AQA GCSE Physics | 8463

SPECIFICATION POINT 4.5.6.1.4

The distance–time relationship

Past-paper questions

Tier	**Foundation**
Question groups	**20**
Available paper years	**2004–2024**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

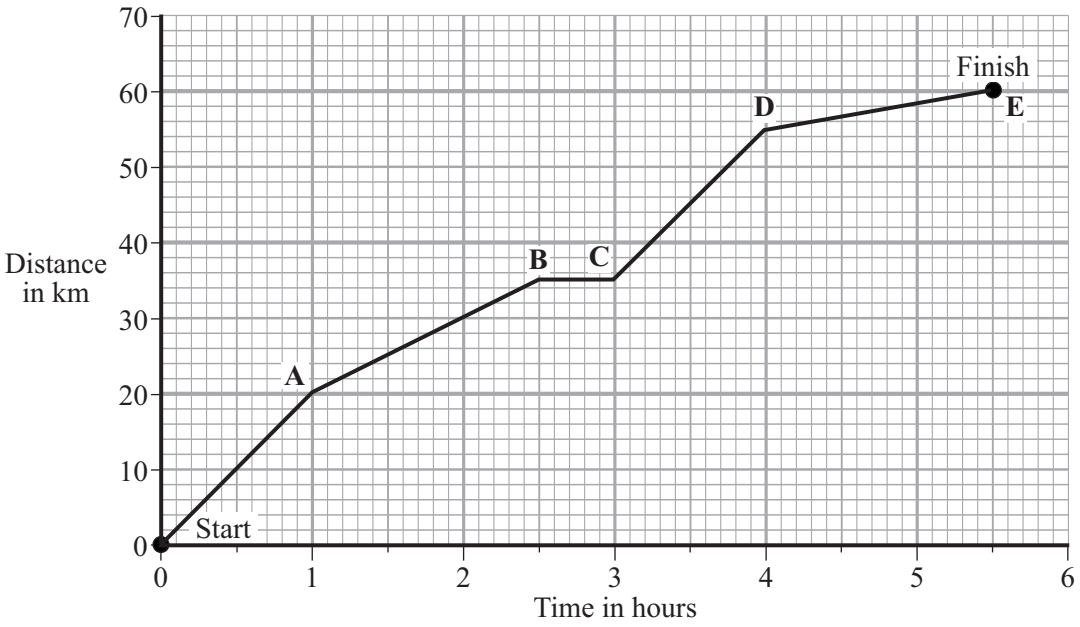
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.5.6.1.4 The distance–time relationship

Question 01

June 2004 | 3451F | Original Q8 | Legacy

8 A horse and rider take part in a long distance race. The graph shows how far the horse and rider travel during the race.



(a) What was the distance of the race?

distance =.....km

(1 mark)

(b) How long did it take the horse and rider to complete the race?

.....

(1 mark)

(c) What distance did the horse and rider travel in the first 2 hours of the race?

distance =.....km

(1 mark)

(d) How long did the horse and rider stop and rest during the race?

.....

(1 mark)

(e) Not counting the time it was resting, between which two points was the horse moving the slowest?

..... and .....

Give a reason for your answer.

.....

.....

(2 marks)

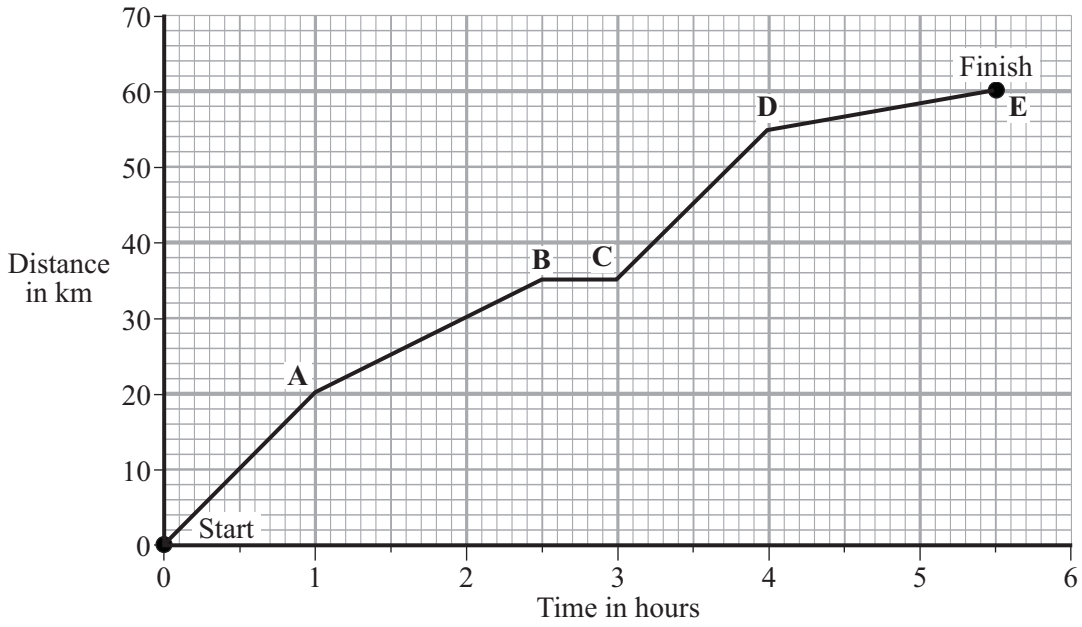
6

4.5.6.1.4 The distance–time relationship

Question 02

June 2004 | 3462F3 | Original Q6 | Legacy

6 A horse and rider take part in a long distance race. The graph shows how far the horse and rider travel during the race.



(a) What was the distance of the race?

distance =.....km

(1 mark)

(b) How long did it take the horse and rider to complete the race?

.....

(1 mark)

(c) What distance did the horse and rider travel in the first 2 hours of the race?

distance =.....km

(1 mark)

(d) How long did the horse and rider stop and rest during the race?

.....

(1 mark)

(e) Not counting the time it was resting, between which two points was the horse moving the slowest?

..... and .....

Give a reason for your answer.

.....

.....

(2 marks)

6

4.5.6.1.4 The distance–time relationship

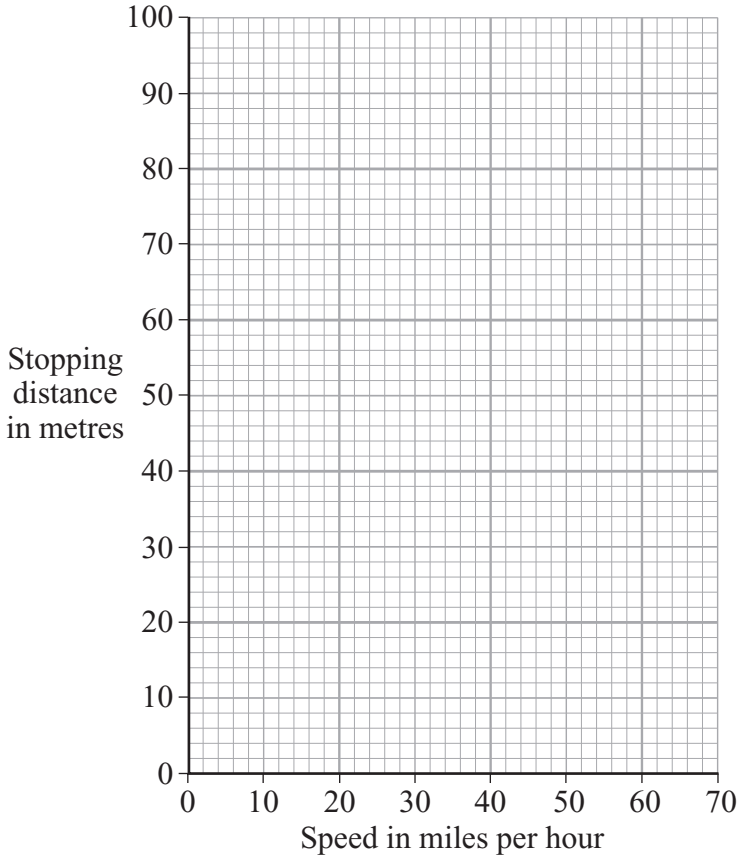
Question 03

June 2006 | 3451 | Original Q15 | Legacy

15 (a) The table shows how the stopping distance of a car, in metres (m), depends on the speed of the car, in miles per hour (mph).

Speed (mph)	20	30	40	50	60	70
Stopping distance (m)	12	23	36	53	73	96

(i) Draw a graph of stopping distance against speed.



(3 marks)

(ii) The speed limit outside a school is 20 mph.

Use the graph to estimate **how much further** a car will travel before it stops when driven at 25 mph instead of 20 mph.

Show clearly how you work out your answer.

.....

.....

(2 marks)

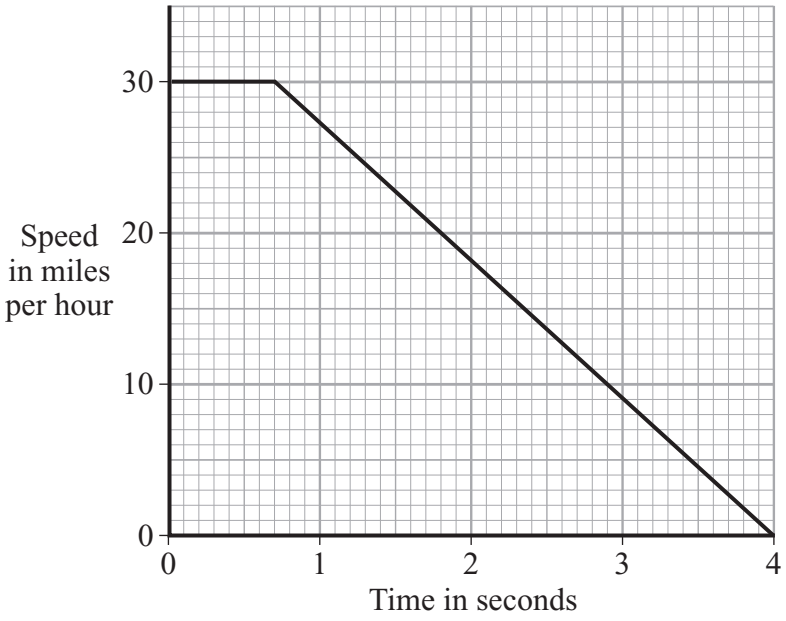
Question 15 continues on the next page

4.5.6.1.4 The distance–time relationship

Question 03 · continued

BLANK

(b) A child ran out in front of a car causing the driver to make an emergency stop. The graph shows how the speed of the car changed from the moment the driver saw the child.



