

Paper Reference(s) **1PH0 / 1H**

Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Physics

Paper 1

Higher Tier

Wednesday 22 May 2019 – Afternoon

Time: 1 hour 45 minutes plus your additional time allowance

INSTRUCTIONS TO CANDIDATES

Write your centre number, candidate number, surname, other names and your signature in the boxes below. Check that you have the correct question paper.

| | | | | | |
|------------------------|---|---|---|---|-------|
| Centre No. | | | | | |
| Candidate No. | | | | | |
| Surname | | | | | |
| Other names | | | | | |
| Signature | | | | | |
| Paper Reference | 1 | P | H | 0 | / 1 H |

- Use **BLACK** ink or ball-point pen.
- Answer **ALL** questions.
- Answer the questions in the spaces provided – there may be more space than you need.
- Calculators may be used.
- Any diagrams may **NOT** be accurately drawn, unless otherwise indicated.
- You must show all your working out with your answer clearly identified at the end of your solution.

MATERIALS REQUIRED FOR EXAMINATION

Calculator, ruler

ITEMS INCLUDED WITH QUESTION PAPERS

Equations booklet

INFORMATION FOR CANDIDATES

- The total mark for this paper is 100.
- The marks for **EACH** question are shown in brackets – use this as a guide as to how much time to spend on each question.
- In questions marked with an asterisk (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.
- An equations booklet is provided.

(Instructions continue on next page)

(Turn over)

ADVICE TO CANDIDATES

- **Read each question carefully before you start to answer it.**
- **Try to answer every question.**
- **Check your answers if you have time at the end.**

Answer ALL questions. Write your answers in the spaces provided.

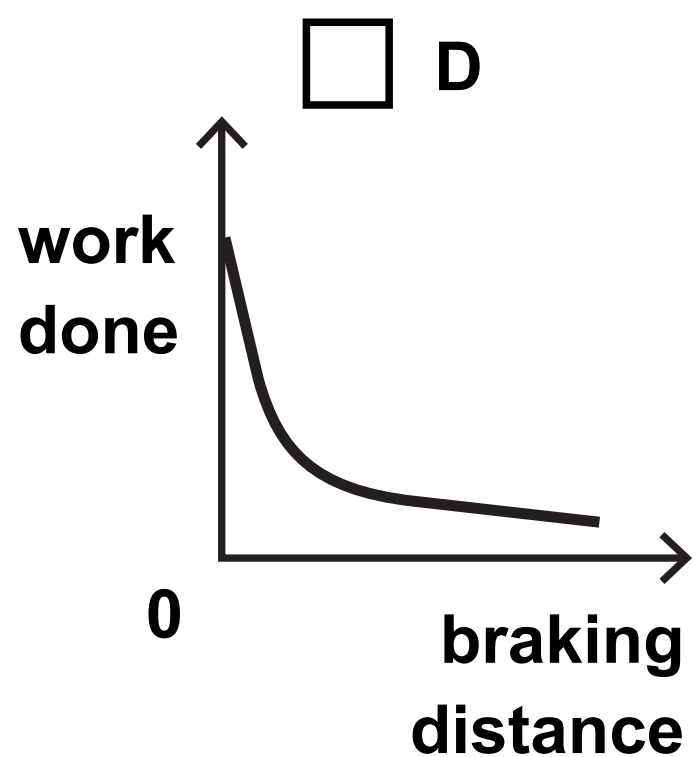
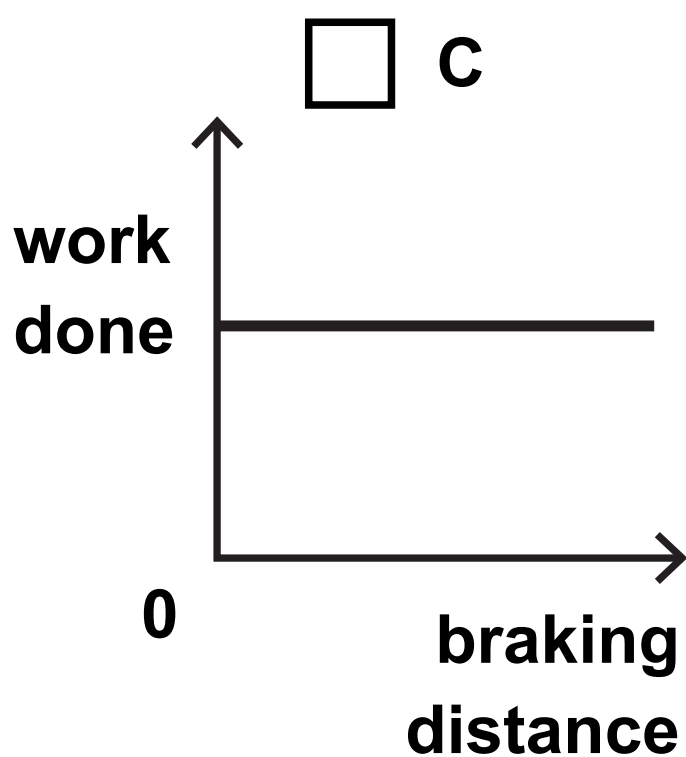
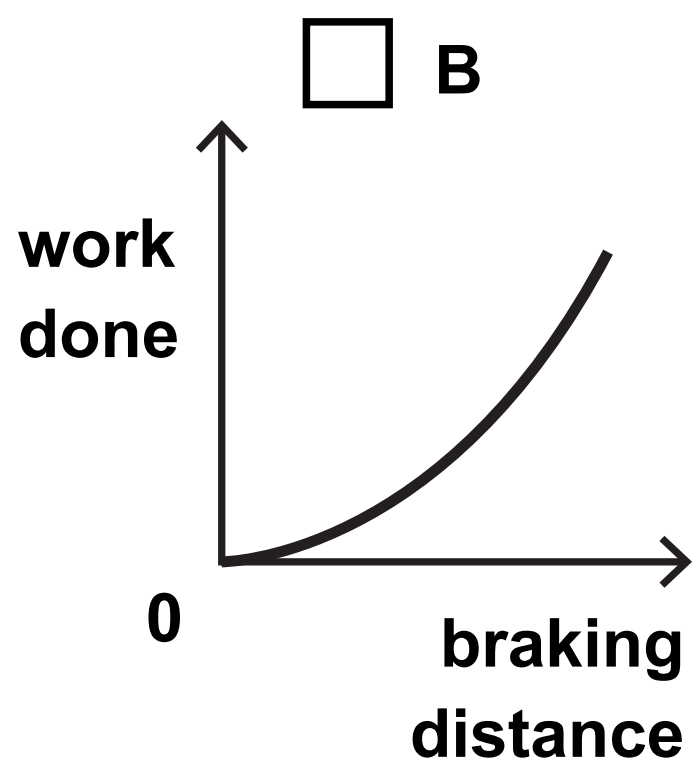
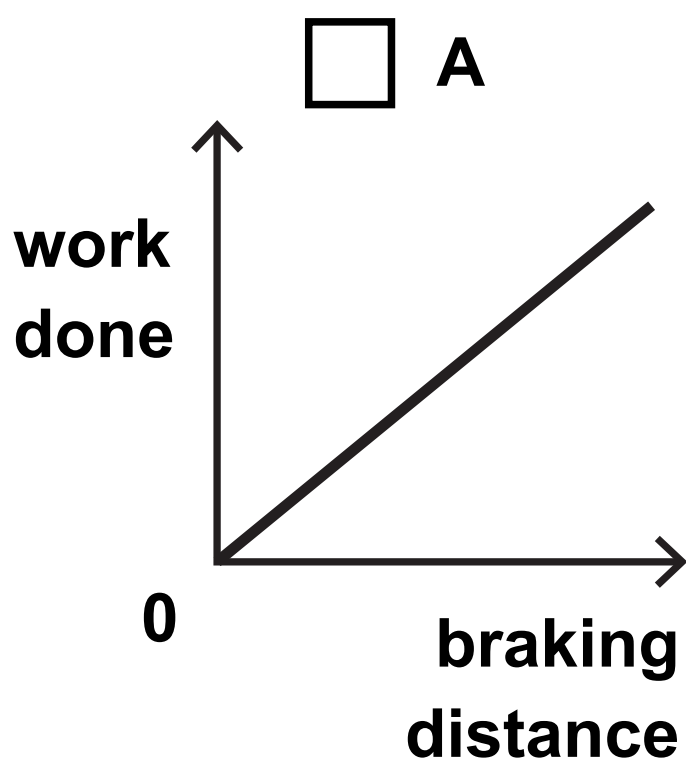
Some questions must be answered with a cross in a box ☐.
If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

