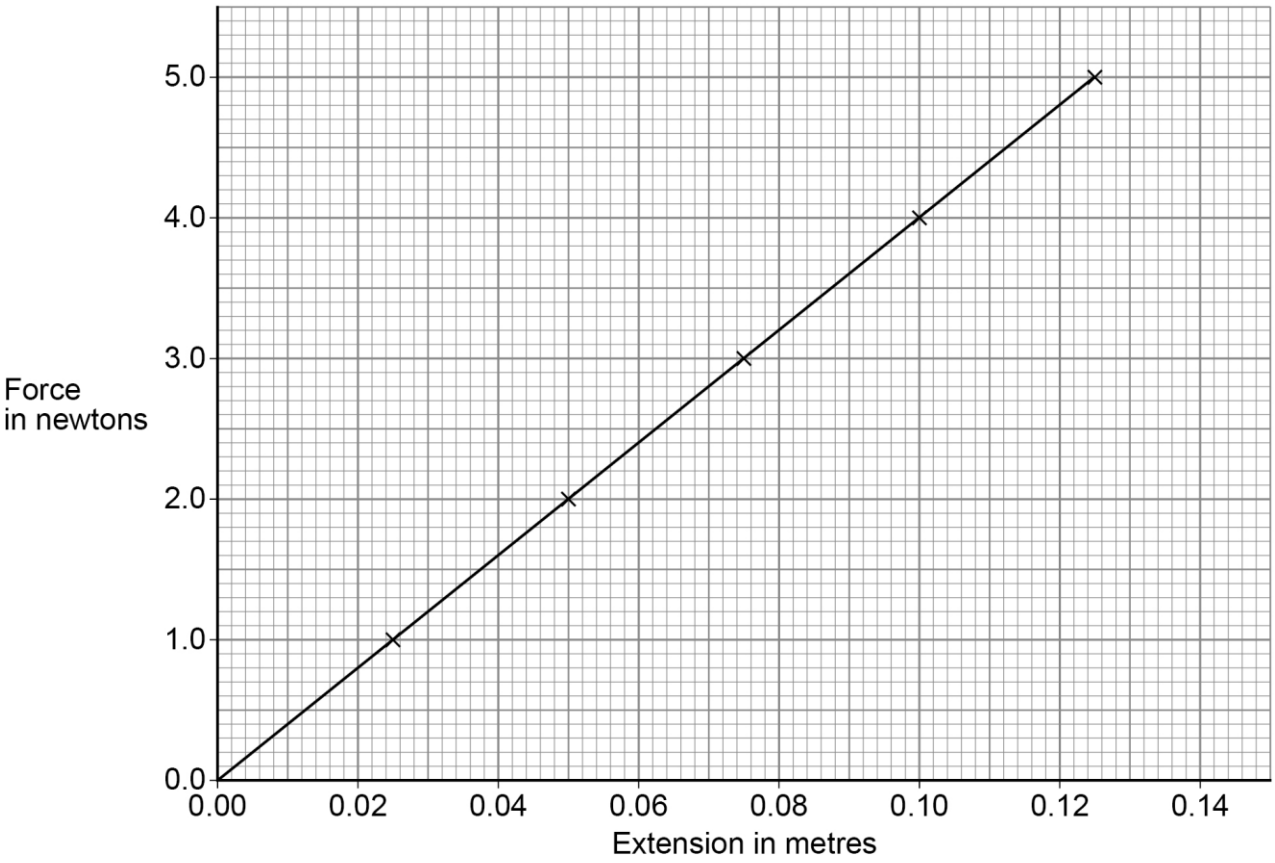
Question 9 continues on the next page

Do not write outside the box

A student investigated the relationship between the force applied to a spring and the extension of the spring.

Figure 21 shows the results.

Figure 21



Do not write outside the box

0 9 . 2 Describe a method the student could use to obtain the results given in **Figure 21**.

You should include a risk assessment for **one** hazard in the investigation.

Your answer may include a diagram.

[6 marks]

- set up a clamp stand with a clamp
- hang the spring from the clamp
- use a second clamp and boss to fix a (half) metre rule alongside the spring
- record the ruler reading that is level with the bottom of the spring
- hang a 1 N / a known weight from the bottom of the spring
- record the new position of the bottom of the spring
- calculate the extension of the spring
- measure the extension of the spring
- add further weights to the spring so the force increases 1 N at a time up to 5 N
- for each new force record the position of the bottom of the spring and calculate / measure the extension

Question 9 continues on the next page

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0 9 . 3 Which equation links extension (*e*), force (*F*) and spring constant (*k*).

