A

AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE

PHYSICS

Foundation Tier

Paper 2

F

8463/2F

Time allowed: 1 hour 45 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

J U N 2 1 8 4 6 3 2 F 0 1

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.**
- **Answer ALL questions in the spaces provided.**
- **Do not write 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.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

Answer ALL questions in the spaces provided.

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.**

[Turn over]

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 list below. [3 marks]

- **m^2/s**
- **m/s**
- **s^2**

Wave speed = _____ Unit _____

0 1 . 4

What is transferred by all waves? [1 mark]

Tick (✓) ONE box.

- ☐ **Energy**
- ☐ **Information**
- ☐ **Water**

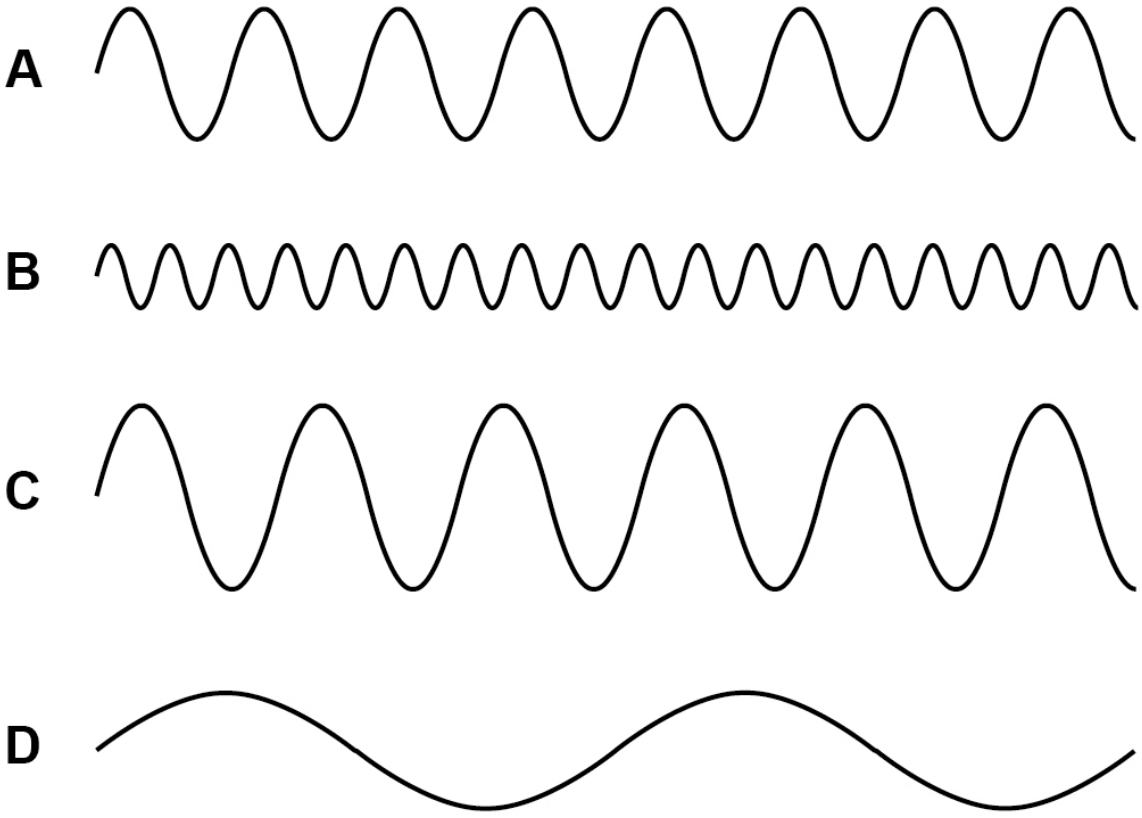
[Turn over]

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**

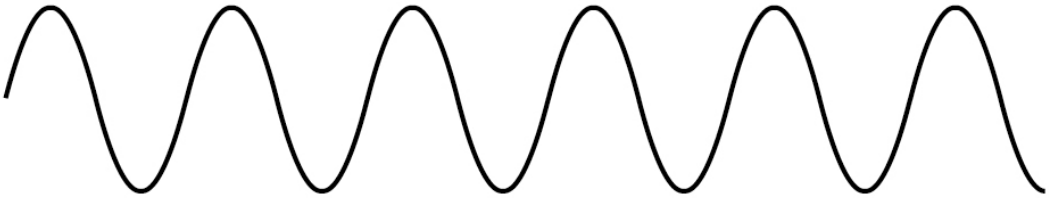
[Turn over]

REPEAT OF FIGURE 2

A

B

C



D

0 1 . 6

Which wave has the highest frequency? [1 mark]

Tick (✓) ONE box.

- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

[Turn over]

8

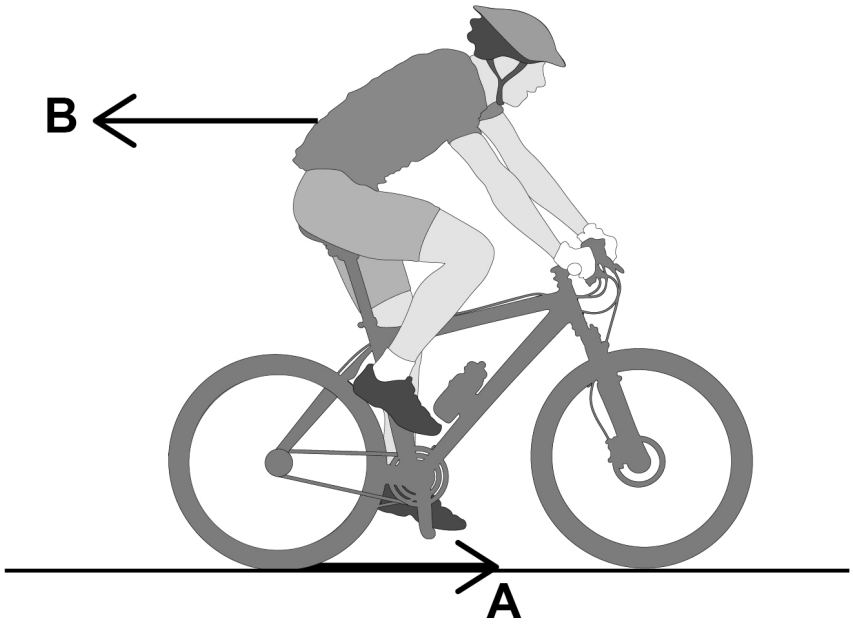
0 2

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

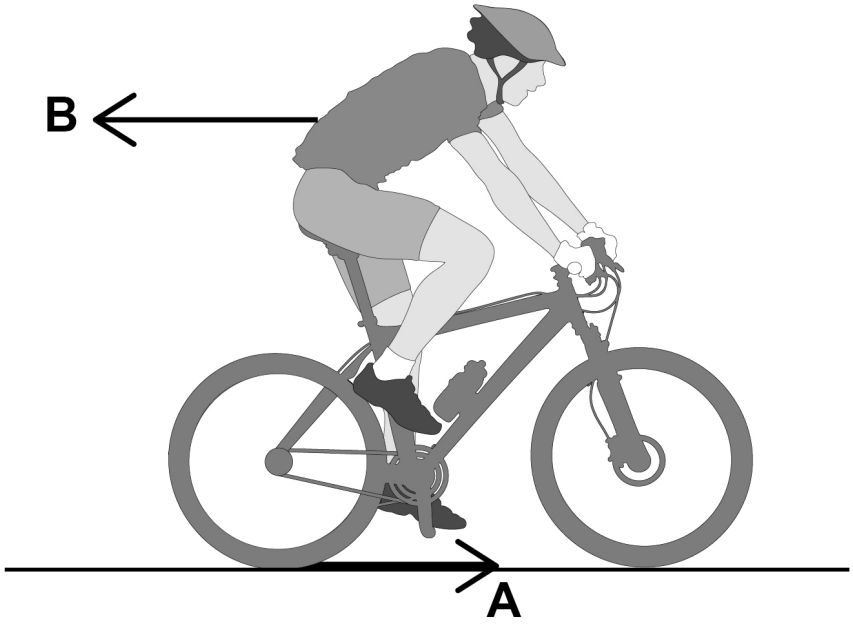
What is force A? [1 mark]

Tick (✓) ONE box.