(Questions begin on next page)

- 1 (a) The work done to bring a car to rest is given by the equation

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

Which of these graphs is correct for the car if a constant braking force is applied? (1 mark)



(Question continues on next page)

(Turn over)

- (b) Before the car brakes it has kinetic energy.
The kinetic energy decreases as it brakes.**

**State what happens to the kinetic energy during
braking. (1 mark)**

(Question continues on next page)

- (c) The graph in Figure 1 shows how the braking distance, d , of a car depends on the velocity, v , of the car when the brakes are first applied.

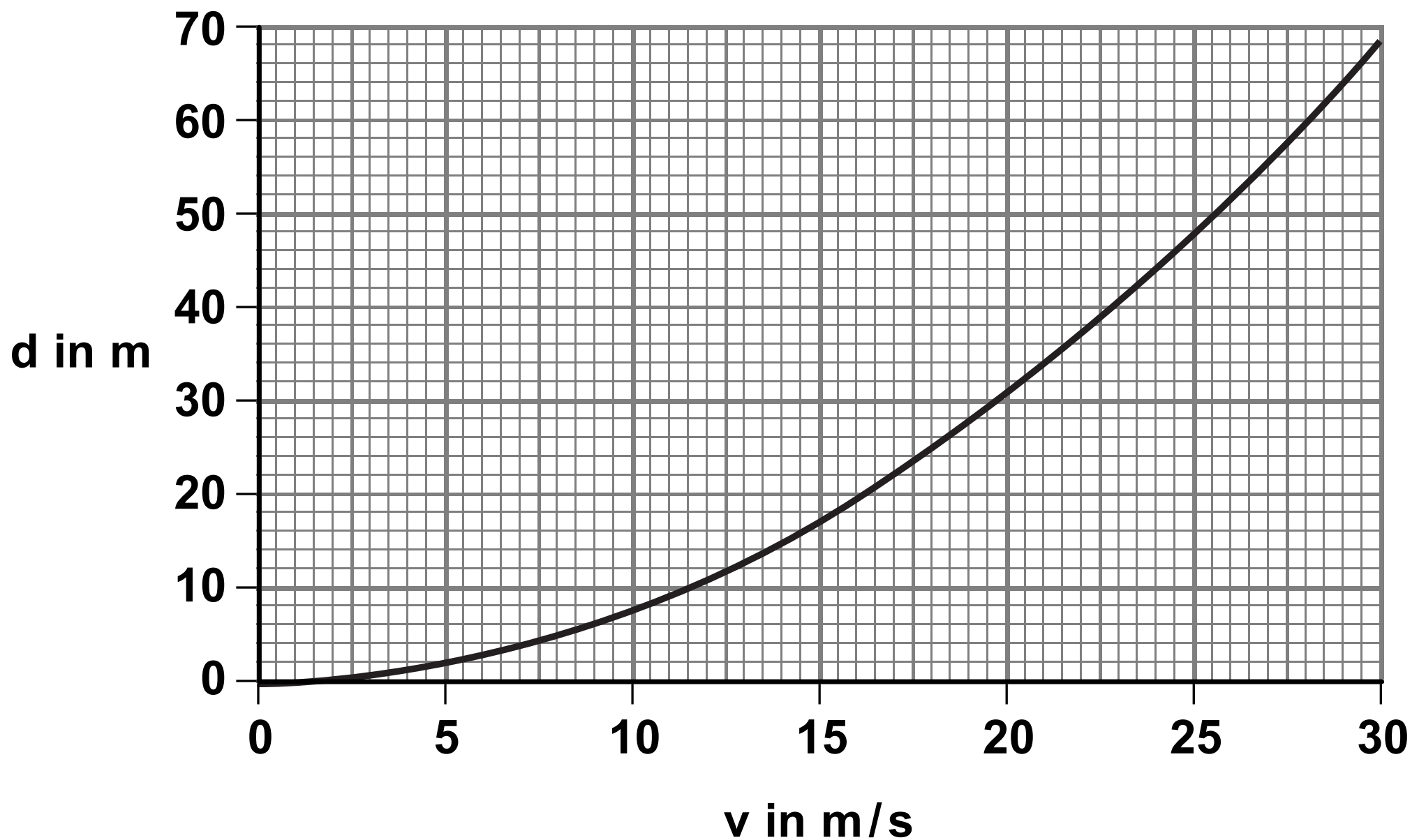


Figure 1

An equation relating braking distance, d , to velocity, v , is

$$d = \frac{v^2}{C}$$

where C is a constant.

(Question continues on next page)

(Turn over)

Use the equation and data from the graph in Figure 1 to calculate a value for C.

Give a unit for C. (4 marks)

C = _____ unit _____

(TOTAL FOR QUESTION 1 = 6 MARKS)

(Questions continue on next page)

2 (a) Which colour of visible light has the longest wavelength? (1 mark)

- ☐ **A blue**
- ☐ **B green**
- ☐ **C red**
- ☐ **D yellow**

(b) Some television remote controls use infrared radiation and other remote controls use radio waves.

Explain why an infrared remote control may not switch on the television from behind an armchair but a radio wave remote control always will. (2 marks)

(Question continues on next page)

(Turn over)

(c) Figure 2 is a diagram of a water wave.

