A

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE

COMBINED SCIENCE: TRILOGY

Foundation Tier
Physics Paper 2F

F

8464/P/2F

Friday 12 June 2020 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.**
- **Pencil should only be used for drawing.**
- **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.**
- **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 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 girl bowling a ball along a ten-pin bowling lane.

FIGURE 1

The girl is trying to knock down the ten pins at the end of the bowling lane.

As the ball travels along the lane the velocity of the ball decreases.

0 1 . 1

Velocity is a vector.

Which statement describes a vector?
[1 mark]

Tick (✓) ONE box.

- ☐ **Vectors have direction only.**
- ☐ **Vectors have magnitude and direction.**
- ☐ **Vectors have magnitude only.**

0 1 . 2

Why does the velocity of the ball decrease as the ball travels along the lane?
[1 mark]

Tick (✓) ONE box.

☐ **The force of gravity slows the ball down.**

☐ **There are no forces acting on the ball.**

☐ **There is a resultant force acting on the ball.**

0 1 . 3

The ball travels along the lane at an average speed of 4.5 m/s

It takes the ball 4.0 seconds to travel the length of the lane.

Calculate the length of the lane.

Use the equation:

distance travelled = speed × time

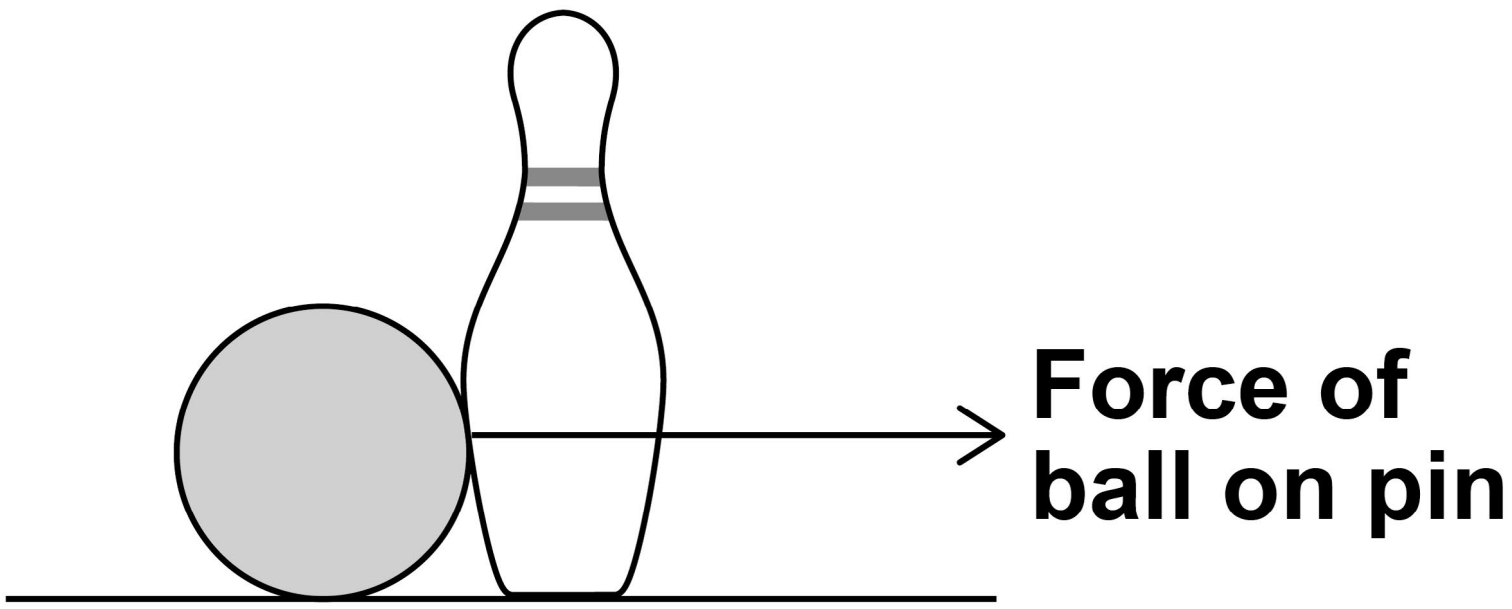
[2 marks]

Length of the lane = _____ m

[Turn over]

FIGURE 2 shows the ball hitting one of the pins.

FIGURE 2



0 1 . 4

Draw an arrow on FIGURE 2 to show the force of the pin on the ball. [2 marks]

0 1 . 5

The velocity of the pin changes from 0 to 12 m/s

It takes 0.15 seconds for the velocity to change.

Calculate the acceleration of the pin.

Use the equation:

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

[2 marks]

Acceleration = _____ m/s^2

0 1 . 6

When the pin is struck it accelerates.

Complete the sentences.

Choose answers from the list.

Each answer can be used once, more than once, or not at all. [3 marks]

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

The displacement of the pin from the girl _____ .

The mass of the pin _____ .

