Surname _____

Forename(s) _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE

PHYSICS

F

Foundation Tier Paper 2

8463/2F

Friday 14 June 2024 Afternoon

Time allowed: 1 hour 45 minutes

[Turn over]

BLANK PAGE

On the front of this book, write your surname and forename(s), your centre number, your candidate number and add your signature.

MATERIALS

For this paper you must have:

- **a ruler**
- **a scientific calculator**
- **a protractor**
- **the Physics Equations Sheet (enclosed).**

[Turn over]

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.**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**
- **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).**
- **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

A group of stars is called a galaxy.

0 1 . 1

What is the name of our galaxy?
[1 mark]

Tick (✓) ONE box.

- ☐ **Black Eye**
- ☐ **Hockey Stick**
- ☐ **Milky Way**
- ☐ **Sculptor Dwarf**

0 1 . 2

The Sun is one of the stars in our galaxy.

What was the Sun originally formed from? [1 mark]

Tick (✓) ONE box.

- ☐ **Dust and gas**
- ☐ **Heavy elements**
- ☐ **Oxygen**

[Turn over]

0 1 . 3

Which of the following forces was involved in the formation of the Sun? [1 mark]

Tick (✓) ONE box.

- ☐ **Electrostatic force**
- ☐ **Gravitational force**
- ☐ **Magnetic force**

0 1 . 4

Stars produce light because they release energy.

Complete the sentence.

Choose the answer from the list.
[1 mark]

- **combustion**
- **conduction**
- **fusion**

The process which releases energy inside stars is _____ .

0 1 . 5

Visible light and infrared radiation travel from the Sun to the Earth.

Which statement describes the time taken for visible light and infrared radiation to travel from the Sun to the Earth? [1 mark]

Tick (✓) ONE box.

- ☐ **Visible light takes less time than infrared radiation**
- ☐ **Visible light takes the same time as infrared radiation**
- ☐ **Visible light takes more time than infrared radiation**

0 1 . 6

Infrared radiation has a longer wavelength than visible light.

Complete the sentence.

Choose the answer from the list.
[1 mark]

- **smaller**
- **the same**
- **greater**

Compared with the frequency of infrared radiation, the frequency of visible light is

_____ .

[Turn over]

0 1 . 7

The Sun and the Earth both emit infrared radiation.

How does the rate of infrared radiation emitted by the Sun compare with the rate of infrared radiation emitted by the Earth?

Give a reason for your answer, on the opposite page. [2 marks]

Tick (✓) ONE box.

☐ **Lower rate than the Earth**

☐ **Same rate as the Earth**

☐ **Greater rate than the Earth**

Reason _____

_____

_____

[Turn over]

8

0 2

Some metals are magnetic and others are non-magnetic.

0 2 . 1

Which of the following metals is magnetic? [1 mark]

Tick (✓) ONE box.

☐ **Aluminium**

☐ **Cobalt**

☐ **Copper**

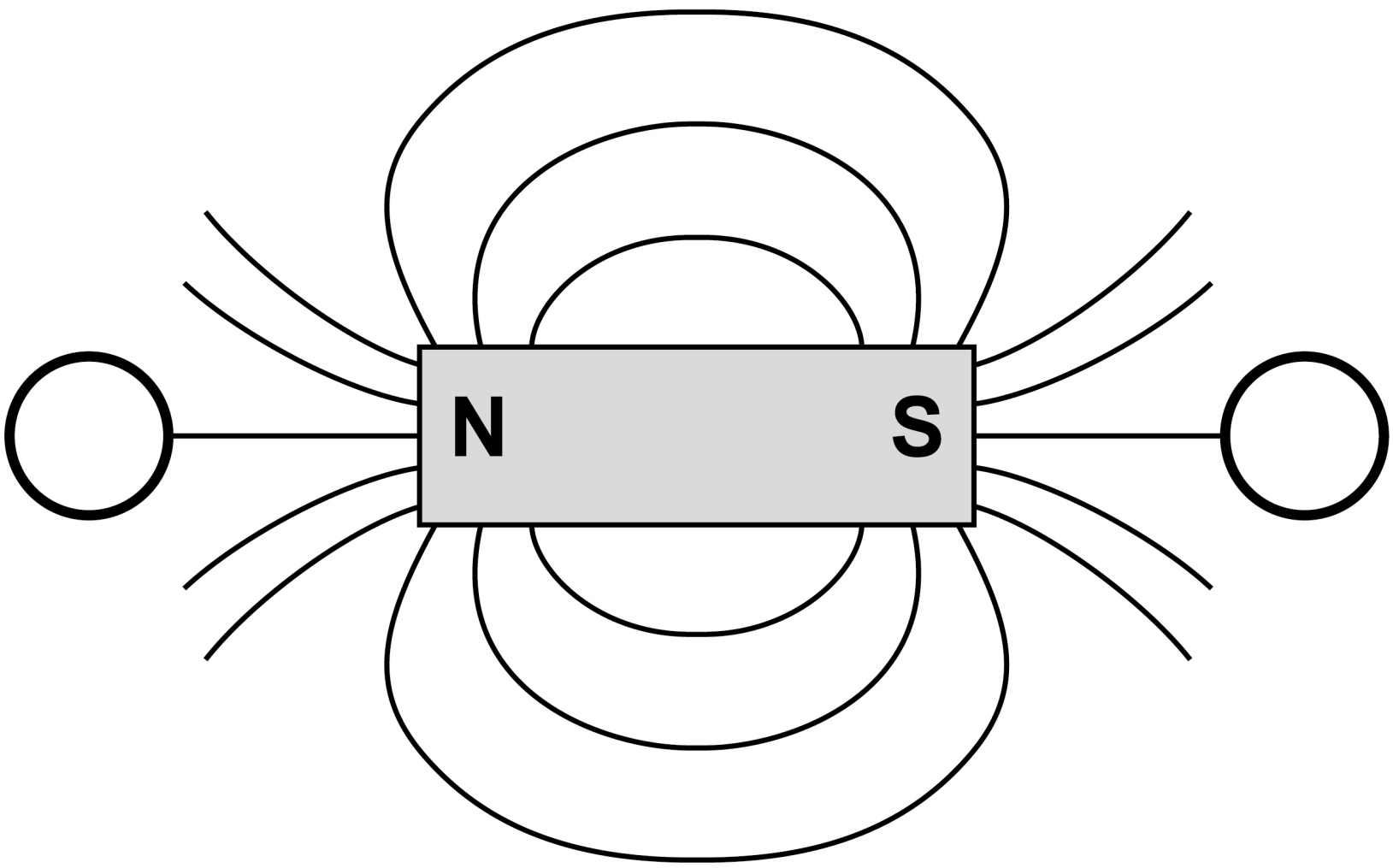
☐ **Zinc**

0 2 . 2

FIGURE 1 shows magnetic field lines around a bar magnet.

The circles represent plotting compasses.

FIGURE 1



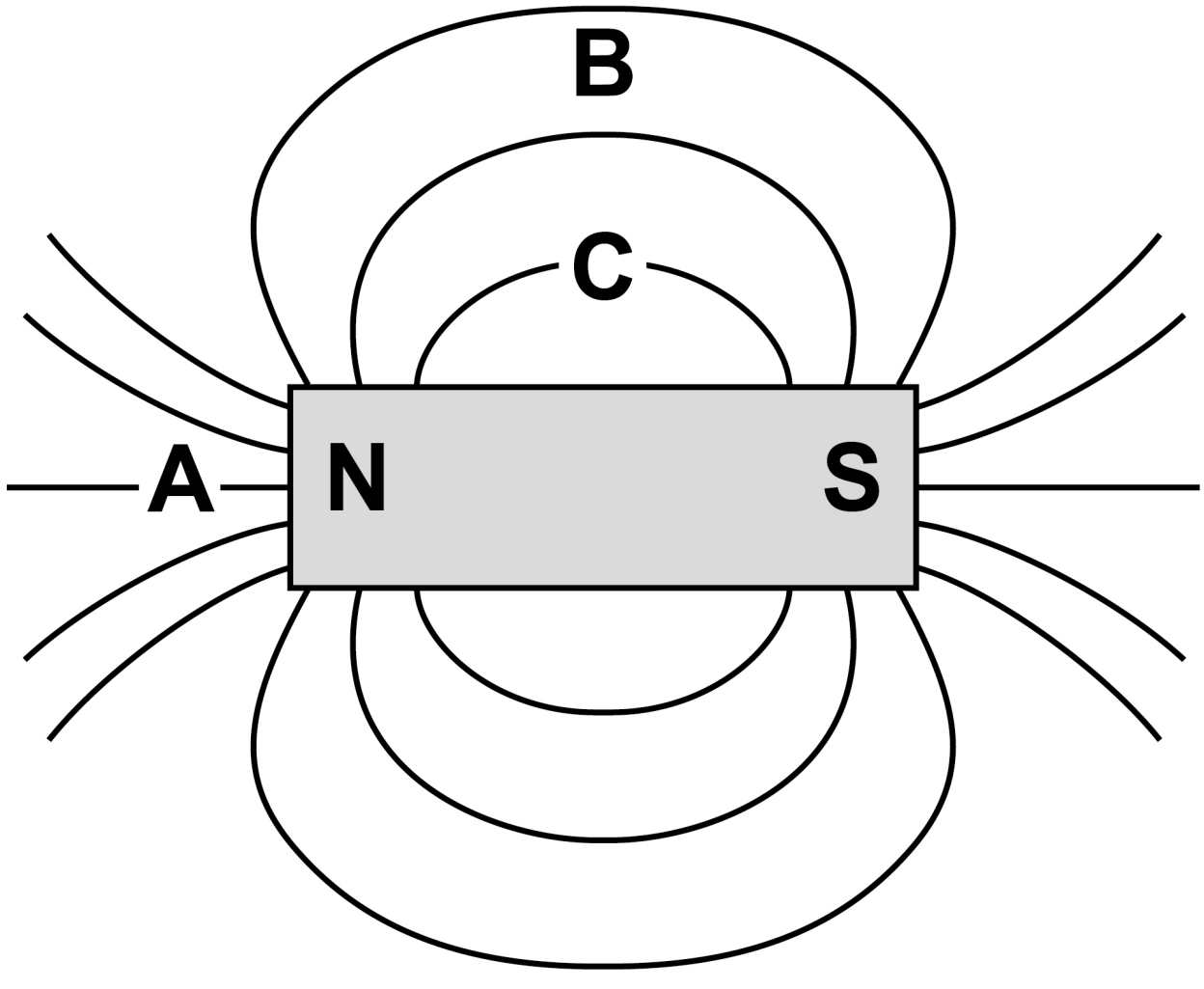
Draw ONE arrow in each circle on FIGURE 1 to show the direction of the magnetic field at each place. [2 marks]

[Turn over]

0 2 . 3

FIGURE 2 shows magnetic field lines around a bar magnet.

FIGURE 2



Which letter shows where the magnetic field is strongest? [1 mark]

Tick (✓) ONE box.

- ☐ **A**
- ☐ **B**
- ☐ **C**

0 2 . 4

FIGURE 3 shows the magnetic field lines between two bar magnets.

