A

AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

GCSE

COMBINED SCIENCE: TRILOGY

Higher Tier

Physics Paper 2H

H

8464/P/2H

Friday 14 June 2019 Morning

Time allowed: 1 hour 15 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]

For this paper you must have:

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

INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **Answer ALL questions in the spaces provided.**
- **Do all rough work in this book. Cross through any work you do not want to be marked.**
- **In all calculations, show clearly how you work out your answer.**

INFORMATION

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

DO NOT TURN OVER UNTIL TOLD TO DO SO

0 1

FIGURE 1 shows a runner using a smart watch and a mobile phone to monitor her run.

FIGURE 1

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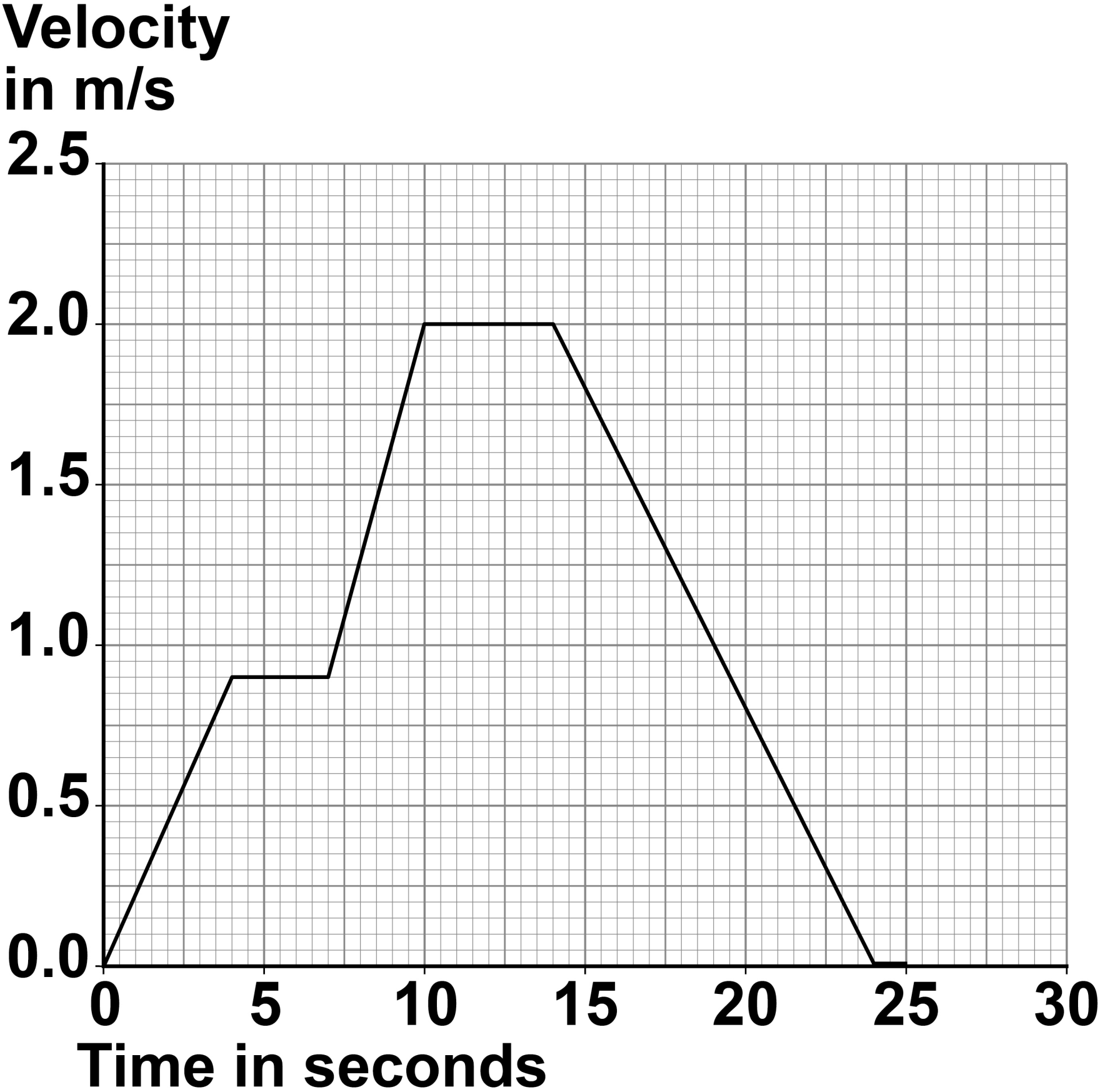
[Turn over]

FIGURE 2 is a velocity–time graph for part of the runner's warm-up.

FIGURE 2



0 1 . 1

Determine the total time for which the velocity of the runner was increasing. [2 marks]

Time = _____ s

0 1 . 2

Determine the deceleration of the runner. [2 marks]

Deceleration = _____ m/s^2

[Turn over]

The smart watch and mobile phone are connected to each other by a system called Bluetooth.

Bluetooth is wireless and uses electromagnetic waves for communication.

0 1 . 3

Suggest why the phone and watch being connected by a wireless system is an advantage when running. [1 mark]

0 1 . 4

Write down the equation that links frequency, wave speed and wavelength. [1 mark]

0 1 . 5

The electromagnetic waves have a frequency of 2 400 000 000 Hz

The speed of electromagnetic waves is 300 000 000 m/s

Calculate the wavelength of the electromagnetic waves. [3 marks]

Wavelength = _____ m

0 1 . 6

TABLE 1 shows some information about four types of Bluetooth.

TABLE 1

Type	Power in milliwatts	Range in metres
1	100	100
2	2.50	10.0
3	1.00	1.00
4	0.50	0.50

Mobile phones use type 2 Bluetooth to communicate with other devices.