A cork is floating on the water.

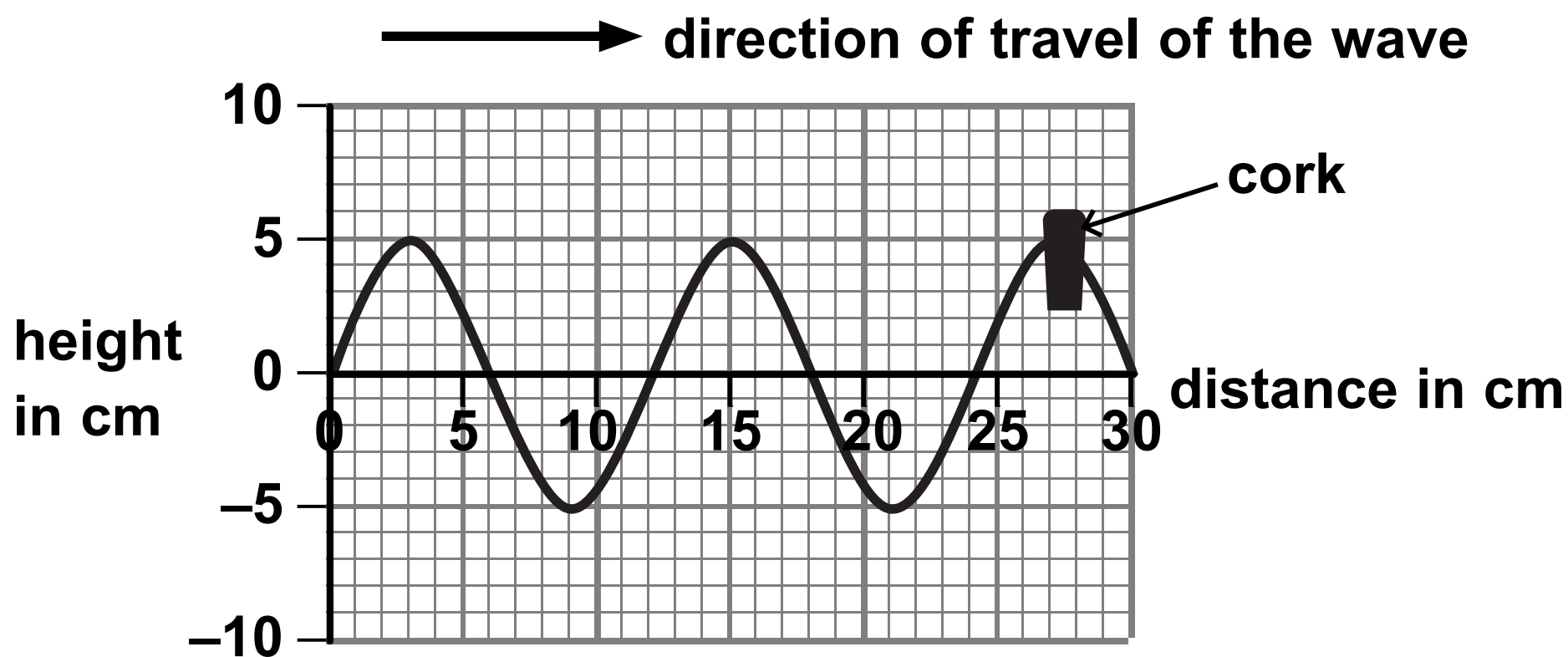


Figure 2

- (i) Use the scale on the diagram to measure the wavelength of the wave. (2 marks)

wavelength = _____ cm

(Question continues on next page)

(Turn over)

(ii) Describe the motion of the cork.

**You should include how the cork moves
relative to the direction of travel of the wave.
(2 marks)**

(Question continues on next page)

(Turn over)

- (d) A different water wave has a wavelength of 0.25 m and a frequency of 1.5 Hz.

Calculate the wave speed. (2 marks)

wave speed = _____ m/s

(TOTAL FOR QUESTION 2 = 9 MARKS)

(Questions continue on next page)

(Turn over)

- 3 (a) Carbon-13 and carbon-14 are isotopes of carbon.

Nuclei of carbon-13 and carbon-14 can be represented by these symbols



Complete the table for an atom of carbon-13 and an atom of carbon-14. (2 marks)

| | number of neutrons in the nucleus | number of electrons in orbit around the nucleus |
|-----------|--------------------------------------|---|
| carbon-13 | | |
| carbon-14 | | |

- (b) (i) State the name of an instrument that can be used to measure radioactivity. (1 mark)

(Question continues on next page)

(Turn over)

- (ii) State TWO sources of background radiation.
(2 marks)

1 _____

2 _____

- (c) Carbon-14 is radioactive and has a half-life of 5 700 years.

The number of radioactive carbon-14 atoms in a very old piece of wood is found to have decreased from 1 000 000 to 125 000.

Determine the age of the piece of wood. (2 marks)

age of wood = _____ years

(Question continues on next page)

(Turn over)

(d) Carbon-14 decays into nitrogen-14.

The symbol for nitrogen-14 is $^{14}_7\text{N}$

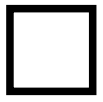
**Explain what happens in a carbon-14 nucleus
when it decays to a nitrogen-14 nucleus. (2 marks)**

(TOTAL FOR QUESTION 3 = 9 MARKS)

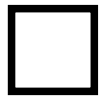
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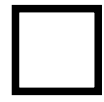
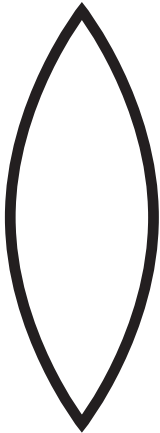
- 4 (a) (i) Which lens is a converging lens with the greatest power? (1 mark)



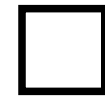
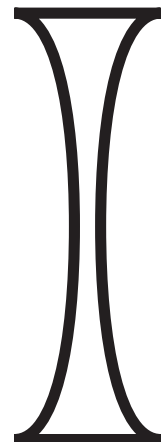
A



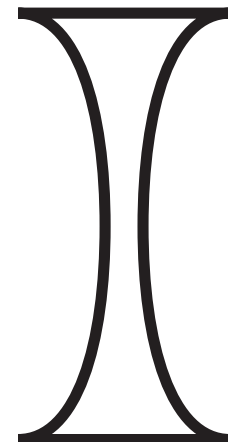
B



C



D



(Question continues on next page)

- (ii) The equation that relates the power of a lens to the focal length of the lens is

$$\text{power (in dioptres)} = \frac{1}{\text{focal length (in metres)}}$$

The power of a lens is 5 dioptres.

Use the equation to calculate the focal length of the lens in cm. (2 marks)

focal length = _____ cm

(Question continues on next page)

(Turn over)

(b) Figure 3 shows a semicircular glass block.