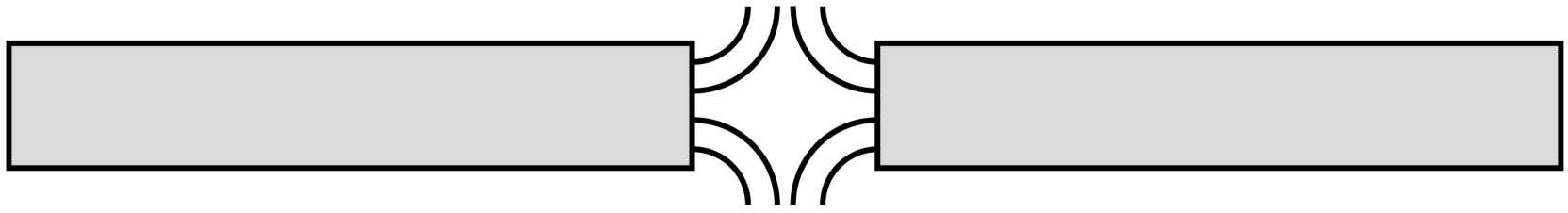


FIGURE 3

Which diagram shows how the magnets are arranged in FIGURE 3? [1 mark]

Tick (✓) ONE box.

☐ 

☐ 

☐ 

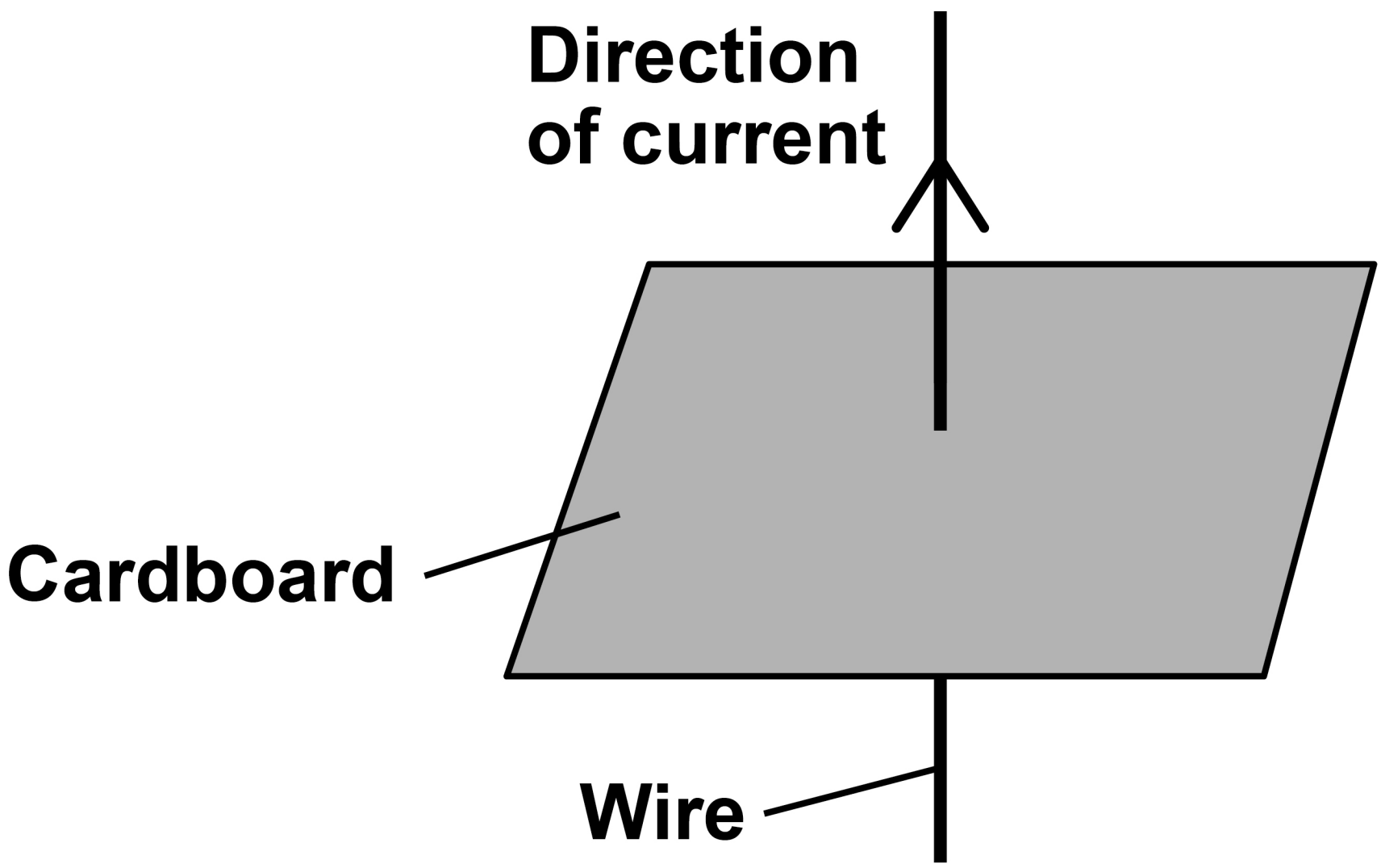
[Turn over]

A teacher demonstrates how a current in a wire creates a magnetic field around the wire.

FIGURE 4 shows the wire passing through a piece of cardboard.

The current can be switched on and off.

FIGURE 4



0 2 . 5

Describe how the teacher can use a plotting compass to demonstrate the magnetic effect of the current in the wire. [2 marks]

0 2 . 6

The teacher decreases the current in the wire.

How does the strength of the magnetic field around the wire change? [1 mark]

Tick (✓) ONE box.

☐ **Decreases**

☐ **Stays the same**

☐ **Increases**

0 2 . 7

The teacher reverses the direction of the current in the wire.

What happens to the magnetic field around the wire? [1 mark]

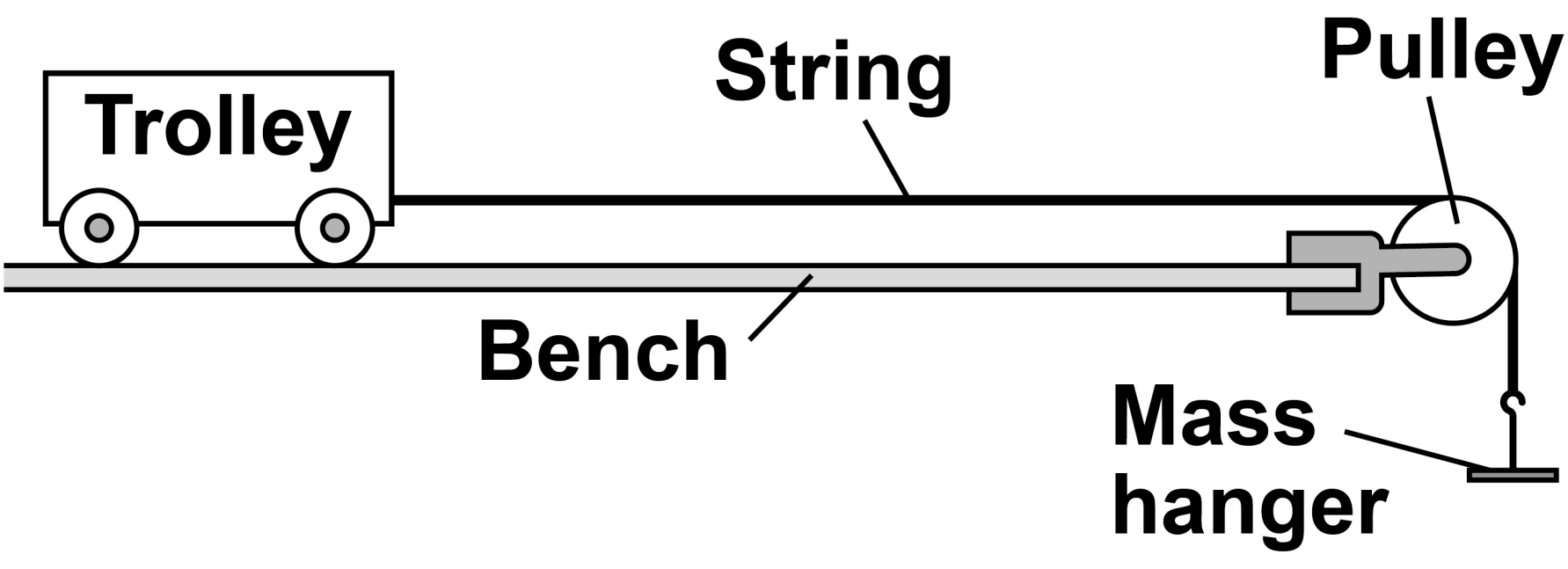
9

0 3

A student investigated how changing the mass of a trolley affects the acceleration of the trolley.

FIGURE 5 shows some of the equipment used.

FIGURE 5



0 3 . 1

The trolley in FIGURE 5 is not moving.

Which force prevents the trolley from moving? [1 mark]

Tick (✓) ONE box.

☐ **Friction**

☐ **Tension**

☐ **Weight**

[Turn over]

The force pulling on the trolley was increased so that the trolley accelerated.

The force was then kept constant and different masses were put on the trolley.

For each different mass the acceleration of the trolley was measured.

0 3 . 2

Draw ONE line from each variable to the correct quantity. [2 marks]

VARIABLE	QUANTITY
Independent variable	Acceleration of the trolley
Dependent variable	Length of the bench
	Total mass of the trolley
	Force pulling on the trolley

0 3 . 3

For one of the masses put on the trolley, the student recorded three values of acceleration.

1.58 m/s^2 1.53 m/s^2 1.54 m/s^2

Calculate the mean acceleration of the trolley. [2 marks]