Suggest TWO reasons why. [2 marks]

1 _____

_____

_____

2 _____

_____

_____

[Turn over]

11

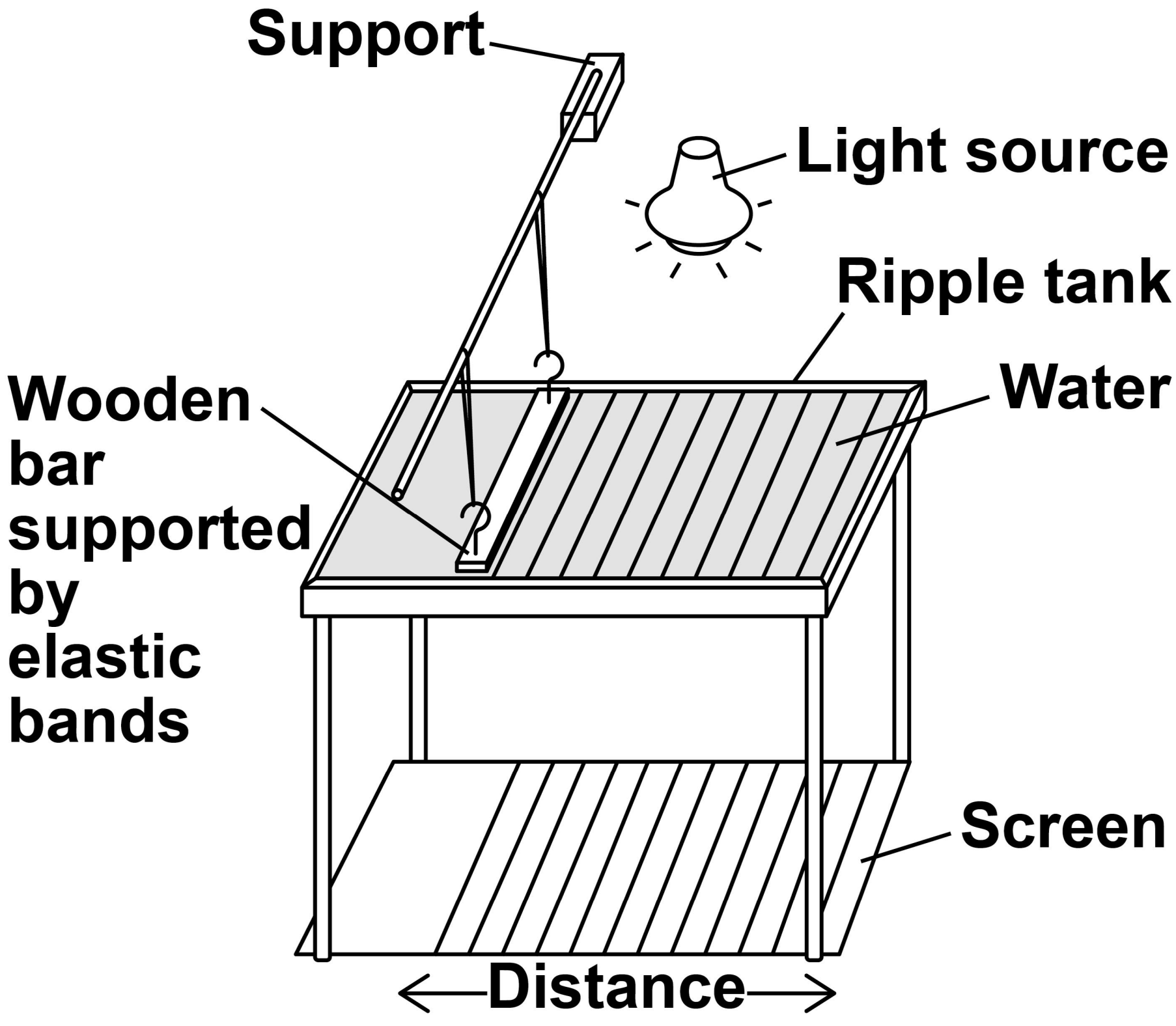
0 2

FIGURE 3 shows the equipment a teacher used to determine the speed of a water wave.

The equipment includes:

- **a ripple tank filled with water**
- **a wooden bar that creates ripples on the surface of the water**
- **a light source which causes a shadow of the ripples on the screen.**

FIGURE 3



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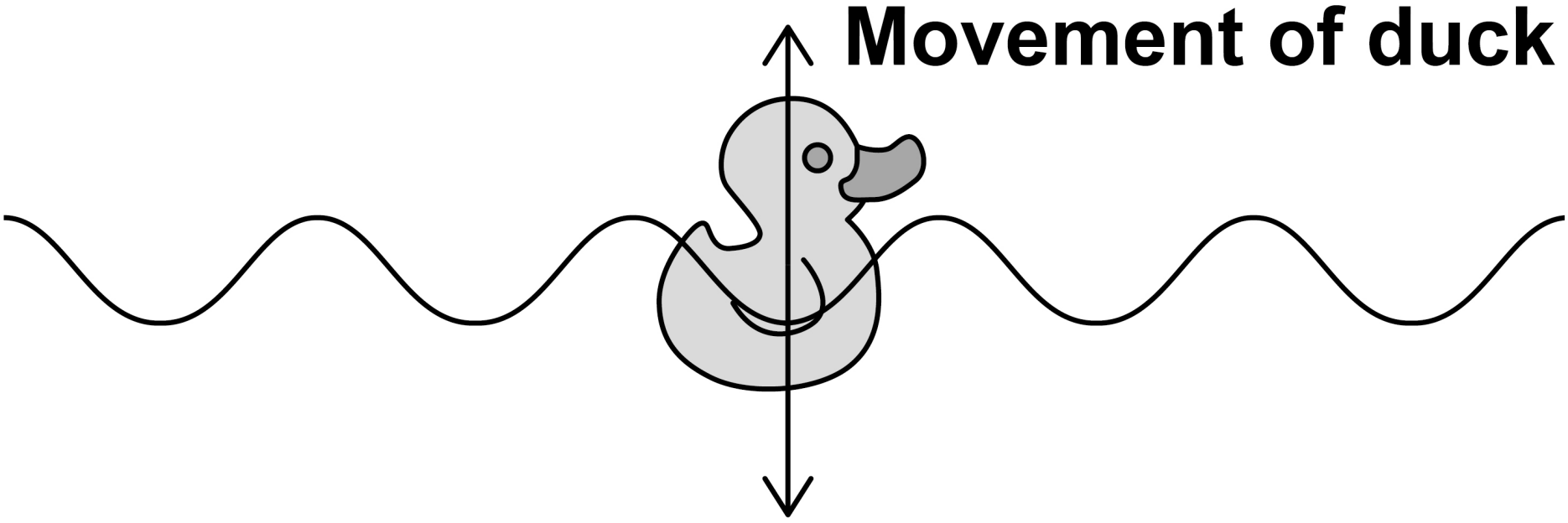
0 2 . 1