- ☐ **Air resistance**
- ☐ **Friction**
- ☐ **Tension**
- ☐ **Upthrust**

[Turn over]

REPEAT OF FIGURE 3



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**

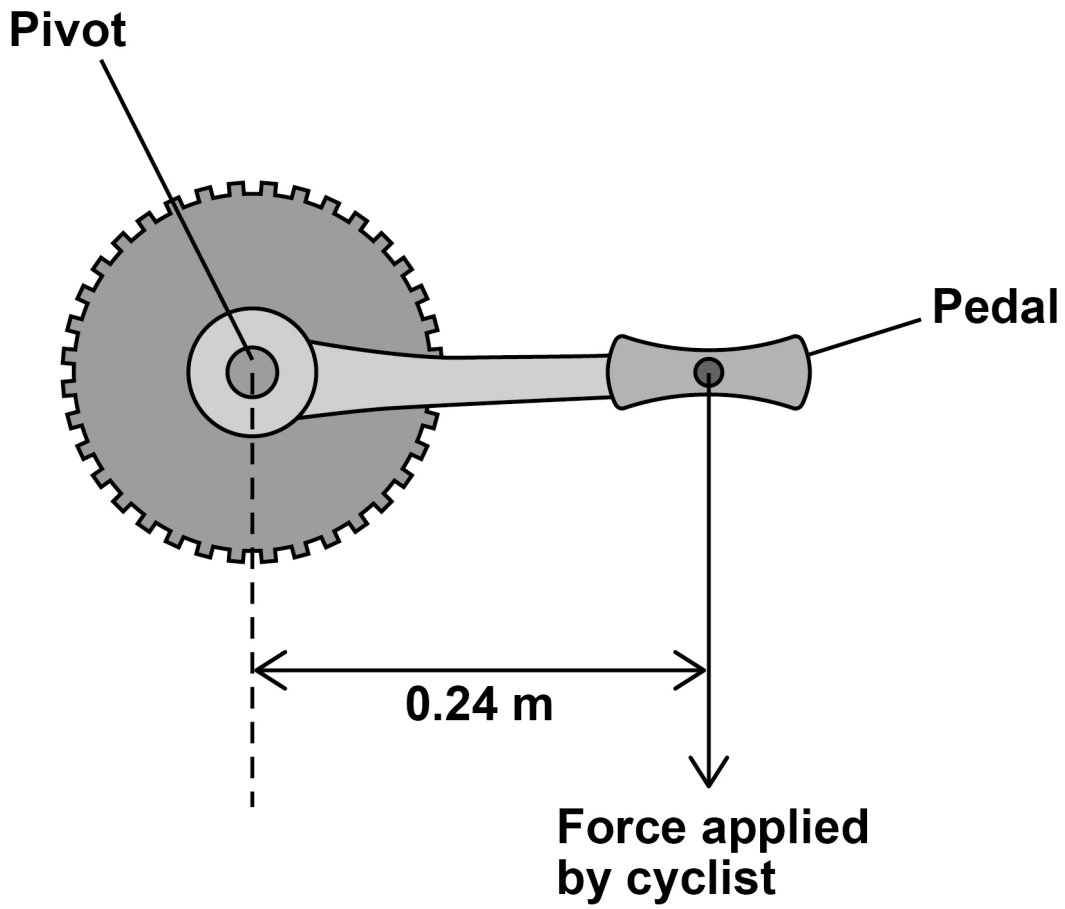
[Turn over]

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:

moment of a force = force × distance

[2 marks]

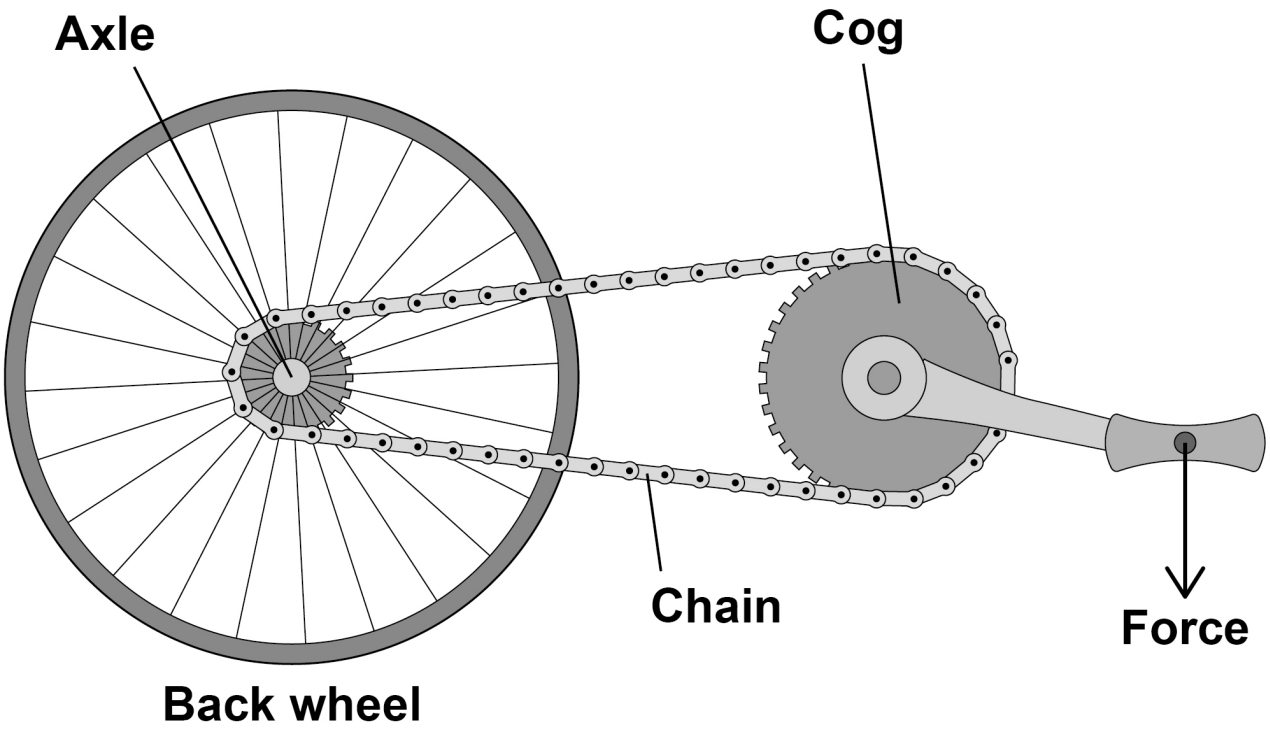
Moment = _____ N/m

[Turn over]

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 list below. [1 mark]

