

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.

## 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.

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



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.



**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:

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

Choose the unit from the box.

**[3 marks]**

$\text{m}^2/\text{s}$	$\text{m}/\text{s}$	$\text{s}^2$
-----------------------	---------------------	--------------

---



---



---

Wave speed = \_\_\_\_\_ Unit \_\_\_\_\_

**0 1 . 4** What is transferred by all waves?

**[1 mark]**

Tick (✓) **one** box.

Energy

Information

Water

**Question 1 continues on the next page**

**Turn over ►**

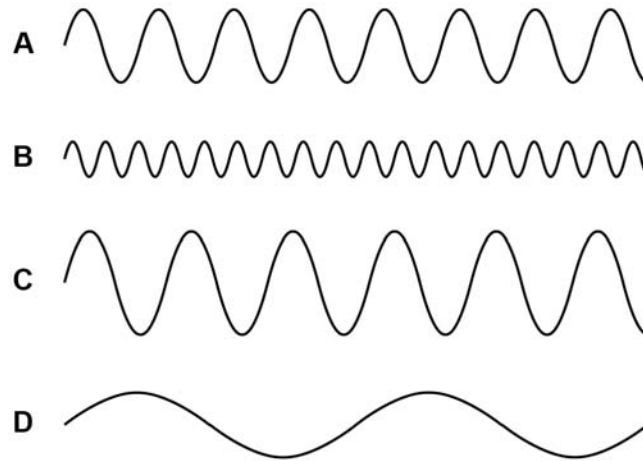


**Figure 2** shows four water waves.

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
---



**Turn over for the next question**

*Do not write  
outside the  
box*

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

**Turn over ►**



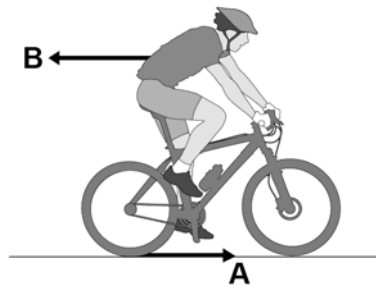
0 2

**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



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

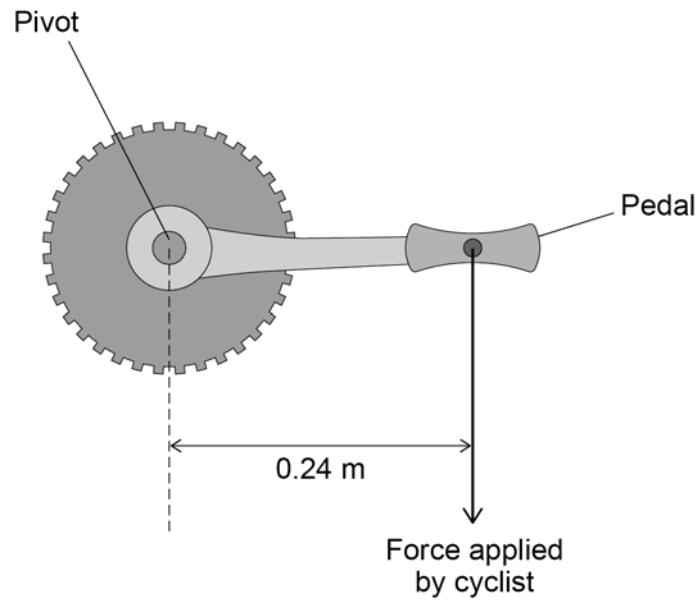
Turn over ►



**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:

$$\text{moment of a force} = \text{force} \times \text{distance}$$

**[2 marks]**

---



---



---

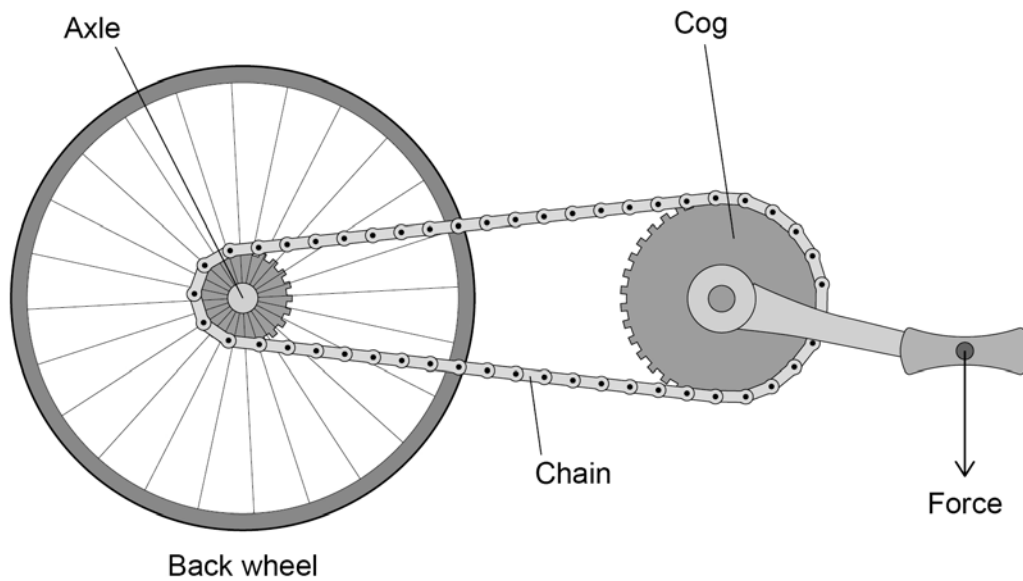
Moment = \_\_\_\_\_ N m





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 \_\_\_\_\_.