Figure 3

Describe how a student could use the semicircular glass block and other apparatus to determine the critical angle for a glass-air boundary.

You should add to the diagram in Figure 3 to help with your answer. (4 marks)

(Continue your answer on next page)

(Turn over)

(Question continues on next page)

- (c) (i) A long time ago, scientists believed that the Earth was at the centre of the Solar System.

Evidence has since proved that the Sun is at the centre of the Solar System.

State ONE OTHER idea about the Solar System that HAS changed over time. (1 mark)

(Question continues on next page)

(ii) Figure 4 shows data for some of the planets of the Solar System.

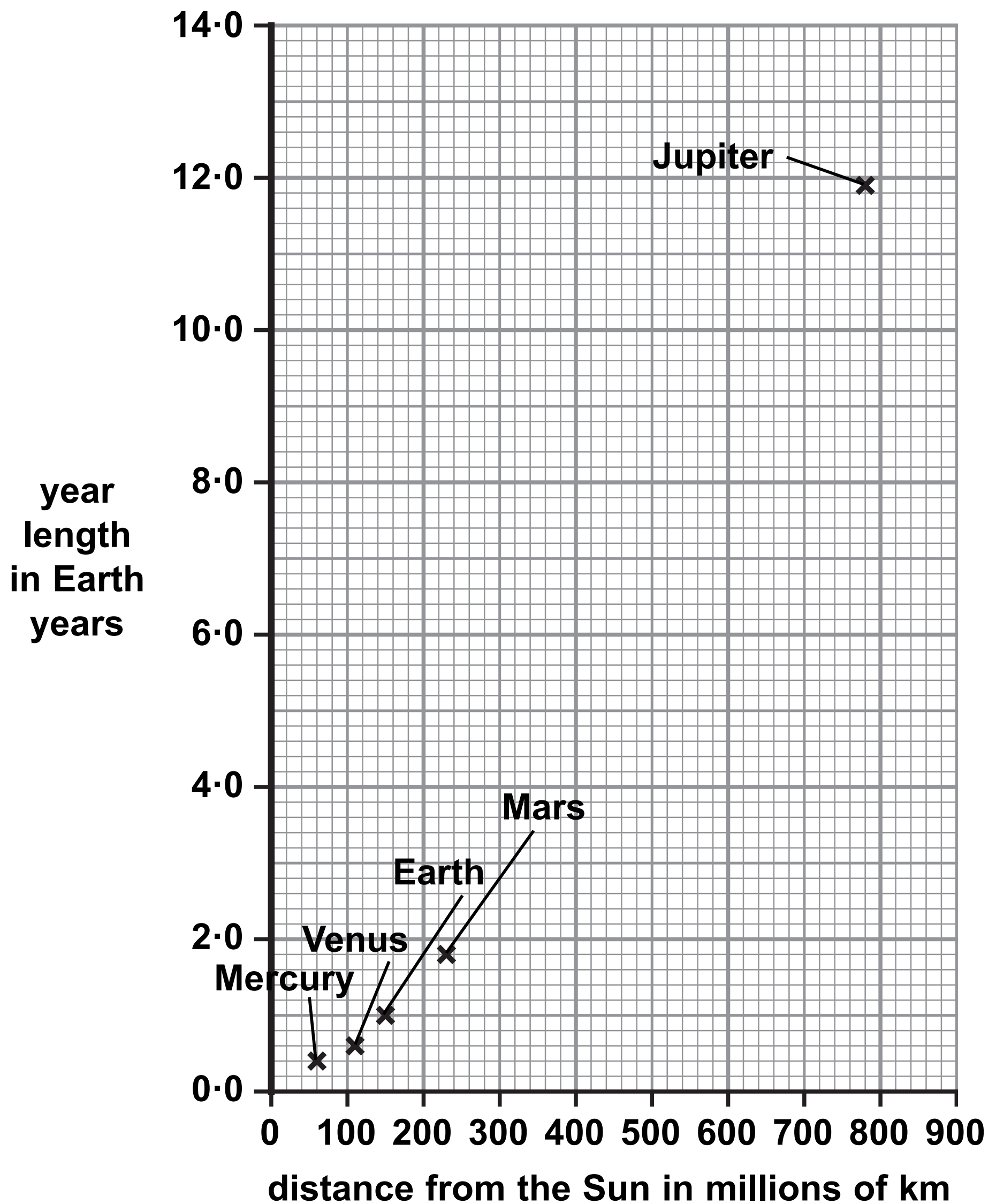


Figure 4

(Question continues on next page)

(Turn over)

Ceres is an asteroid that orbits the Sun between Mars and Jupiter.

It takes Ceres 4.6 Earth years to make one orbit of the Sun.

Use the graph to estimate the distance of Ceres from the Sun.

Show your working. (3 marks)

distance of Ceres from the Sun = _____ millions of km

(TOTAL FOR QUESTION 4 = 11 MARKS)

(Questions continue on next page)

- 5 Figure 5 shows a way of projecting a small trolley up a sloping track.

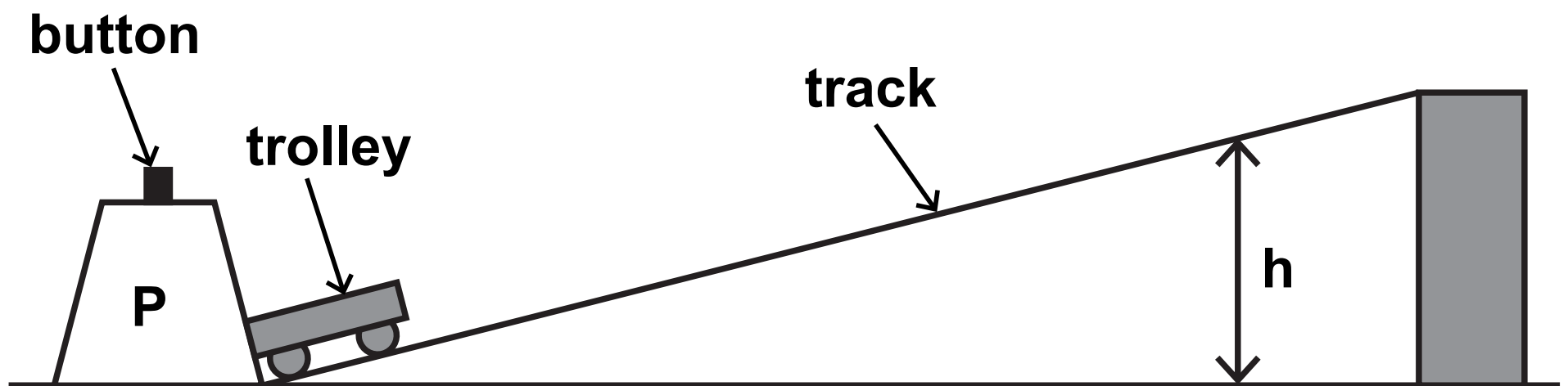


Figure 5

When the button is pressed, a spring is released in P that projects the trolley up the track.