(i) What was the driver's reaction time?

.....

(1 mark)

(ii) Describe the motion of the car during the first 0.5 seconds.

.....

(1 mark)

(iii) How long did it take the car to stop once the brakes were applied?

.....

(1 mark)

(iv) The drug cannabis makes the reactions of a person slower.

Explain how the stopping distance of the car would change if the driver had been smoking cannabis.

.....

.....

.....

.....

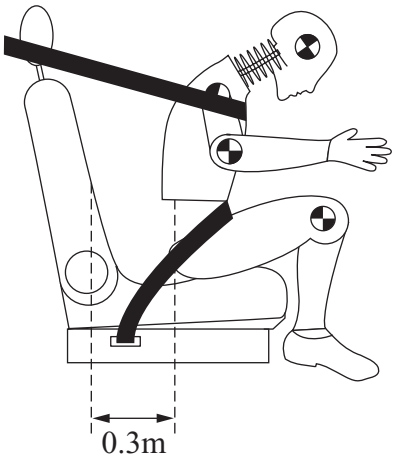
(2 marks)

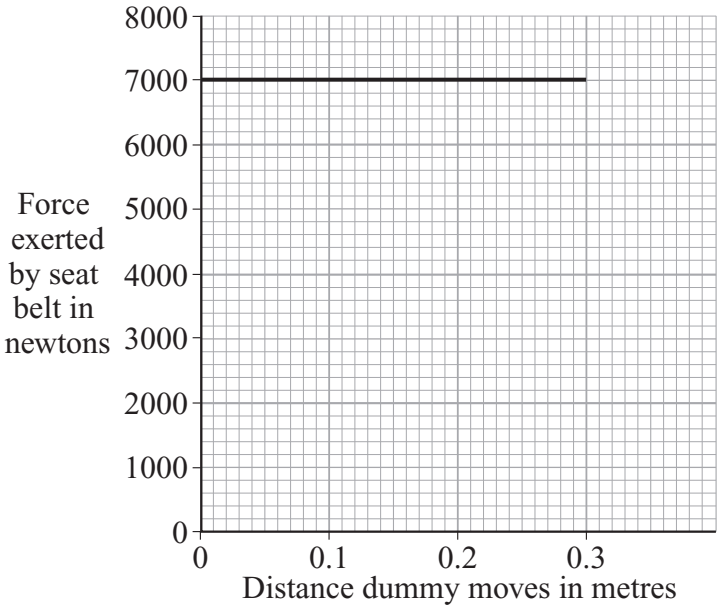
4.5.6.1.4 The distance–time relationship

Question 03 · continued

BLANK

(c) The diagram shows how far a dummy in a car crash test moves before it is stopped by the seat belt. The graph shows the force exerted by the seat belt on the dummy during the crash.





(i) Write down the equation that links distance moved, force applied and work done.

.....

(1 mark)

(ii) Calculate the work done to stop the dummy.

Show clearly how you work out your answer.

.....

.....

.....

Work done = ... joules

(2 marks)

(iii) How much energy is transferred from the dummy during the crash?

.....

(1 mark)

14

4.5.6.1.4 The distance–time relationship

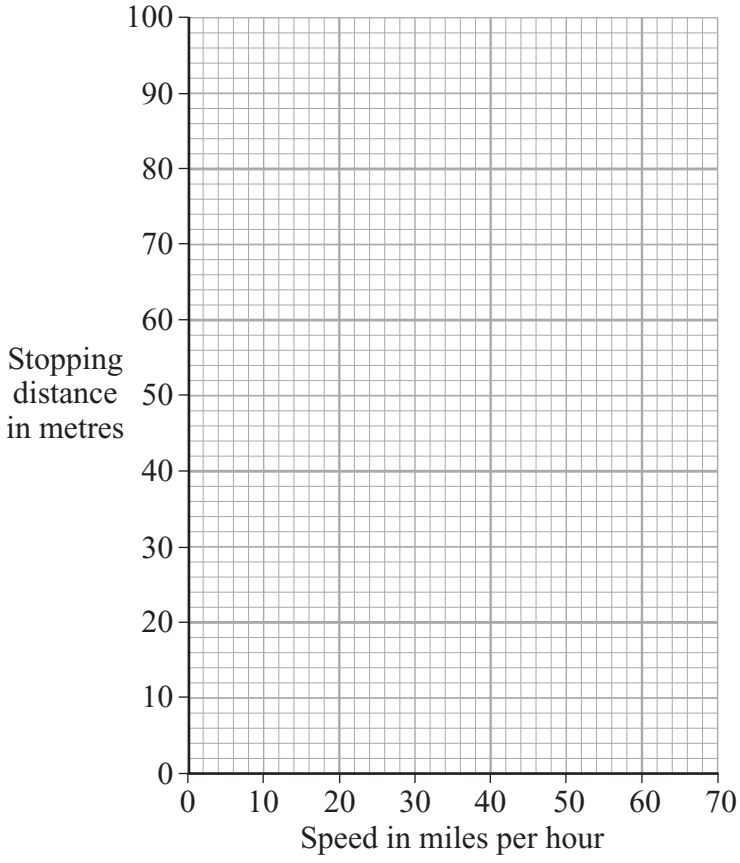
Question 04

June 2006 | 3462 | Original Q13 | Legacy

13 (a) The table shows how the stopping distance of a car, in metres (m), depends on the speed of the car, in miles per hour (mph).

Speed (mph)	20	30	40	50	60	70
Stopping distance (m)	12	23	36	53	73	96

(i) Draw a graph of stopping distance against speed.



(3 marks)

(ii) The speed limit outside a school is 20 mph.

Use the graph to estimate **how much further** a car will travel before it stops when driven at 25 mph instead of 20 mph.

Show clearly how you work out your answer.

.....

.....

(2 marks)

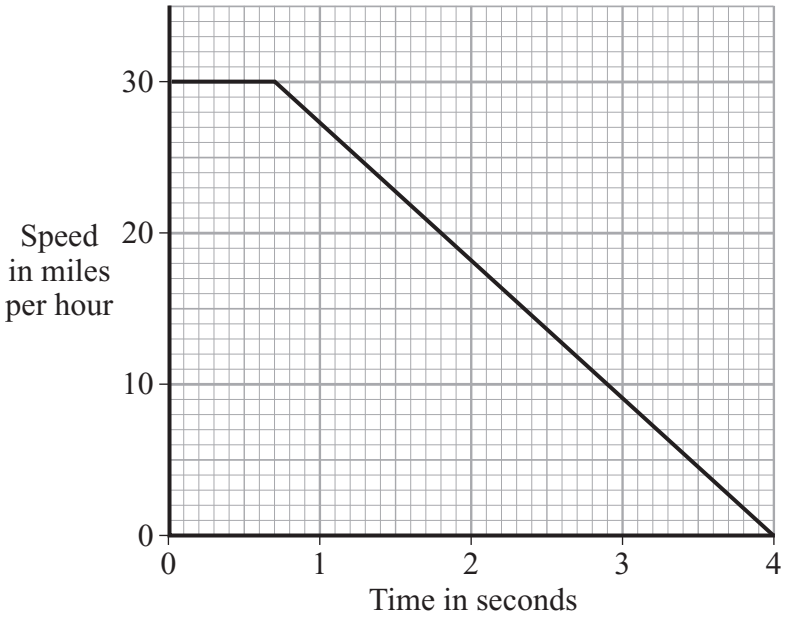
Question 13 continues on the next page

4.5.6.1.4 The distance–time relationship

Question 04 · continued

BLANK

(b) A child ran out in front of a car causing the driver to make an emergency stop. The graph shows how the speed of the car changed from the moment the driver saw the child.



(i) What was the driver's reaction time?

.....

(1 mark)

(ii) Describe the motion of the car during the first 0.5 seconds.

.....

(1 mark)

(iii) How long did it take the car to stop once the brakes were applied?

.....

(1 mark)

(iv) The drug cannabis makes the reactions of a person slower.

Explain how the stopping distance of the car would change if the driver had been smoking cannabis.

.....

.....

.....

.....

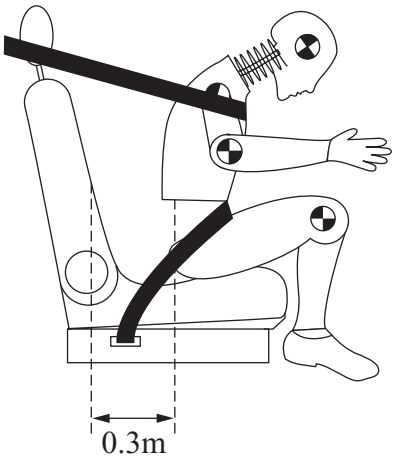
(2 marks)

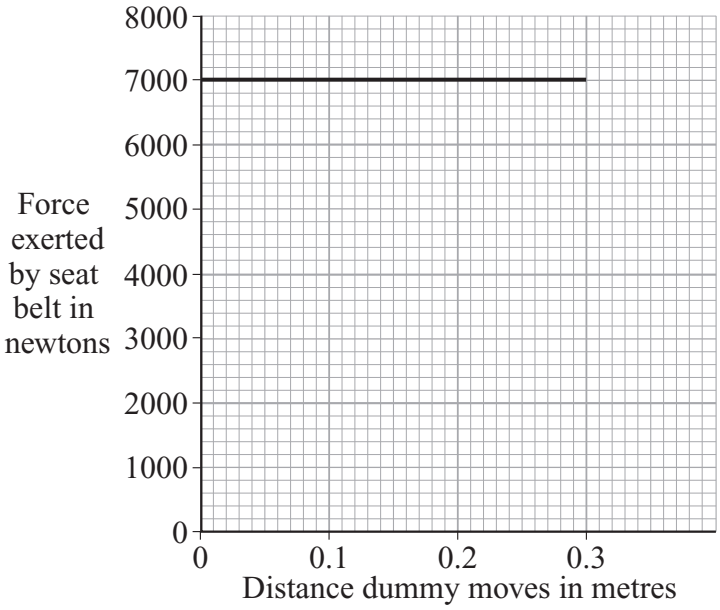
4.5.6.1.4 The distance–time relationship

Question 04 · continued

BLANK

(c) The diagram shows how far a dummy in a car crash test moves before it is stopped by the seat belt. The graph shows the force exerted by the seat belt on the dummy during the crash.





(i) Write down the equation that links distance moved, force applied and work done.

.....