Question 2 continues on the next page

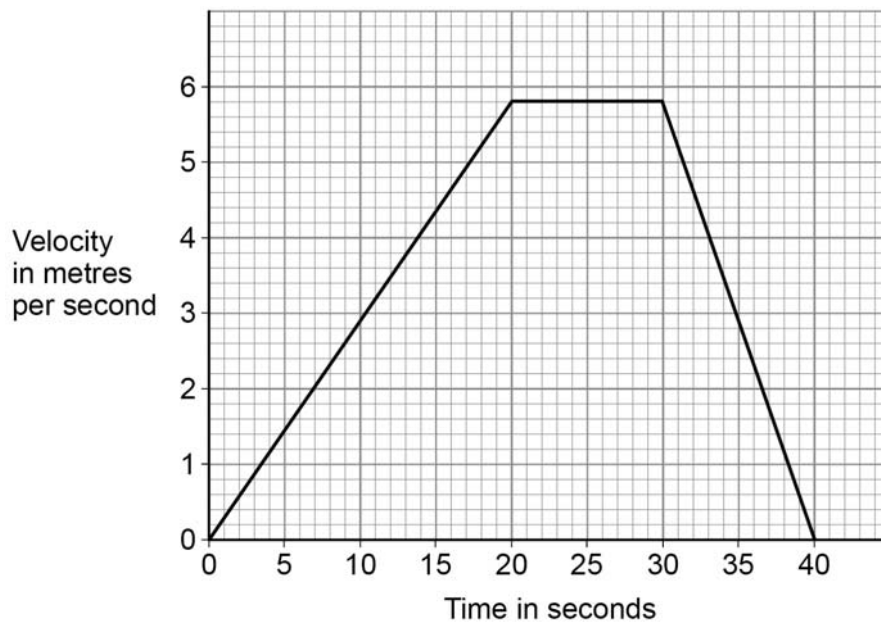
Turn over ►



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

Do not write  
outside the  
box

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



**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]**

---



---



---

Acceleration of the cyclist = \_\_\_\_\_ m/s<sup>2</sup>

**0 2 . 8** Complete the sentence.

Choose the answer from the box.

**[1 mark]**

<b>deceleration</b>	<b>speed</b>	<b>velocity</b>
---------------------	--------------	-----------------

Between 30 and 40 seconds the cyclist moves with

a constant \_\_\_\_\_ .

**Question 2 continues on the next page**

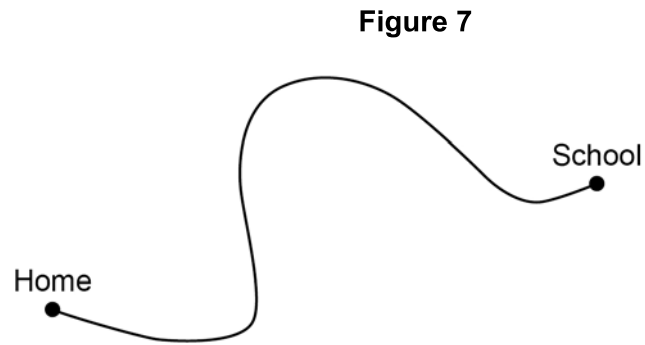
**Turn over ►**



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

Do not write  
outside the  
box

**Figure 7** shows the route the cyclist followed.



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

[1 mark]