Describe how equipment in FIGURE 3, on page 13, can be used to measure the wavelength, frequency and speed of a water wave. [6 marks]

The teacher put a plastic duck in the ripple tank as shown in FIGURE 4.

The plastic duck moved up and down as the waves in the water passed.

FIGURE 4



0 2 . 2

How does the movement of the plastic duck in FIGURE 4 demonstrate that water waves are transverse? [1 mark]

0 2 . 3

The teacher measured the maximum height and the minimum height of the plastic duck above the screen as the wave passed.

The teacher repeated his measurements.

TABLE 2 shows the teacher's measurements.

TABLE 2

Maximum height in mm	**509**	**513**	**511**
Minimum height in mm	**503**	**498**	**499**

Calculate the mean amplitude of the water wave. [3 marks]

Mean amplitude = _____ mm

10

[Turn over]

0 3

Some quantities are scalars and some are vectors.

0 3 . 1

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

Tick (✓) TWO boxes.

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

0 3 . 2

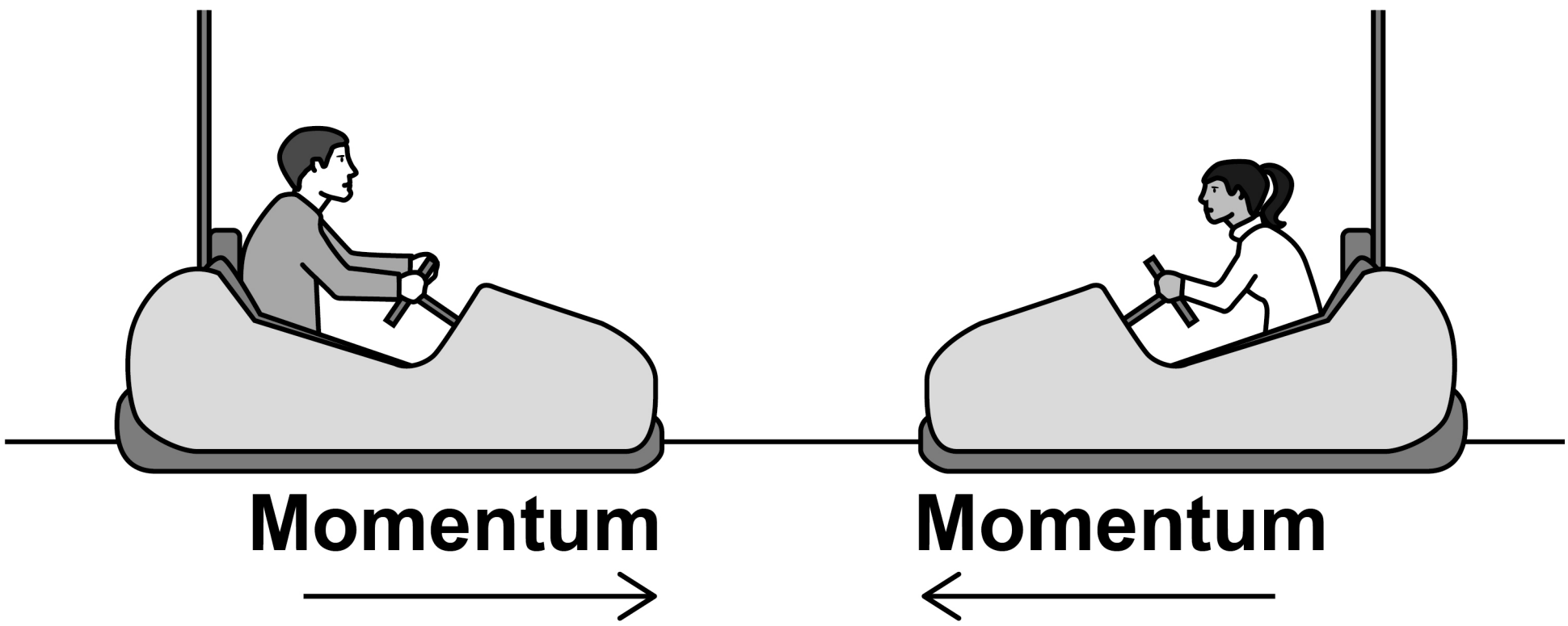
Give the difference between a vector quantity and a scalar quantity. [1 mark]

Bumper cars are a fairground ride and are designed to bump into each other.

FIGURE 5 shows two bumper cars moving towards each other.

The momentum of each bumper car is shown by an arrow.

FIGURE 5



0 3 . 3

Give TWO factors that affect the momentum of each bumper car.
[2 marks]

1 _____

2 _____

0 3 . 4

The bumper cars crash into each other and stop.