The trolley travels up the track, stops and then rolls back down.

The spring in P always exerts the same force when projecting the trolley.

- (a) A student investigates how the mass of the trolley affects the maximum vertical height, h , reached by the trolley.

State the measurements the student should make to complete the investigation.

(Question continues on next page)

(Turn over)

**You should make use of the equipment shown in Figure 5 and any other equipment that is needed.
(4 marks)**

(Question continues on next page)

(Turn over)

(b) Figure 6 is a graph of the student's results.

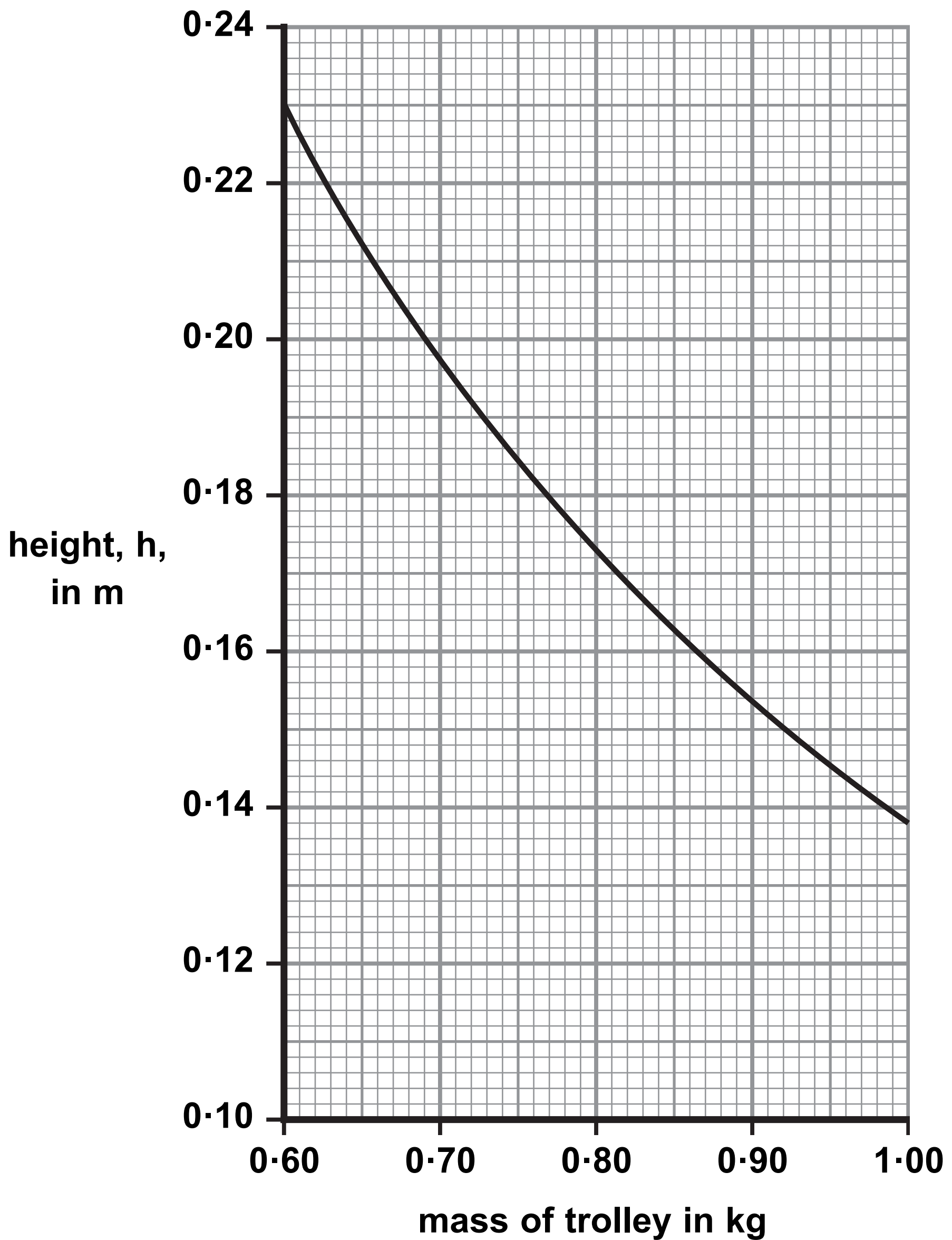


Figure 6

(Question continues on next page)

(Turn over)

The student states that the energy transferred by the spring is the same each time it is used.

Use data from any two points on the graph in Figure 6 to support this statement. (3 marks)

(Question continues on next page)

- (c) Describe how the student could extend the investigation to determine the average speed of the trolley as it rolls back down the track. (3 marks)**

(TOTAL FOR QUESTION 5 = 10 MARKS)

(Questions continue on next page)

(Turn over)

- 6 (a) The diagram in Figure 7 shows two students, P and Q, trying to measure the speed of sound in air.

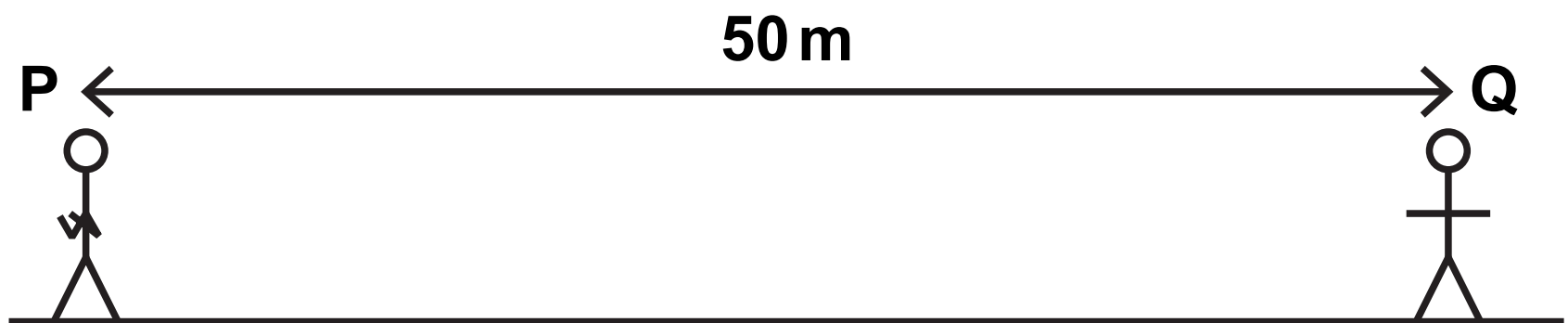


Figure 7

P will clap his hands together.

When Q sees P clap his hands, she will start a timer.

When Q hears the clap, she will stop the timer.

Explain ONE way the students could improve their method. (2 marks)

(Question continues on next page)

(Turn over)

- (b) Figure 8 shows a long metal rod and a hammer. The rod is hit at one end by the hammer.