- **axle**
- **chain**
- **cog**

The force from the cyclist pushing down on the pedal

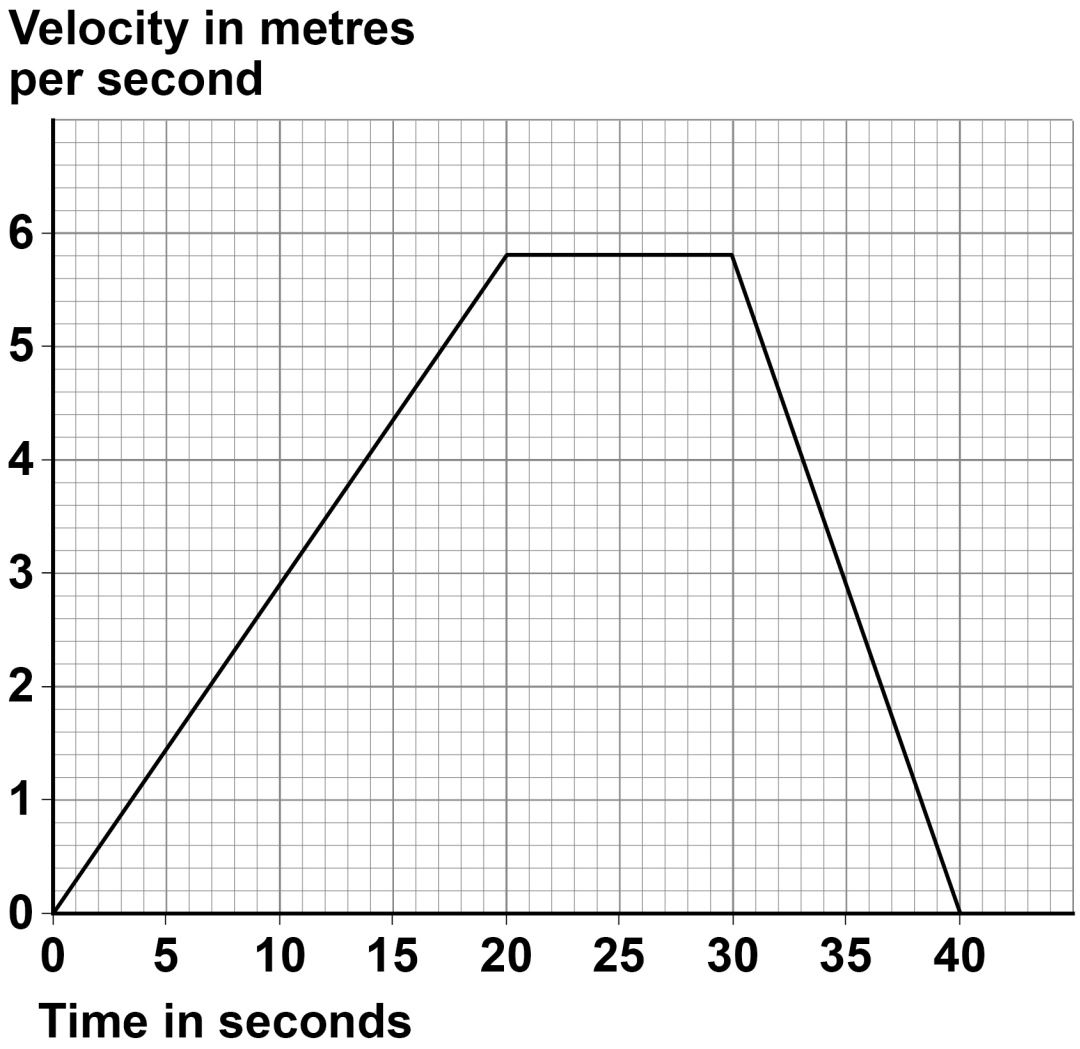
is transmitted to the back wheel by the

_____ .

[Turn over]

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**

[Turn over]

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^2

0 2 . 8

Complete the sentence.

Choose the answer from the list below. [1 mark]

- **deceleration**
- **speed**
- **velocity**

Between 30 and 40 seconds the cyclist moves with

a constant _____ .

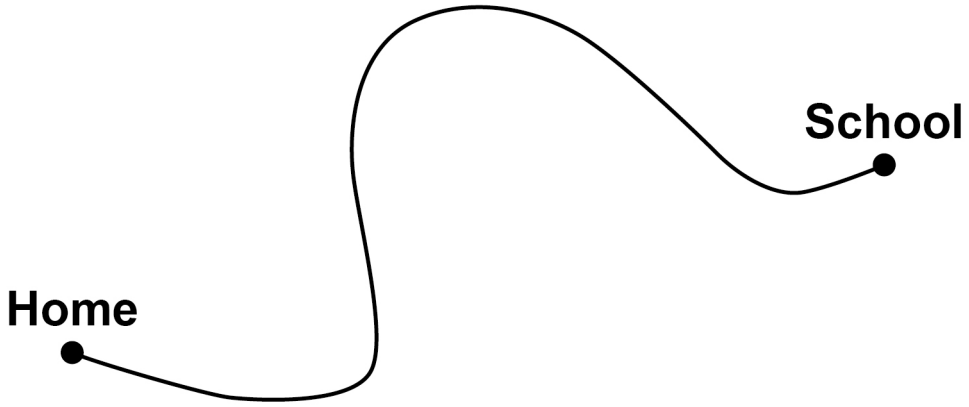
[Turn over]

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

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[Turn over]

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**

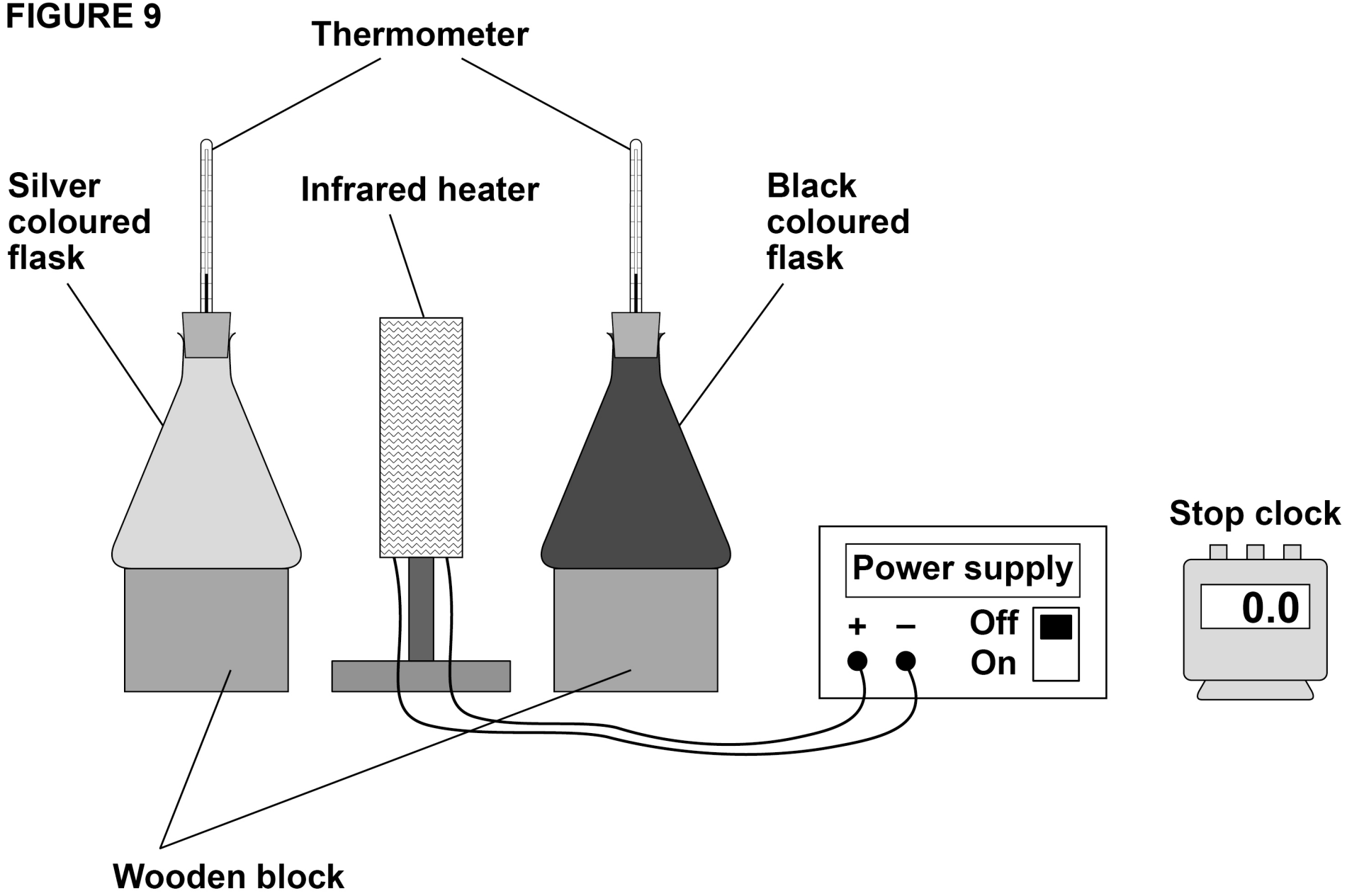
☐ **D**

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

FIGURE 9, on page 28, shows the equipment used.