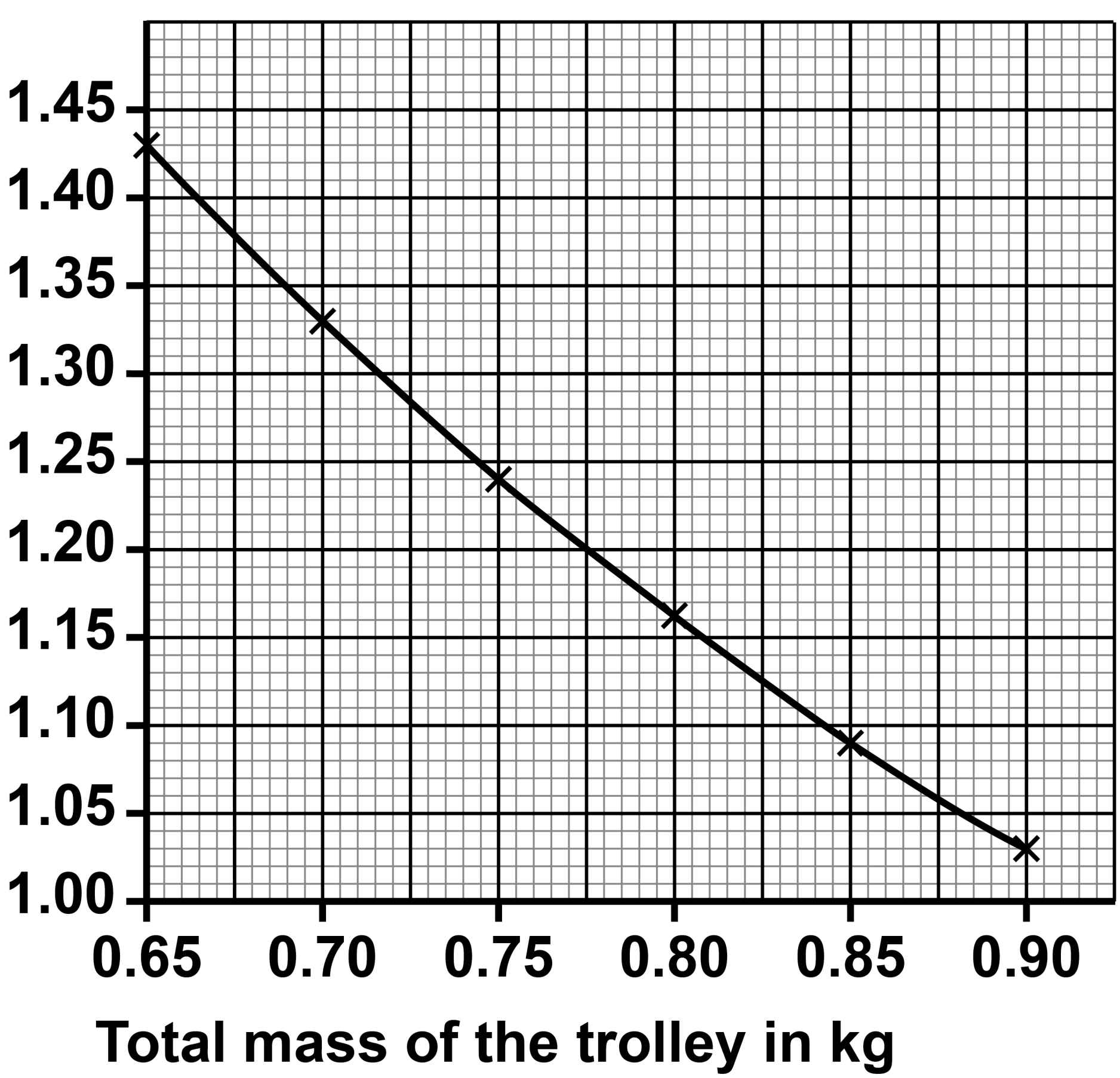
Mean acceleration = _____ m/s^2

BLANK PAGE

[Turn over]

FIGURE 6 shows some of the results.

FIGURE 6



0 3 . 4

Describe the relationship shown in FIGURE 6. [1 mark]

0 3 . 5

When the total mass of the trolley was 1.5 kg, the acceleration of the trolley was 0.62 m/s^2.

Calculate the resultant force acting on the trolley.

Use the equation:

resultant force = mass × acceleration

[2 marks]

Resultant force = _____ N

8

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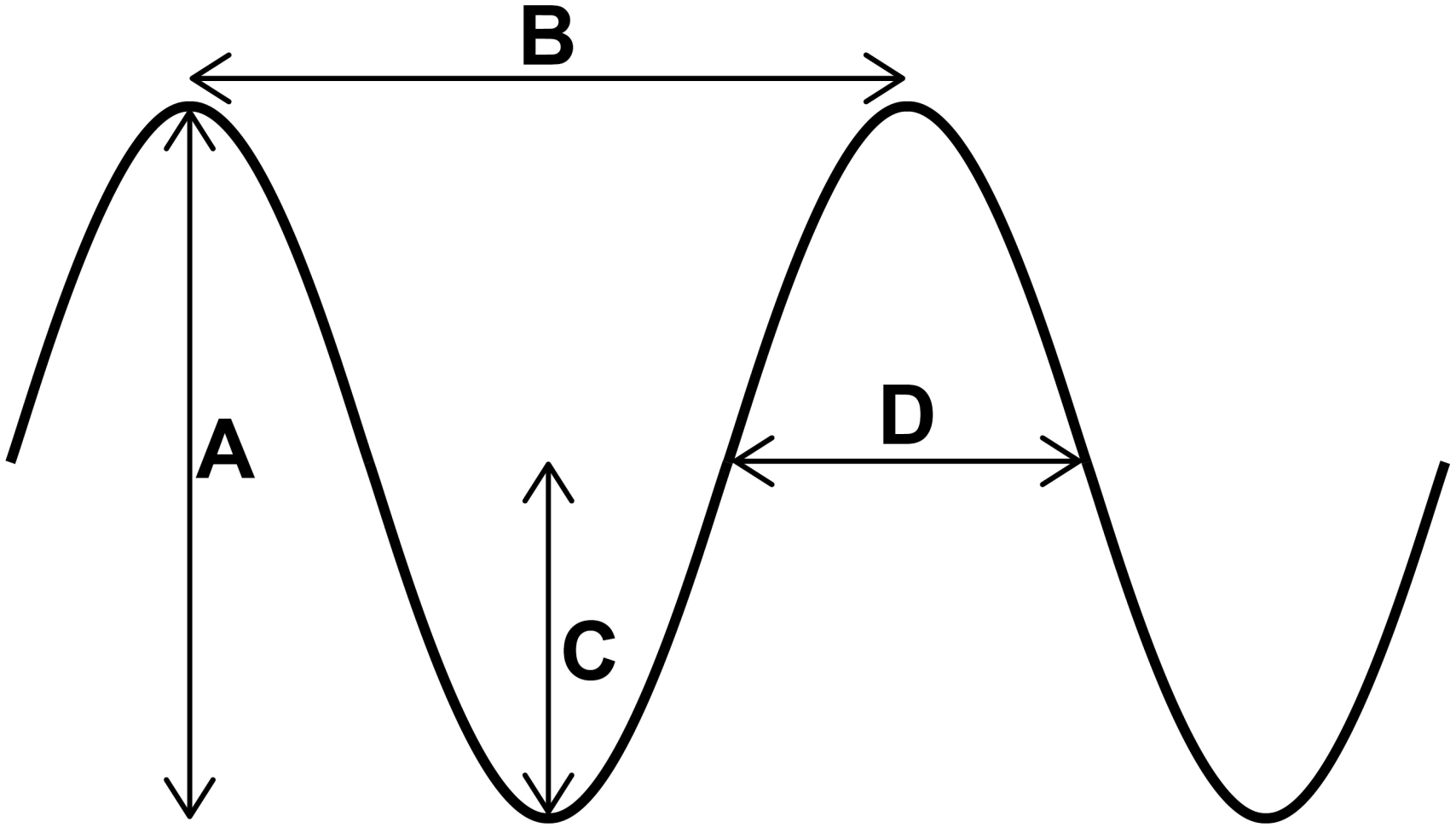
[Turn over]

0	4

FIGURE 7 represents a transverse wave.

FIGURE 7



0 4 . 1

Which arrow represents the amplitude of the wave? [1 mark]

Tick (✓) ONE box.

☐ **A**

☐ **B**

☐ **C**

☐ **D**

[Turn over]

0 4 . 2

Which arrow, on page 34, represents the wavelength of the wave? [1 mark]

Tick (✓) ONE box.

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

0 4 . 3

A wave has a frequency of 5000 Hz.

Calculate the period of the wave.

Use the equation:

$$\text{period} = \frac{1}{\text{frequency}}$$

[2 marks]

Period = _____ s

[Turn over]

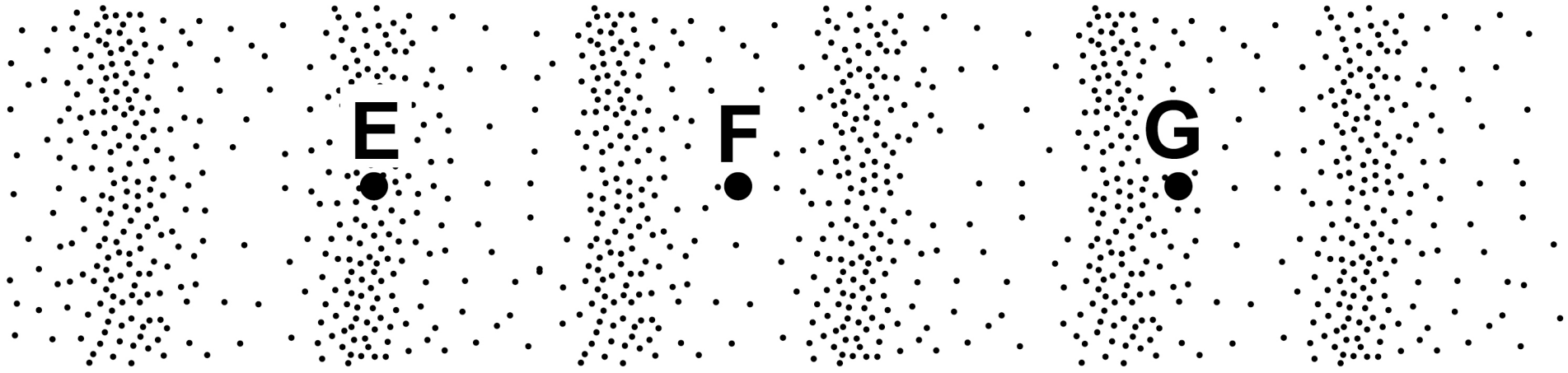
0 4 . 4

Give ONE example of a transverse wave that can travel through a vacuum.
[1 mark]

0 4 . 5

FIGURE 8 represents a longitudinal wave.

FIGURE 8



Which point is at the centre of a rarefaction? [1 mark]

Tick (✓) ONE box.

☐ **E**

☐ **F**

☐ **G**

0 4 . 6

A sound wave has a frequency of 750 Hz.

speed of sound in air = 330 m/s

Calculate the wavelength of the sound wave.

Use the equation:

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

[2 marks]

Wavelength = _____ m

BLANK PAGE

[Turn over]

0 4 . 7

Describe a method that could be used to determine the speed of sound in air.
[4 marks]

[Turn over]

0 4 . 8

When a sound wave moves from air into water, the speed of the wave increases.

The frequency of the sound wave does NOT change.

Complete the sentence.

Choose the answer from the list.
[1 mark]

- **decreases**
- **stays the same**
- **increases**

When a sound wave moves from air into water its wavelength _____ .