This causes a sound wave to travel along the inside of the metal rod.

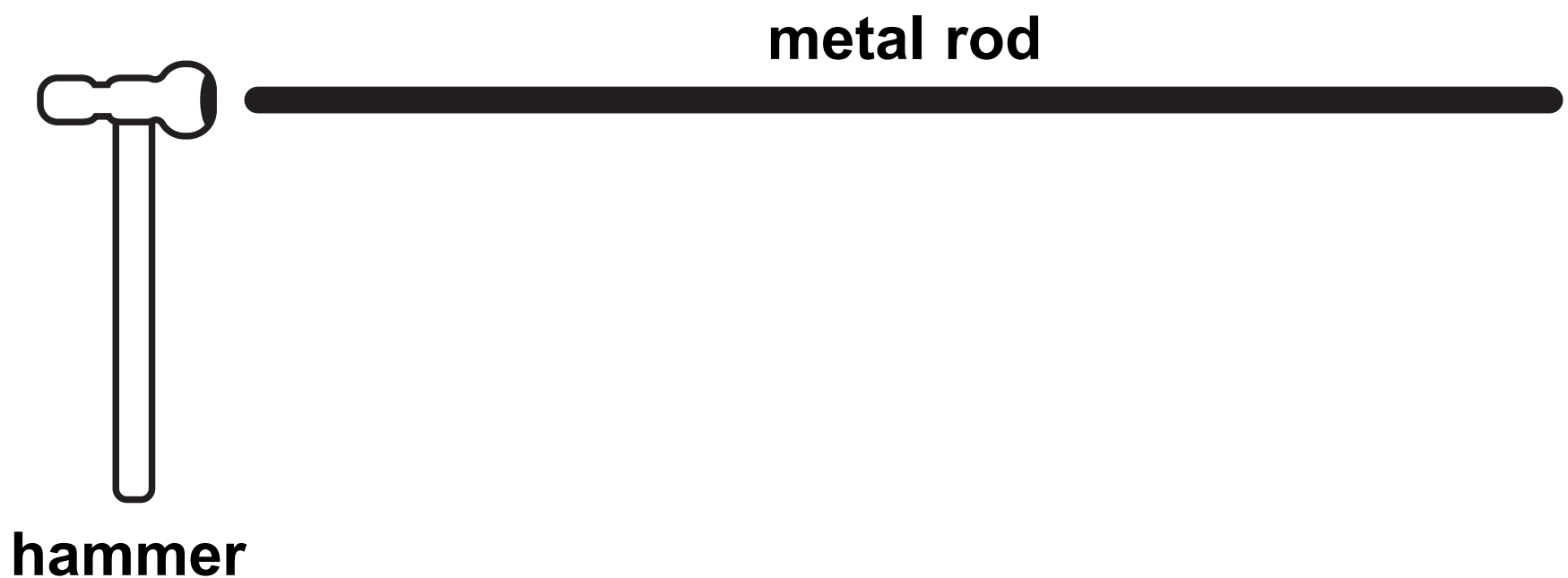


Figure 8

Describe how hitting the rod causes a sound wave to travel along the inside of the rod. (2 marks)

(c) Sound travels slower in air than it does in water.

Figure 9 shows the direction of travel of a sound wave approaching a boundary between air and water.

The sound wave refracts at the boundary between air and water.

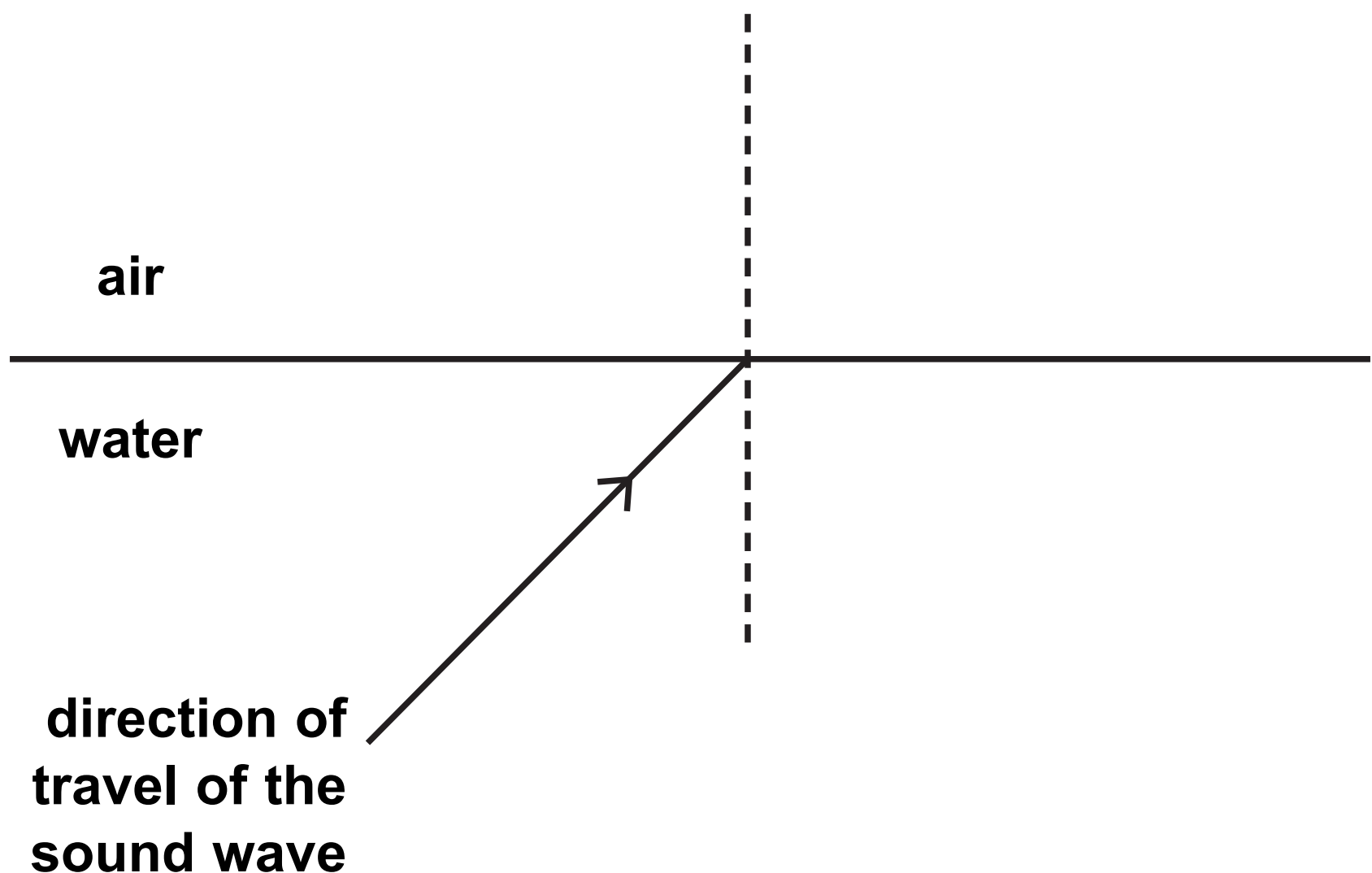


Figure 9

Complete the diagram in Figure 9 to show the direction the sound wave travels in the air.
(2 marks)

(Question continues on next page)

(Turn over)

- (d) Sound travels slower in cold air than it does in warm air.