11



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

Turn over ►



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**

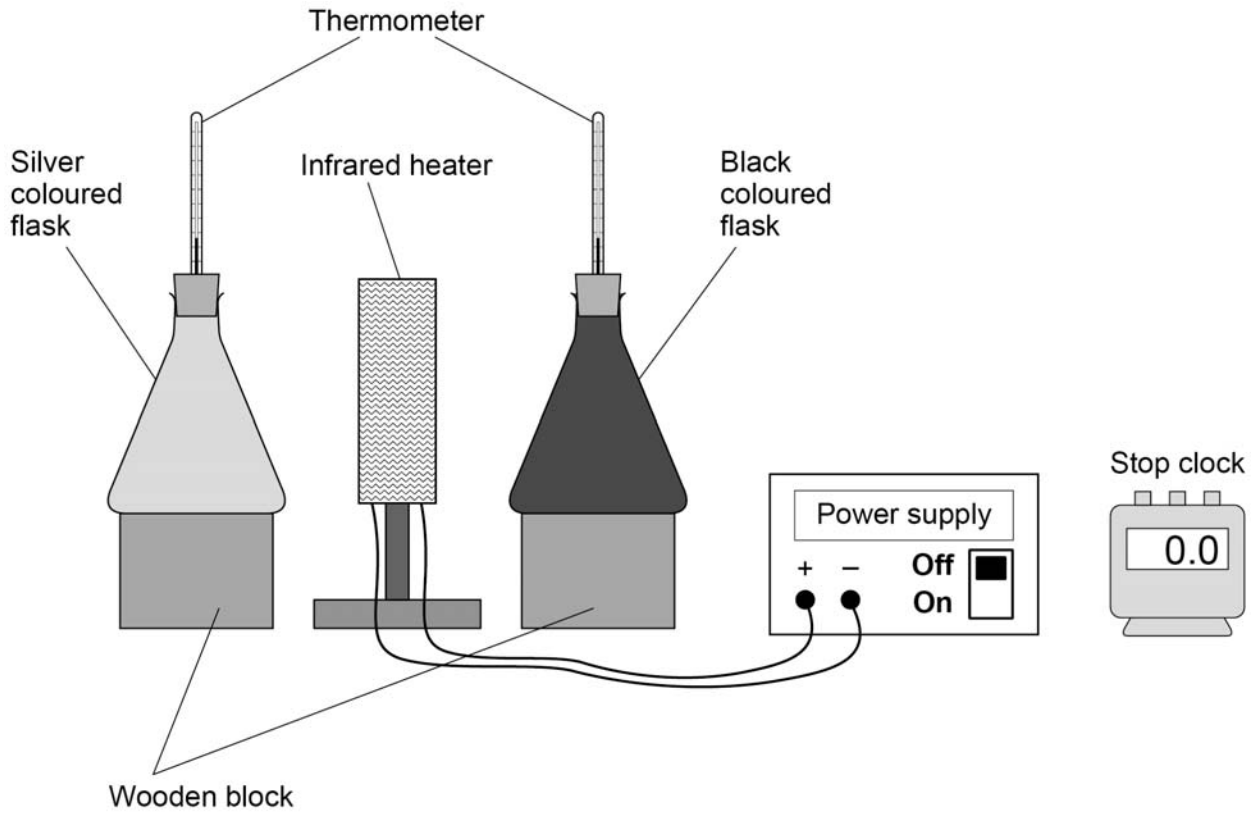




Table 1 shows the results.

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]

---

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

What should the student do with the anomalous result?

[1 mark]

---



---

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

[1 mark]

---



---

Mean temperature increase = \_\_\_\_\_ °C





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.

Do not write  
outside the  
box

10

**Turn over for the next question**

**Turn over ►**

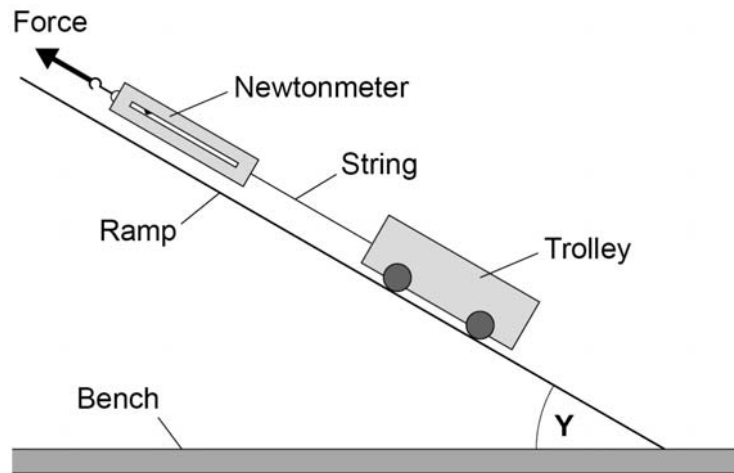


0 4

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**

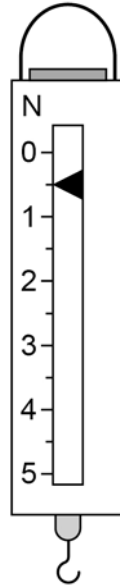
[1 mark]