13

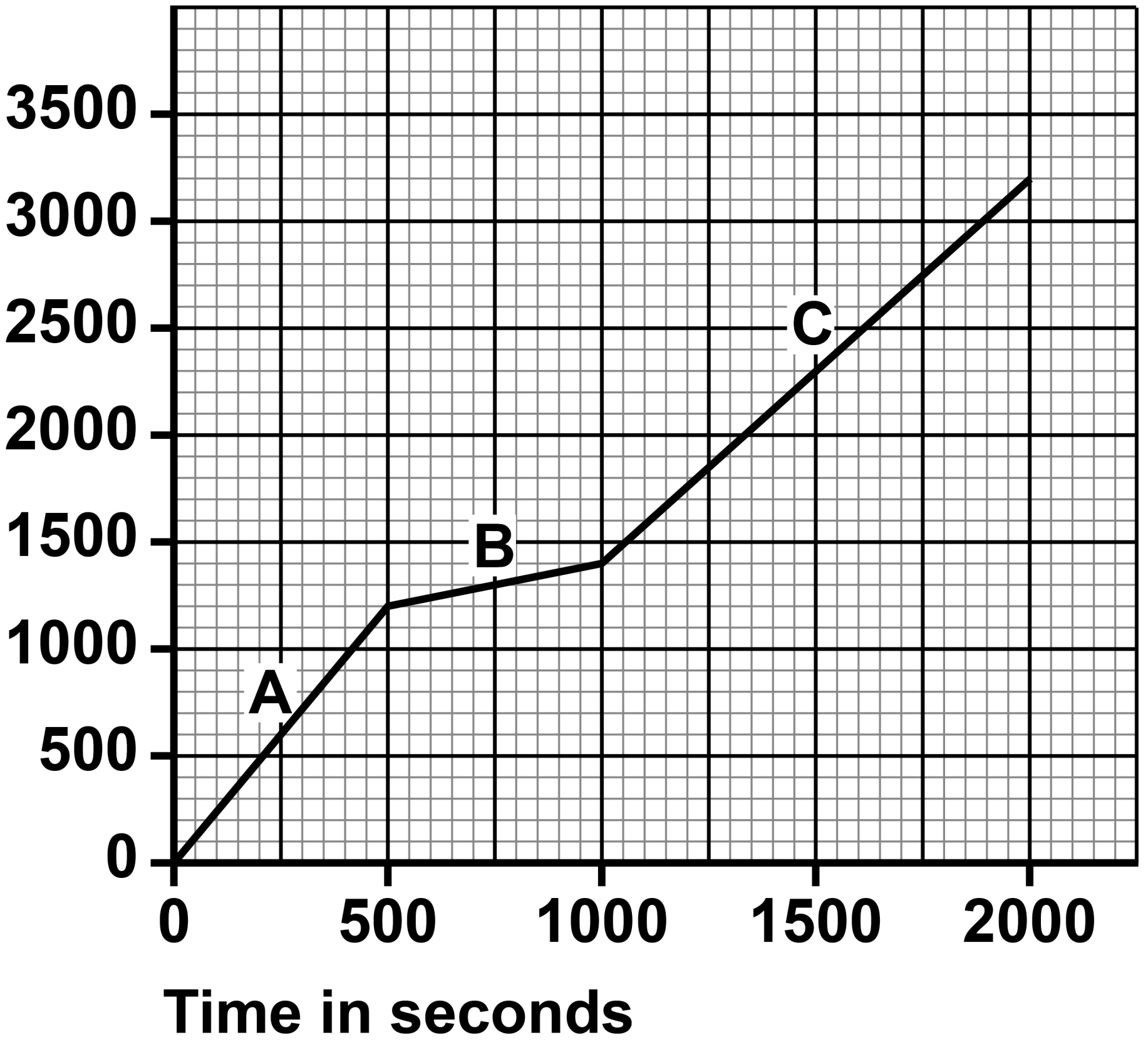
0 5

A person has been for a walk.

FIGURE 9, on page 46, shows the distance–time graph for the walk.

[Turn over]

FIGURE 9


Distance in metres
3500
3000
2500
2000
1500
1000
500
0
A
B
C
0
500
1000
1500
2000
Time in seconds

0 5 . 1

Some quantities are scalar quantities and others are vector quantities.

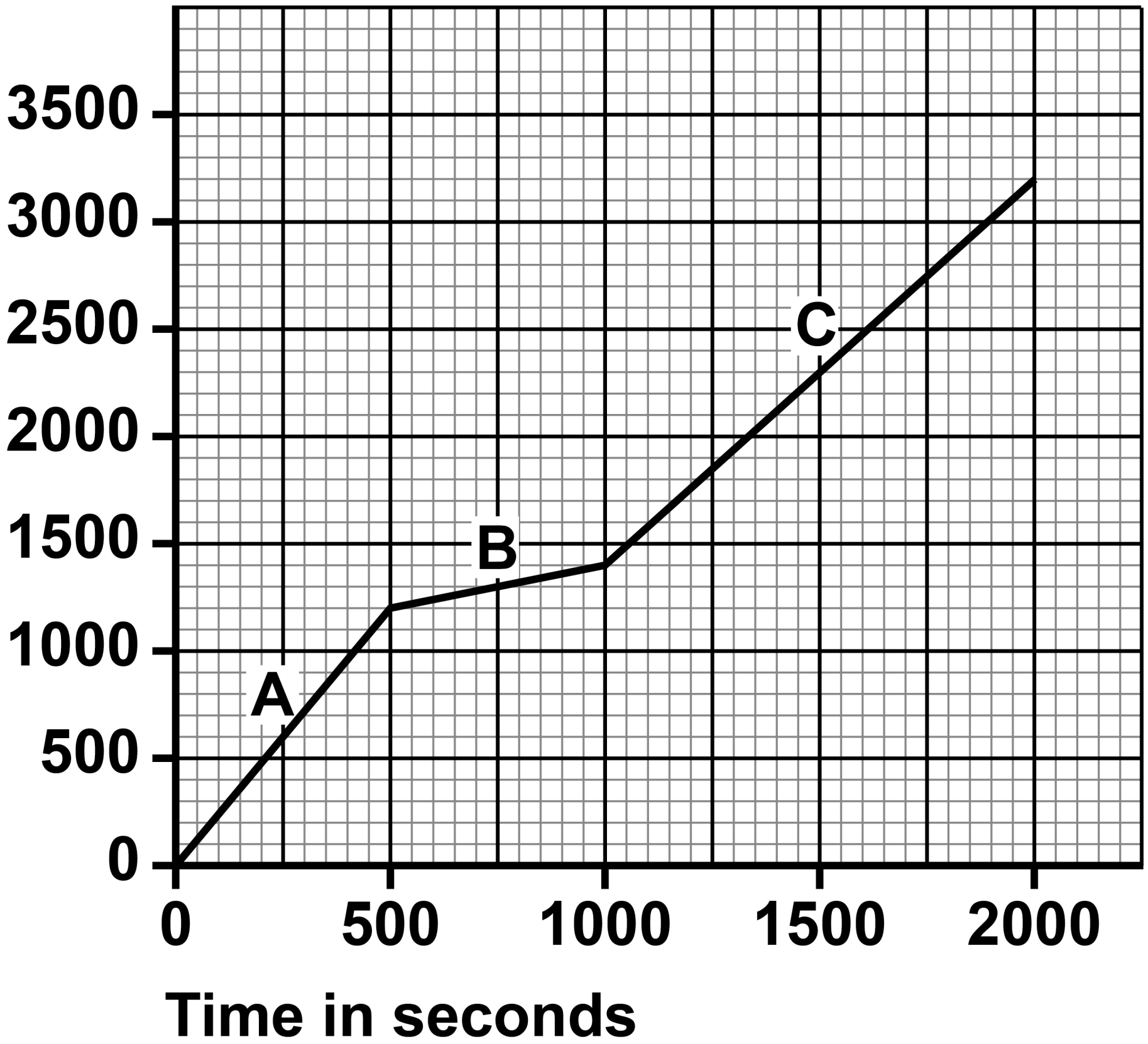
Which of the following are scalar quantities? [2 marks]

Tick (✓) TWO boxes.

- ☐ **Displacement**
- ☐ **Distance**
- ☐ **Force**
- ☐ **Speed**
- ☐ **Velocity**

[Turn over]

REPEAT OF FIGURE 9



0 5 . 2

What was the total distance walked by the person in 2000 seconds? [1 mark]

Total distance = _____ m

[Turn over]

0 5 . 3

Calculate the average speed of the person during the 2000 seconds.

Use your answer to Question 05.2, on page 49.

Use the equation:

$$\text{average speed} = \frac{\text{total distance}}{\text{total time}}$$

[2 marks]

Average speed = _____ m/s

0 5 . 4

Which section of FIGURE 9, on page 48, shows the person walking the slowest?

Give a reason for your answer. [2 marks]

Tick (✓) ONE box.

☐ **A**

☐ **B**

☐ **C**

Reason _____

_____

_____

[Turn over]

0 5 . 5

The person walked slowest when going up some steps.

Complete the sentence.

Choose the answer from the list.
[1 mark]

- **air resistance**
- **friction**
- **gravity**

When walking up the steps, the person did more work against the force of

_____ .

0 5 . 6

On another day, the person ran the same route.

What is a typical speed for a person running? [1 mark]

Tick (✓) ONE box.

☐ **0.3 m/s**

☐ **3.0 m/s**

☐ **30 m/s**

☐ **300 m/s**

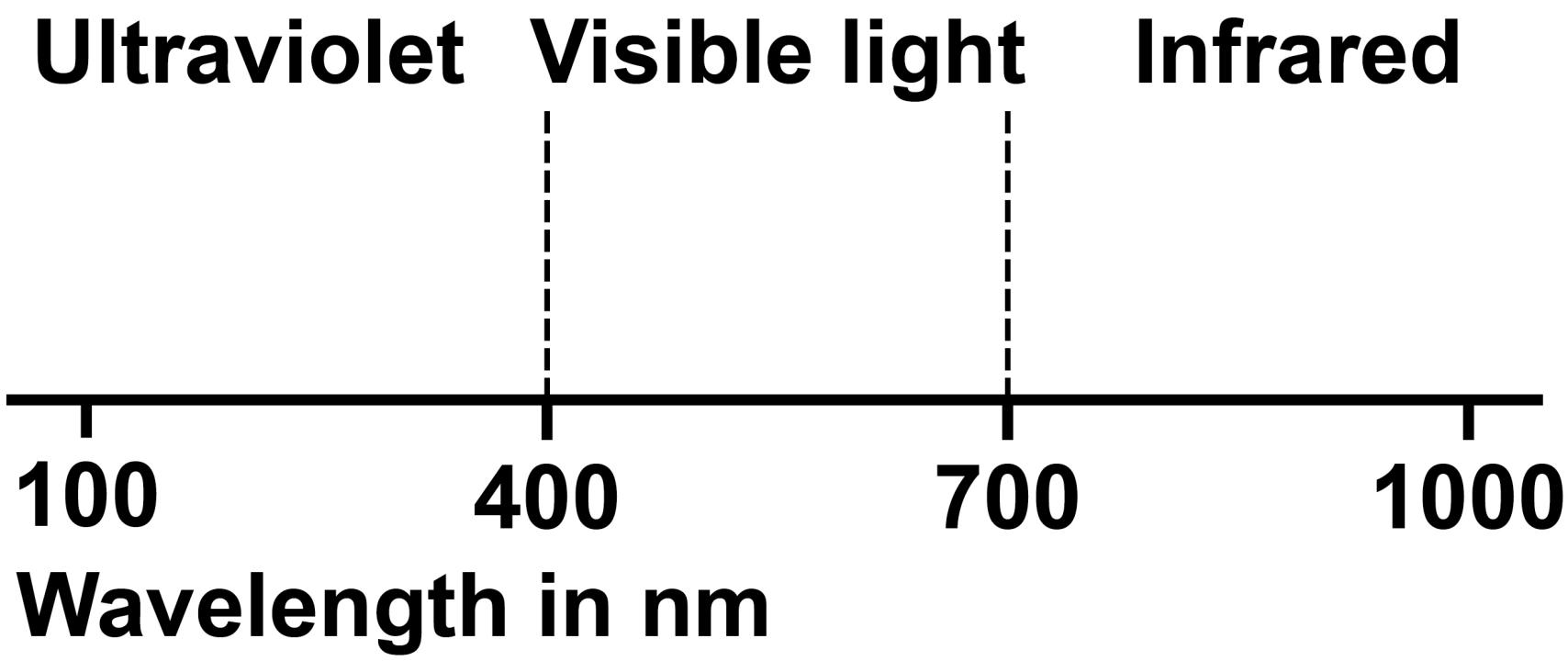
[Turn over]

9

0 6

FIGURE 10 shows the wavelengths of some types of electromagnetic radiation.