(1 mark)

(ii) Calculate the work done to stop the dummy.

Show clearly how you work out your answer.

.....

.....

.....

Work done = ... joules

(2 marks)

(iii) How much energy is transferred from the dummy during the crash?

.....

(1 mark)

14

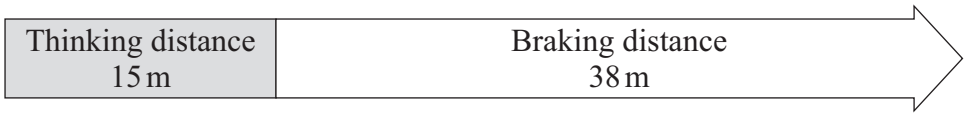
4.5.6.1.4 The distance–time relationship

Question 05

June 2008 | PHY2F | Original Q1 | Legacy

1 (a) A car driver makes an emergency stop.

The chart shows the 'thinking distance' and the 'braking distance' needed to stop the car.



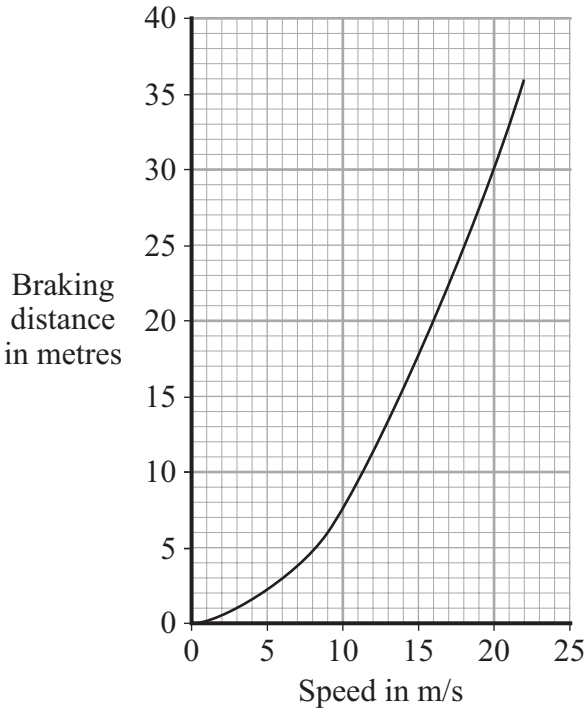
Calculate the total stopping distance of the car.

.....

Stopping distance = ... m

(1 mark)

1 (b) The graph shows how the braking distance of a car driven on a dry road changes with the car's speed.



The braking distance of the car on an icy road is longer than the braking distance of the car on a dry road.

1 (b) (i) Draw a new line on the graph to show how the braking distance of the car on an icy road changes with speed.

(2 marks)

Question 1 continues on the next page

4.5.6.1.4 The distance–time relationship

Question 05 · continued

for mark

1 (b) (ii) Which **two** of the following would also increase the braking distance of the car?

Put a tick (✓) in the box next to each of your answers.

rain on the road ☐

the driver having drunk alcohol ☐

car brakes in bad condition ☐

the driver having taken drugs ☐

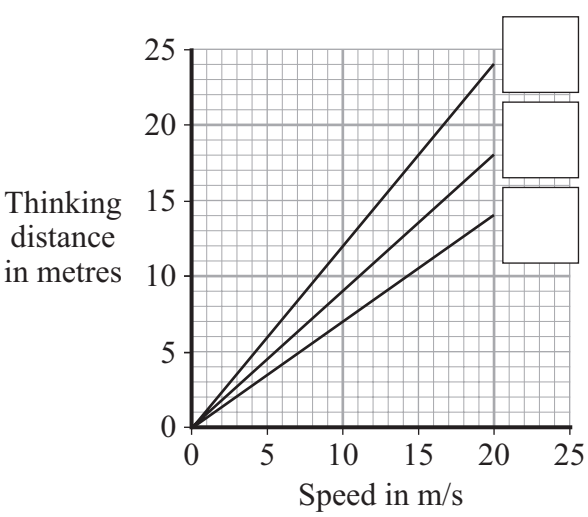
(2 marks)

1 (c) The thinking distance depends on the driver's reaction time.

The table shows the reaction times of three people driving under different conditions.

Car driver	Condition	Reaction time in seconds
A	Wide awake with no distractions	0.7
B	Using a hands-free mobile phone	0.9
C	Very tired and listening to music	1.2

The graph lines show how the thinking distance for the three drivers, **A**, **B** and **C**, depends on how fast they are driving the car.



1 (c) (i) Match each graph line to the correct driver by writing **A**, **B** or **C** in the box next to the correct line.

(2 marks)

4.5.6.1.4 The distance–time relationship

Question 05 · continued

for mark

1 (c) (ii) The information in the table cannot be used to tell if driver **C**'s reaction time is increased by being tired **or** by listening to music.

Explain why.

.....

.....

.....

.....

(2 marks)

9

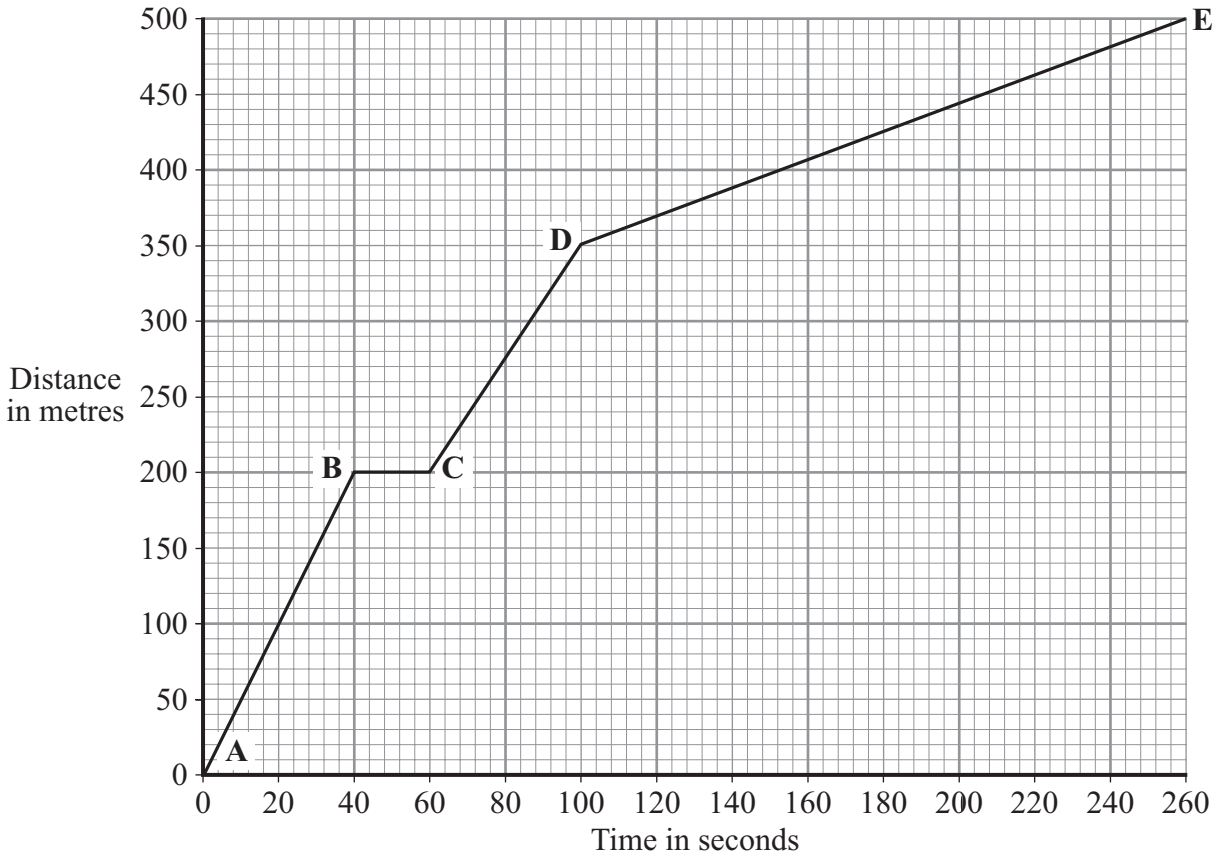
Turn over for the next question

4.5.6.1.4 The distance–time relationship

Question 06

June 2009 | PHY2F | Original Q3 | Legacy

3 Part of a bus route is along a high street.
The distance–time graph shows how far the bus travelled along the high street and how long it took.



3 (a) The bus travels the **slowest** between points **D** and **E**.

How can you tell this from the graph?

.....

.....

(1 mark)

3 (b) Between which two points was the bus travelling the **fastest**?

Put a tick (✓) in the box next to your answer.

Points	
A–B	
B–C	
C–D	

(1 mark)

4.5.6.1.4 The distance–time relationship

Question 06 · continued

for mark

3 (c) There is a bus stop in the high street.
This is marked as point **B** on the graph.

3 (c) (i) What is the distance between point **A** on the graph and the bus stop?

Distance ..... metres
(1 mark)

3 (c) (ii) How long did the bus stop at the bus stop?
Show clearly how you work out your answer.

.....

Time = ... seconds
(2 marks)

3 (d) A cyclist made the same journey along the high street.
The cyclist started at the same time as the bus and completed the journey in 200 seconds. The cyclist travelled the whole distance at a constant speed.

3 (d) (i) Draw a line on the graph to show the cyclist's journey. *(2 marks)*

3 (d) (ii) After how many seconds did the cyclist overtake the bus?

The cyclist overtook the bus after ..... seconds.
(1 mark)

8

4.5.6.1.4 The distance–time relationship

Question 07

6 A cyclist travelling along a straight level road accelerates at 1.2 m/s^2 for 5 seconds. The mass of the cyclist and the bicycle is 80 kg.

6 (a) Use the equation in the box to calculate the resultant force needed to produce this acceleration.

resultant force = mass × acceleration

Show clearly how you work out your answer and give the unit.