The kinetic energy of the pin

_____ .

BLANK PAGE

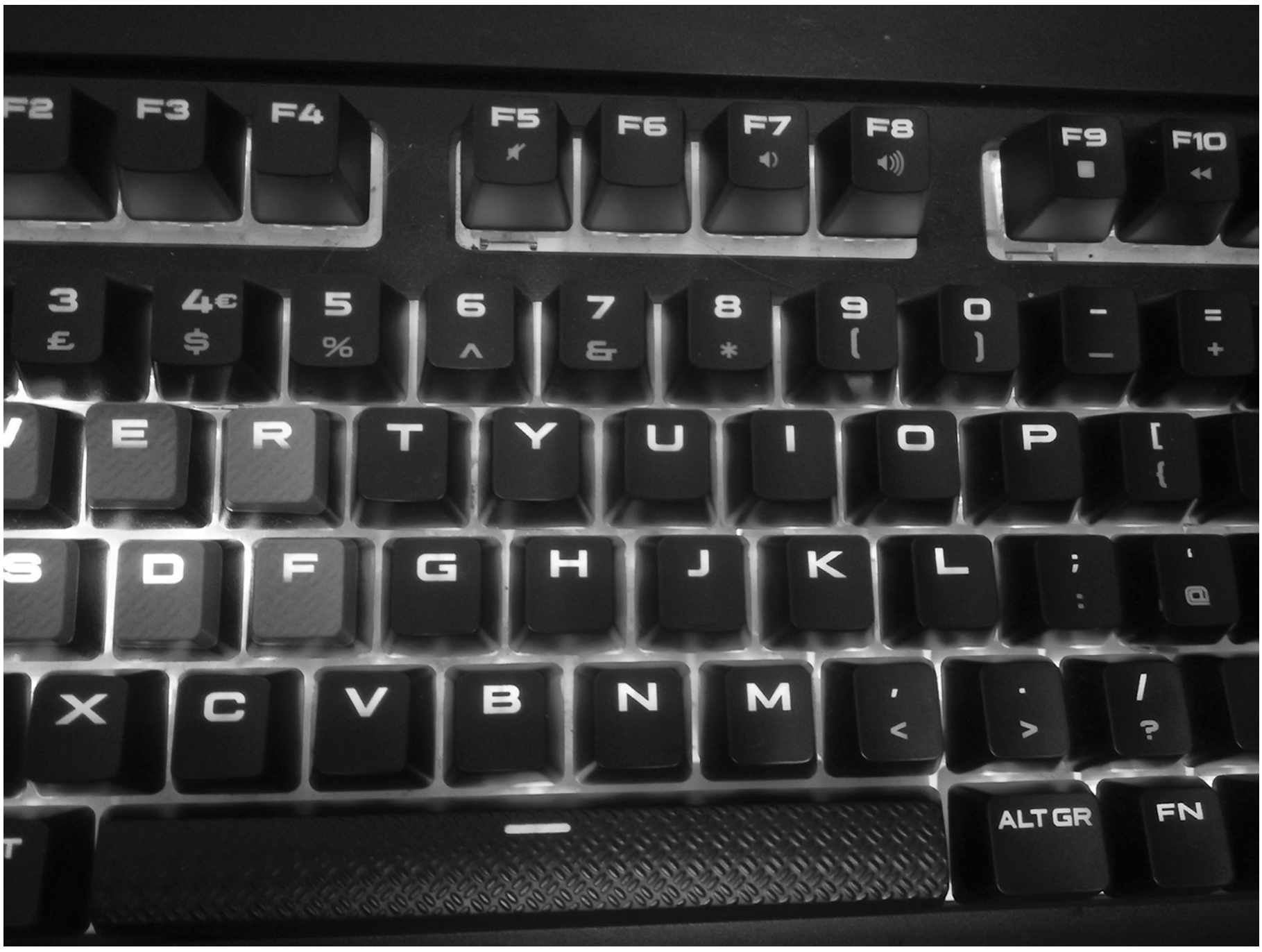
[Turn over]

0 2

FIGURE 3 shows a computer keyboard.

There is a spring under each key.

FIGURE 3



0 2 . 1

Why do the keys have springs under them? [1 mark]

Tick (✓) ONE box.

- ☐ **Springs make the keys easier to press.**
- ☐ **Springs make the keys lighter.**
- ☐ **Springs push the keys back to their original position.**

[Turn over]

BLANK PAGE

0 2 . 2

Why does every spring used in the keyboard have the same spring constant? [1 mark]

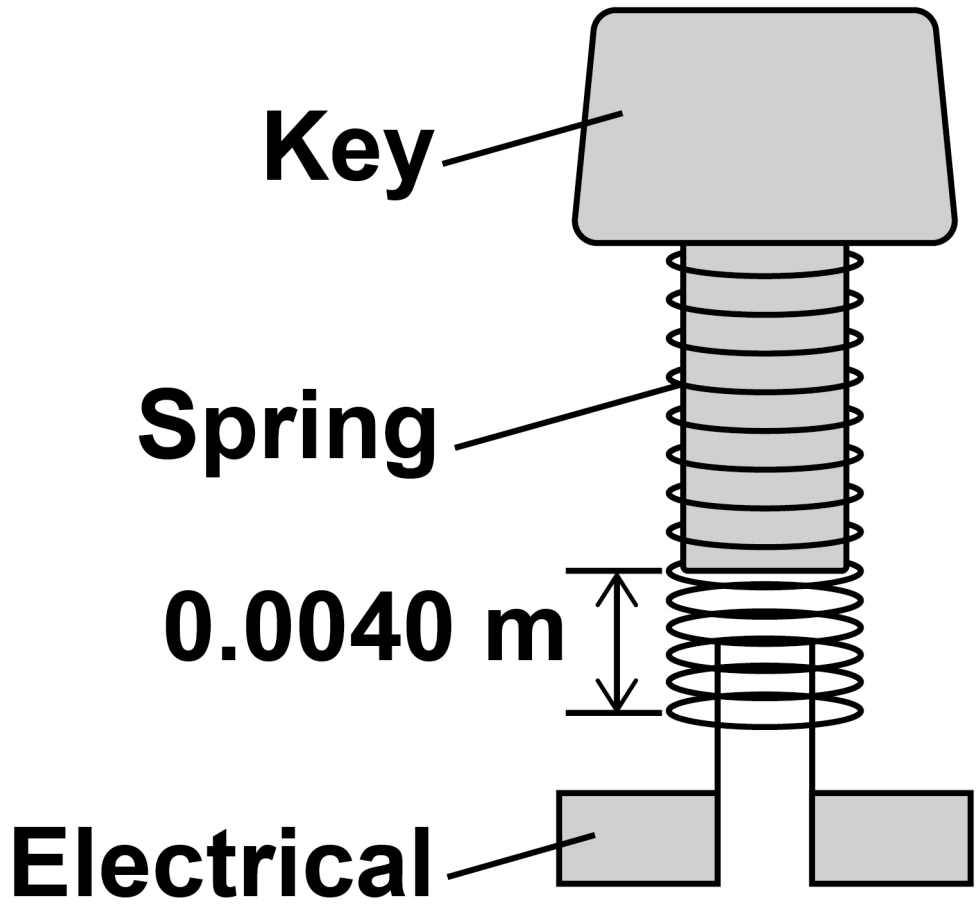
Tick (✓) ONE box.

- ☐ So that more than one key can be pressed at the same time.
- ☐ So that the same force is needed to press each key.
- ☐ So that the springs are all the same length.

[Turn over]

FIGURE 4 shows one of the keys and its spring.

FIGURE 4



0 2 . 3

What happens to the length of the spring when the key is pressed? [1 mark]

0 2 . 4

How far must the key move before it touches the switch? [1 mark]

Tick (✓) ONE box.

- ☐ **4.0 mm**
- ☐ **4.0 cm**
- ☐ **4.0 µm**

0 2 . 5

If a key is not pressed with enough force, no signal is sent to the computer.