FIGURE 10



0 6 . 1

Suggest ONE piece of equipment that can be used to detect infrared radiation. [1 mark]

0 6 . 2

Which of the following values is a wavelength of red light? [1 mark]

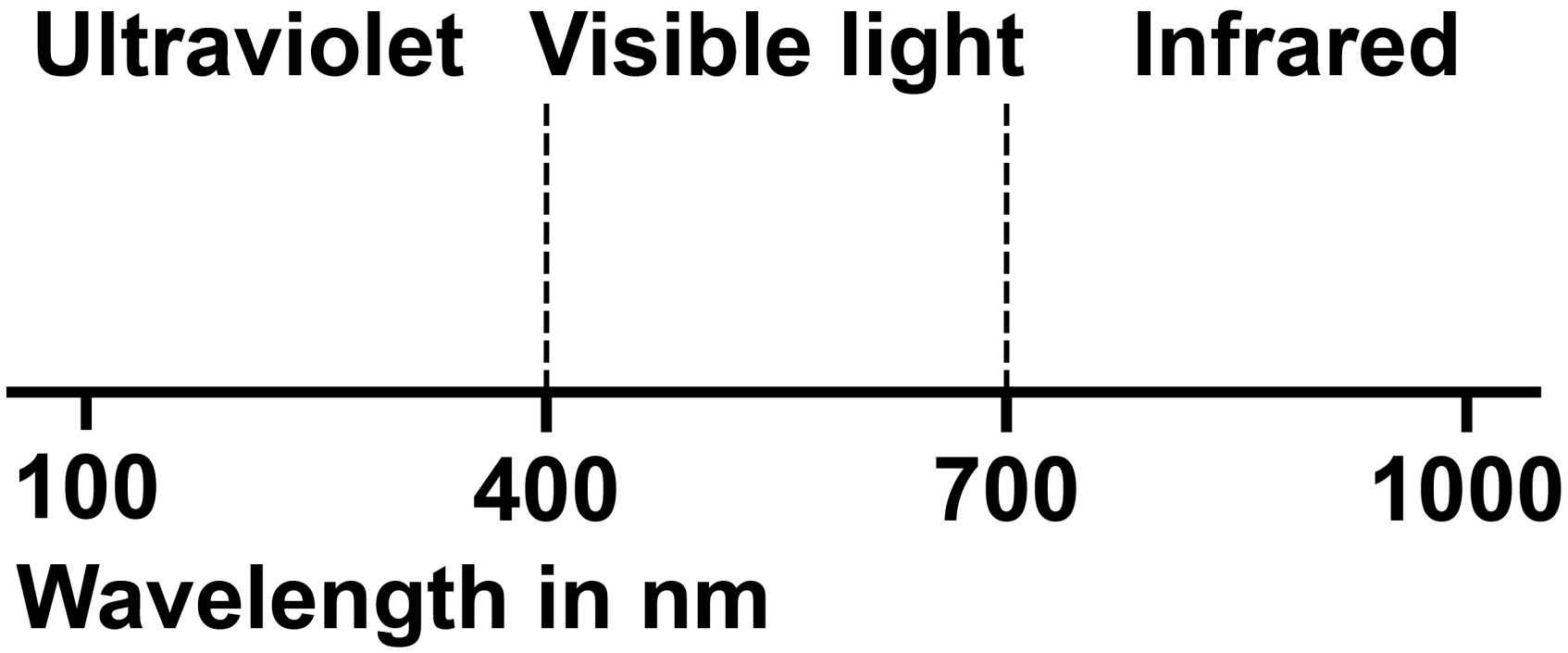
Tick (✓) ONE box.

- ☐ **320 nm**
- ☐ **410 nm**
- ☐ **690 nm**
- ☐ **750 nm**

[Turn over]

FIGURE 10 is repeated below.

FIGURE 10



0 6 . 3

The eyes of a bee can detect electromagnetic radiation with wavelengths between 300 nm and 600 nm.

Give TWO ways the radiation detected by the eyes of a bee is different from the radiation detected by human eyes.
[2 marks]

1 _____

_____

_____

2 _____

_____

_____

[Turn over]

0 6 . 4

Complete the sentences.

Choose the answers from the list.
[2 marks]

- **absorbed**
- **emitted**
- **reflected**
- **refracted**

When sunlight shines on a red flower, the red light is _____ .

All other colours of light shining on the red flower are _____ .

0 6 . 5

A gardener looks at a red flower through a green filter.

How does the flower appear to the gardener? [1 mark]

Tick (✓) ONE box.

- ☐ **Black**
- ☐ **Green**
- ☐ **Red**
- ☐ **White**

[Turn over]

0 6 . 6

The leaves of the plant reflect light.

The leaves have a rough surface.

What type of reflection happens at the leaf surface? [1 mark]

_____

_____

8

BLANK PAGE

[Turn over]

0 7

A swimming pool is being filled with water.

0 7 . 1

Calculate the weight of the water in the swimming pool when the mass of the water is 25 000 kg.

gravitational field strength = 9.8 N/kg

Use the equation:

weight = mass × gravitational field strength

[2 marks]

_____

_____

Weight = _____ N

[Turn over]

0 7 . 2

When the swimming pool is full, the weight of the water is 1 960 000 N.

The bottom of the swimming pool has an area of 49 m^2.

Calculate the pressure at the bottom of the swimming pool when it is full.

Use the equation:

$$\text{pressure} = \frac{\text{weight}}{\text{area}}$$

Choose the unit from the list. [3 marks]

- **m^2**
- **m^3**
- **N**
- **Pa**

Pressure = _____ Unit _____

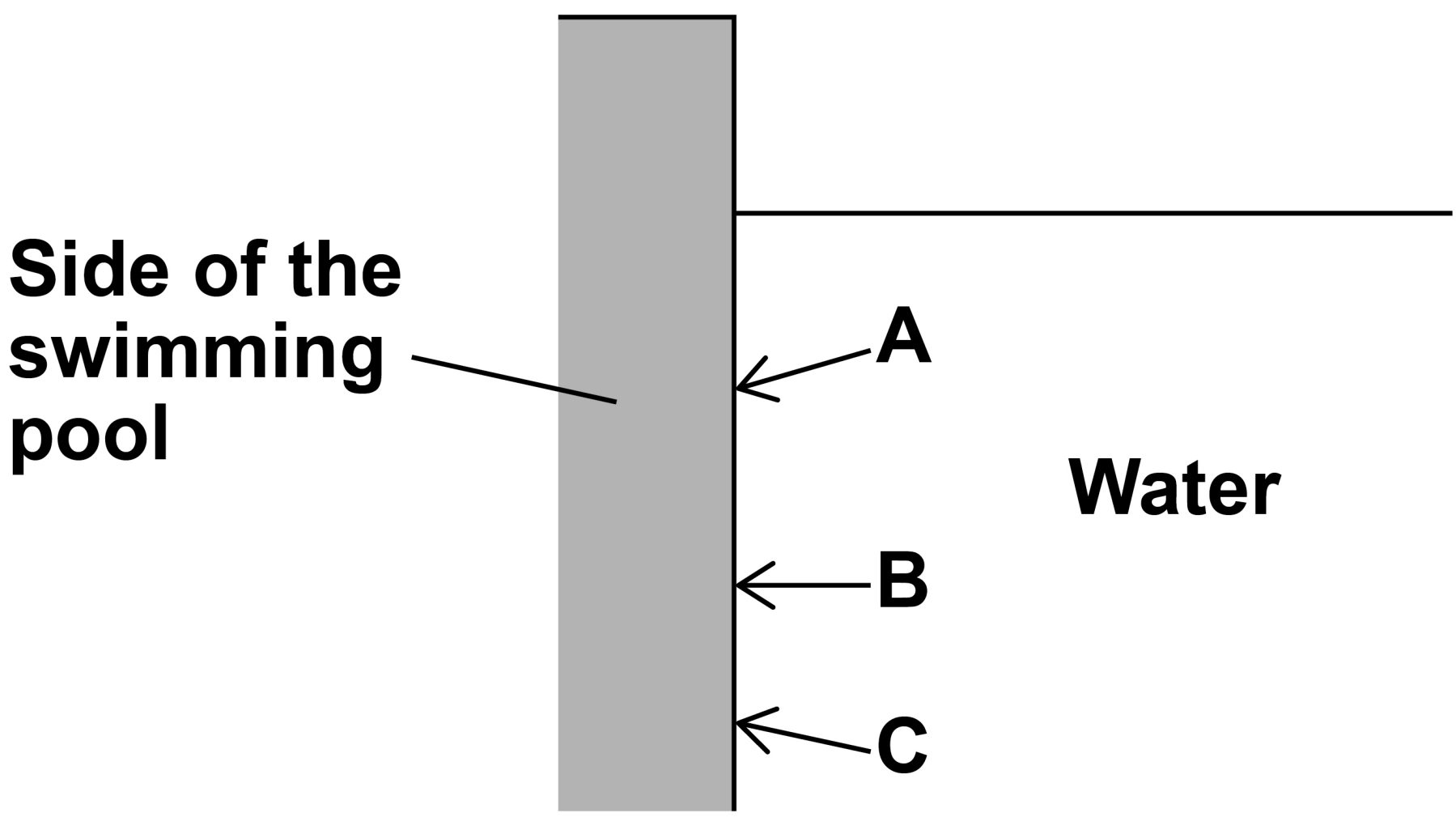
[Turn over]

0 7 . 3

There is a force acting on the side of the swimming pool because of the water pressure.

FIGURE 11 shows the side of the swimming pool.

FIGURE 11



Which arrow shows the direction of the force acting on the side of the swimming pool? [1 mark]

Tick (✓) ONE box.

- ☐ **A**
- ☐ **B**
- ☐ **C**

0 7 . 4

A child is swimming in the pool. The velocity of the child is 0.70 m/s.

The child then accelerates for 5.0 s, reaching a final velocity of 1.3 m/s.

Calculate the acceleration of the child.

Use the equation:

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

[2 marks]

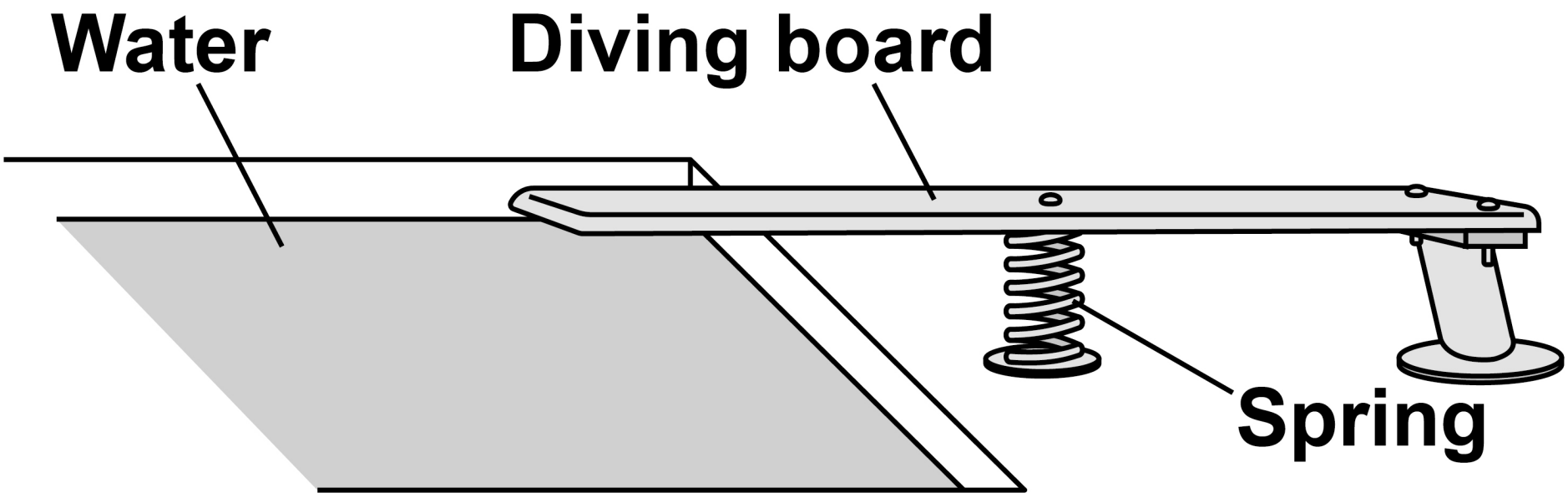
Acceleration = _____ m/s^2

BLANK PAGE

[Turn over]

FIGURE 12 shows a diving board at the side of the swimming pool.