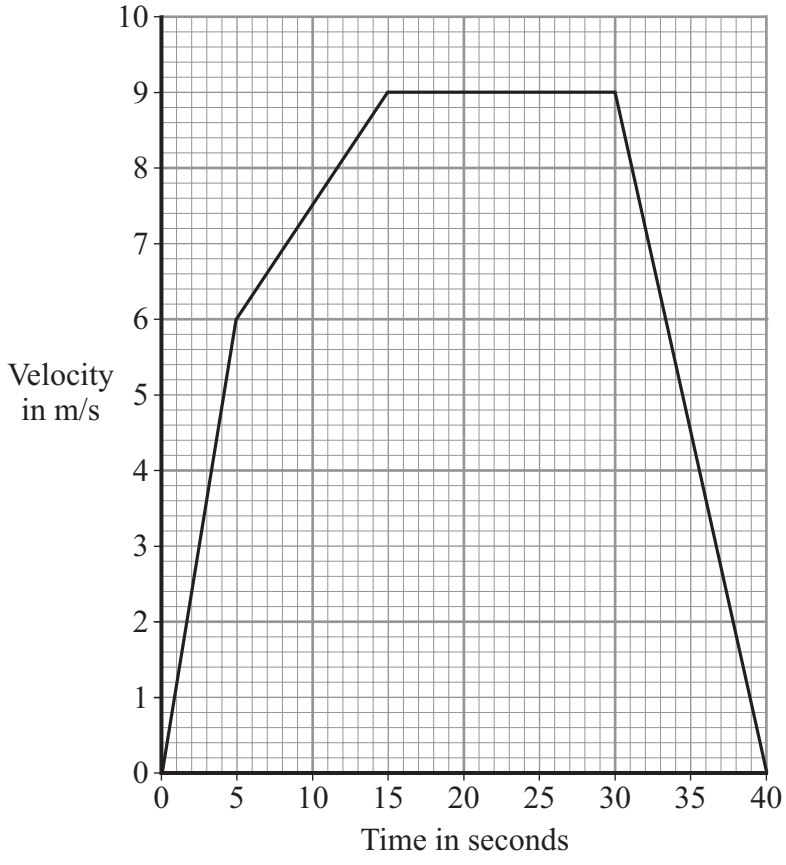
.....

.....

Resultant force = ...

(3 marks)

6 (b) The graph shows how the velocity of the cyclist changes with time.



4.5.6.1.4 The distance–time relationship

Question 07 · continued

for mark

6 (b) (i) Complete the following sentence.

The velocity includes both the speed and the ..... of the cyclist.

(1 mark)

6 (b) (ii) Why has the data for the cyclist been shown as a line graph instead of a bar chart?

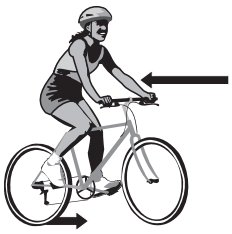
.....

.....

(1 mark)

6 (b) (iii) The diagrams show the horizontal forces acting on the cyclist at three different speeds. The length of an arrow represents the size of the force.

A



B



C



Which **one** of the diagrams, **A**, **B** or **C**, represents the forces acting when the cyclist is travelling at a constant 9 m/s?

.....

Explain the reason for your choice.

.....

.....

.....

.....

.....

.....

(3 marks)

8

4.5.6.1.4 The distance–time relationship

Question 08

June 2010 | PHY3F | Original Q7 | Legacy

7 (a) Read this passage from a health leaflet.

> Most children can hear the full range of sounds which can be detected by the human ear. But as people get older, they cannot hear the higher frequencies.

7 (a) (i) Complete this statement.

Most children can detect sounds in the frequency range

..... Hz to ..... Hz.

(1 mark)

7 (a) (ii) What word is used to describe sound with a frequency so high that it cannot be heard by humans?

.....

(1 mark)

7 (b) Read this cutting from a newspaper.

> A shopkeeper has fitted a special loudspeaker outside his store.
> "We used to have gangs of young people out there," he said, "but now, when I switch on the special loudspeaker, they hate the sound and go away."
> Older people are not bothered by the sound because the frequency is too high for them to hear it.

Some people support the use of the special loudspeaker but other people do not.

Give **one** reason against its use.

.....

.....

(1 mark)

7 (c) Machines are often very noisy. They transfer energy, and some of the energy is transformed into sound.

What is the cause of the sound?

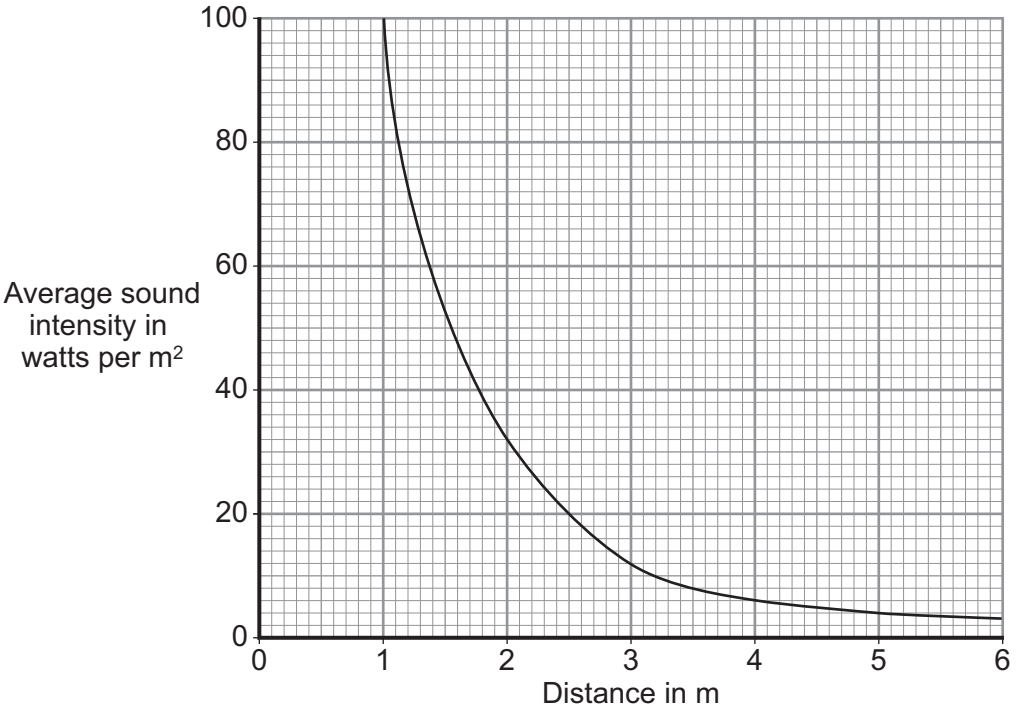
.....

(1 mark)

4.5.6.1.4 The distance–time relationship

Question 08 · continued June 2010 | PHY3F | Original Q7 | Legacy

7 (d) Sound from a machine may damage the hearing of people who work close by. A safety officer measures the sound intensity at different distances from a noisy machine. The average results are shown on the graph.



7 (d) (i) Describe the pattern shown by the graph.

Use one or more examples from the graph to support your description.

.....

.....

.....

.....

(2 marks)

7 (d) (ii) Average results were plotted.

Explain why taking results several times and then calculating average values is more reliable than taking only a single result.

.....

.....

.....

.....

(2 marks)

8

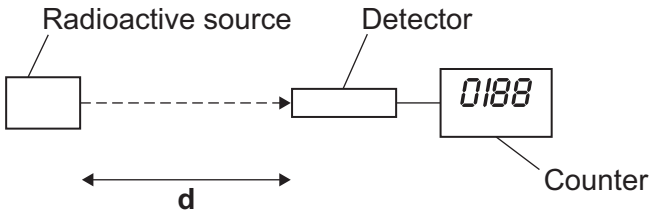
4.5.6.1.4 The distance–time relationship

Question 09

November 2010 | PHY1BP | Original Q6 | Legacy

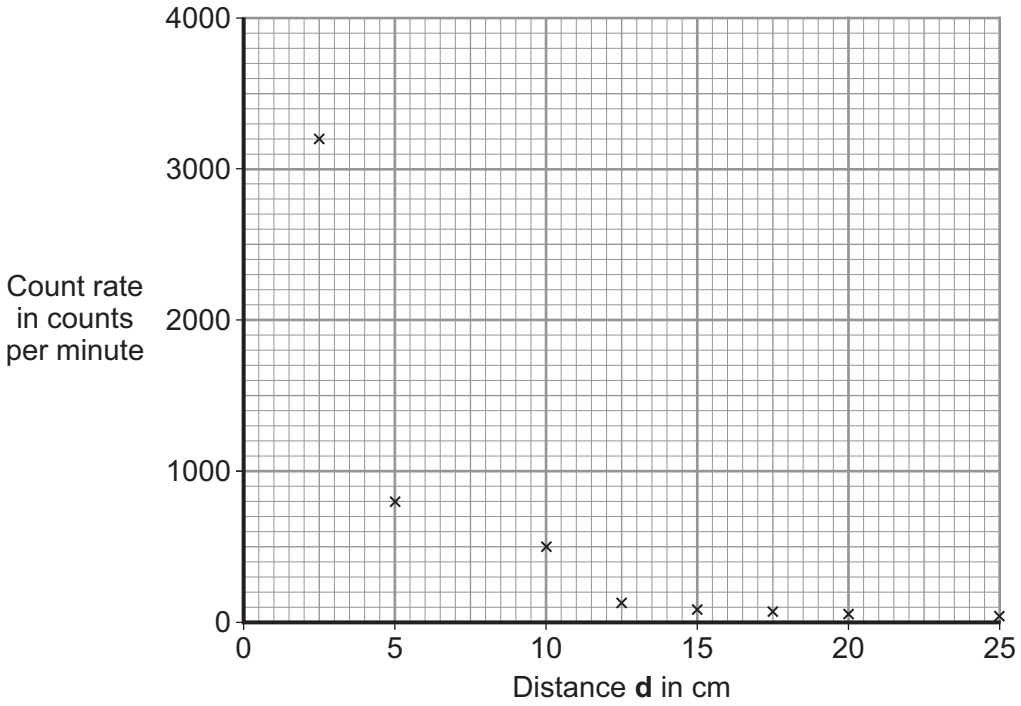
QUESTION SIX

A radioactive source gives out gamma radiation. A student wanted to know how the count rate from the source changes as the distance from the source increases. The following apparatus was set up.



The count rate was measured for a number of different distances, **d**.

The student plotted the results on graph paper.



4.5.6.1.4 The distance–time relationship

Question 09 · continued November 2010 | PHY1BP | Original Q6 | Legacy

6A A line graph should be drawn because . . .

1 both variables are categoric.

2 both variables are continuous.

3 both variables are ordered.

4 one variable is categoric and the other variable is continuous.

6B The range of distance measurements is . . .

1 2.5 – 5.0 cm

2 2.5 – 10.0 cm

3 2.5 – 20.0 cm

4 2.5 – 25.0 cm

6C Each reading was repeated twice and the mean calculated.