[Turn over]

FIGURE 9


Thermometer
Silver coloured flask
Infrared heater
Black coloured flask
Power supply
+
–
Off
On
Stop clock
0.0
Wooden block

0 3 . 2

Complete the sentence.

Choose the answer from the list below. [1 mark]

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

In this investigation the distance between each flask and the infrared heater is

_____ variable.

[Turn over]

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, on page 28, could be used to test this hypothesis. [4 marks]

[Turn over]

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

[Turn over]

BLANK PAGE

0 3 . 7

What conclusion can be made from TABLE 1 on page 32? [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.**

[Turn over]

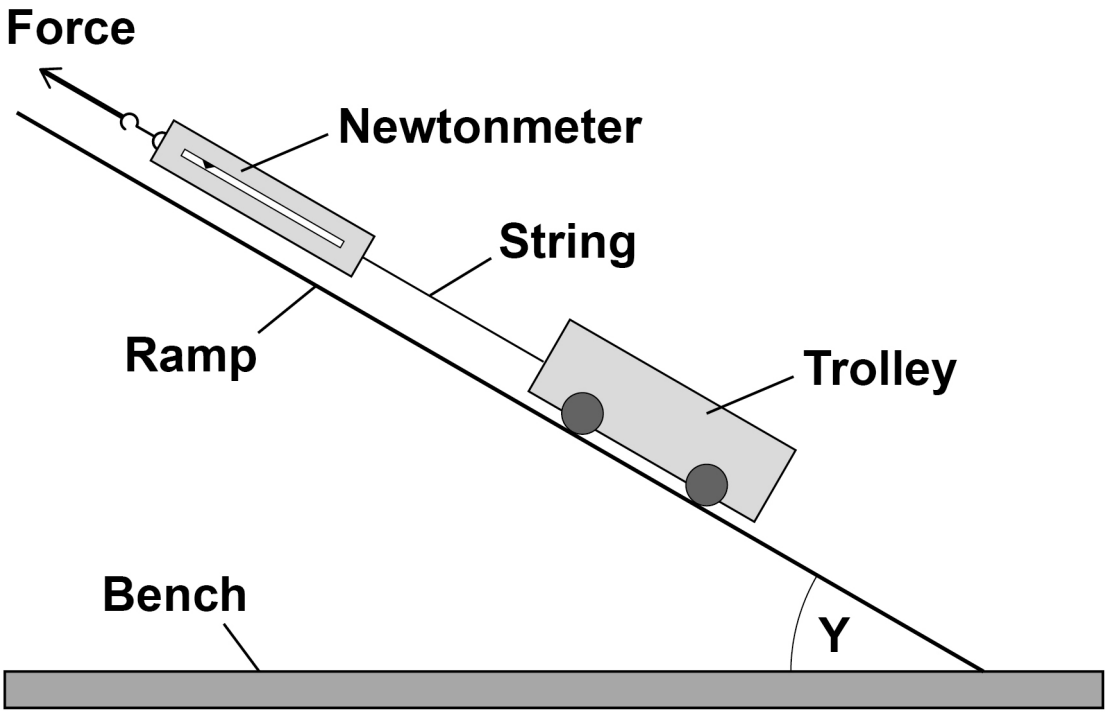
10

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]

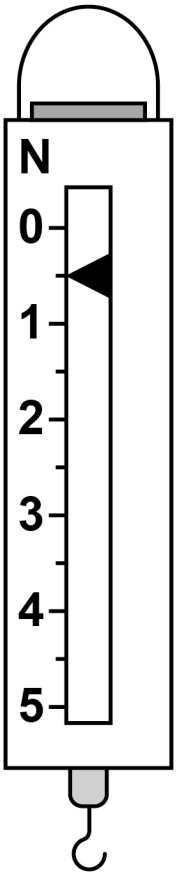
Angle Y = _____ degrees

BLANK PAGE

[Turn over]

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**

[Turn over]

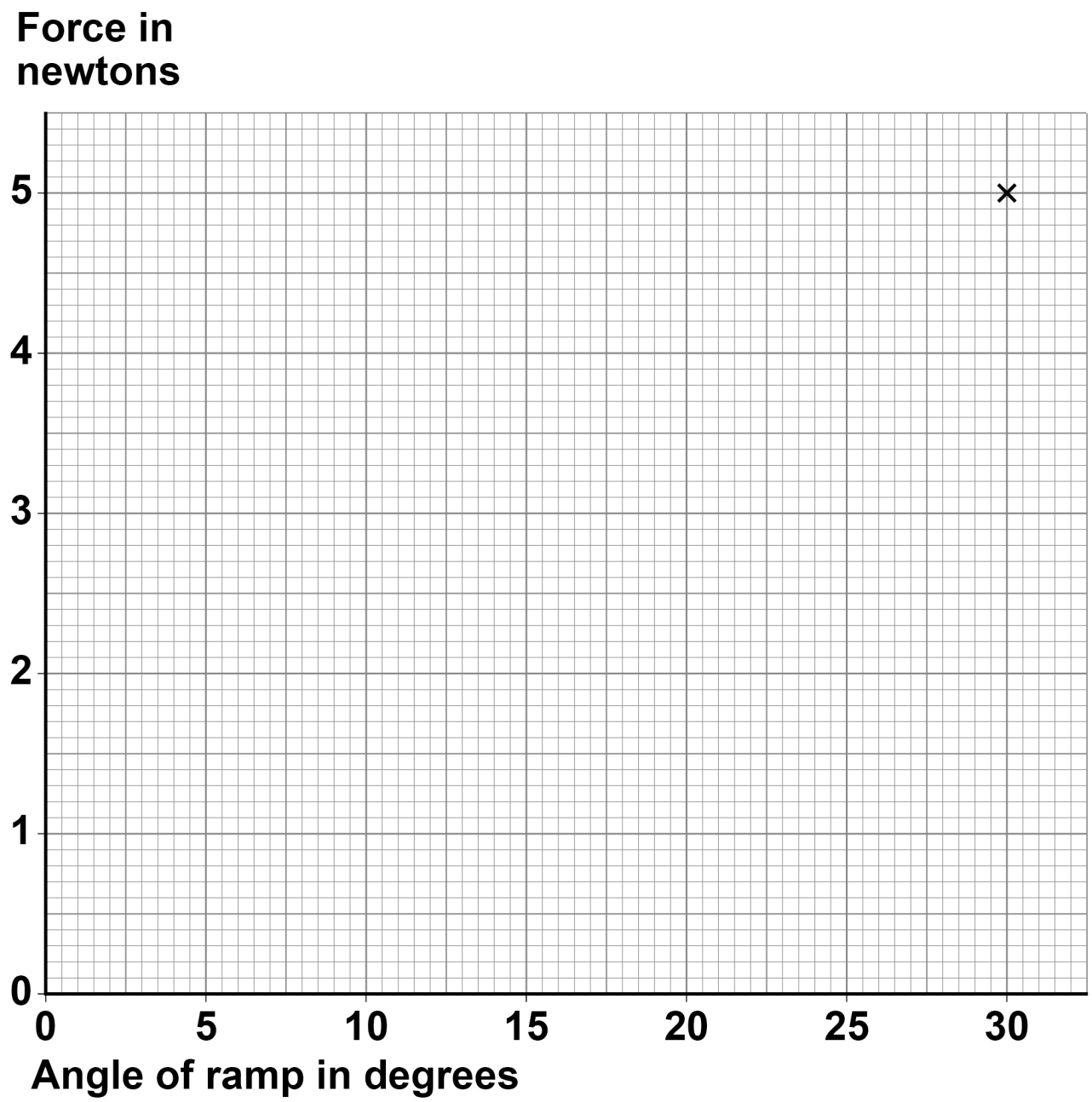
TABLE 2 shows the corrected results.