Explain why. [2 marks]

0 2 . 6

The spring in FIGURE 4, on page 16, has a spring constant of 200 N/m

Calculate the force on the spring when the key moves a distance of 0.0040 m

Use the equation:

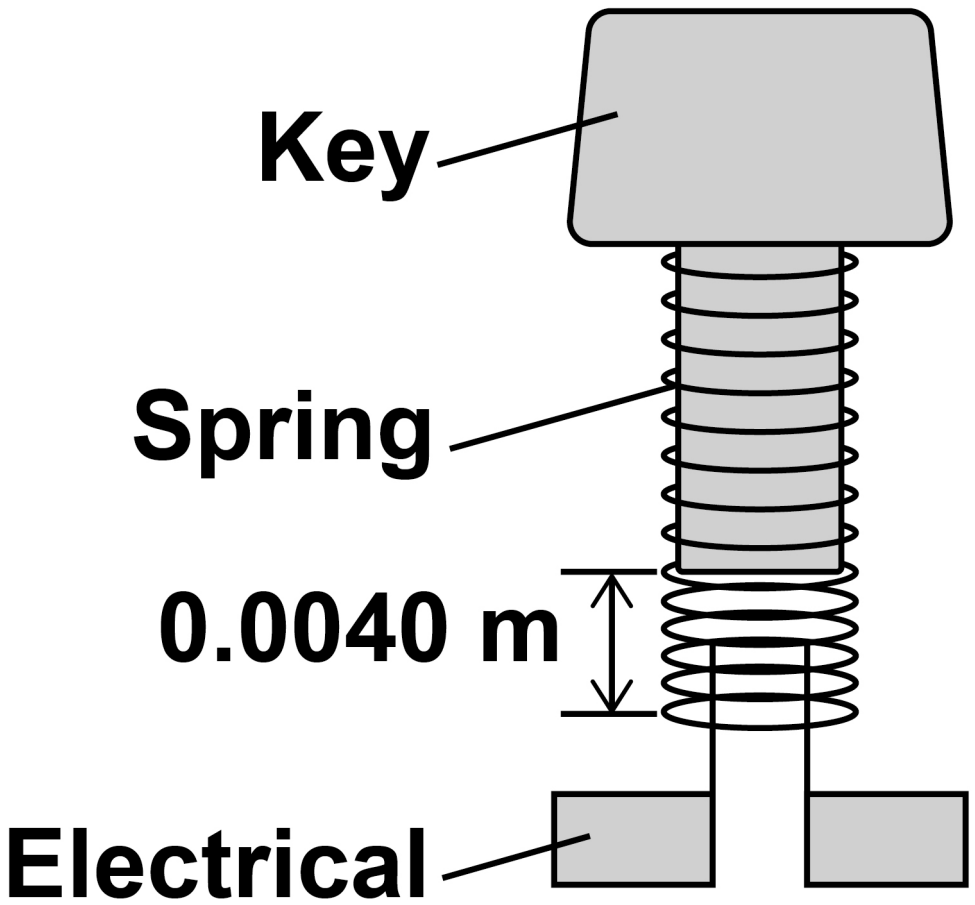
force = spring constant × compression

[2 marks]

Force = _____ N

[Turn over]

REPEAT OF FIGURE 4



0 2 . 7

Suggest TWO ways the spring in the key in FIGURE 4 could be changed so that the switch can be closed more quickly.
[2 marks]

1 _____

_____

_____

2 _____

_____

_____

10

0 3

X-rays and gamma rays are types of electromagnetic waves.

X-rays are used for medical imaging.

0 3 . 1

Which substance will NOT absorb X-rays? [1 mark]

Tick (✓) ONE box.

☐ **Bone**

☐ **Metal**

☐ **Skin**

TABLE 1 shows the effect of exposure to different doses of radiation.

TABLE 1

Dose in mSv	Effect on the human body
100	slightly increased risk of cancer
1000	5% increased risk of cancer
5000	high risk of death

0 3 . 2

During one X-ray a person receives a dose of 0.100 mSv

Why is this dose unlikely to harm the person? [1 mark]

0 3 . 3

A doctor takes an X-ray photograph of a person.

When taking the X-ray photograph, the doctor stands behind a screen.

Suggest why. [1 mark]

0 3 . 4

Which of the following are gamma rays used for? [1 mark]

Tick (✓) ONE box.

- ☐ **Cooking food**
- ☐ **Energy-efficient lamps**
- ☐ **Sterilising medical equipment**

0 3 . 5

Why are gamma rays and X-rays harmful to humans? [1 mark]

Tick (✓) ONE box.

- ☐ **They are ionising**
- ☐ **They are radioactive**
- ☐ **They travel at the speed of light**

0 3 . 6

Electromagnetic waves are also used in communications.

Describe how microwaves and visible light are used in communications.
[4 marks]