This made the data more . . .

1 accurate.

2 discrete.

3 reliable.

4 sensitive.

6D The result shown at 10 cm is anomalous and . . .

1 the graph line should be drawn to pass through this result.

2 was caused by a systematic error in the ruler.

3 was caused by a systematic error in the counter.

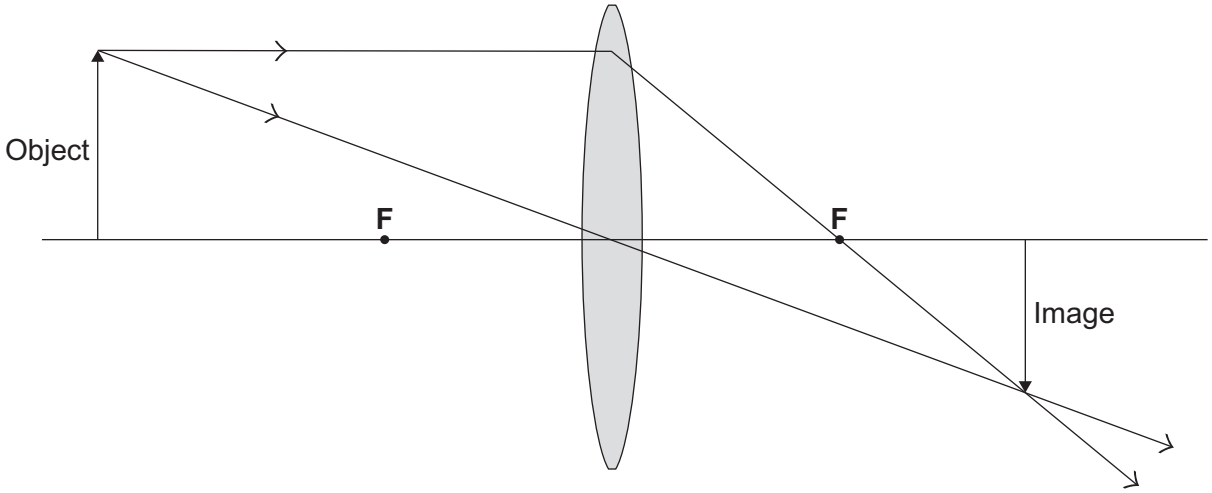
4 should be ignored when drawing the graph line.

4.5.6.1.4 The distance–time relationship

Question 10

January 2011 | PHY3F | Original Q7 | Legacy

7 The diagram shows a lens, the position of an object and the position of the image of the object.



7 (a) What type of lens is shown?

.....

(1 mark)

7 (b) What is the name of the points, **F**, shown each side of the lens?

.....

(1 mark)

7 (c) (i) The image is real and can be put on a screen.

How can you tell **from the diagram** that the image is real?

.....

.....

(1 mark)

7 (c) (ii) Draw a ring around a word in the box which describes the image produced by the lens.

inverted	**larger**	**upright**

(1 mark)

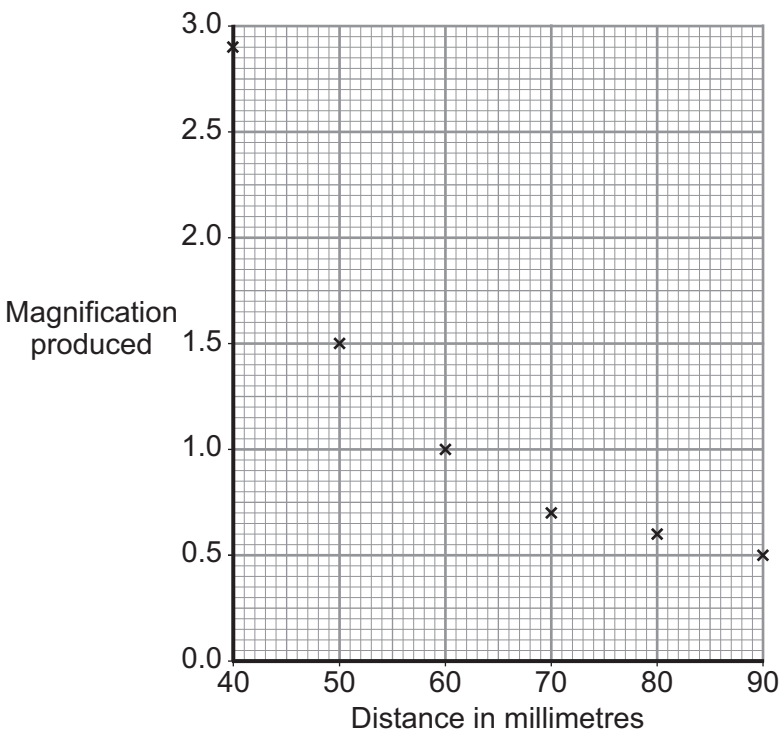
4.5.6.1.4 The distance–time relationship

Question 10 · continued

7 (d) A student investigates the relationship between the distance from the object to the lens and the magnification produced by the lens.
The student's results are given in the table.
The student did not repeat any measurements.

Distance in millimetres	Height of object in millimetres	Height of image in millimetres	Magnification produced
40	20	58	2.9
50	20	30	1.5
60	20	20	1.0
70	20	14	0.7
80	20	12	0.6
90	20	10	0.5

The student plots the points for a graph of *magnification produced* against *distance*.



7 (d) (i) Draw a *line of best fit* for these points.

(1 mark)

4.5.6.1.4 The distance–time relationship

Question 10 · continued

7 (d) (ii) Complete the following sentence by drawing a ring around the correct word in the box.

A line graph has been drawn because both variables are

described as being

categoric.
continuous.
discrete.

(1 mark)

7 (d) (iii) Describe the relationship between *magnification produced* and *distance*.

.....

.....

.....

(2 marks)

8

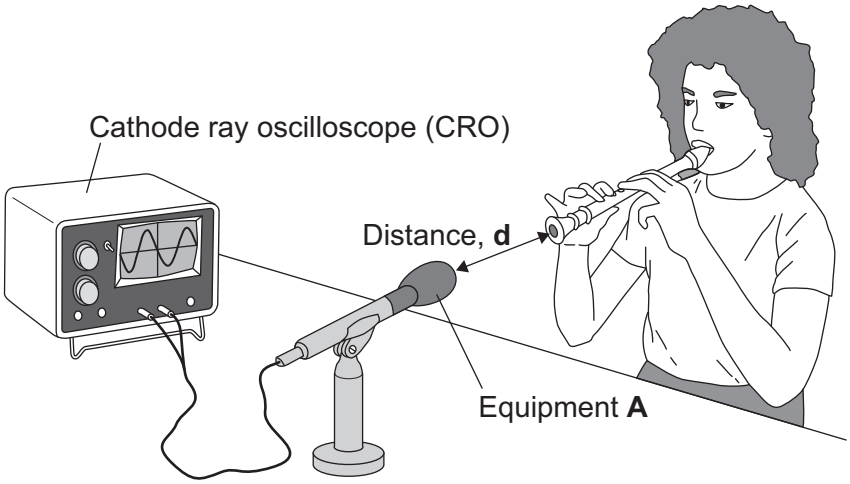
4.5.6.1.4 The distance–time relationship

Question 11

June 2011 | PHY3F | Original Q7 | Legacy

7 A group of students investigates sound waves.

The diagram shows part of their investigation.



7 (a) Identify the equipment labelled **A**.

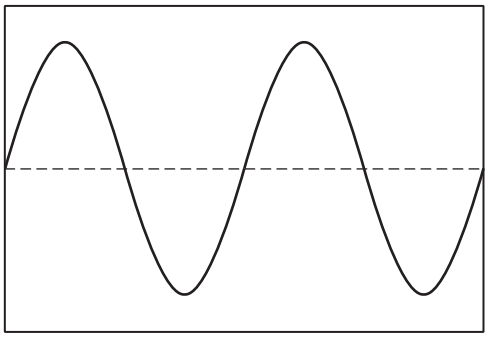
.....

(1 mark)

7 (b) The student plays the same note in the same way at different distances from equipment **A**.

Another student records the amplitude of the wave shown on the cathode ray oscilloscope (CRO).

7 (b) (i) Label this wave to show its amplitude.



(1 mark)

7 (b) (ii) Complete the sentence.

Increasing the amplitude of a sound wave will increase the .....

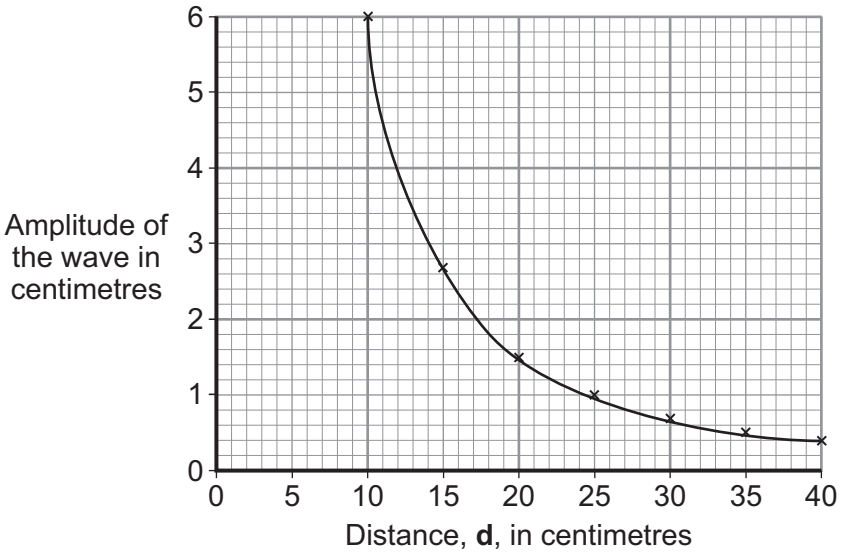
of the sound.

(1 mark)

4.5.6.1.4 The distance–time relationship

Question 11 · continued June 2011 | PHY3F | Original Q7 | Legacy

7 (c) The graph shows the students' average results from several sets of measurements.



Use the graph to find the distance, **d**, in centimetres, at which the average amplitude is likely to be 2 centimetres.