FIGURE 12



0 7 . 5

The original length of the spring is 0.84 m.

When the child stands on the diving board, the length of the spring decreases by 0.21 m.

Calculate the percentage change in the length of the spring. [2 marks]

Percentage change in length =

_____ %

[Turn over]

Use the Physics Equations Sheet to answer questions 07.6 and 07.7.

0 7 . 6

Write down the equation which links extension (*e*), force applied to a spring (*F*) and spring constant (*k*). [1 mark]

0 7 . 7

The force applied to the spring by the weight of the child is 336 N.

The change in length of the spring is 0.21 m.

Calculate the spring constant of the spring. [3 marks]

Spring constant = _____ N/m

[Turn over]

0 7 . 8

The child steps off the diving board and falls into the swimming pool.

The initial velocity of the child is 0 m/s.

acceleration due to gravity = 9.8 m/s^2

Calculate the final velocity when the child has fallen a distance of 0.95 m through the air.

Give your answer to 2 significant figures.

Use the Physics Equations Sheet.
[4 marks]

Final velocity of child (2 significant figures) = _____ m/s

18

[Turn over]

0 8

A student investigated the refraction of light by a glass block.

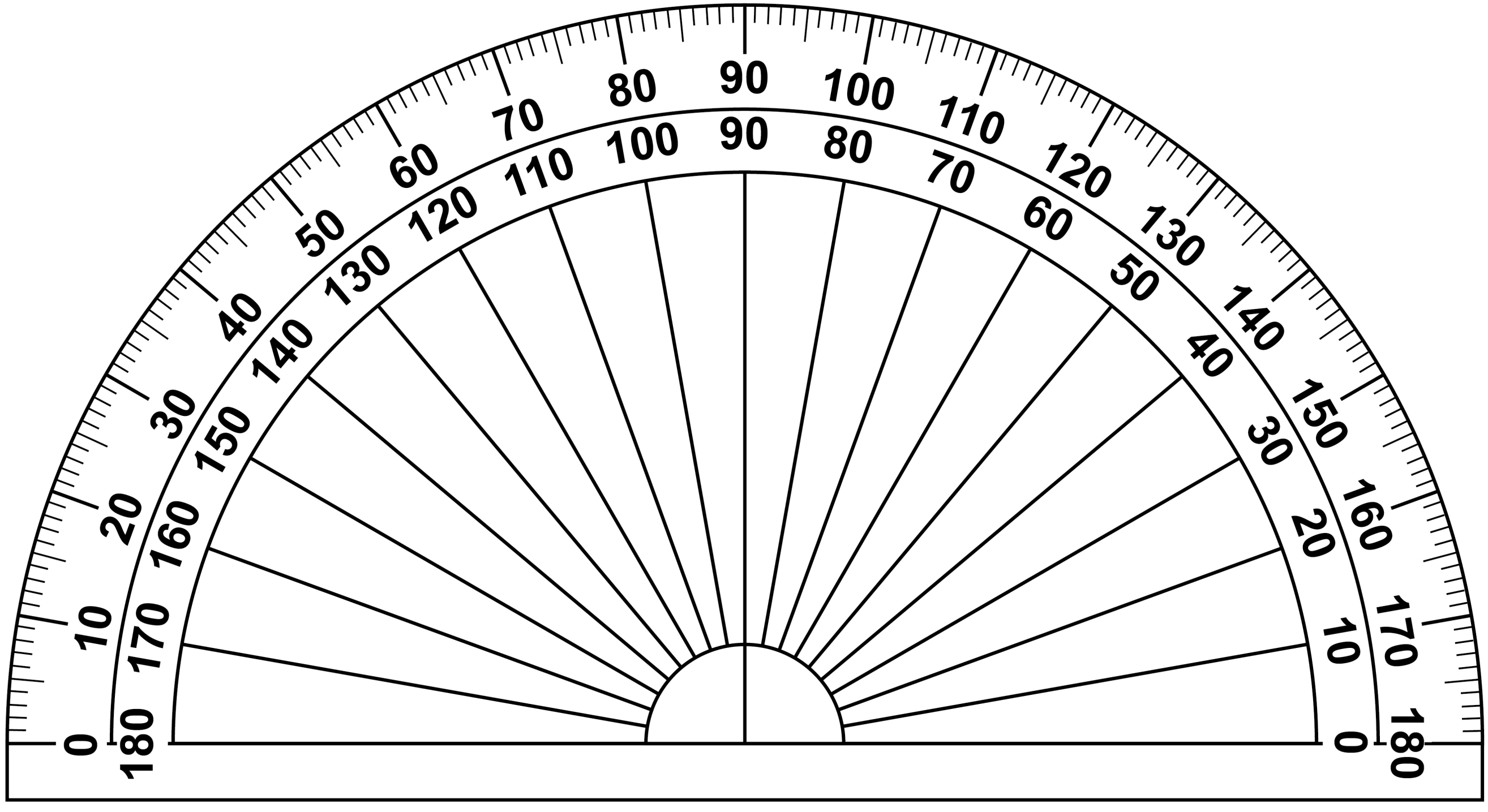
FIGURE 13, on the opposite page, shows the protractor used to measure the angles of incidence and the angles of refraction.

0 8 . 1

What is the resolution of the protractor used to measure the angles? [1 mark]

Resolution = _____ °

FIGURE 13



[Turn over]

TABLE 1 shows the results.

TABLE 1

ANGLE OF INCIDENCE IN DEGREES	ANGLE OF REFRACTION IN DEGREES
10	6
20	12
30	18
40	23
50	28
60	32

0 8 . 2

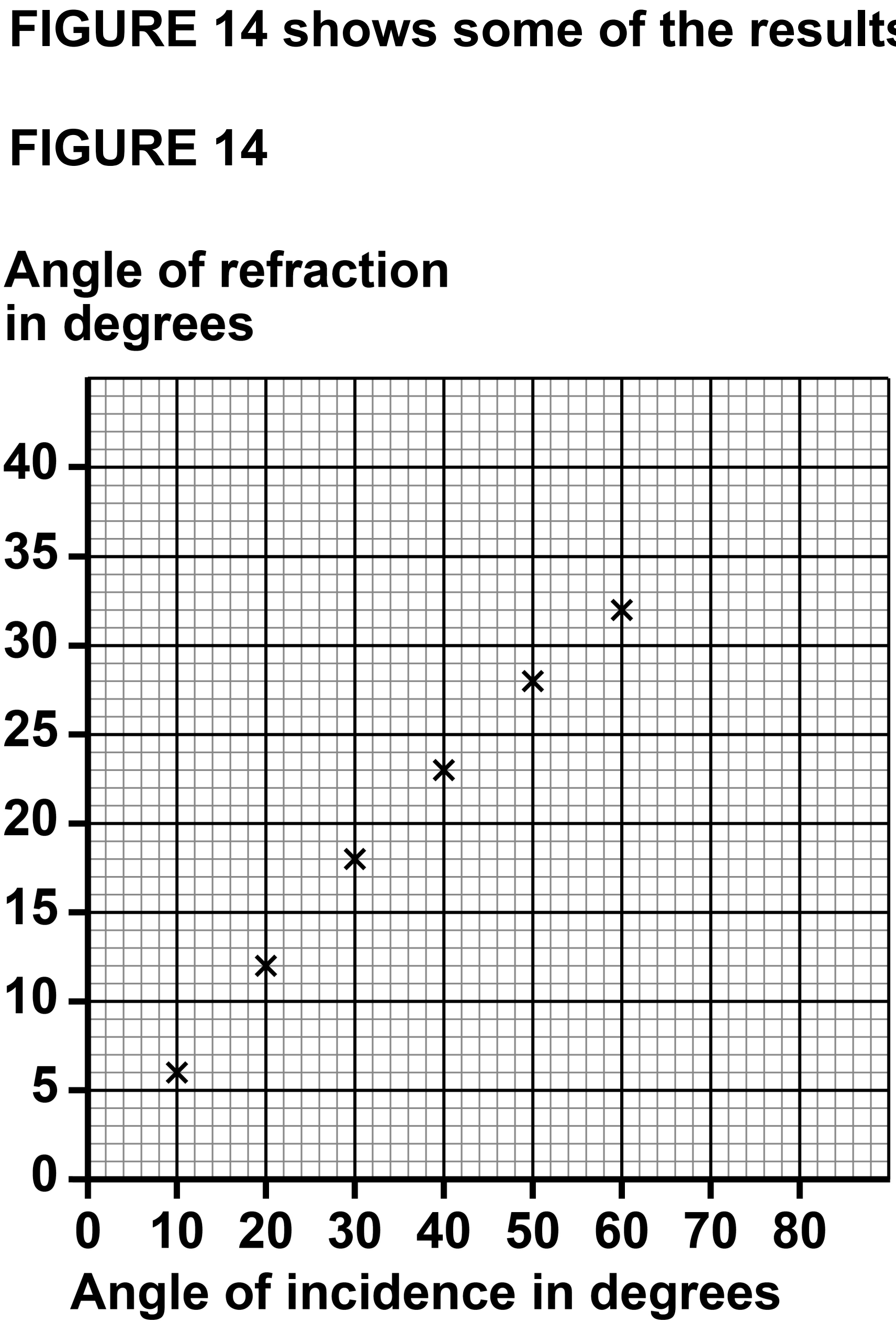
Describe a method the student could have used to obtain the data in TABLE 1.

You may include a labelled diagram.
[6 marks]

[Turn over]

FIGURE 14 shows some of the results.

FIGURE 14



The student measured the angles of refraction for two additional angles of incidence.

TABLE 2 shows the additional results.

TABLE 2

ANGLE OF INCIDENCE IN DEGREES	ANGLE OF REFRACTION IN DEGREES
70	35
80	37

0 8 . 3

Complete FIGURE 14.

You should:

- plot the results from TABLE 2
- draw the line of best fit.