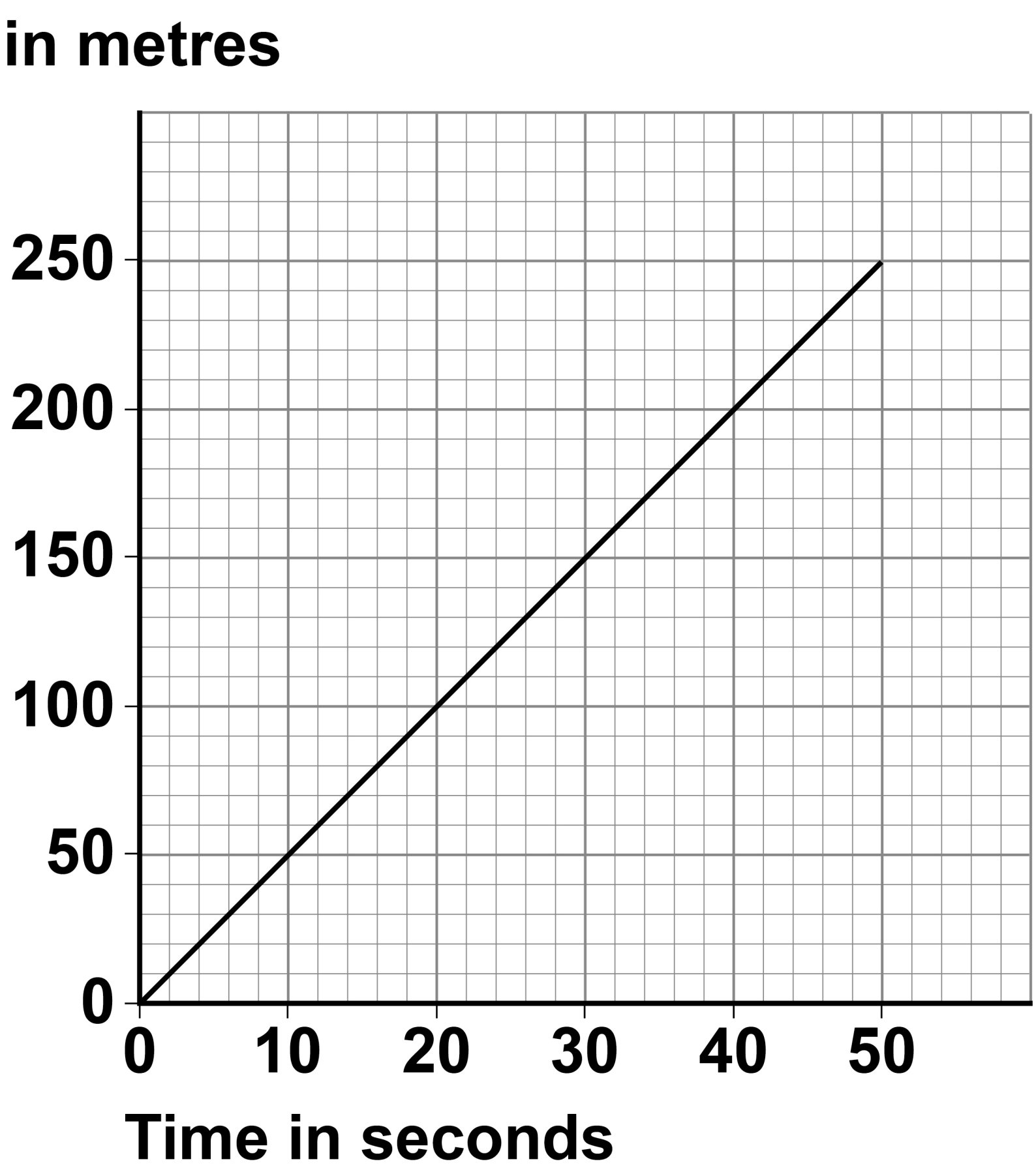
Microwaves _____

Visible light _____

0 4

FIGURE 5 shows a distance-time graph for 50 seconds of a bicycle ride.

FIGURE 5



0 4 . 1

The gradient of the distance-time graph gives the speed of the bicycle.

Determine the speed of the bicycle.
[2 marks]

Speed = **m/s**

[Turn over]

0 4 . 2

Which force acting on the moving bicycle is a non-contact force? [1 mark]

Tick (✓) ONE box.

- ☐ **Air resistance**
- ☐ **Friction**
- ☐ **Gravitational force**
- ☐ **Normal contact force**

BLANK PAGE

[Turn over]

0 4 . 3

The bicycle travels a distance of 250 m

The bicycle exerts a constant horizontal force of 30 N on the ground.

Calculate the work done.

Use the equation:

work done = force × distance

Choose the unit from the list. [3 marks]

- **J**
- **kg**
- **m**

_____

_____

_____

Work done = _____ Unit _____

[Turn over]

0 4 . 4

The bicycle travels at a constant speed.

Complete the sentences.

Choose answers from the list. [3 marks]

- **chemical**
- **frictional**
- **kinetic**
- **magnetic**
- **tension**

As the bicycle moves, work is done against _____ forces.

There is no change in the cyclist's _____ store of energy.

There is a decrease in the cyclist's _____ store of energy.

9

BLANK PAGE

[Turn over]

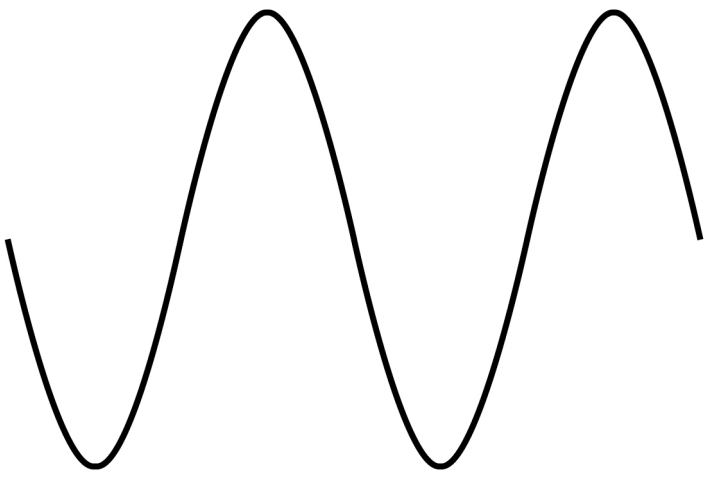
0 5

FIGURE 6 shows four waves.

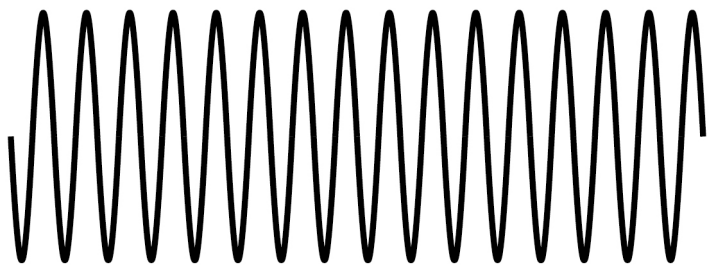
The waves are drawn to the same scale.

FIGURE 6

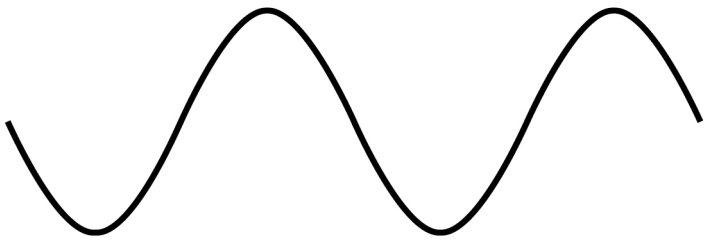
A



B



C



D

0 5 . 1

Which wave has the greatest amplitude?
[1 mark]

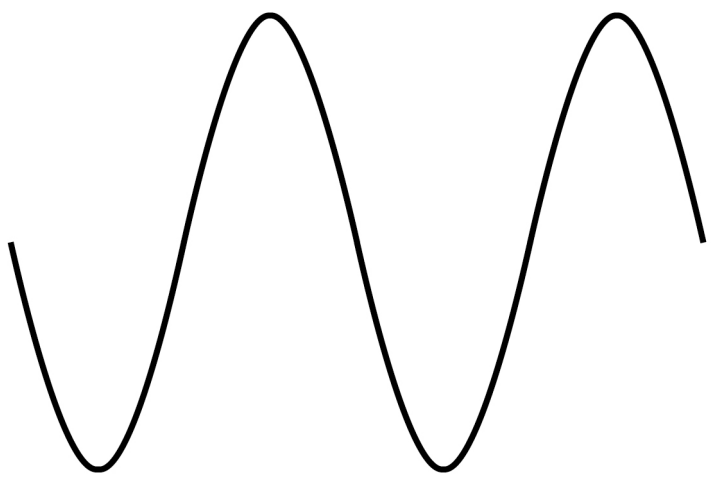
Tick (✓) ONE box.