Explain why both bumper cars stop after the crash. [4 marks]

9

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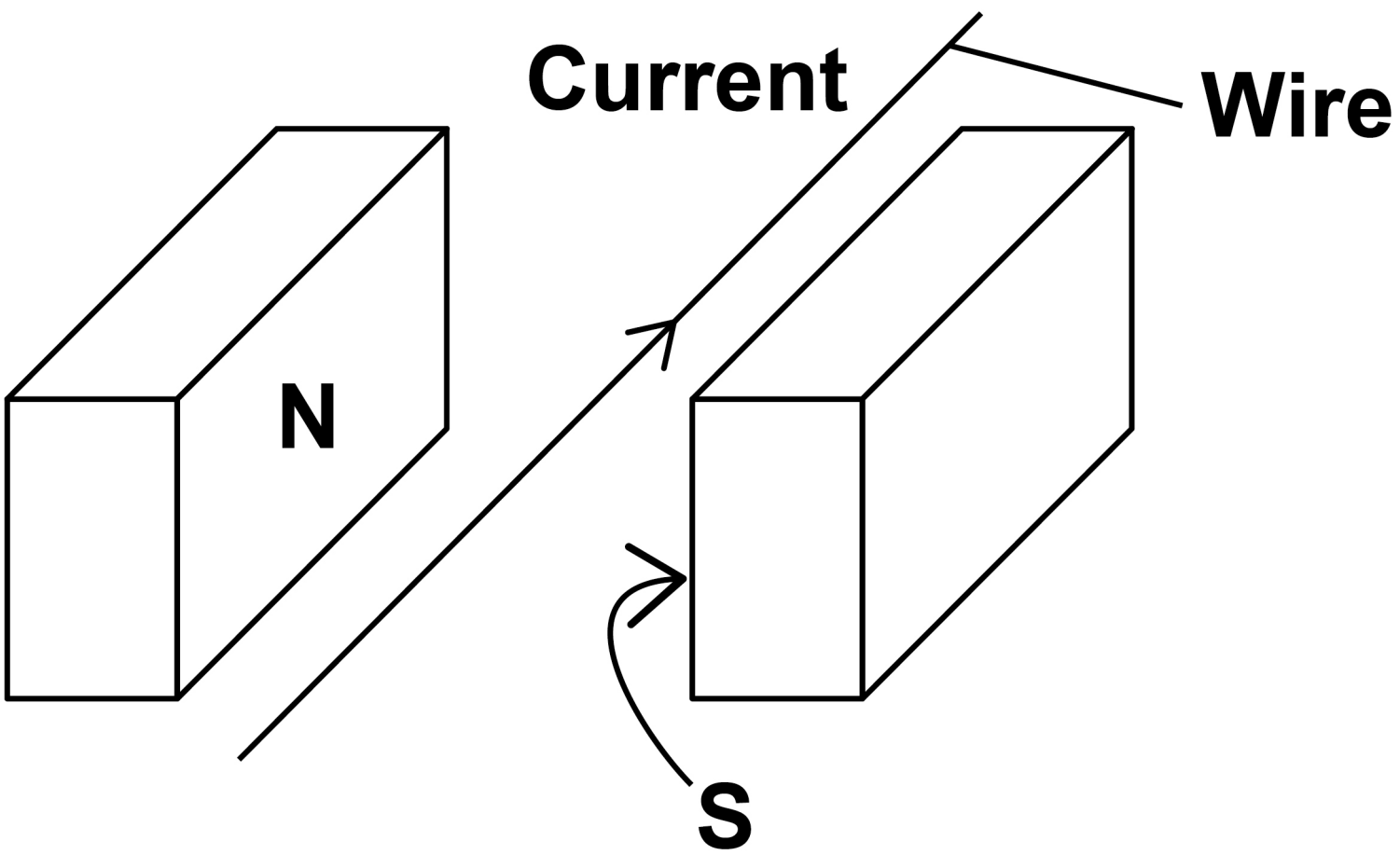
[Turn over]

0 4

FIGURE 6 shows a wire in a magnetic field.

The direction of the current in the wire is shown.

FIGURE 6



0 4 . 1

There is a force on the wire due to the current in the magnetic field.

In which direction is the force on the wire? [1 mark]

Tick (✓) ONE box.

☐ →

☐ ↓

☐ ←

☐ ↑

[Turn over]

0 4 . 2

Give TWO ways that the direction of the force on the wire could be reversed.
[2 marks]

1 _____

_____

_____

0 4 . 3

The length of the wire in the magnetic field is 0.050 m

The force on the wire is 0.072 N

magnetic flux density = 360 mT

Calculate the current in the wire.

Use the Physics Equations Sheet.

[4 marks]