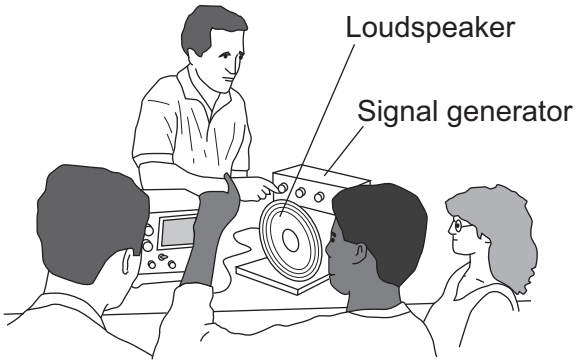
Distance = ... cm.
(1 mark)

7 (d) Write a conclusion for this investigation.

.....

.....
(1 mark)

7 (e) A physics teacher uses a signal generator and a loudspeaker to demonstrate the range of hearing of a group of students.



What is the range of frequencies most humans can hear?

Most humans can hear from ..... Hz to ..... Hz.
(2 marks)

7

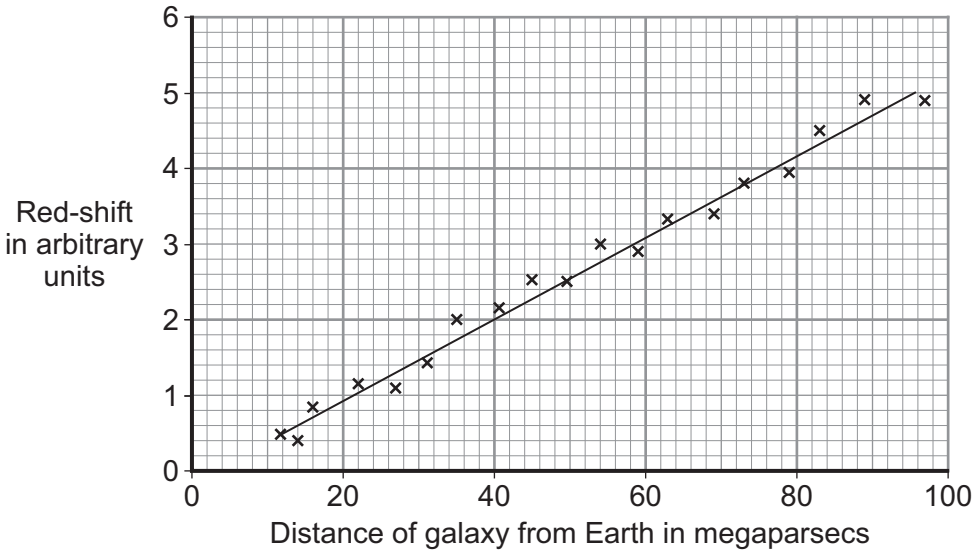
4.5.6.1.4 The distance–time relationship

Question 12

November 2011 | PHY1BP | Original Q7 | Legacy

QUESTION SEVEN

The graph shows the red-shift for a number of galaxies.



A megaparsec is a unit of distance used by astronomers.

7A The graph shows that . . .

1 the further away from Earth a galaxy is, the smaller the red-shift.

2 the further away from Earth a galaxy is, the bigger the red-shift.

3 the amount of red-shift is the same however far from Earth the galaxy is.

4 there is no relationship between red-shift and the distance from Earth.

7B A scientist is concerned that not all the points on the graph lie on the straight line.

How can the scientist check that the results are reliable?

1 ignore the results that do not fit on the line

2 use more precise measuring instruments

3 make the observations from space telescopes

4 compare the data with that obtained by other scientists

4.5.6.1.4 The distance–time relationship

Question 12 · continued November 2011 | PHY1BP | Original Q7 | Legacy

7C A galaxy produces a red-shift of 2 units.

How far from Earth is it?

1 20 megaparsecs

2 40 megaparsecs

3 60 megaparsecs

4 80 megaparsecs

7D Data is obtained for another distant galaxy that shows red-shift. This data does not fit the pattern of the other galaxies.

Data such as this that does not fit the pattern is called . . .

1 accurate.

2 anomalous.

3 precise.

4 sensitive.

4.5.6.1.4 The distance–time relationship

Question 13

7 (a) Scientists have observed that the wavelengths of the light from galaxies moving away from the Earth are longer than expected.

7 (a) (i) What name is given to this observation?

.....

(1 mark)

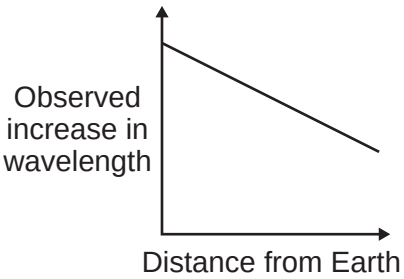
7 (a) (ii) Draw a ring around the correct answer in the box to complete the sentence.

This observation gives scientists evidence that

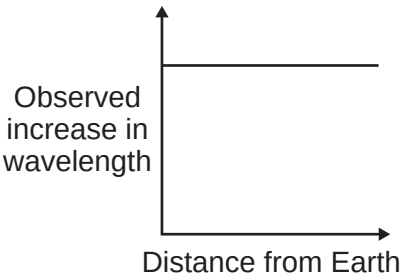
light can be stretched.
galaxies are changing colour.
the Universe is expanding.

(1 mark)

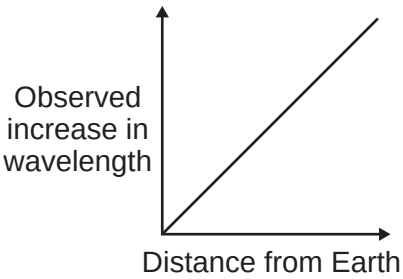
7 (a) (iii) There is a pattern linking the size of the observed increase in the wavelengths of light from a galaxy and the distance the galaxy is from the Earth.



L



M



N

Which **one** of the graphs, **L**, **M** or **N**, shows the correct pattern?

Write the correct answer in the box.

(1 mark)

4.5.6.1.4 The distance–time relationship

Question 13 · continued

7 (b) Observations help scientists answer questions about the Universe.

Scientists **cannot** answer every question.

Which **one** of the following questions **cannot** be answered by scientists?

Tick (✓) **one** box.

How old is the Universe? ☐

Why was the Universe created? ☐

How fast does light travel through the Universe? ☐

(1 mark)

4

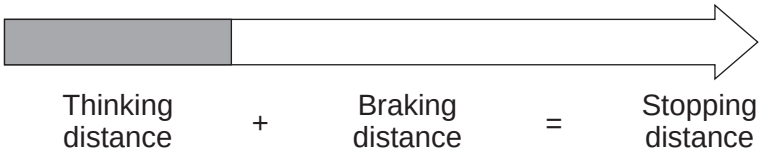
Turn over for the next question

4.5.6.1.4 The distance–time relationship

Question 14

June 2013 | PH2FP | Original Q6 | Legacy

6 The diagram shows how the thinking distance and braking distance of a car add together to give the stopping distance of the car.



6 (a) Use words from the box to complete the sentence.

distance	**energy**	**force**	**time**

The stopping distance is found by adding the distance the car travels during the driver's reaction ..... and the distance the car travels under the braking ..... . *(2 marks)*

6 (b) Which **one** of the following would **not** increase the thinking distance?

Tick (✓) **one** box.

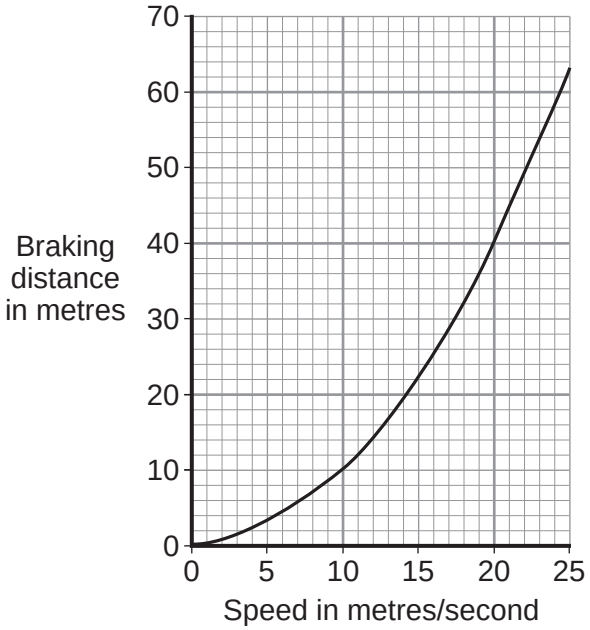
The car driver being tired. ☐

The car tyres being badly worn. ☐

The car being driven faster. ☐

(1 mark)

6 (c) The graph shows how the braking distance of a car changes with the speed of the car. The force applied to the car brakes does not change.



4.5.6.1.4 The distance–time relationship

Question 14 · continued June 2013 | PH2FP | Original Q6 | Legacy

6 (c) (i) What conclusion about braking distance can be made from the graph?

.....

.....

.....

.....

(2 marks)

6 (c) (ii) The graph is for a car driven on a dry road.

Draw a line on the graph to show what is likely to happen to the braking distance at different speeds if the same car was driven on an icy road.

(1 mark)

6 (d) A local council has reduced the speed limit from 30 miles per hour to 20 miles per hour on a few roads. The reason for reducing the speed limit was to reduce the number of accidents.

6 (d) (i) A local newspaper reported that a councillor said:

"It will be much safer because drivers can react much faster when driving at 20 miles per hour than when driving at 30 miles per hour."

This statement is wrong. Why?

.....

.....

(1 mark)

6 (d) (ii) The local council must decide whether to introduce the lower speed limit on a lot more roads.

What evidence should the local council collect to help make this decision?

.....

.....

.....

.....

(2 marks)

9

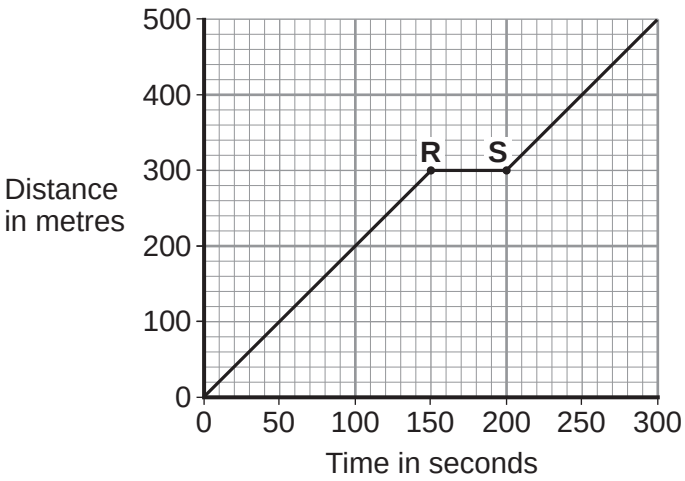
4.5.6.1.4 The distance–time relationship

Question 15

June 2014 | PH2FP | Original Q2 | Legacy

2 (a) **Figure 3** shows the distance–time graph for a person walking to a bus stop.