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

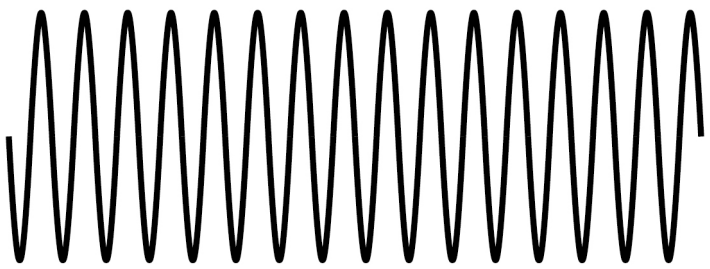
[Turn over]

REPEAT OF FIGURE 6

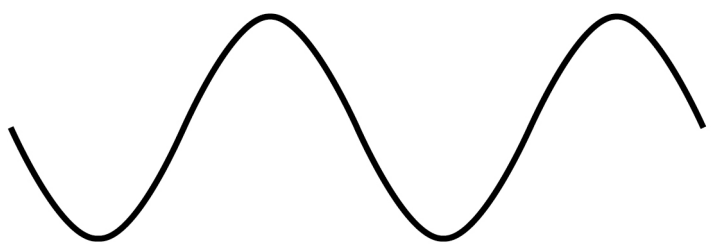
A



B



C



D

0 5 . 2

Which wave has the greatest frequency?
[1 mark]

Tick (✓) ONE box.

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

[Turn over]

0 5 . 3

Which wave has the greatest wavelength?
[1 mark]

Tick (✓) ONE box.

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

0 5 . 4

A wave has a frequency of 1650 Hz and a wavelength of 0.200 m

Calculate the wave speed.

Use the equation:

wave speed = frequency × wavelength

[2 marks]

Wave speed = _____ m/s

[Turn over]

A student uses a mobile phone app that displays sound waves.

FIGURE 7 shows the student holding the mobile phone close to a loudspeaker.

FIGURE 7

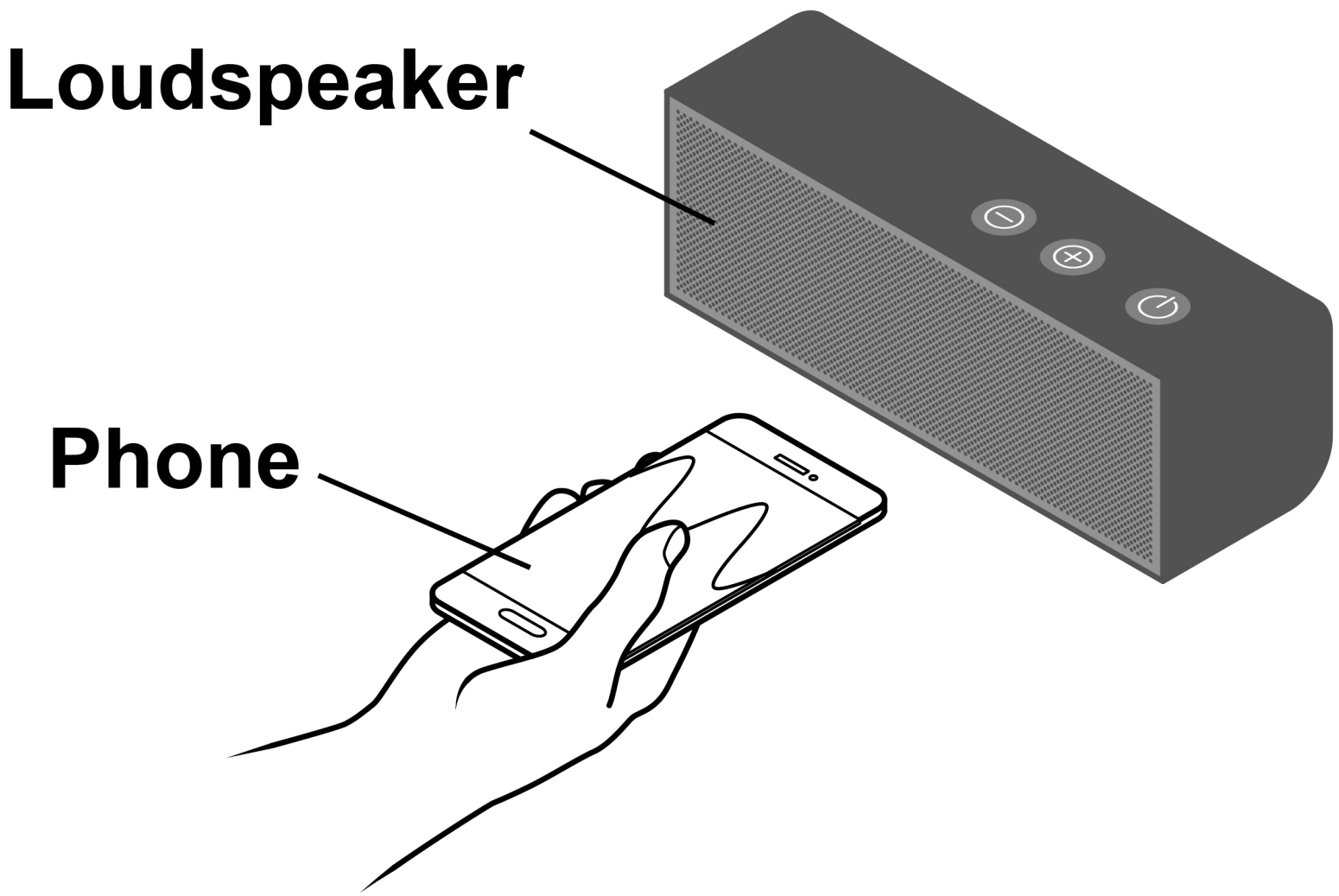
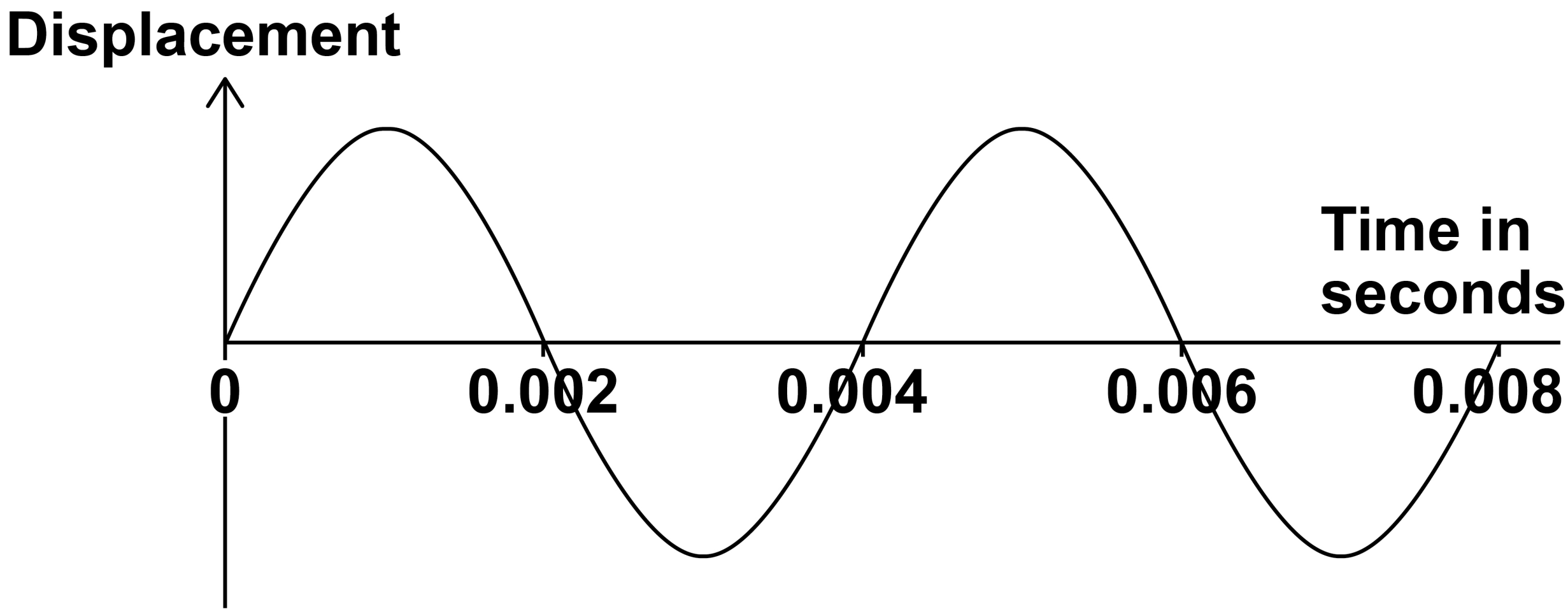