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

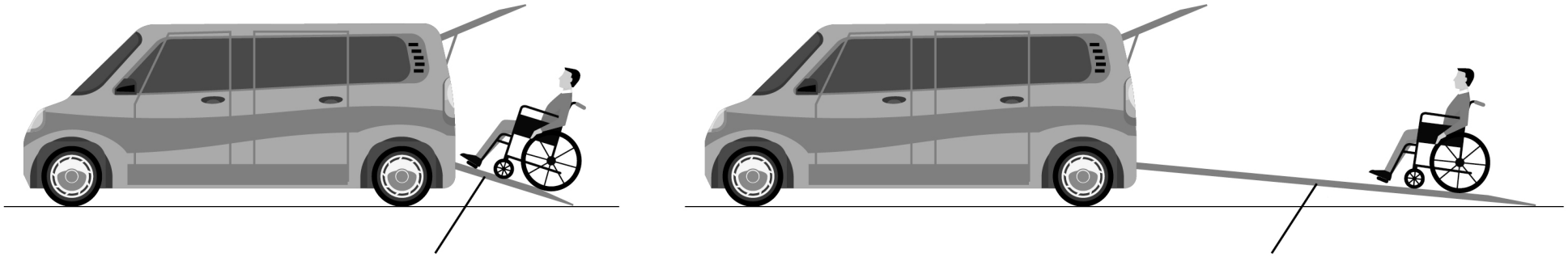
Plot the missing results from TABLE 2 on FIGURE 12.
[2 marks]

[Turn over]

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]

[Turn over]

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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]

45

Work done = _____ J

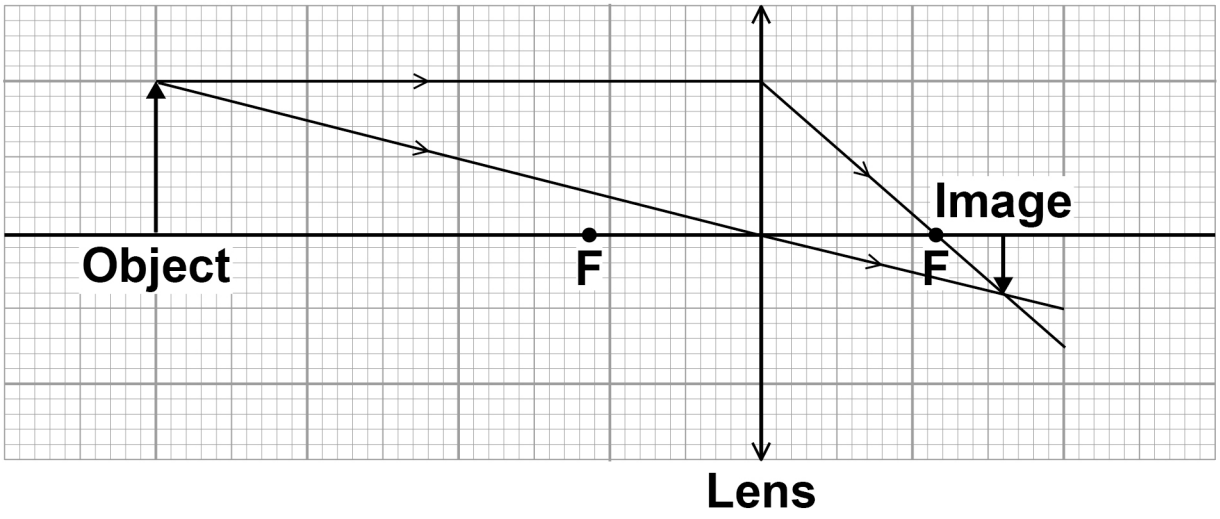
[Turn over]

9

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

[Turn over]

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, on page 46? [2 marks]

Tick (✓) TWO boxes.

- ☐ **Enlarged**
- ☐ **Inverted**
- ☐ **Real**
- ☐ **Upright**
- ☐ **Virtual**

[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 list below. [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

BLANK PAGE

[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**

[Turn over]

0 6 . 3

All stars have a life cycle.

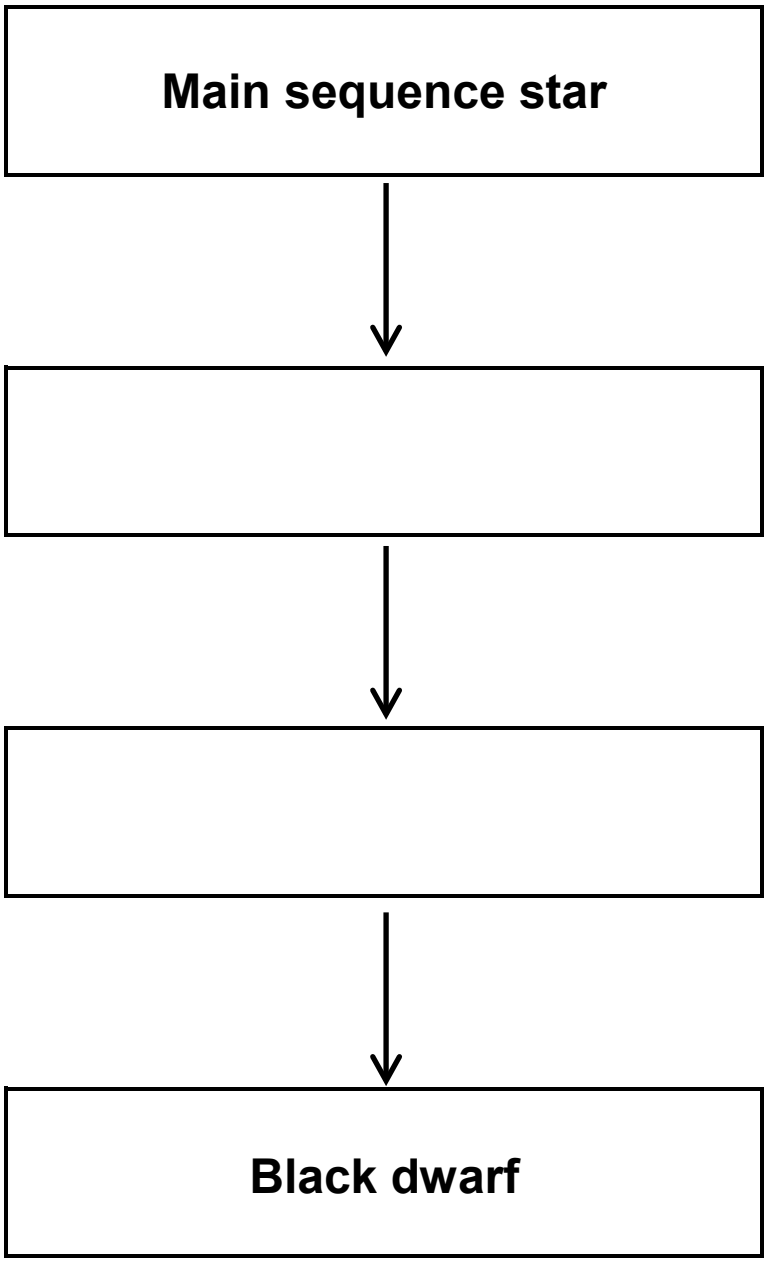
FIGURE 15 shows part of the life cycle of a star that becomes a black dwarf.

Complete FIGURE 15 on the opposite page.

Choose answers from the list below. [2 marks]

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

FIGURE 15



[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	× 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 _____

_____

_____

_____

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**

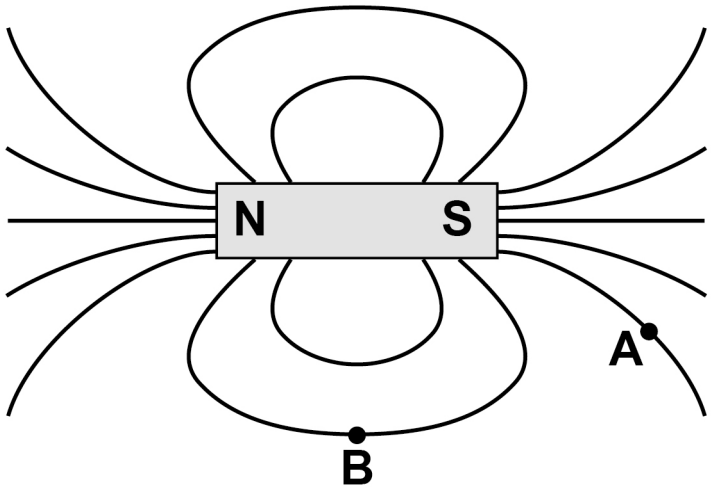
☐ **Supernova**

[Turn over]

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 list below. [1 mark]

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

A bar magnet is an example of _____ .