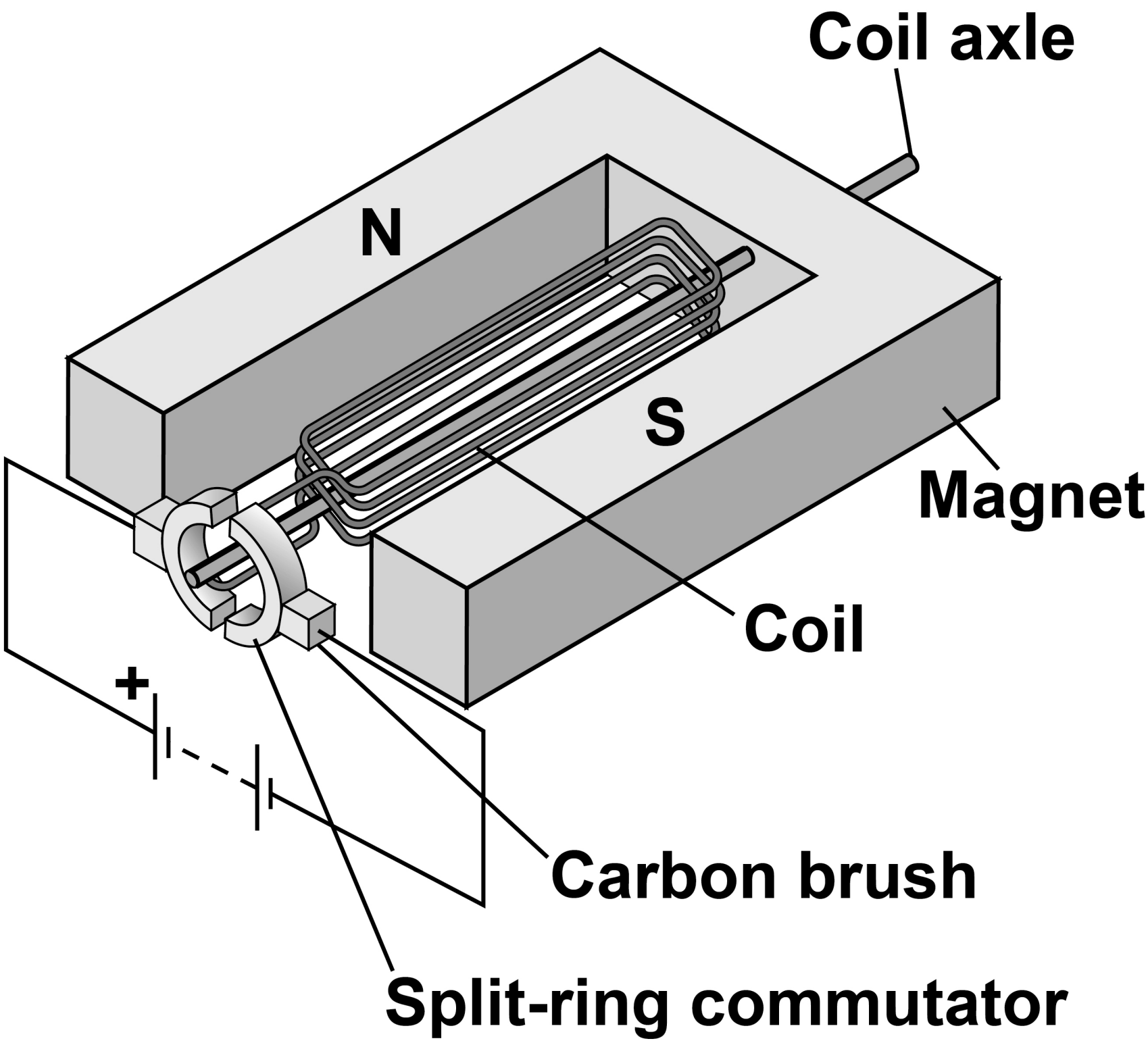
Current = _____ A

[Turn over]

0 4 . 4

FIGURE 7 shows a simple motor.

FIGURE 7

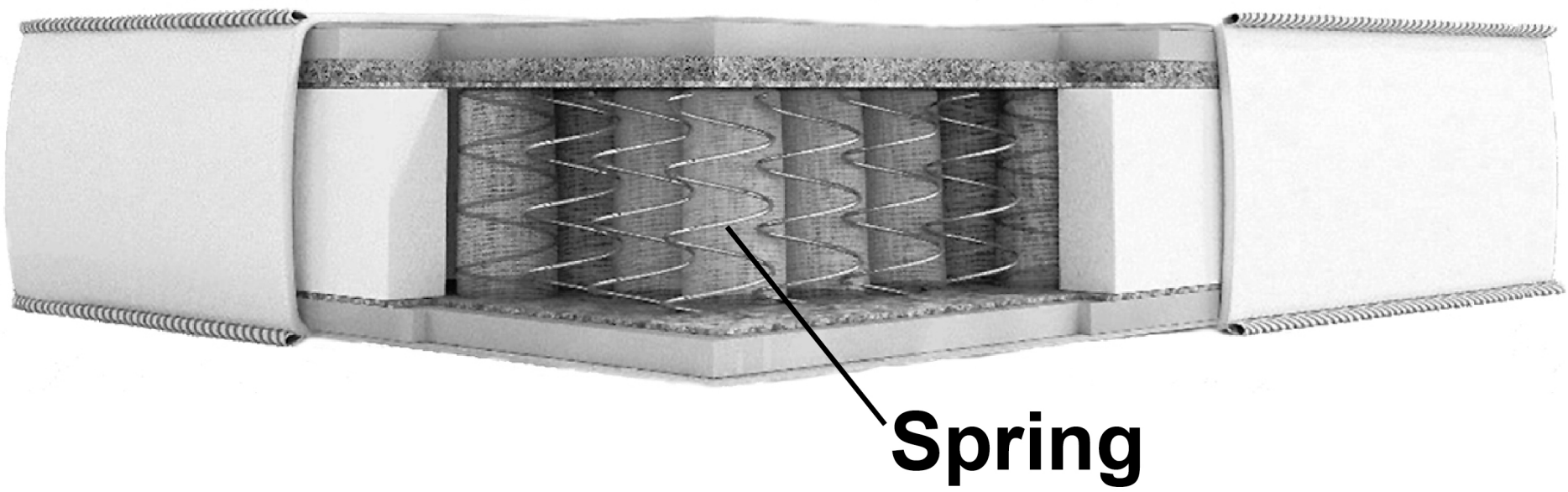


Explain why the coil rotates when there is a current in the coil. [4 marks]

0 5

FIGURE 8 shows some springs inside a mattress.

FIGURE 8



0 5 . 1

Which proportionality is true when a force is applied to a spring? [1 mark]

Tick (✓) ONE box.

- ☐ **Force ∝ energy stored**
- ☐ **Force ∝ extension**
- ☐ **Force ∝ length**
- ☐ **Force ∝ spring constant**

[Turn over]

A mattress contains 1200 identical springs.

A person lies on the mattress and the springs compress.