FIGURE 8 shows the wave pattern seen on the phone screen.

FIGURE 8



[Turn over]

BLANK PAGE

0 5 . 5

What is the period of the wave shown in FIGURE 8?
[1 mark]

Tick (✓) ONE box.

☐ **0.002 s**

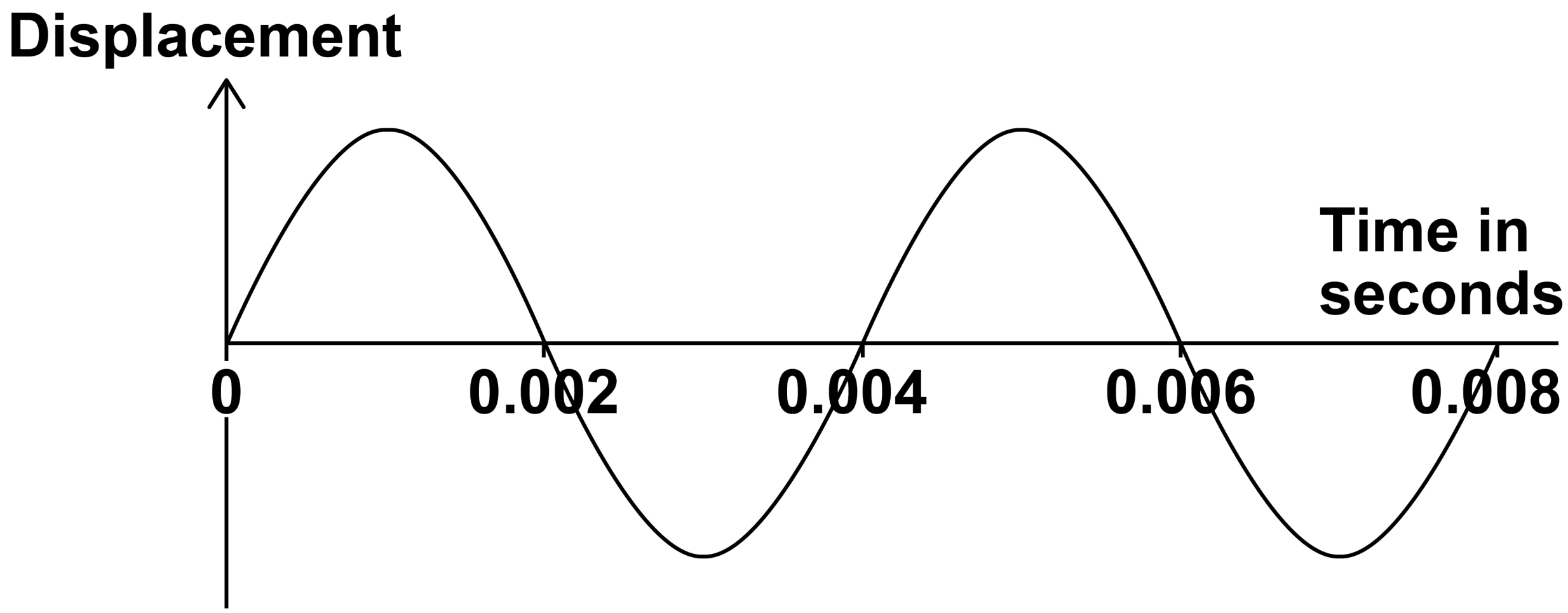
☐ **0.004 s**

☐ **0.006 s**

☐ **0.008 s**

[Turn over]

REPEAT OF FIGURE 8



0 5 . 6

Determine the frequency of the wave shown in FIGURE 8.

Use the Physics Equations Sheet. [3 marks]

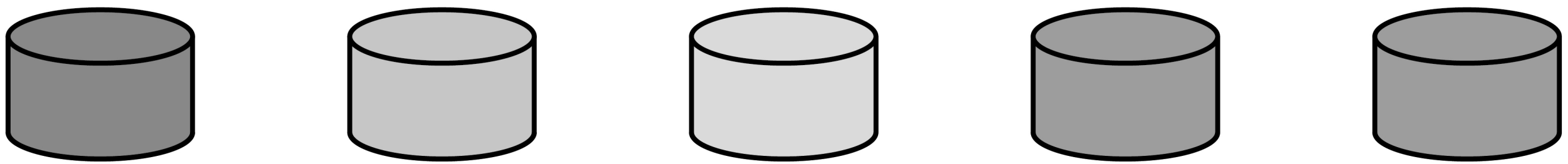
Frequency = _____ Hz

[Turn over]

0 6

FIGURE 9 shows five different metal samples.