[Turn over]

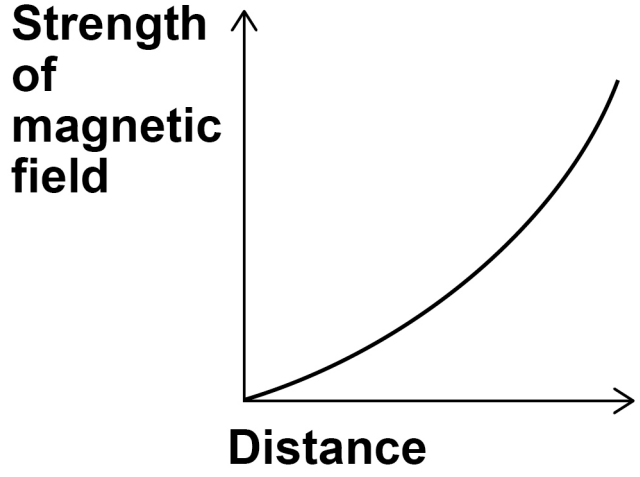
0 7 . 3

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

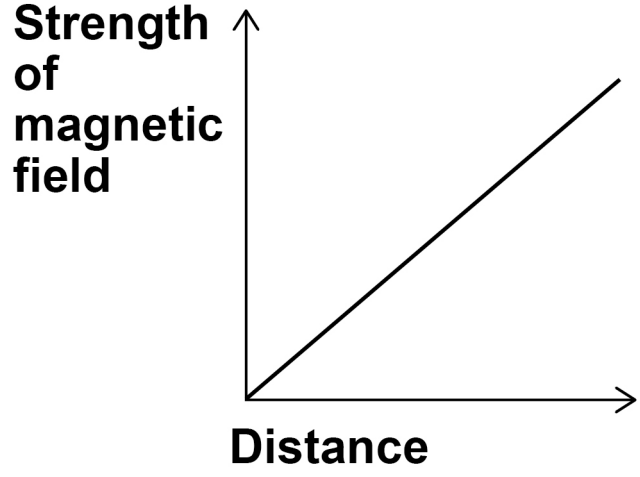
Give a reason for your answer. [2 marks]

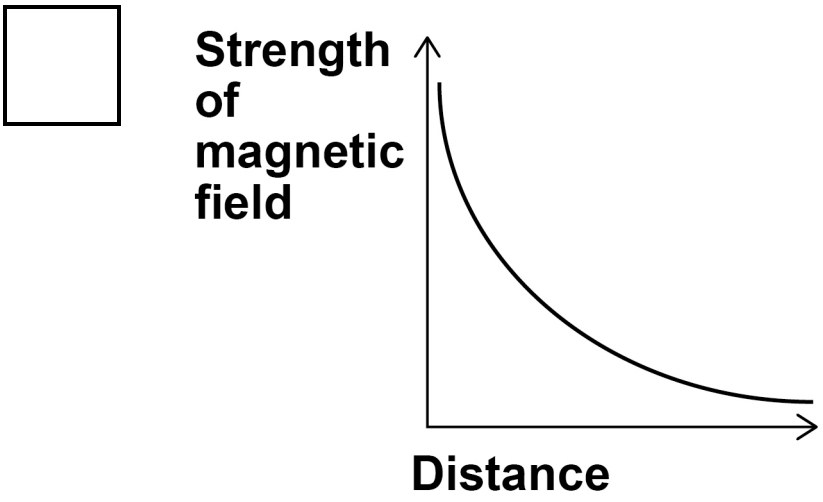
Tick (✓) ONE box.

☐



☐





Reason _____

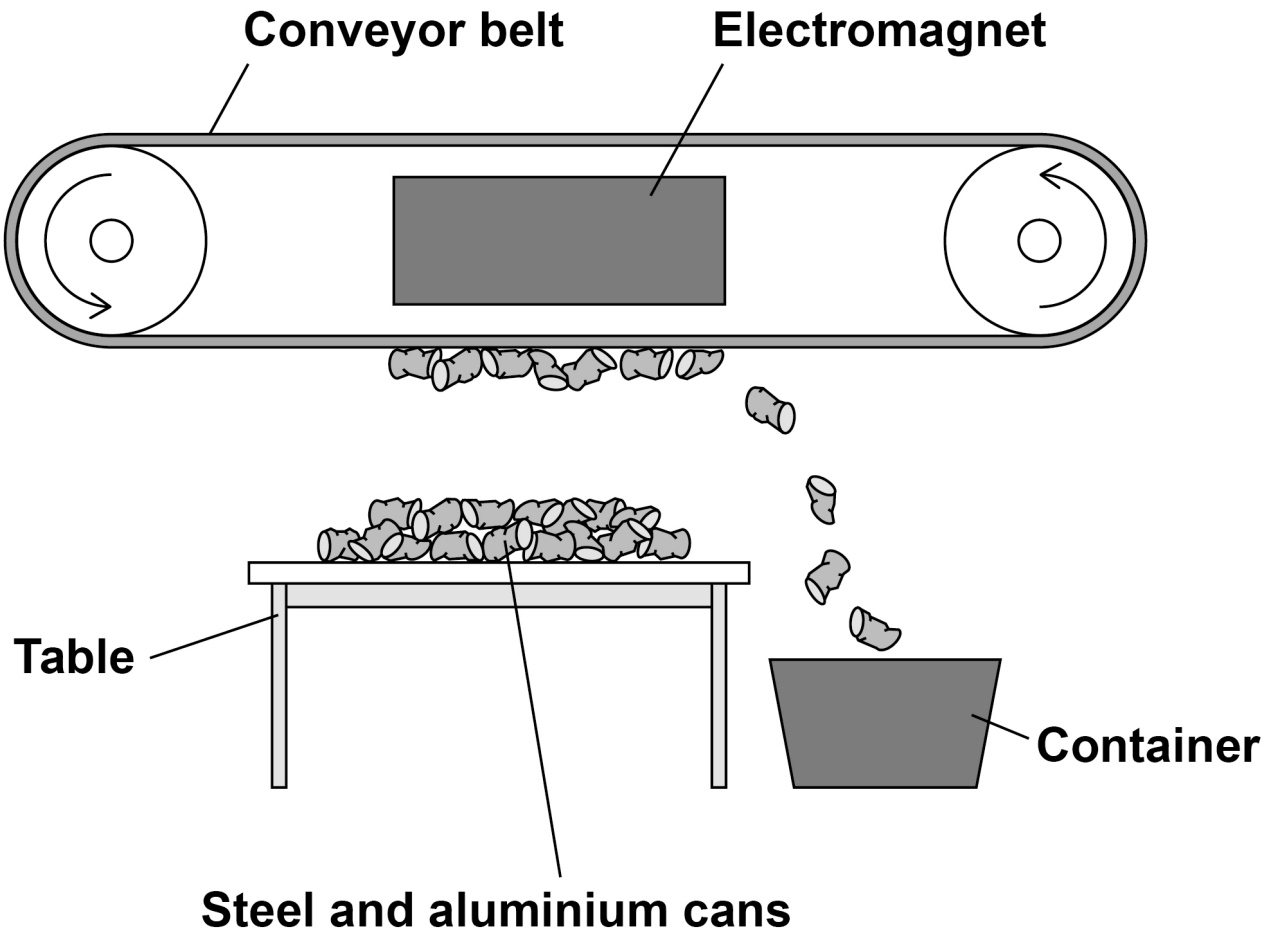
_____

_____

[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]

[Turn over]

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

[Turn over]

13

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]

[Turn over]

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]