The mean force on each spring in the mattress is 0.49 N

0 5 . 2

Calculate the mass of the person.

gravitational field strength = 9.8 N/kg

[4 marks]

Mass = _____ kg

[Turn over]

0 5 . 3

The mean compression of each spring is 3.5×10^{-3} m

Calculate the spring constant of each spring in the mattress.

Give the unit. [4 marks]

Spring constant = _____

Unit = _____

0 5 . 4

For a given force, different springs compress by different amounts.

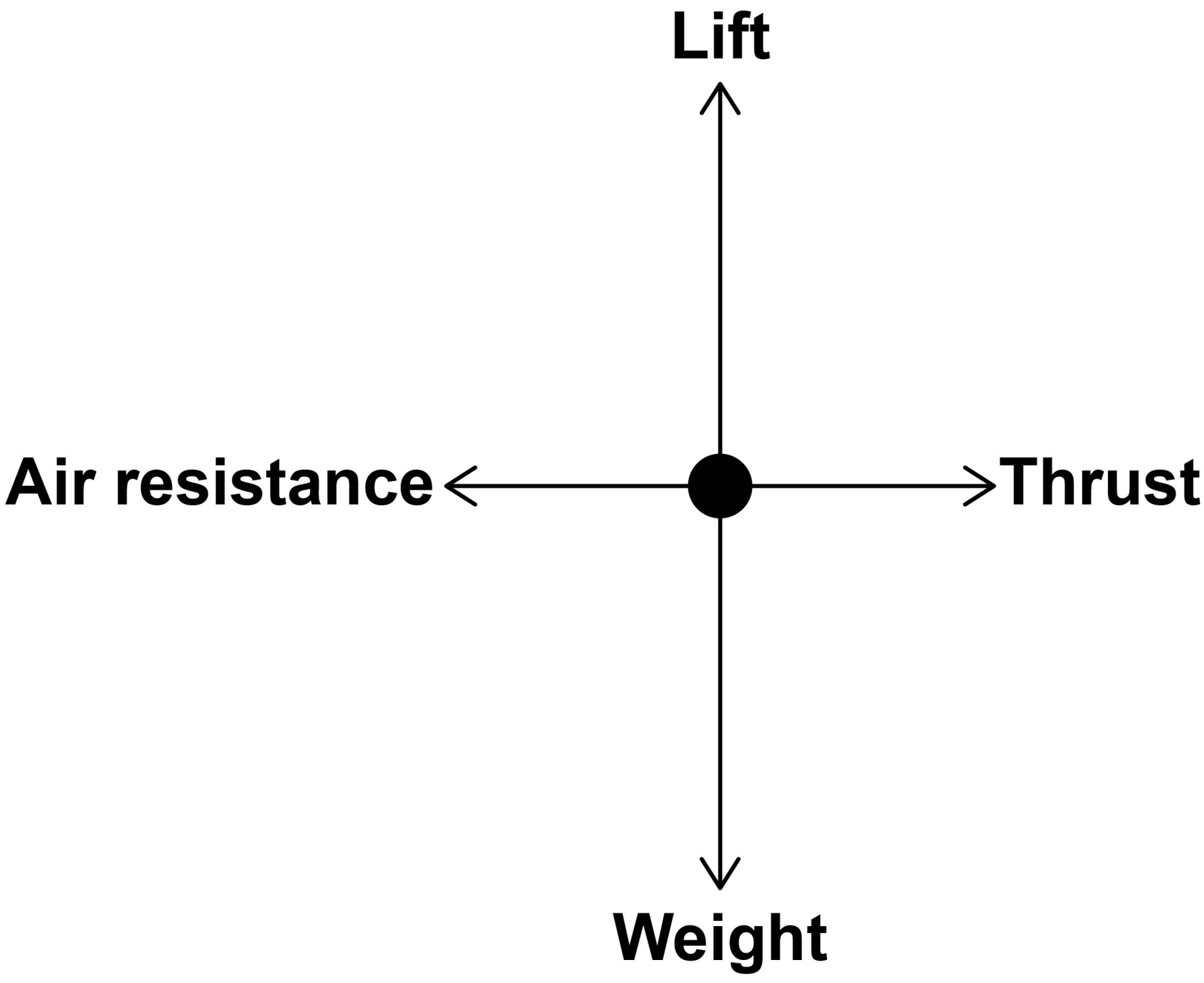
Explain what property of the springs would make the mattress soft. [2 marks]

0 6

FIGURE 9 shows a free body diagram for an aeroplane flying at a constant speed and at a constant height.

The speed of the aeroplane is much greater than the speed at which the aeroplane lands.

FIGURE 9



0 6 . 1

Explain how the forces need to change so the aeroplane can land. [4 marks]

0 6 . 2

The aeroplane lands at a speed of 80 m/s

After landing, the aeroplane takes 28 s to decelerate to a speed of 10 m/s

The mean resultant force on the aeroplane as it decelerates is 750 000 N

Calculate the mass of the aeroplane.
[5 marks]