FIGURE 9



Iron **Steel** **Aluminium** **Copper** **Tin**

0 6 . 1

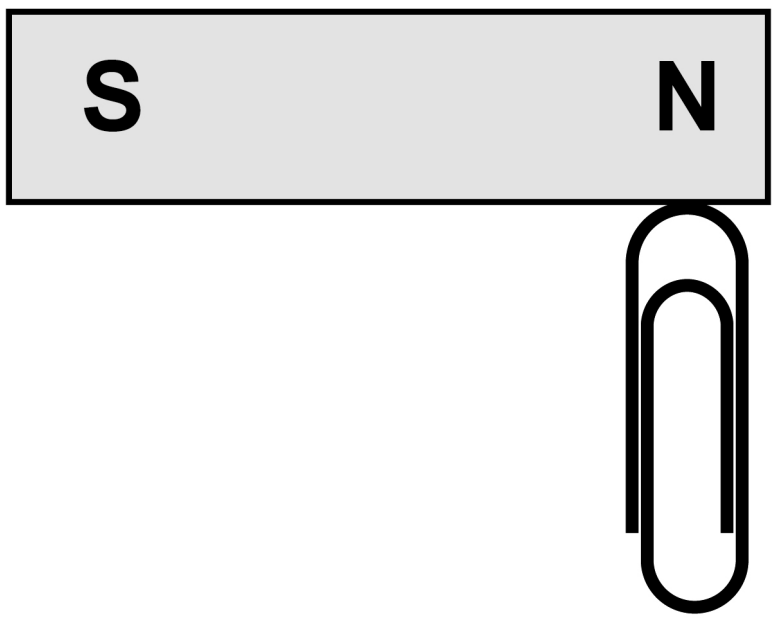
A student placed a magnet close to each metal sample.

Describe what happened. [2 marks]

[Turn over]

FIGURE 10 shows a paper clip being attracted to a permanent magnet.

FIGURE 10



0 6 . 2

The paper clip in FIGURE 10 is not a permanent magnet.

Explain what would happen if the paper clip was removed and brought close to the south pole of the permanent magnet.
[2 marks]

0 6 . 3

Write down the equation that links gravitational field strength (*g*), mass (*m*) and weight (*W*). [1 mark]

---

0 6 . 4

The student added more paperclips to one end of the magnet.

The maximum number of paperclips the magnet could hold was 20

Each paper clip had a mass of 1.0 g

gravitational field strength = 9.8 N/kg

Calculate the maximum force the magnet can exert. [3 marks]

Force = _____ N

[Turn over]

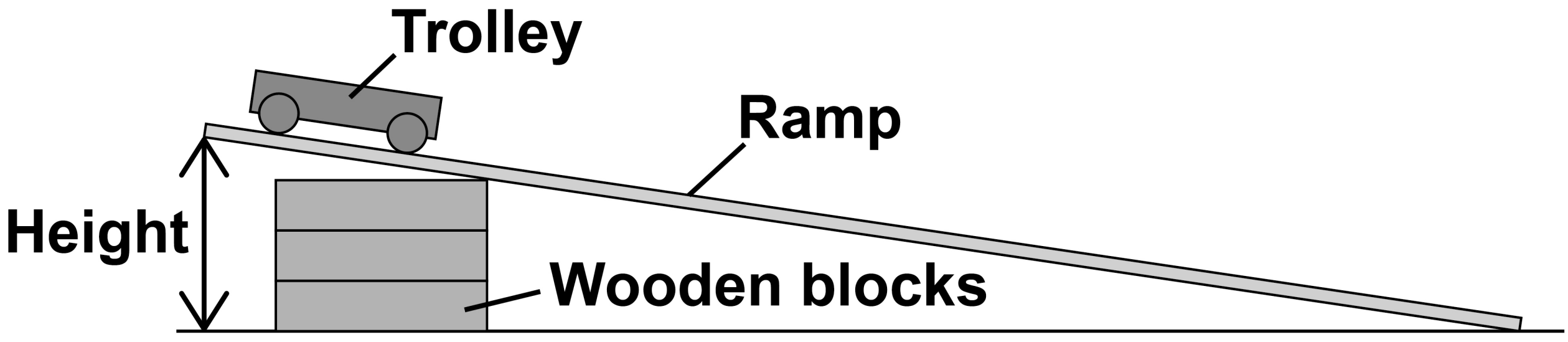
8

0 7

A student investigated how the height of a ramp affects the acceleration of a trolley down the ramp.

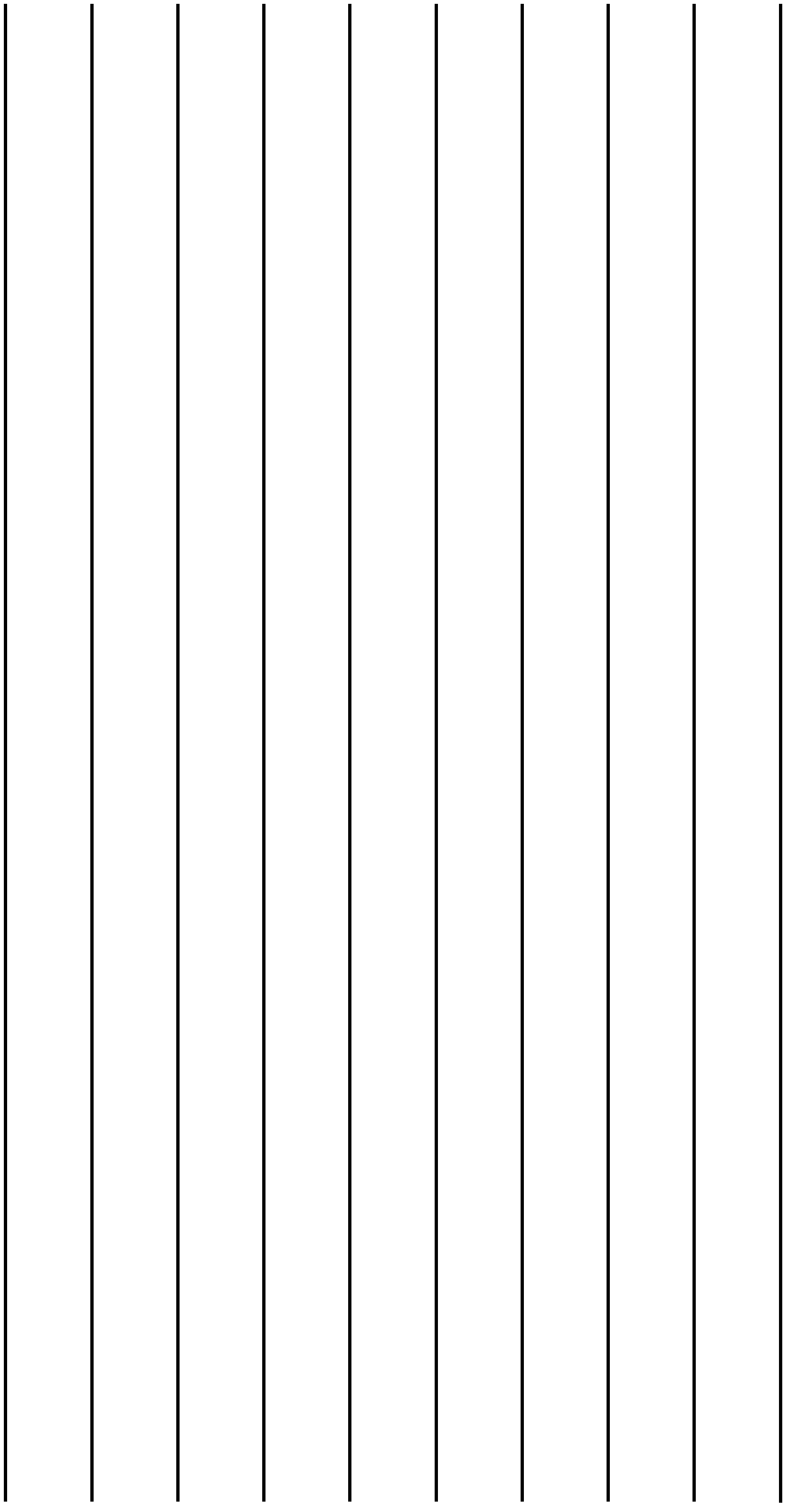
FIGURE 11 shows some of the equipment used.