Angle **Y** = \_\_\_\_\_ 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



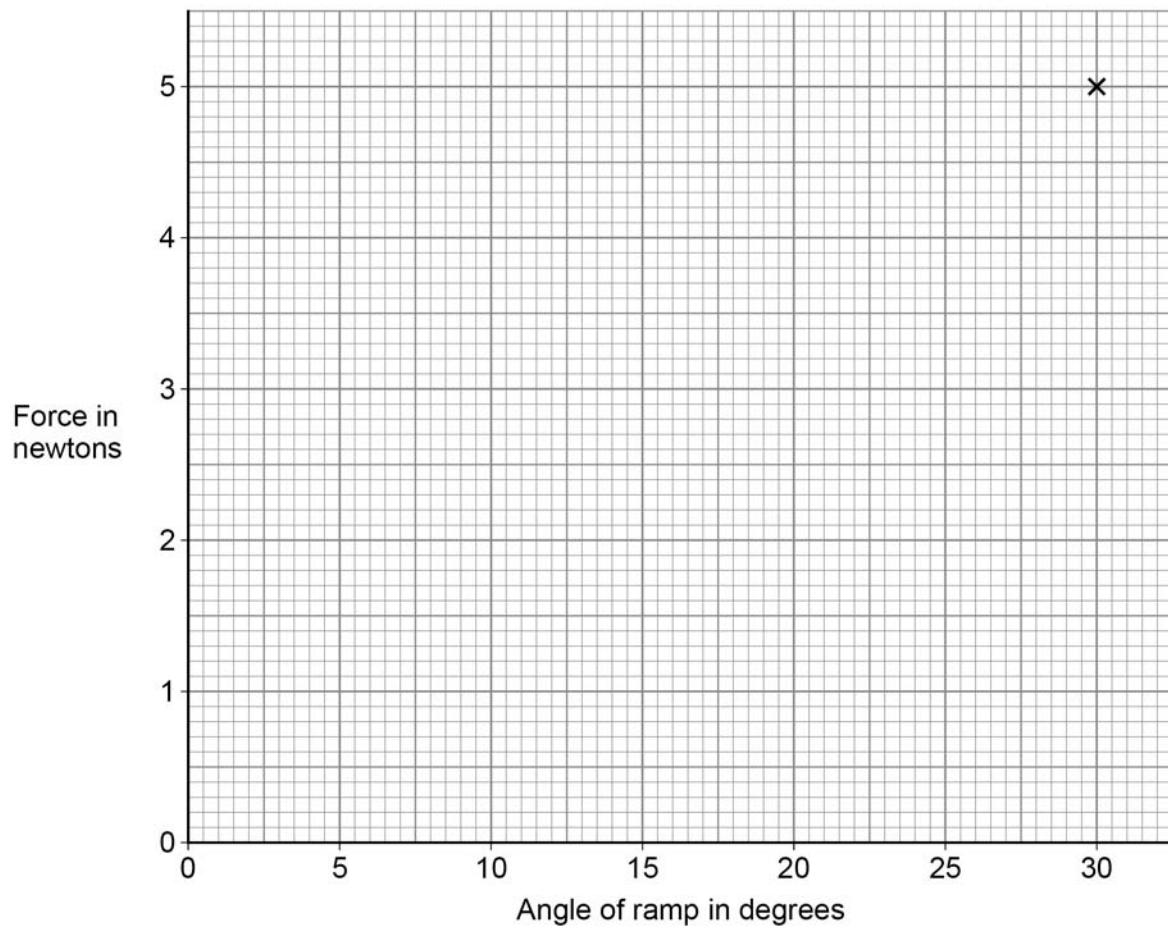
Table 2 shows the corrected results.

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



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

**[2 marks]**

**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]**

---



---



---



---

**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:

$$\text{work done} = \text{force} \times \text{distance}$$

**[2 marks]**

---



---



---

Work done = \_\_\_\_\_ J

9

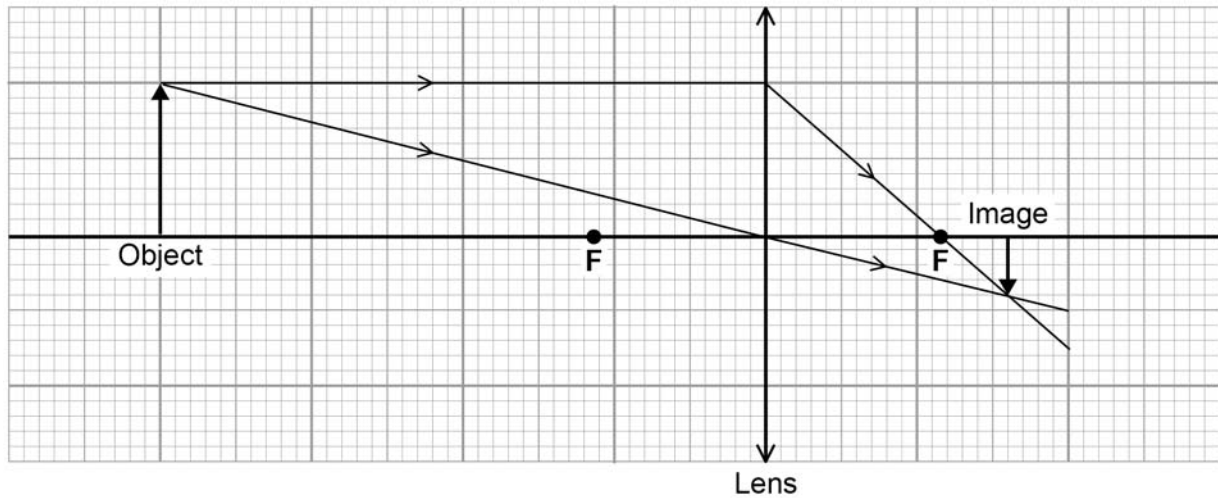
Turn over ►



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 = \_\_\_\_\_ cm

Object height = \_\_\_\_\_ cm



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 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****Turn over ►**

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

\_\_\_\_\_ .