Mass = _____ kg

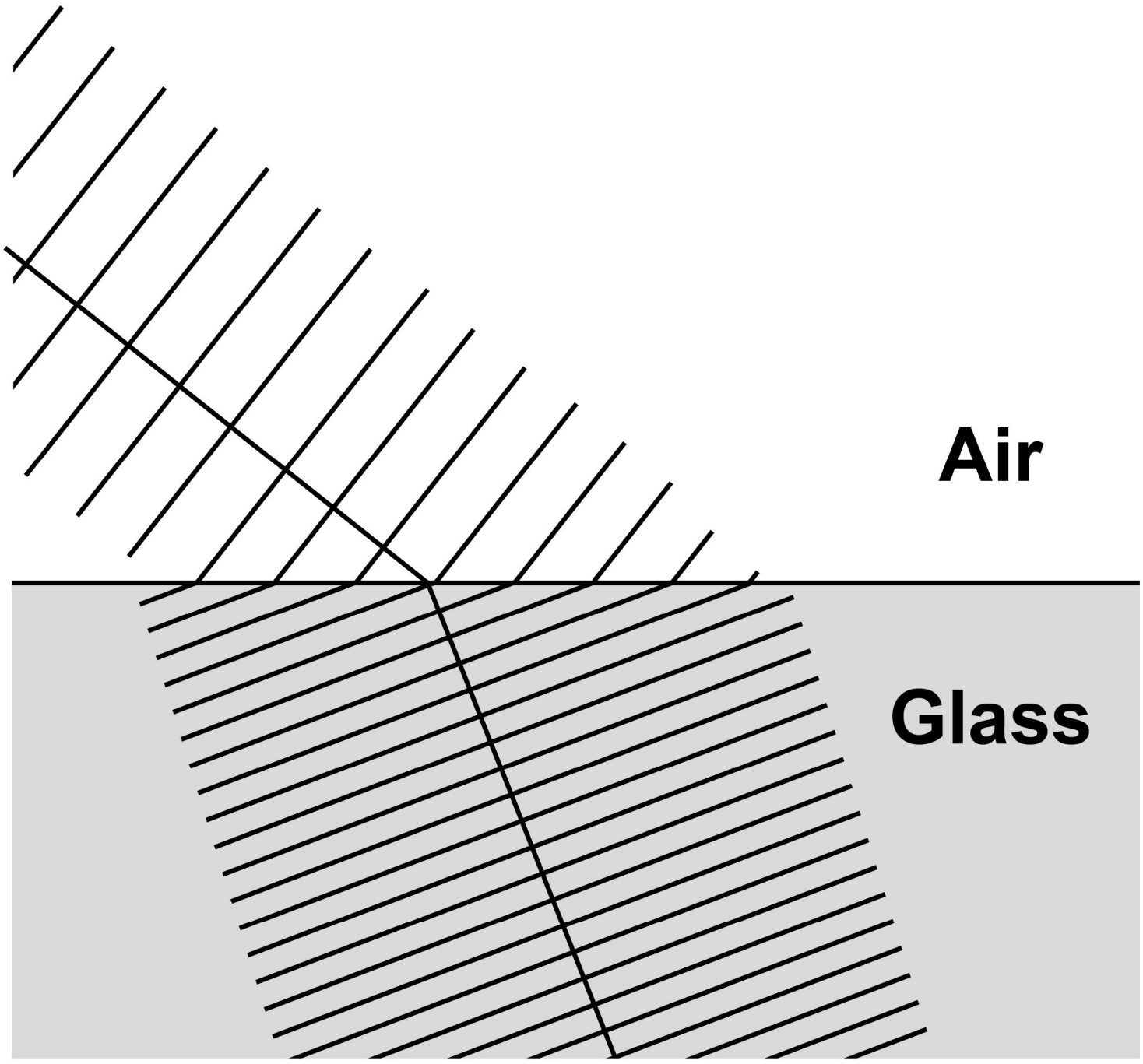
9

[Turn over]

0	7

Wave front diagrams are used to explain why light refracts when it passes from air into glass.