The equation relating the speed of sound in air to the density of the air is

$$\text{speed of sound} = \frac{K}{\sqrt{(\text{density})}} \quad \text{where } K \text{ is a constant.}$$

The table in Figure 10 gives some data about the speed of sound in air and the density of air.

| | speed of sound in m/s | density of air in kg/m ³ |
|-------------|--------------------------|--|
| in cold air | 331 | 1.29 |
| in warm air | | 1.16 |

Figure 10

Use the equation and the data in the table in Figure 10 to calculate the speed of sound in warm air.

(Question continues on next page)

Give your answer to an appropriate number of significant figures. (3 marks)

speed of sound in warm air = _____ m/s

(TOTAL FOR QUESTION 6 = 9 MARKS)

(Questions continue on next page)

(Turn over)

7 (a) The force that keeps an object moving in a circular path is known as the (1 mark)

- ☐ **A balancing force**
- ☐ **B centripetal force**
- ☐ **C reaction force**
- ☐ **D resistance force**

(Question continues on next page)

- (b) Figure 11 shows an object moving in a circular path.

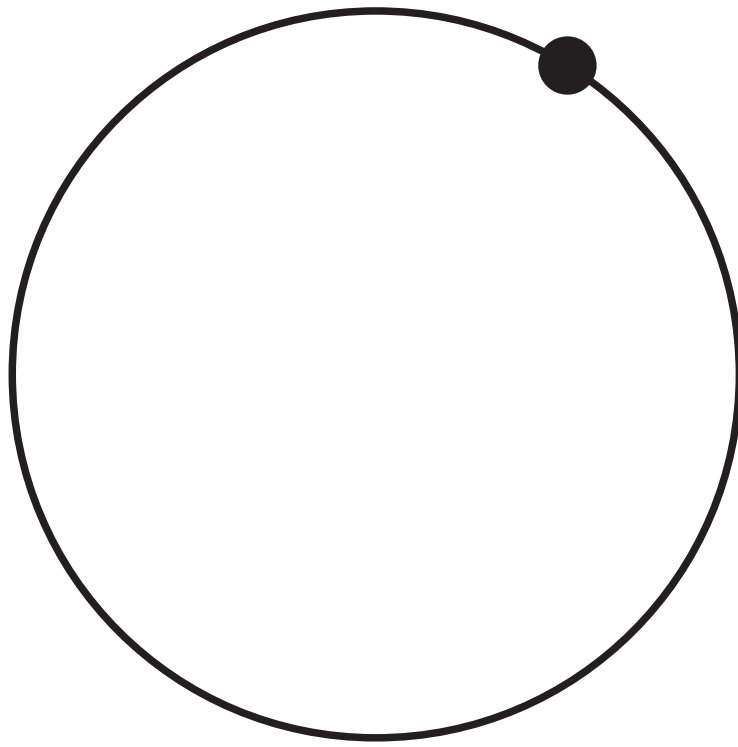


Figure 11

- (i) Draw an arrow on Figure 11 to show the direction of the force that keeps the object moving in a circular path. (1 mark)
- (ii) The object in Figure 11 is moving at constant speed.

Explain why it is not moving with constant velocity. (2 marks)

(Continue your answer on next page)

(Turn over)

(Question continues on next page)

(c) Figure 12 shows a skier on a slope.

The skier travels down the slope with a constant acceleration.

The speed of the skier is measured at points P and Q.

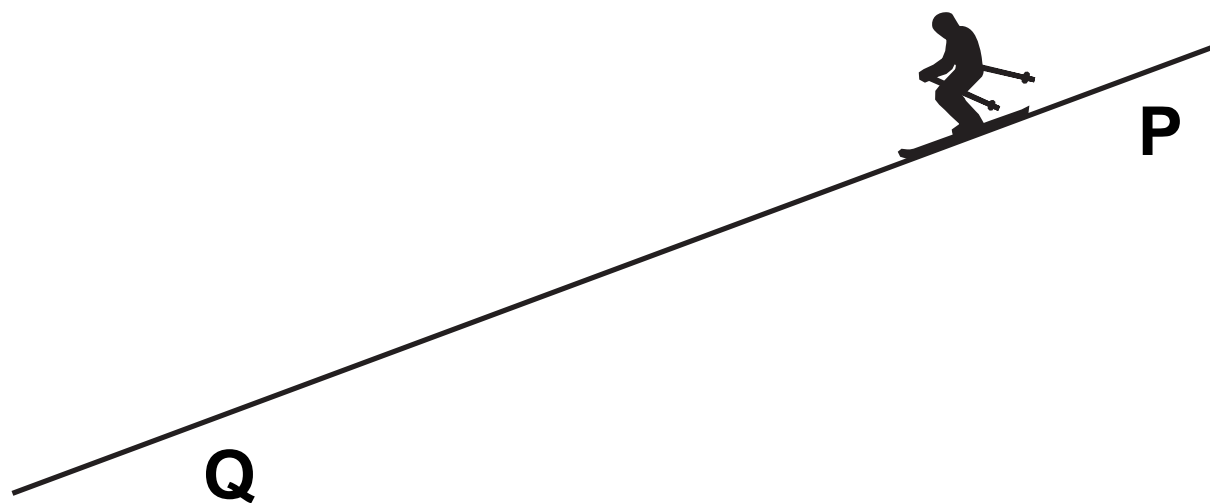


Figure 12

The table in Figure 13 gives some data about the skier making one downhill run.

| | |
|--------------|---------------------|
| acceleration | 3.0 m/s^2 |
| speed at P | 7.6 m/s |
| speed at Q | 24 m/s |

Figure 13

(Question continues on next page)

(Turn over)

- (i) Calculate the distance from P to Q.

Use an equation selected from the equations booklet. (3 marks)

distance from P to Q = _____ m

(Question continues on next page)

(Turn over)

- (ii) Calculate the time taken for the skier to travel from P to Q. (3 marks)

time from P to Q = _____ s

(TOTAL FOR QUESTION 7 = 10 MARKS)

(Questions continue on next page)

(Turn over)

8 (a) Energy from the nuclei of atoms can be used in medical diagnosis and treatment.

(i) Fluorine-18 is a radioactive isotope used in PET scanners for medical diagnosis.

**Explain why fluorine-18 must be produced close to the hospital where it is used.
(2 marks)**

(Question continues on next page)

- (ii) Some tumours inside the body can be treated by using either alpha radiation or gamma radiation.