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

---

8



**Turn over for the next question**

*Do not write  
outside the  
box*

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

**Turn over ►**



**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]**

---

---

---

---

Gravitational field strength = \_\_\_\_\_ 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



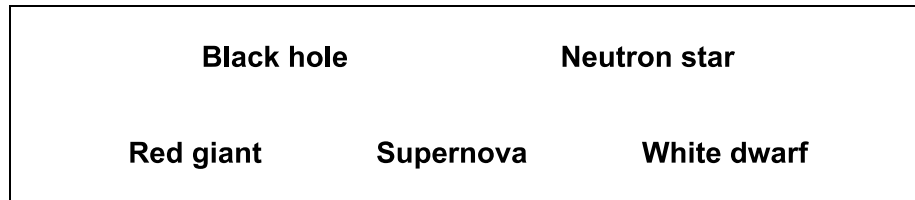
0 6 . 3 All stars have a life cycle.

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

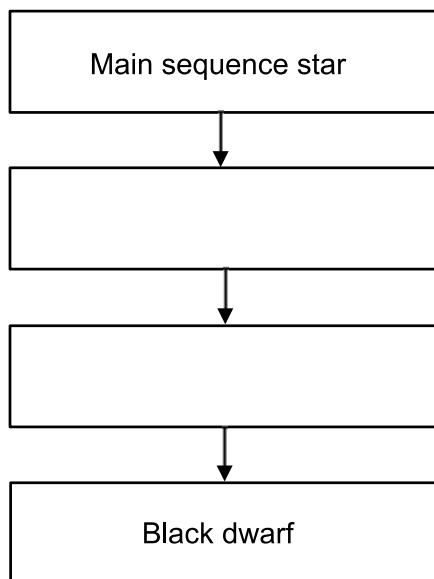
Complete **Figure 15**.

Choose answers from the box.

**[2 marks]**



**Figure 15**



**Question 6 continues on the next page**

**Turn over ►**



**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	$\times 25.0$
Y	$\times 15.0$
Z	$\times 0.9$

**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 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**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



**Turn over for the next question**

*Do not write  
outside the  
box*

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

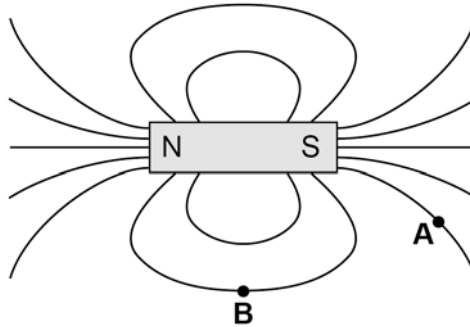
**Turn over ►**



07

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

Figure 16



07.1

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

[1 mark]

07.2

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 \_\_\_\_\_ .



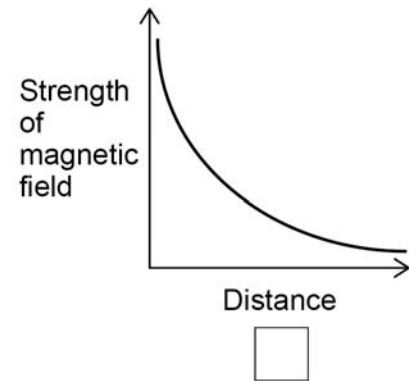
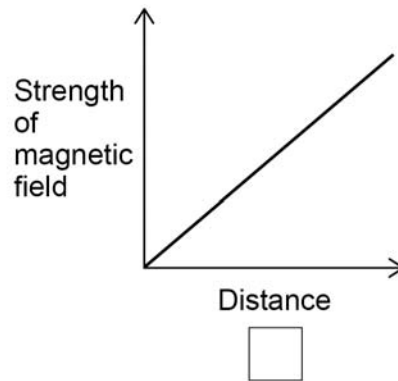
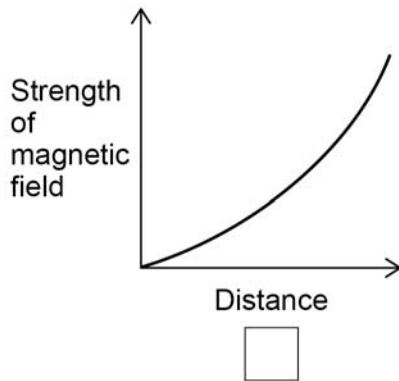
07.3

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 \_\_\_\_\_

\_\_\_\_\_

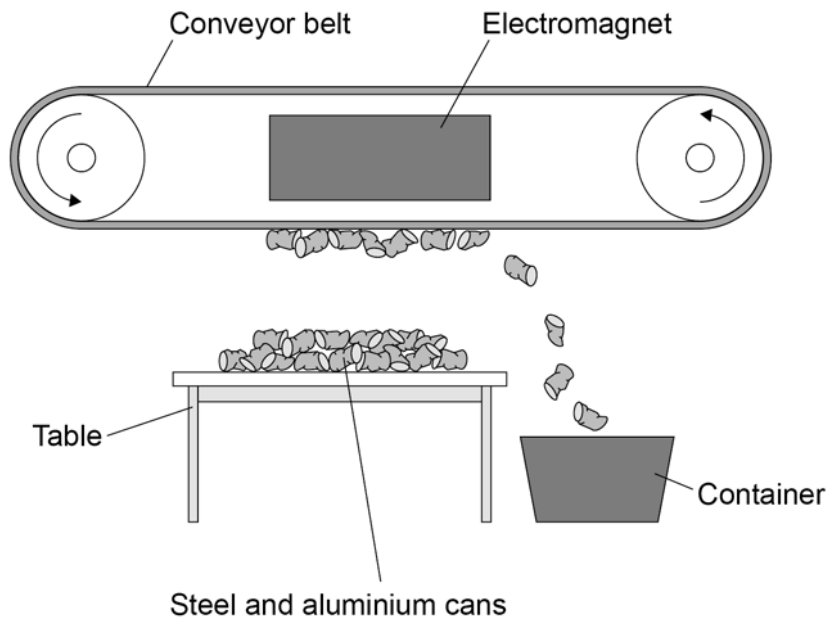
**Question 7 continues on the next page**