[1 mark]

Tick (✓) **one** box.

force = spring constant × (extension)^2 ☐

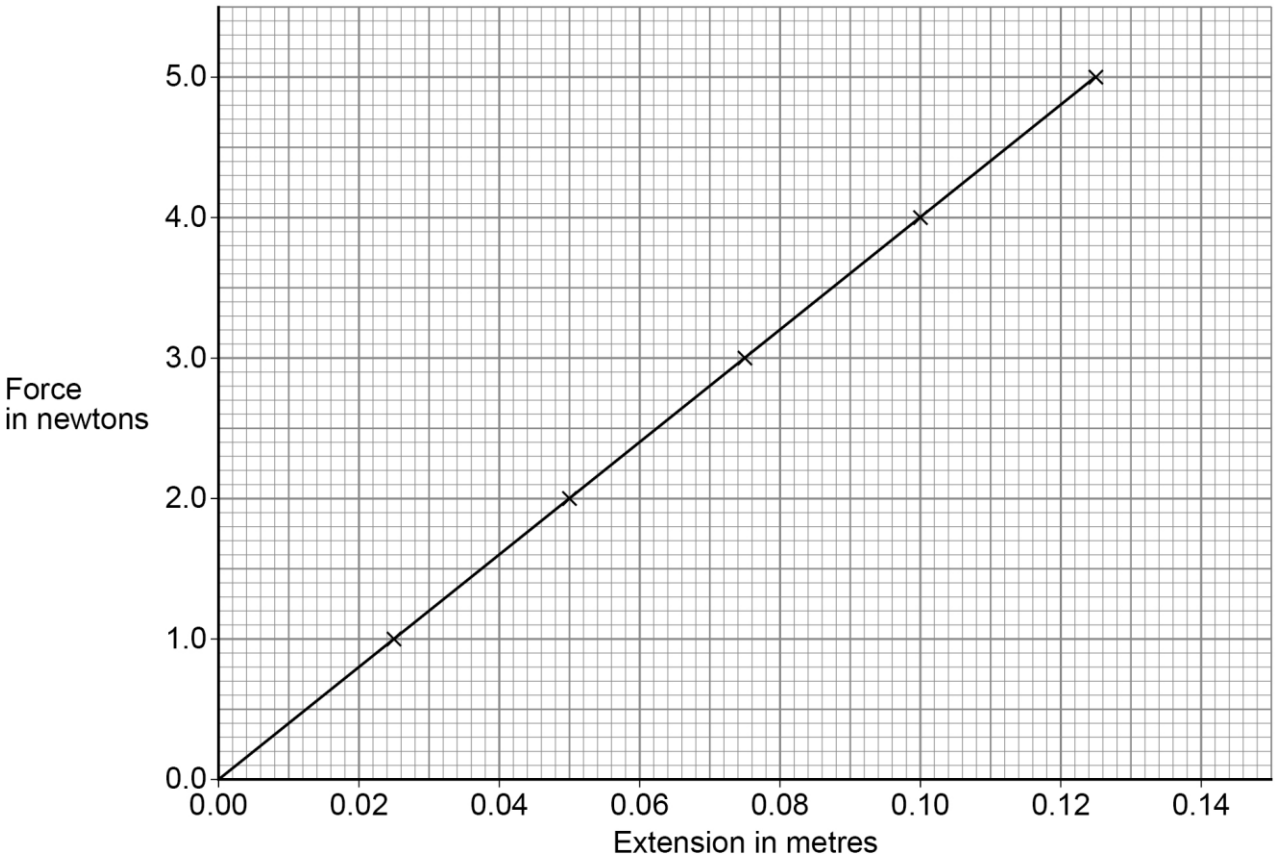
force = spring constant × extension ☑

force = $\frac{\text{extension}}{\text{spring constant}}$ ☐

force = $\frac{\text{spring constant}}{\text{extension}}$ ☐

Figure 21 is repeated below.

Figure 21



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0 9 . 4 Determine the spring constant of the spring.

Use **Figure 21**.

[3 marks]

k = 5.00/0.125

k = 40 (N/m)

Spring constant = 40 N/m

0 9 . 5 The student concluded:

'The extension of the spring is directly proportional to the force applied to the spring.'

Describe how **Figure 21** supports the student's conclusion.

[2 marks]

the line is straight and passes through the origin

Question 9 continues on the next page

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0 9 . 6 The student repeated the investigation using a different spring with a spring constant of 13 N/m.

Calculate the elastic potential energy of the spring when the extension of the spring was 20 cm.

Use the Physics Equations Sheet.

[3 marks]

e = 0.20 m

Ee = 0.5 × 13 × 0.202

Ee = 0.26 (J)

Elastic potential energy = 0.26 J

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END OF QUESTIONS

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