[2 marks]

[Turn over]

0 8 . 4

How does FIGURE 14, on page 82, show that the angle of refraction is NOT directly proportional to the angle of incidence? [1 mark]

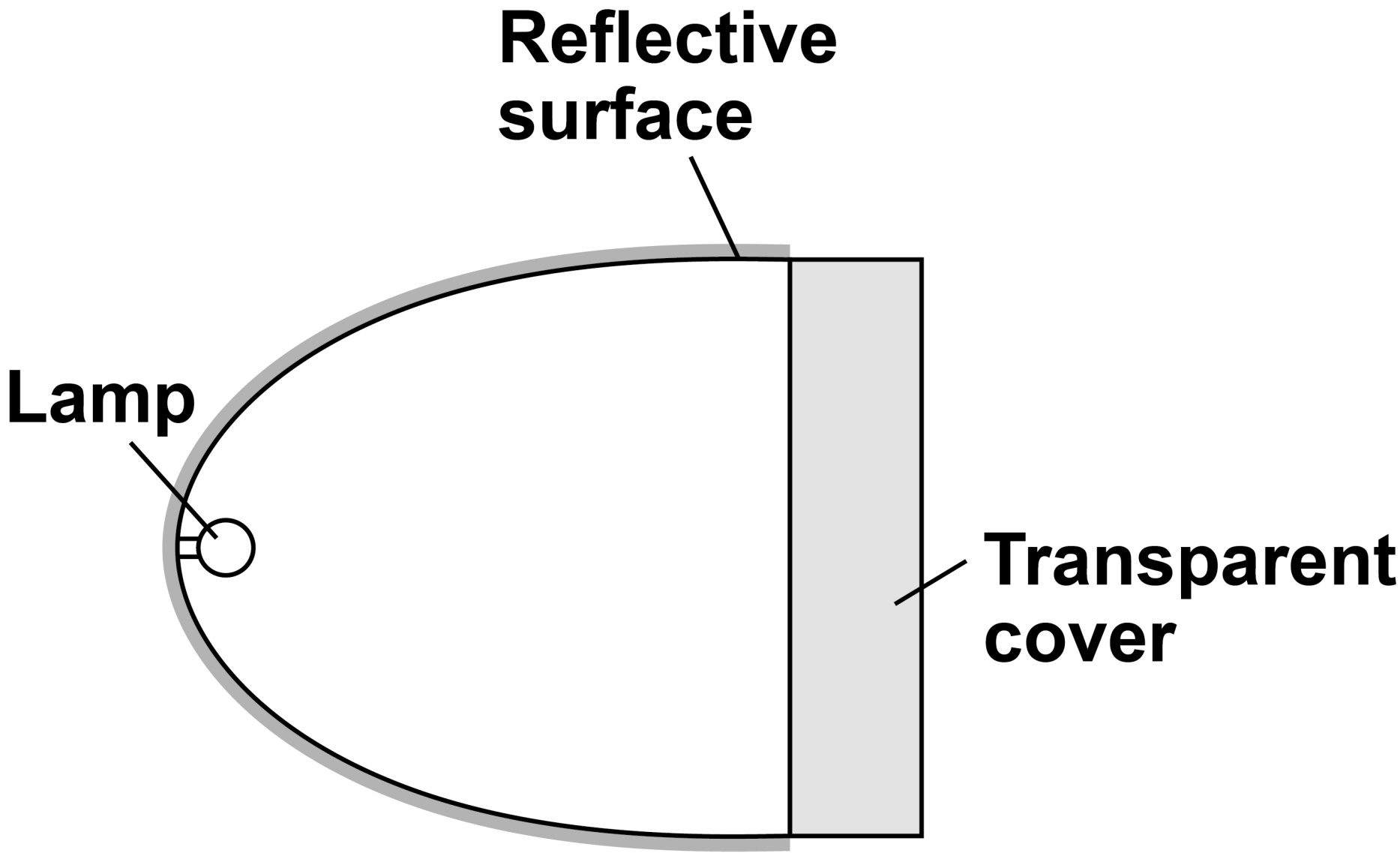
BLANK PAGE

[Turn over]

FIGURE 15 shows a diagram of a car headlight.

The headlight has a lamp, a reflective surface and a transparent cover.

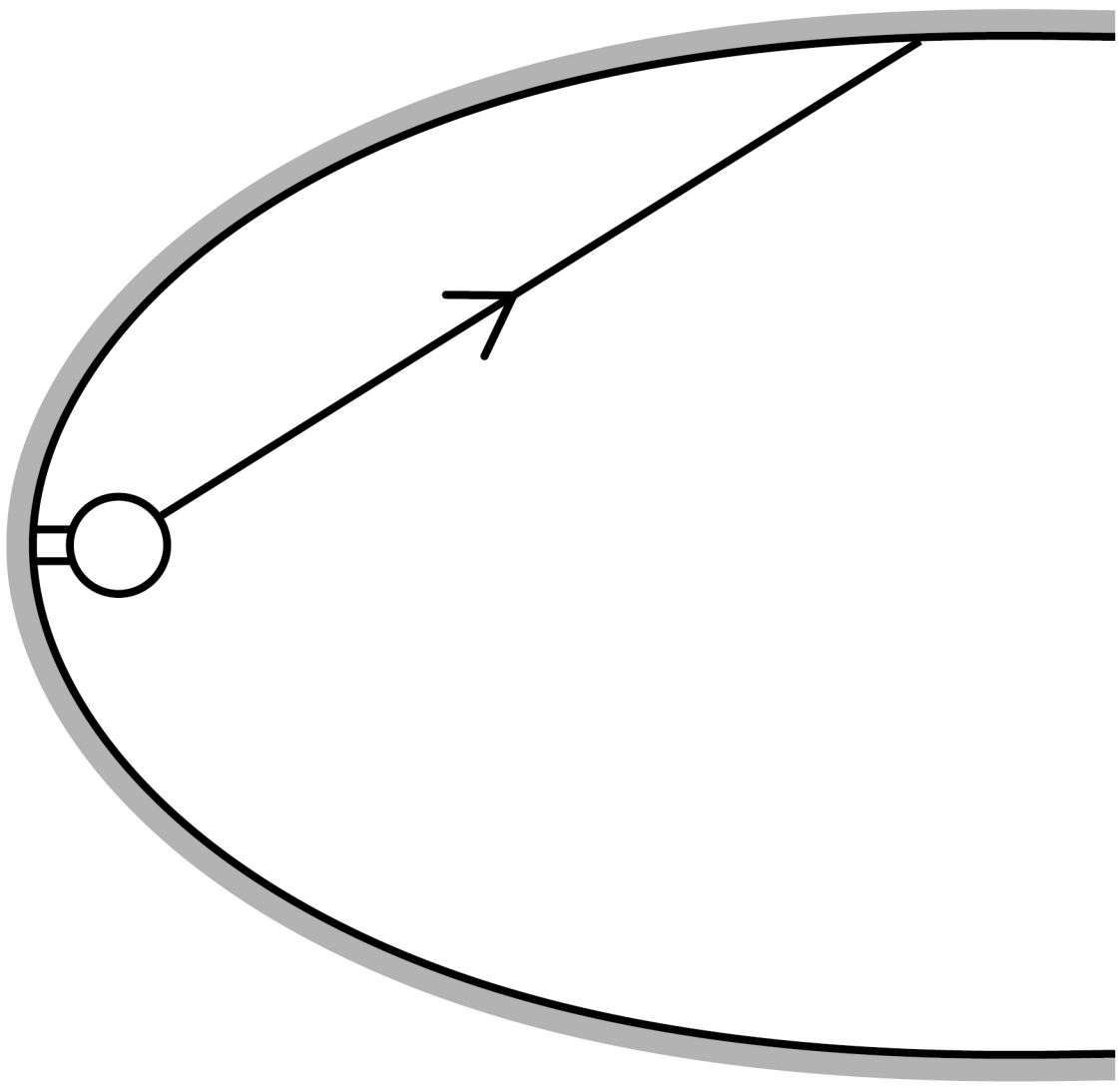
FIGURE 15



0 8 . 5

FIGURE 16, on the opposite page, shows a ray of light incident on the reflective surface.

FIGURE 16



Complete FIGURE 16 to show the reflected ray of light.

You should include the normal line at the point where the incident ray meets the reflecting surface. [2 marks]

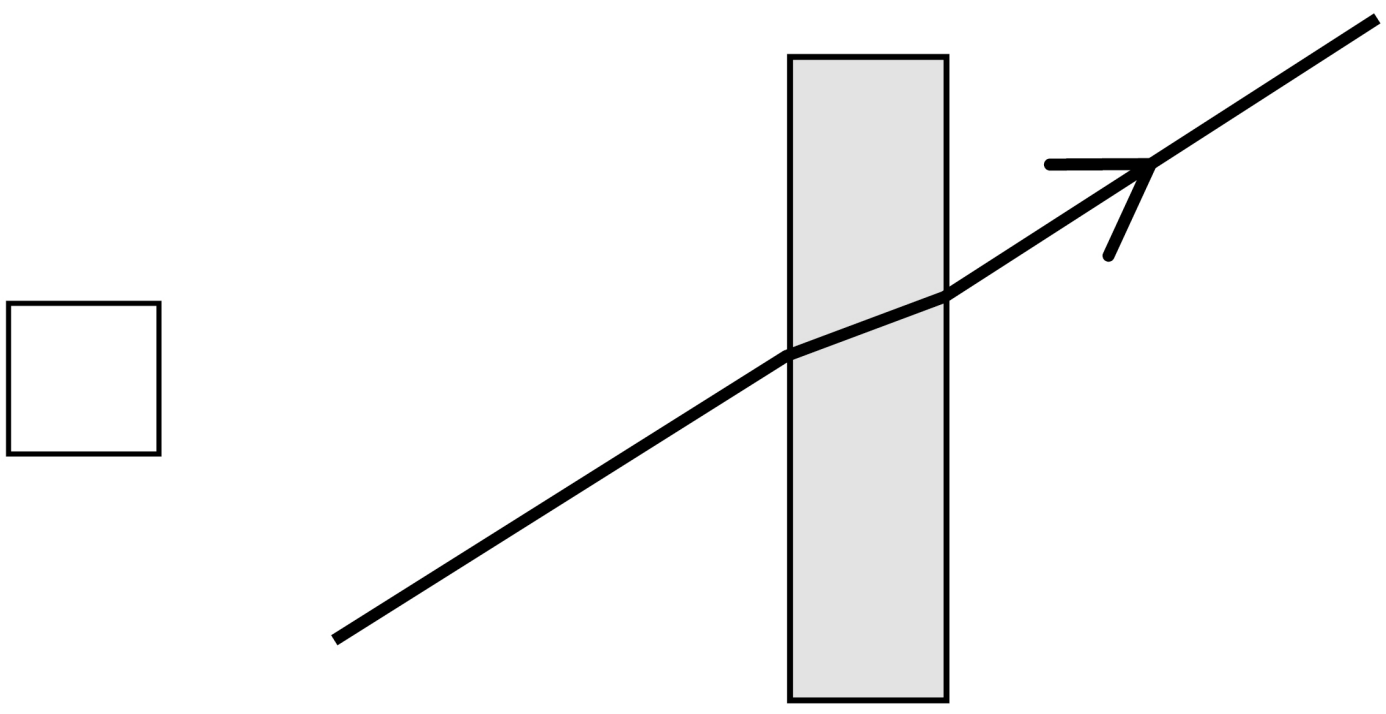
[Turn over]