**Turn over ►**



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]

---

---

---

---





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 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

0 7 . 6

Write down the equation which links distance travelled ( $s$ ), speed ( $v$ ) and time ( $t$ ).

[1 mark]

\_\_\_\_\_

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]

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Time taken (2 significant figures) = \_\_\_\_\_ s

13

**Turn over for the next question**

**Turn over ►**



**There are no questions printed on this page**

*Do not write  
outside the  
box*

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**





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

**[1 mark]**

Tick (✓) **one** box.

resultant force = mass  $\times$  acceleration

resultant force = mass  $\times$  acceleration<sup>2</sup>

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]**

---

---

---

---

---

Deceleration = \_\_\_\_\_ m/s<sup>2</sup>

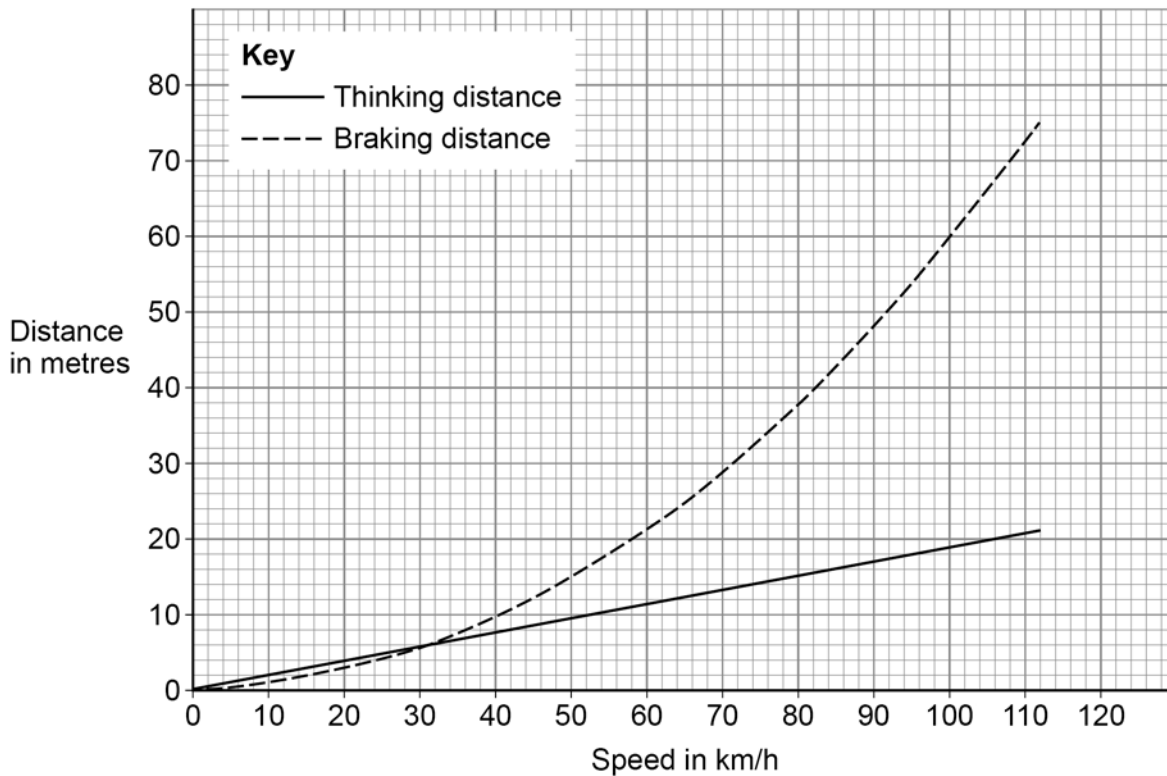


0 8 . 4

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

*Do not write  
outside the  
box*

**Figure 18**



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

**[2 marks]**

---



---



---

Stopping distance = \_\_\_\_\_ m

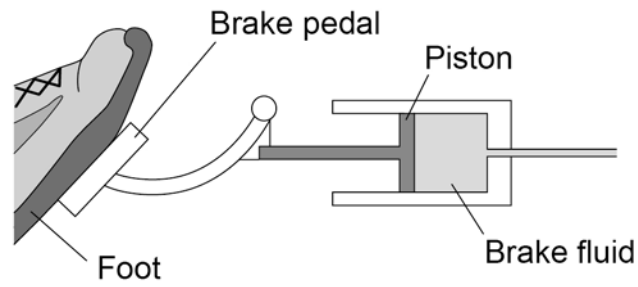
**Question 8 continues on the next page**