FIGURE 10



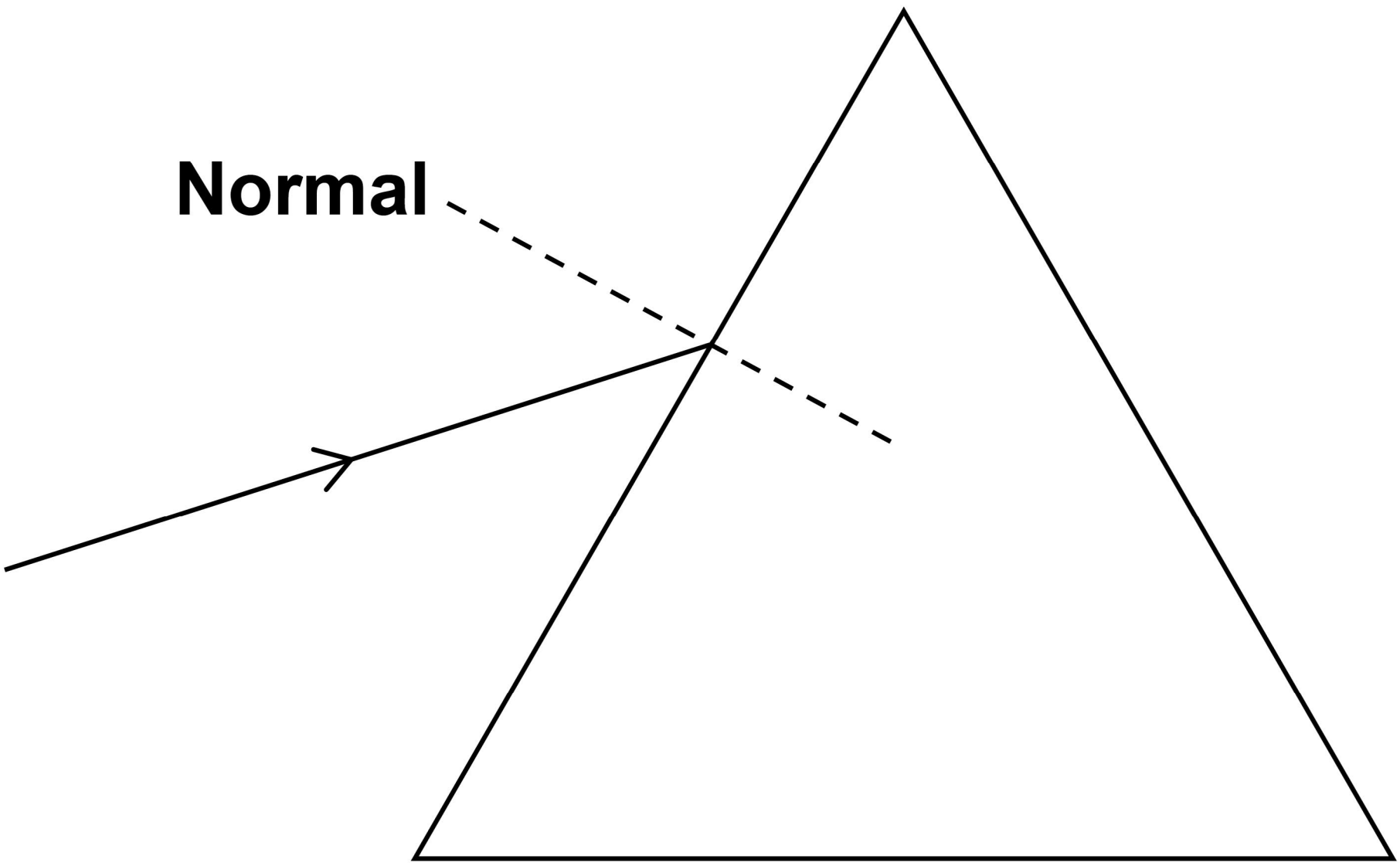
0 7 . 1

Explain why the light refracts as it passes from air into glass. [3 marks]

0 7 . 2

FIGURE 11 shows a ray of red light entering a glass prism.

FIGURE 11



Complete the ray diagram to show the ray emerging from the glass prism.
[3 marks]

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[Turn over]

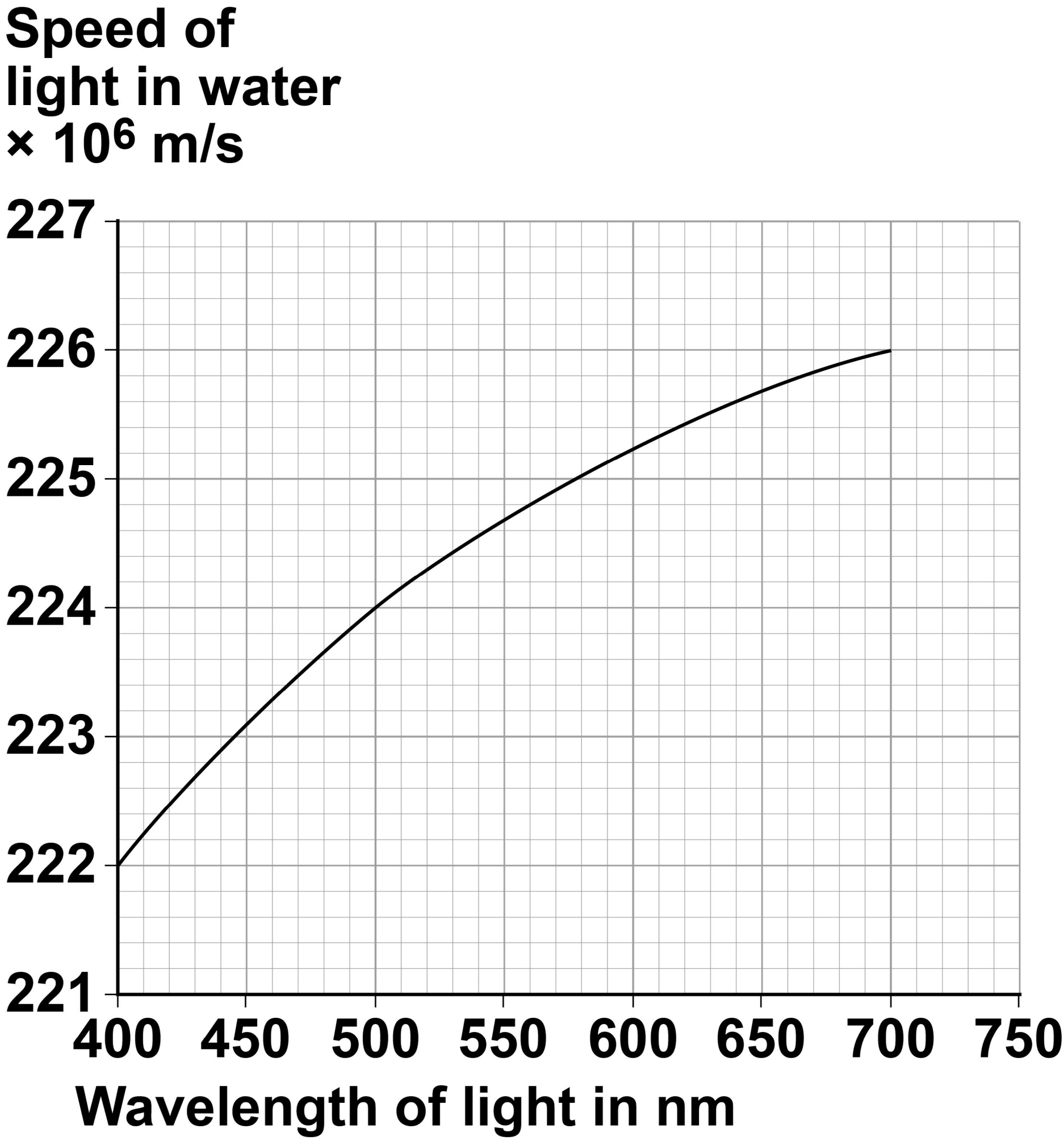
0 7 . 3

White light is made up of a continuous spectrum of different wavelengths that all travel at 3×10^8 m/s in air.

Rainbows are produced because different wavelengths of light travel at different speeds in water.

FIGURE 12, on the opposite page, shows the speed of different wavelengths of light in water.

FIGURE 12



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Explain why violet light is refracted the most as it enters water. [3 marks]

END OF QUESTIONS

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Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	