Figure 3



2 (a) (i) Which **one** of the following statements describes the motion of the person between points **R** and **S** on the graph?

Tick (✓) **one** box.

[1 mark]

Not moving ☐

Moving at constant speed ☐

Moving with increasing speed ☐

4.5.6.1.4 The distance–time relationship

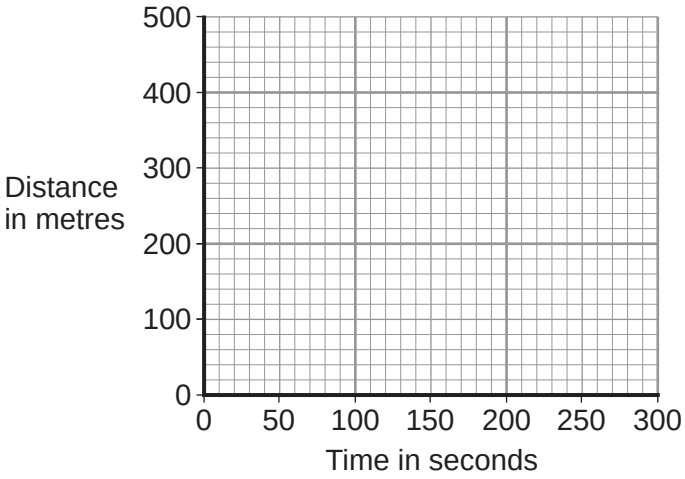
Question 15 · continued

2 (a) (ii) Another person, walking at constant speed, travels the same distance to the bus stop in 200 seconds.

Complete **Figure 4** to show a distance–time graph for this person.

[1 mark]

Figure 4



2 (b) A bus accelerates away from the bus stop at 2.5 m/s^2.

The total mass of the bus and passengers is 14 000 kg.

Calculate the resultant force needed to accelerate the bus and passengers.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

.....

.....

.....

Resultant force = ... N

4

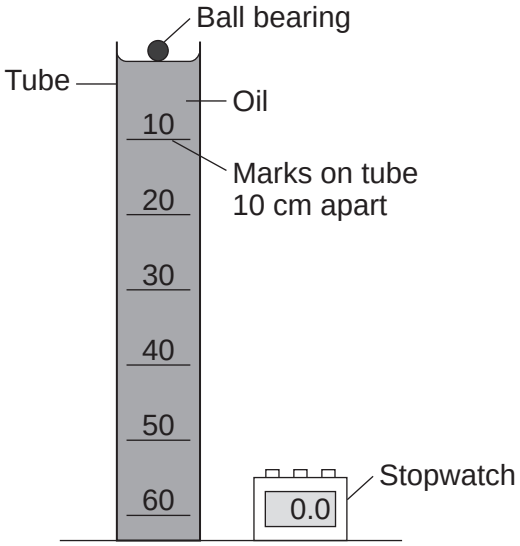
4.5.6.1.4 The distance–time relationship

Question 16

June 2016 | PH2FP | Original Q8 | Legacy

8 A student investigated how the speed of a ball bearing changes as the ball bearing falls through a tube of oil.
Figure 12 shows the equipment the student used.

Figure 12



The student measured the time taken for the ball bearing to fall different distances.
Each distance was measured from the top of the oil.

8 (a) What is likely to have been the main source of error in this investigation?

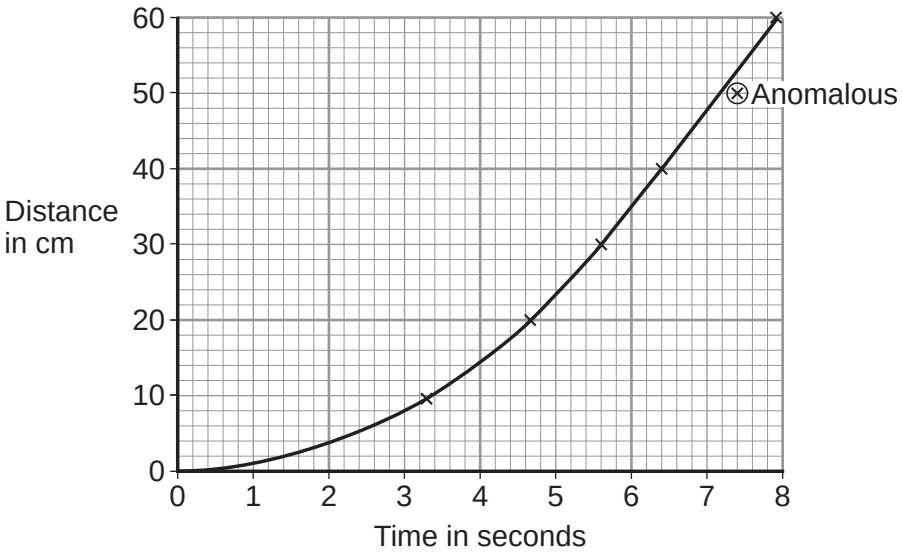
[1 mark]

4.5.6.1.4 The distance–time relationship

Question 16 · continued

8 (b) **Figure 13** shows the student's results plotted as a graph.

Figure 13



8 (b) (i) The student has identified one of the results as being anomalous.

Use the correct answer from the box to complete the sentence.

[1 mark]

after	as	before

The anomalous result was caused by the stopwatch being started _____ the ball bearing was released.

8 (b) (ii) What can you conclude from the graph about the speed of the ball bearing during the first four seconds?

[1 mark]

_____

_____

8 (b) (iii) The graph shows that the ball bearing reached its terminal velocity.

Describe how the graph would be used to calculate the terminal velocity of the ball bearing.

[1 mark]

_____

_____

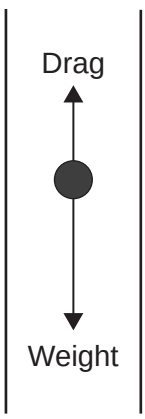
Question 8 continues on the next page

4.5.6.1.4 The distance–time relationship

Question 16 · continued

8 (b) (iv) The directions of the two forces acting on the ball bearing as it falls through the oil are shown in **Figure 14**.

Figure 14



Explain, in terms of the forces shown in **Figure 14**, why the ball bearing reaches its terminal velocity.

[2 marks]

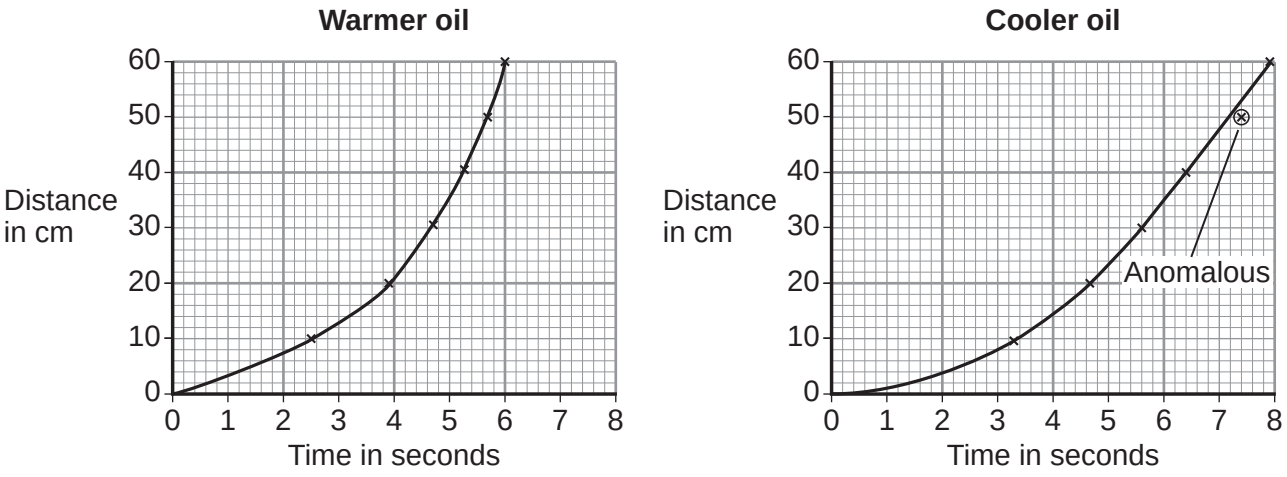
4.5.6.1.4 The distance–time relationship

Question 16 · continued

8 (c) The student repeated the investigation using warmer oil.

Figure 15 shows the set of results using the warmer oil **and** the set of results using the cooler oil.

Figure 15



Compare the two graphs in **Figure 15**.

Use the correct answer from the box to complete the sentence.

[3 marks]

less than	**equal to**	**greater than**

After falling 40 cm, the drag force on the ball bearing in the warmer oil is

_____ the drag force on the ball bearing in the cooler oil.

Explain the reason for your answer.

_____

_____

_____

_____

9

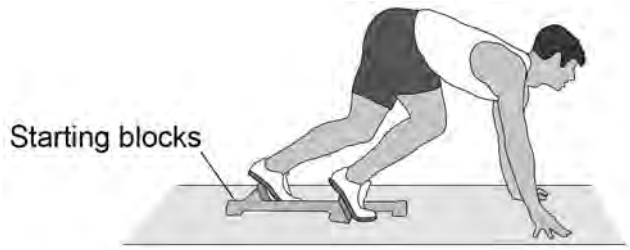
4.5.6.1.4 The distance–time relationship

Question 17

June 2019 | 8463/2F | Original Q1

0 1 **Figure 1** shows an athlete on starting blocks waiting to start a 100 metre race.

Figure 1



0 1 . 1 Complete the sentence.

Choose the answer from the box.

[1 mark]

equal to	**greater than**	**less than**

The force from the athlete pushing backwards on the starting blocks

is _____ the force from the starting

blocks pushing forwards on the athlete.