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

Do not write  
outside the  
box

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.

$$p = F \times A$$

$$p = F \times A^2$$

$$p = \frac{F}{A}$$

$$p = \frac{A}{F}$$





**There are no questions printed on this page**

*Do not write  
outside the  
box*

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

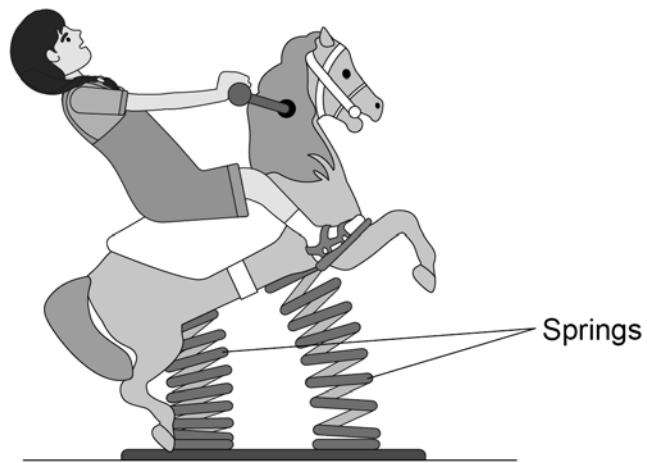




0 9

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]

---

---

---

---

Question 9 continues on the next page

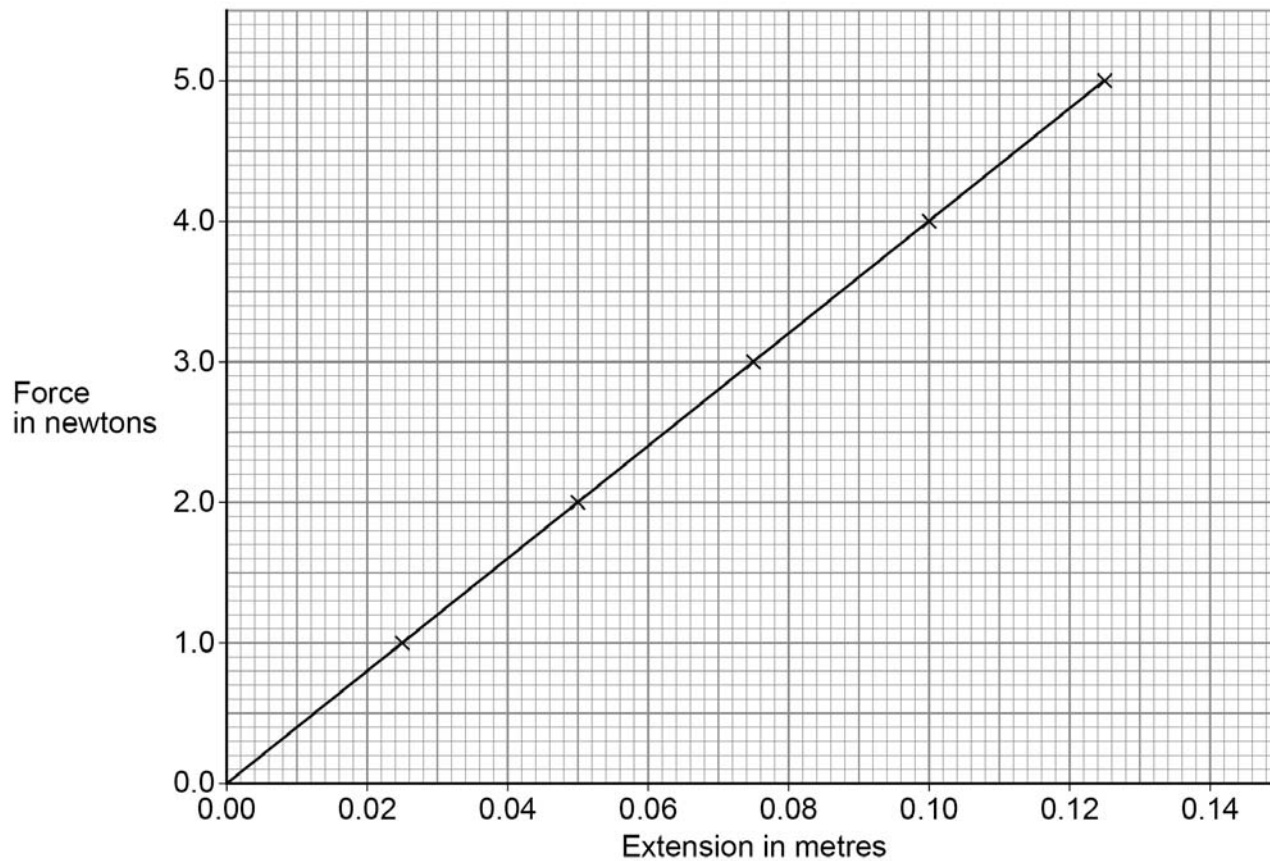


A student investigated the relationship between the force applied to a spring and the extension of the spring.