FIGURE 11



0 7 . 1

Plan an investigation to determine how the height of the ramp affects the acceleration of the trolley. [6 marks]



BLANK PAGE

[Turn over]

TABLE 2 shows the results.

TABLE 2

Height of ramp in metres	0.1	0.2	0.3	0.4	0.5	0.6
Acceleration in m/s^2	0.9	1.3	2.1	3.2	3.9	4.3

The first two results have been plotted on FIGURE 12, on the opposite page.

0 7 . 2

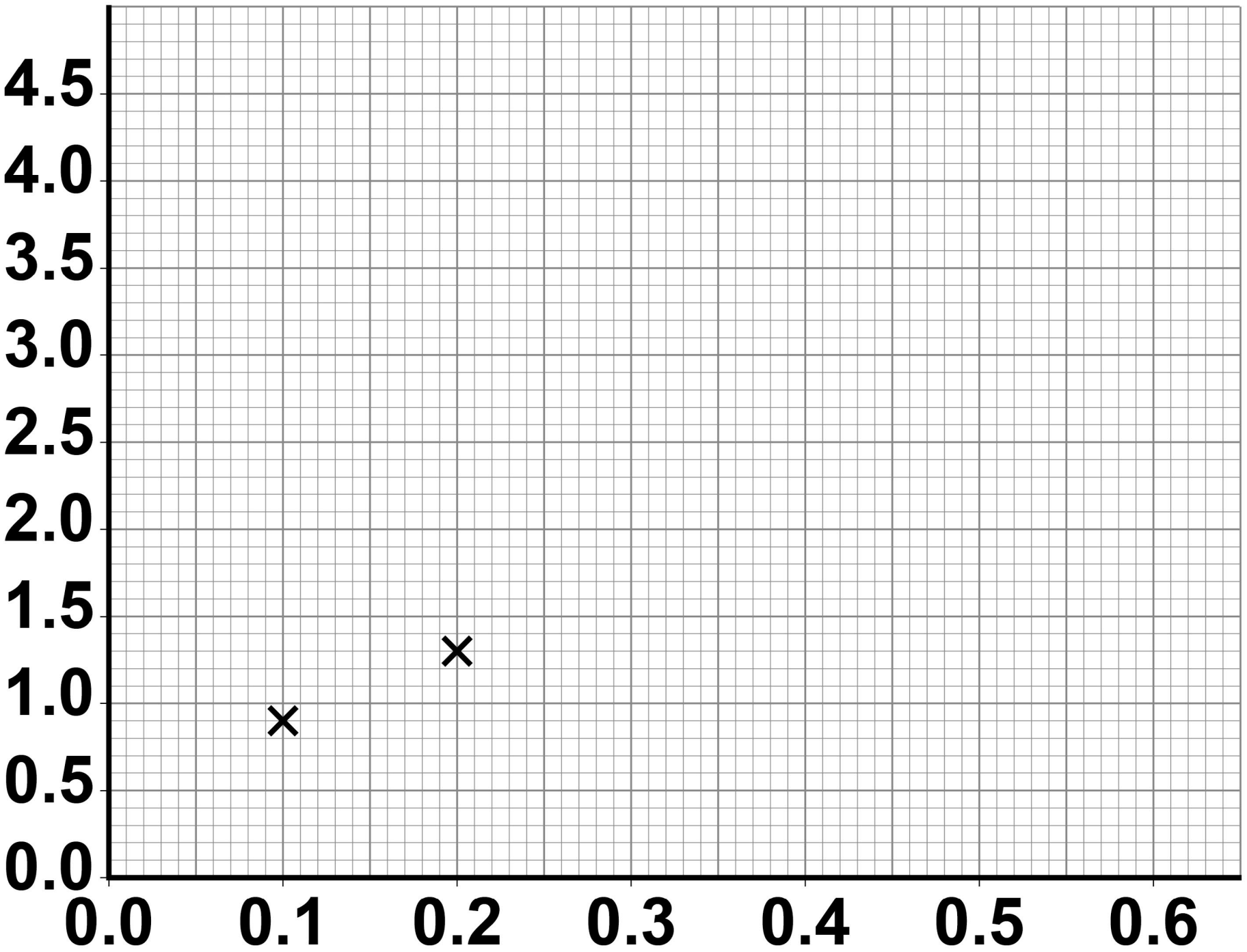
Complete FIGURE 12, on the opposite page.

You should:

- **label the axes**
- **plot the remaining results from TABLE 2**
- **draw a line of best fit.**

[4 marks]

FIGURE 12



[Turn over]

0 7 . 3

Write down the equation that links acceleration (*a*), mass (*m*) and resultant force (*F*). [1 mark]

0 7 . 4

When the resultant force on the trolley was 0.63 N the acceleration of the trolley was 2.1 m/s^2

Calculate the mass of the trolley.

[3 marks]

Mass of trolley = _____ kg

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.

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.

BLANK PAGE

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