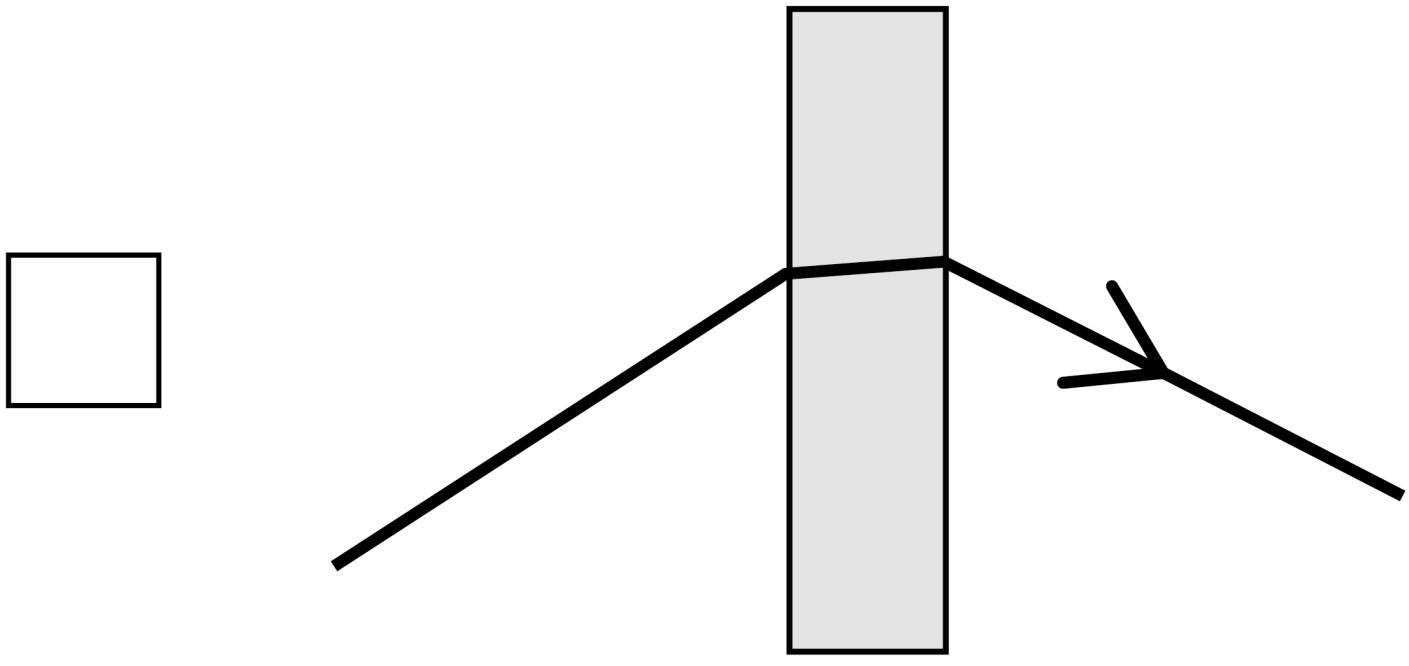
0 8 . 6

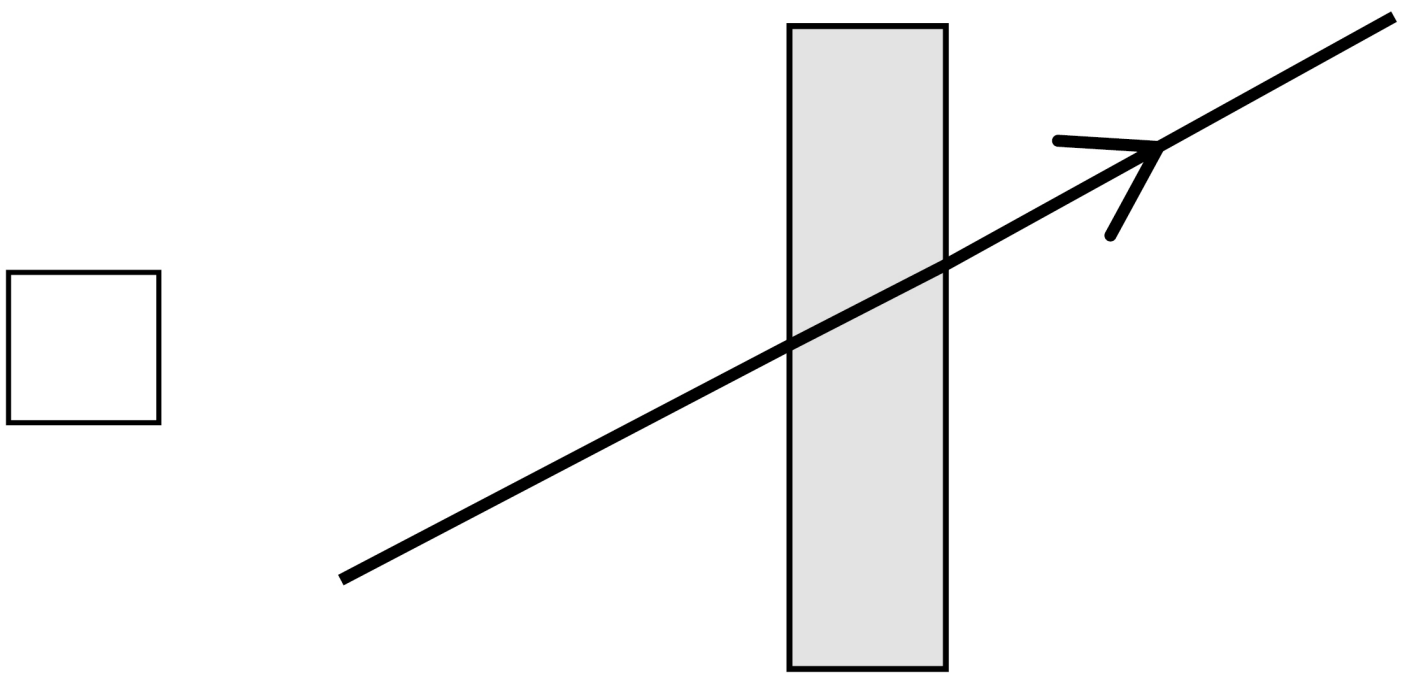
Rays of light pass through the transparent cover of the headlight.

Which diagram, below and on the opposite page, shows how a ray of light passes through the transparent cover? [1 mark]

Tick (✓) ONE box.







[Turn over]

0	9

FIGURE 17 shows a young child using a baby walker.

FIGURE 17

0 9 . 1

The child is standing still.

What is the resultant VERTICAL force on the child?

Give a reason for your answer. [2 marks]

Resultant vertical force = _____ N

Reason _____

_____

_____

[Turn over]

Use the Physics Equations Sheet to answer questions 09.2 and 09.3.

0 9 . 2

Write down the equation which links distance (*s*), force (*F*) and work done (*W*). [1 mark]

0 9 . 3

The child pushed the baby walker 2.8 m across a horizontal floor.

The work done by the child was 35 J.

Calculate the horizontal force the child applied to the baby walker. [3 marks]

Horizontal force = _____ N

[Turn over]

0 9 . 4

The child pushed the baby walker from a carpet onto a hard floor.

The child applied the same horizontal force to the baby walker.

Explain why the speed of the baby walker increased. [2 marks]

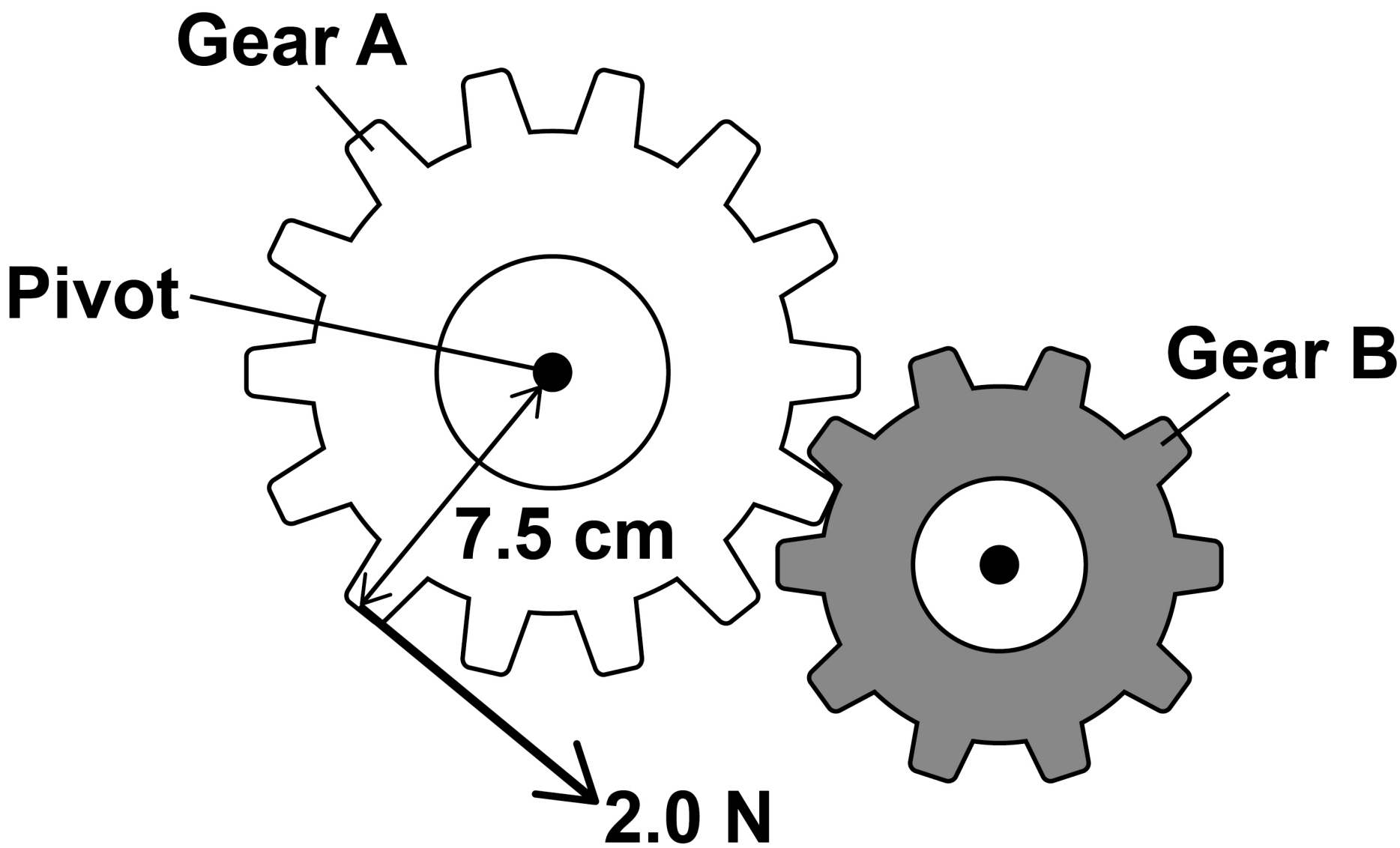
BLANK PAGE

[Turn over]

There are some toy gears on the front of the baby walker.

FIGURE 18 shows the gears.

FIGURE 18



The child applies a force to gear A.

This causes a moment about the pivot, so gear A rotates.

Use the Physics Equations Sheet to answer questions 09.5 and 09.6.

0 9 . 5

Write down the equation which links distance (*d*), force (*F*) and moment of a force (*M*). [1 mark]

_____

_____

[Turn over]

0 9 . 6

The child applies a force of 2.0 N on gear A.

The perpendicular distance between the force and the pivot is 7.5 cm.

Calculate the moment of the force about the pivot. [3 marks]

Moment of force = _____ Nm

0 9 . 7

Explain what happens to gear B when the child applies the force to gear A.
[2 marks]

END OF QUESTIONS

14

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

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For Examiner's Use	
Question	Mark
1	
2	
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