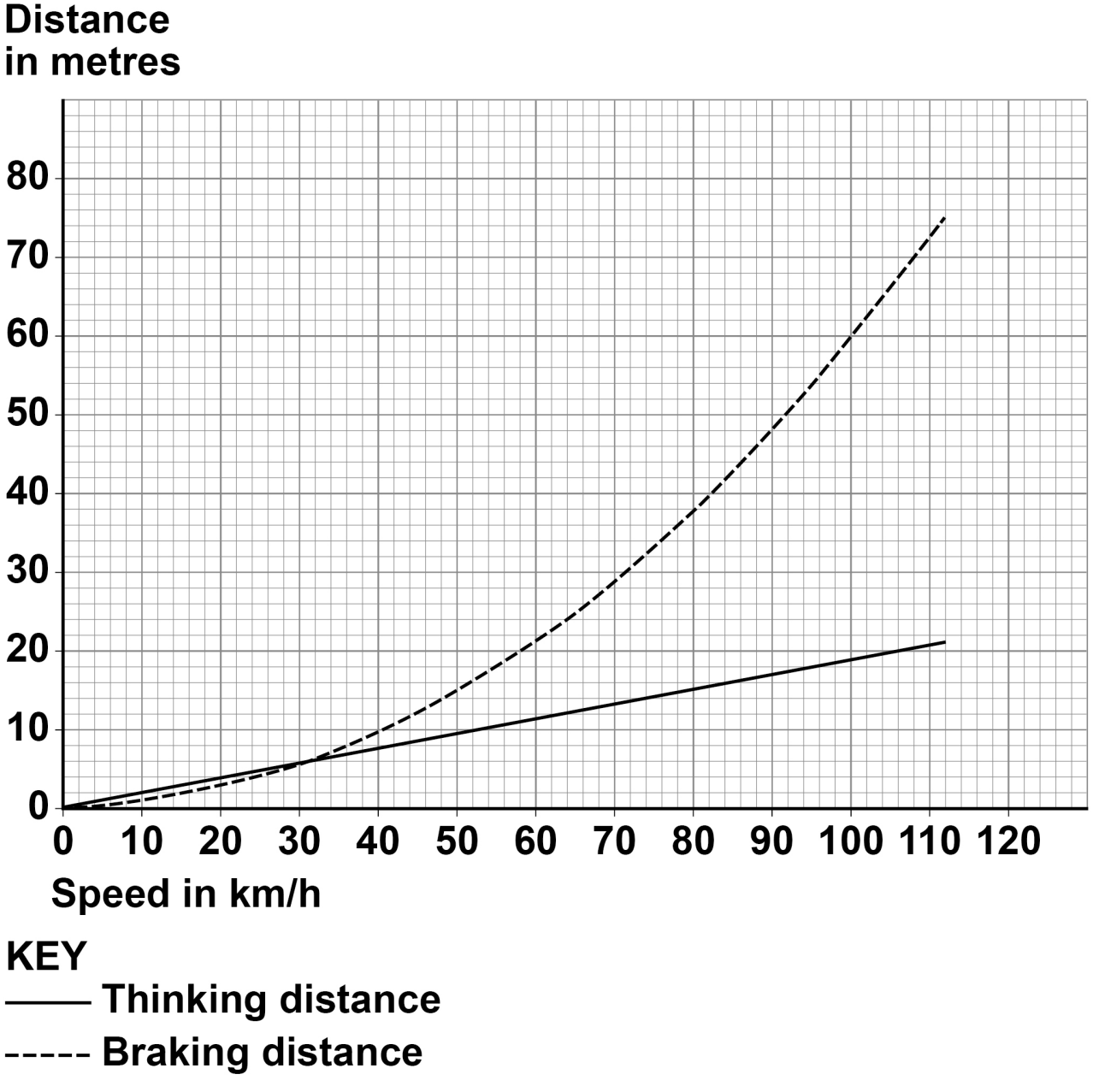
Deceleration = _____ m/s^2

[Turn over]

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



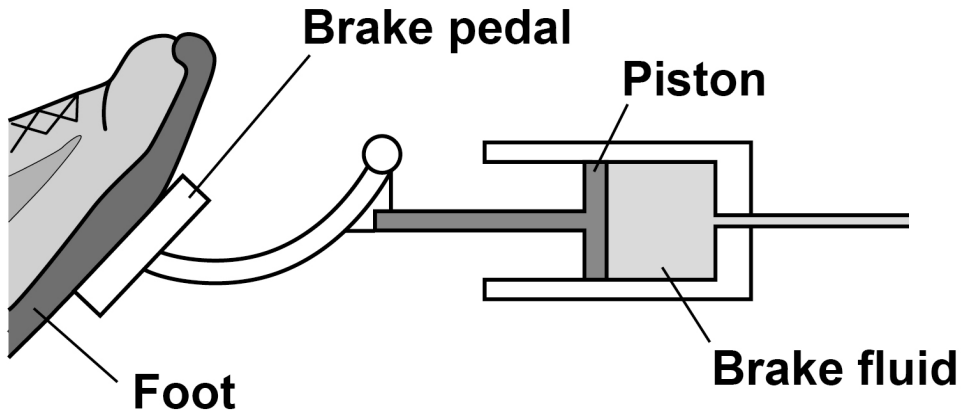
Determine the stopping distance when the car is travelling at 80 km/h. [2 marks]

Stopping distance = _____ m

[Turn over]

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.

☐ $p = F \times A$

☐ $p = F \times A^2$

☐ $p = \frac{F}{A}$

☐ $p = \frac{A}{F}$

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[Turn over]

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]

Surface area (in standard form) = _____

Unit _____

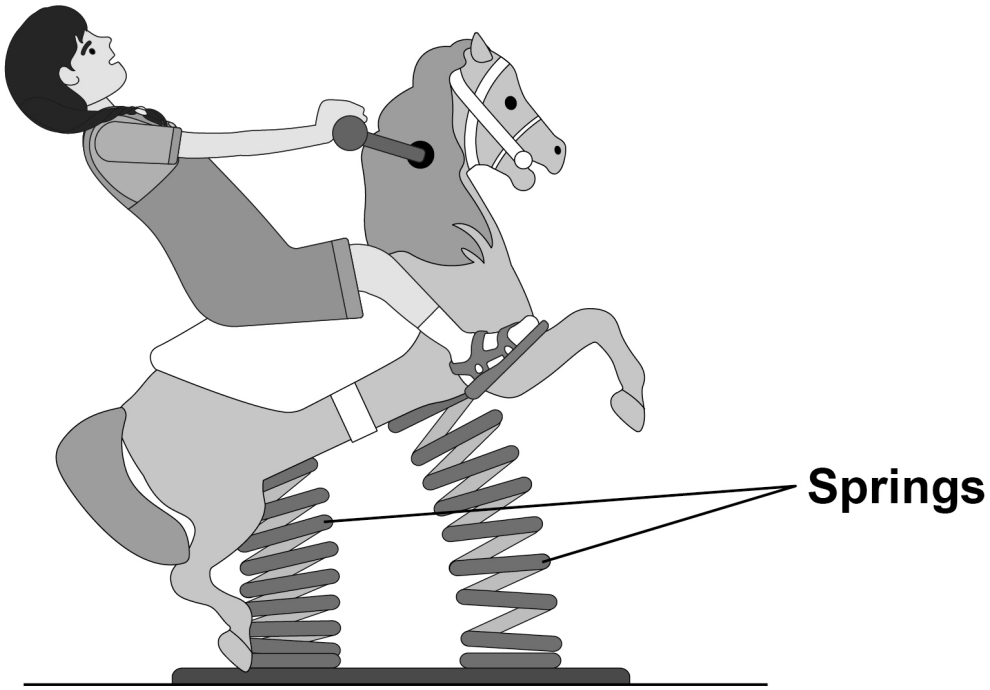
[Turn over]

16

0 9

FIGURE 20 shows a child on a playground toy.