**Explain why the source of alpha radiation is usually inside the body but the source of gamma radiation can be outside the body.
(4 marks)**

(Continue your answer on next page)

(Turn over)

(b) (i) In a controlled chain reaction of uranium-235, which of these could cause a uranium-235 nucleus to undergo fission? (1 mark)

☐ **A an alpha particle**

☐ **B a beta particle**

☐ **C a neutron**

☐ **D a proton**

(Question continues on next page)

(Turn over)

- (ii) The kinetic energy of one of the particles released in a fission reaction is $1.2 \times 10^{-11} \text{ J}$.

The mass of the particle is $1.4 \times 10^{-25} \text{ kg}$.

Calculate the velocity of the particle.
(3 marks)

velocity of the particle = _____ m/s

(TOTAL FOR QUESTION 8 = 10 MARKS)

(Questions continue on next page)

(Turn over)

9 (a) Some sunglasses have photochromic lenses.

Photochromic lenses are clear when the lenses are indoors but they darken in bright sunlight to reduce the effects of the sunlight.

Photochromic lenses react to ultraviolet light.

Suggest a benefit of making the lenses go dark with ultraviolet light. (1 mark)

(Question continues on next page)

(b) Radio waves from Jupiter take 40 minutes to reach Earth.

Light waves from the Sun take 8 minutes to reach Earth.

Calculate how many times further it is from Earth to Jupiter than from Earth to the Sun.

State the property of electromagnetic radiation that is used in your answer. (2 marks)

_____ times

property _____

(c) Ultraviolet waves cover a range of frequencies.

Scientists divide this range into three types, UVA, UVB and UVC.

The table in Figure 14 shows the frequency range for each type.

| type | frequency range in Hz |
|------|--|
| UVA | 7.5×10^{14} to 9.4×10^{14} |
| UVB | 9.4×10^{14} to 10×10^{14} |
| UVC | 10×10^{14} to 30×10^{14} |

Figure 14

Figure 15 is a diagram about the effect that the Earth's atmosphere has on three types of ultraviolet radiation.

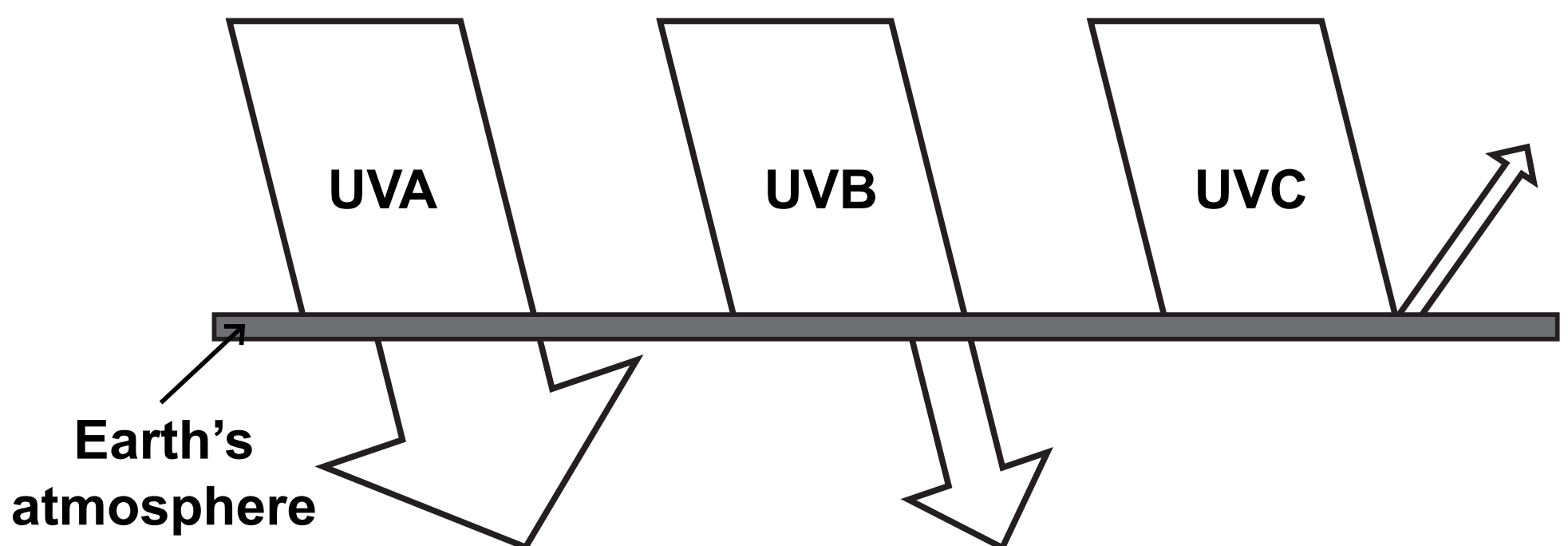


Figure 15

(Question continues on next page)

(Turn over)

Describe how the effects change with WAVELENGTH, using information from Figure 14 and Figure 15.

The width of the arrows drawn indicates the amount of radiation that is involved.

Calculations are NOT required. (4 marks)

(Continue your answer on next page)

(Turn over)

(Question continues on next page)

***(d) Radio waves and gamma radiation are at opposite ends of the electromagnetic spectrum.**

Compare how these two electromagnetic radiations are produced. (6 marks)

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(Continue your answer on next page)

(Turn over)

10 (a) Stars may originate as a nebula.

- (i) Describe the process that then occurs to produce the conditions necessary for nuclear fusion in a new star. (3 marks)**

(Question continues on next page)

(Turn over)

- (ii) The energy, E , released in nuclear fusion is equivalent to loss in mass, m , according to the equation.

$$E = mc^2$$

where c is the velocity of light.

$$c = 3.00 \times 10^8 \text{ m/s}$$

In 1 second, the energy radiated by the Sun is $3.86 \times 10^{26} \text{ J}$.

Calculate the loss in mass of the Sun in 1 second.
(2 marks)

loss in mass = _____ kg

(Question continues on next page)

(Turn over)

***(b) The Big Bang theory gives an explanation for the origin of the Universe.**

Explain how evidence supports the ideas that

- **the Universe is expanding**
- **the Universe began at a single point.**

(6 marks)

(Continue your answer on next page)

(Turn over)

(Question continues on next page)

(Turn over)

(c) A star has evolved to become a neutron star.

The mass, M , of the neutron star, of radius R , is given by

$$M = \frac{4 \times \pi \times D \times R^3}{3} \quad \text{where } D \text{ is a constant}$$

$$M = 4 \times 10^{30} \text{ kg}$$

$$D = 6 \times 10^{17} \text{ kg/m}^3$$

Use the equation to calculate the value for R . (2 marks)

$$R = \underline{\hspace{2cm}} \text{ m}$$

(TOTAL FOR QUESTION 10 = 13 MARKS)

TOTAL FOR PAPER = 100 MARKS

END