*Do not write  
outside the  
box*

**Figure 21** shows the results.

**Figure 21**





09.3

Which equation links extension ( $e$ ), force ( $F$ ) and spring constant ( $k$ ).

[1 mark]

Tick (✓) **one** box.

force = spring constant  $\times$  (extension)<sup>2</sup>

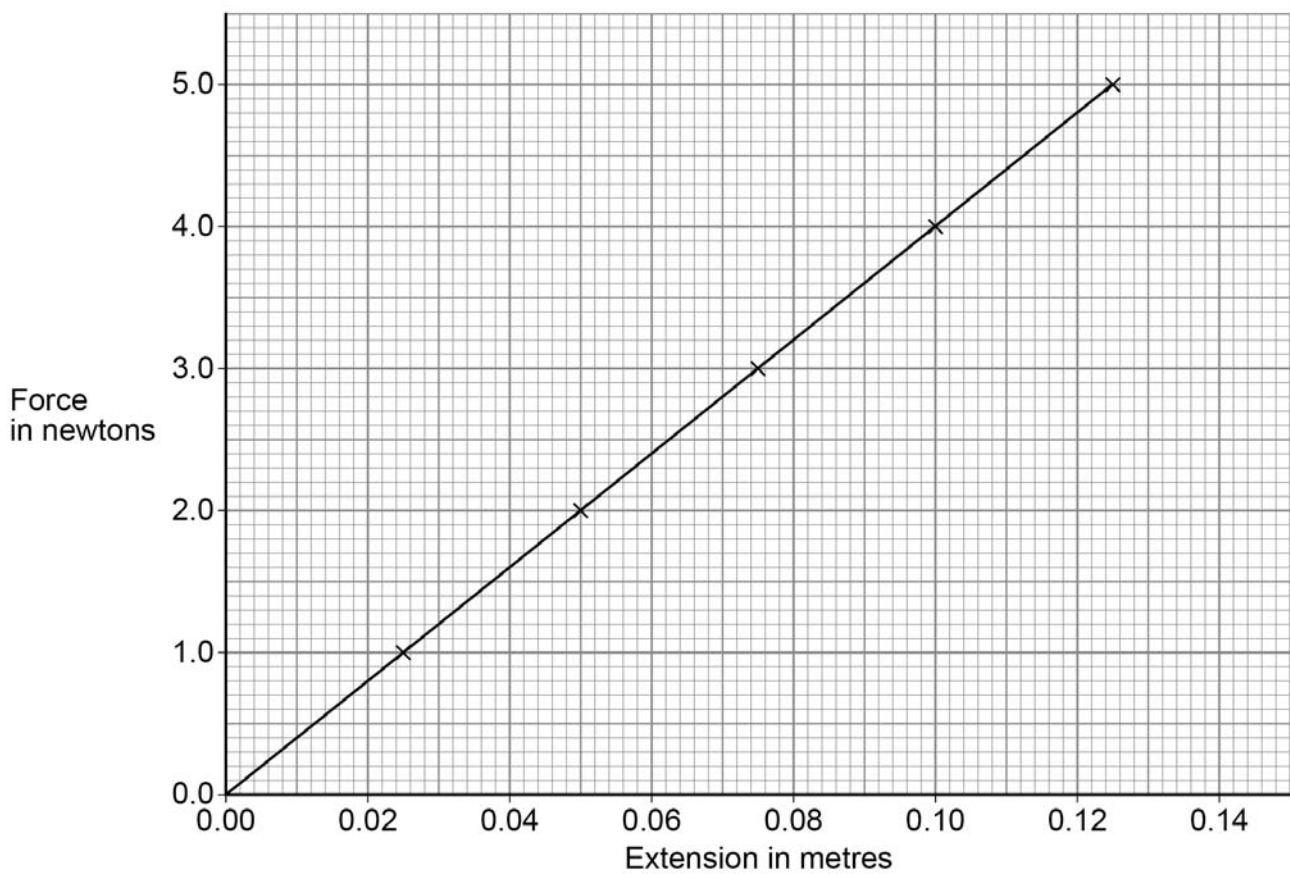
force = spring constant  $\times$  extension

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

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

Figure 21 is repeated below.

Figure 21

Do not write  
outside the  
box

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

Use **Figure 21**.

[3 marks]

---

---

---

---

---

Spring constant = \_\_\_\_\_ 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]

---

---

---

---

**Question 9 continues on the next page**

**Turn over ►**



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]

---

---

---

---

---

---

---

Elastic potential energy = \_\_\_\_\_ J

17

**END OF QUESTIONS**



**There are no questions printed on this page**

*Do not write  
outside the  
box*

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**













**There are no questions printed on this page**

*Do not write  
outside the  
box*

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

**Copyright information**

For confidentiality purposes, all acknowledgements of third-party copyright material are published in a separate booklet. This booklet is published after each live examination series and is available for free download from [www.aqa.org.uk](http://www.aqa.org.uk).

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements. If you have any queries please contact the Copyright Team.

Copyright © 2021 AQA and its licensors. All rights reserved.



5 2



2 1 6 G 8 4 6 3 / 2 F

IB/M/Jun21/8463/2F