FIGURE 20



0 9 . 1

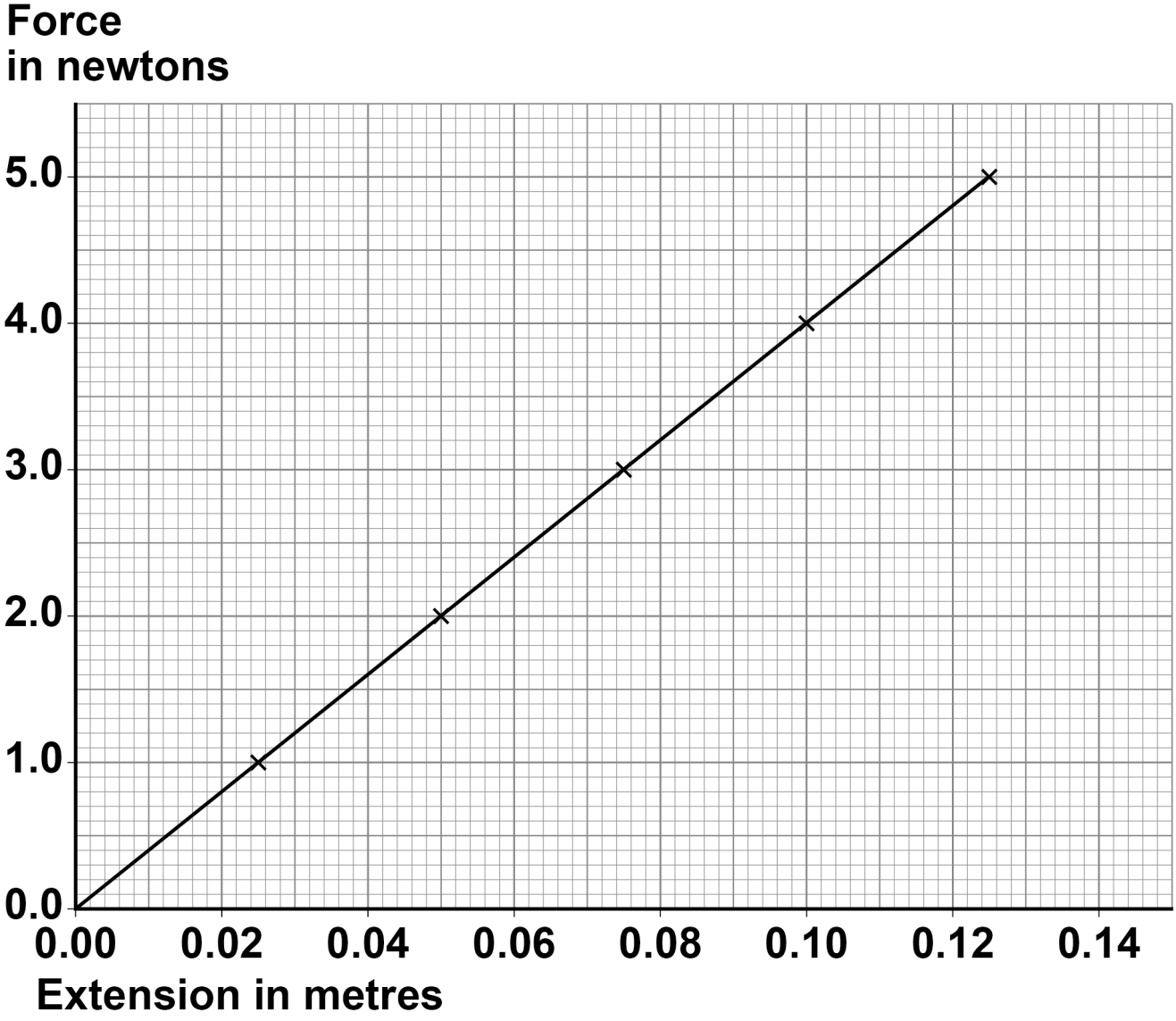
The springs have been elastically deformed.

Explain what is meant by ‘elastically deformed’.
[2 marks]

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



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]

0 9 . 3

Which equation links extension (e), force (*F*) and spring constant (*k*). [1 mark]

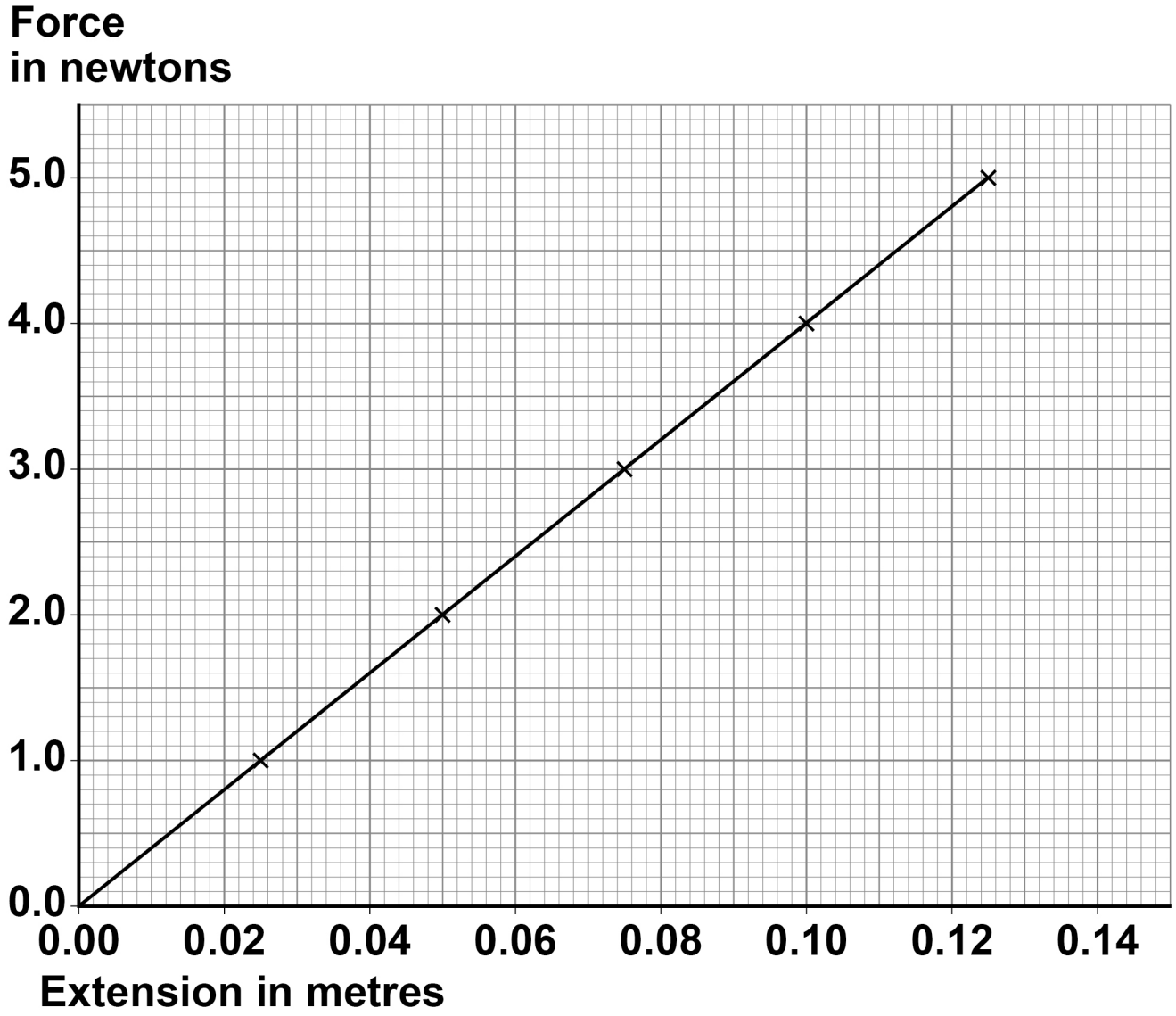
Tick (✓) ONE box.

- ☐ **force = spring constant × (extension)^2**
- ☐ **force = spring constant × extension**
- ☐ **force = $\frac{\text{extension}}{\text{spring constant}}$**
- ☐ **force = $\frac{\text{spring constant}}{\text{extension}}$**

[Turn over]

FIGURE 21 is repeated below.

FIGURE 21



0 9 . 4

Determine the spring constant of the spring.

Use FIGURE 21. [3 marks]

Spring constant = _____ N/m

[Turn over]

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, on page 82, supports the student’s conclusion. [2 marks]

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

END OF QUESTIONS

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Additional page, if required.
Write the question numbers in the left-hand margin.

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Question	Mark
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