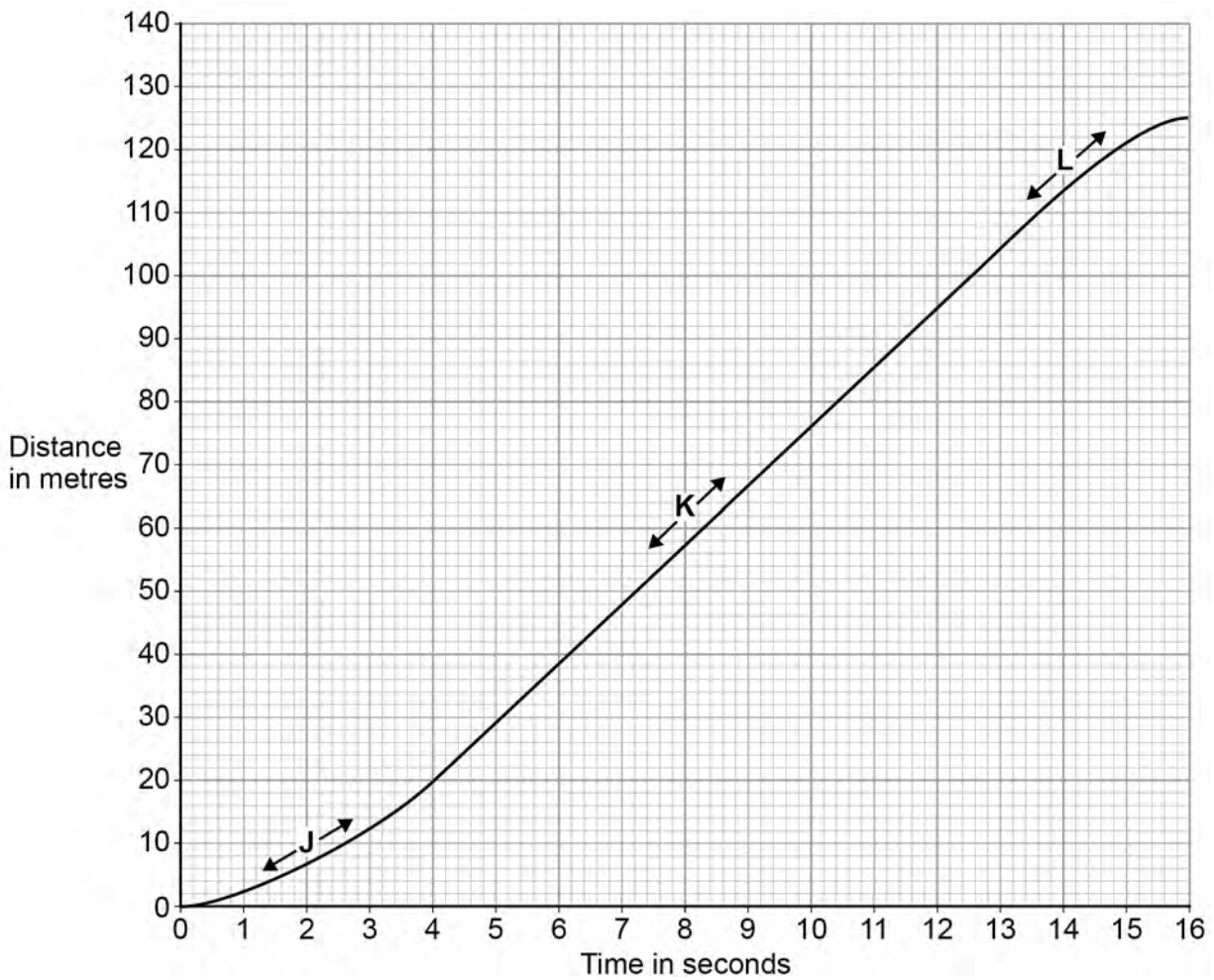
Question 1 continues on the next page

4.5.6.1.4 The distance–time relationship

Question 17 · continued

Figure 2 shows a distance-time graph for the athlete from the moment the race starts.

Figure 2



4.5.6.1.4 The distance–time relationship

Question 17 · continued

0 1 . 2 Three parts of the distance-time graph are labelled **J**, **K** and **L**.

Draw **one** line from **each** of the labels to the correct description of the athlete's motion for that part of the graph.

[2 marks]

Labels	Description of motion
J	not moving
K	constant speed
L	decreasing speed
	increasing speed

0 1 . 3 What distance does the athlete travel after the end of the race before stopping?

[1 mark]

Distance = _____ m

0 1 . 4 Calculate the average speed of the athlete between the start and finish of the 100 metre race.

Use the equation:

$$\text{average speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

[2 marks]

_____

_____

_____

Average speed = _____ m/s

4.5.6.1.4 The distance–time relationship

Question 17 · continued June 2019 | 8463/2F | Original Q1

0 1 . 5 The athlete runs faster than a typical person.

What is the average running speed of a typical person in metres per second?

[1 mark]

Tick (✓) **one** box.

- 1.5 ☐
- 3.0 ☐
- 4.5 ☐
- 6.0 ☐

7

4.5.6.1.4 The distance–time relationship

Question 18

November 2020 | 8463/2F | Original Q7

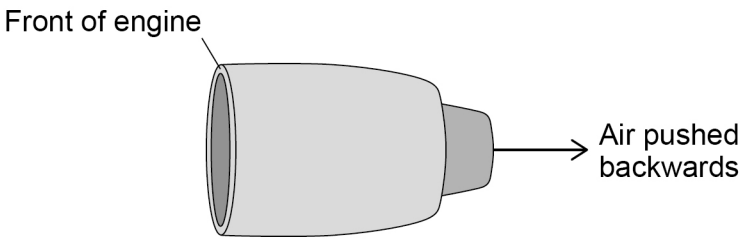
0 7 . 1 An aircraft travels at a constant velocity.

How is the velocity of the aircraft different to the speed of the aircraft?

[1 mark]

0 7 . 2 **Figure 11** shows one of the engines on the aircraft.

Figure 11



Air is taken into the front of the engine and pushed out of the back of the engine.

Explain the effect this has on the engine.

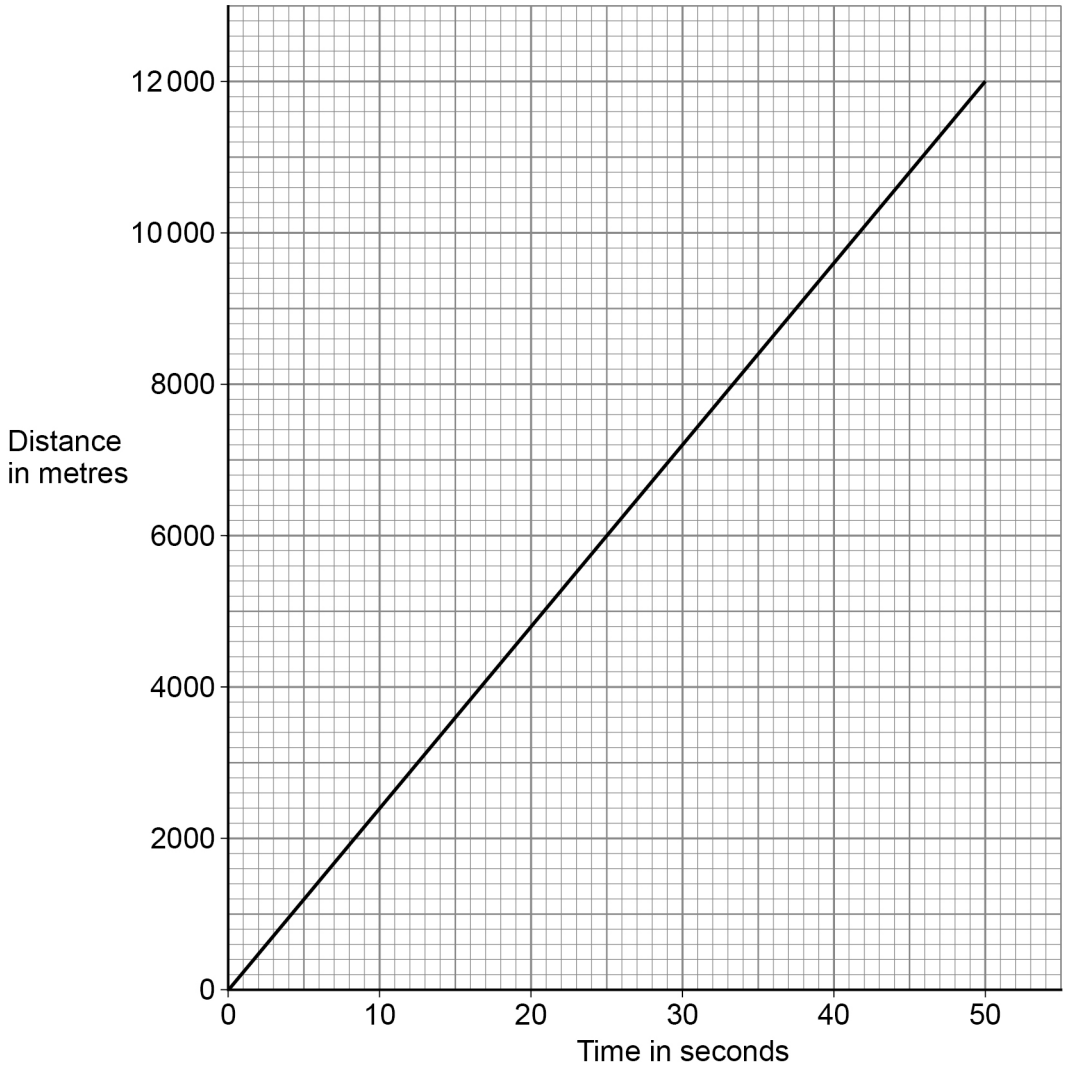
[2 marks]

4.5.6.1.4 The distance–time relationship

Question 18 · continued

0 7 . 3 **Figure 12** shows a distance-time graph for the aircraft.

Figure 12



Determine the speed of the aircraft.

[3 marks]

Speed = _____ m/s

Question 7 continues on the next page

4.5.6.1.4 The distance–time relationship

Question 18 · continued

0 7 . 4 Write down the equation that links acceleration (a), change in velocity (Δv) and time taken (t).

[1 mark]

0 7 . 5 At a different stage of the flight, the aircraft was travelling at a velocity of 250 m/s.

The aircraft then decelerated at 0.14 m/s^2.

Calculate the time taken for the aircraft to decelerate from 250 m/s to 68 m/s.

[4 marks]

Time = _____ s

4.5.6.1.4 The distance–time relationship

Question 18 · continued

0 7 . 6 Write down the equation that links distance (*s*), force (*F*) and work done (*W*).

[1 mark]

0 7 . 7 When the aircraft landed, it travelled 2000 m before stopping.

The work done to stop the aircraft was 140 000 000 J.

Calculate the mean force used to stop the aircraft.

[3 marks]

Mean force = _____ N

15

4.5.6.1.4 The distance–time relationship

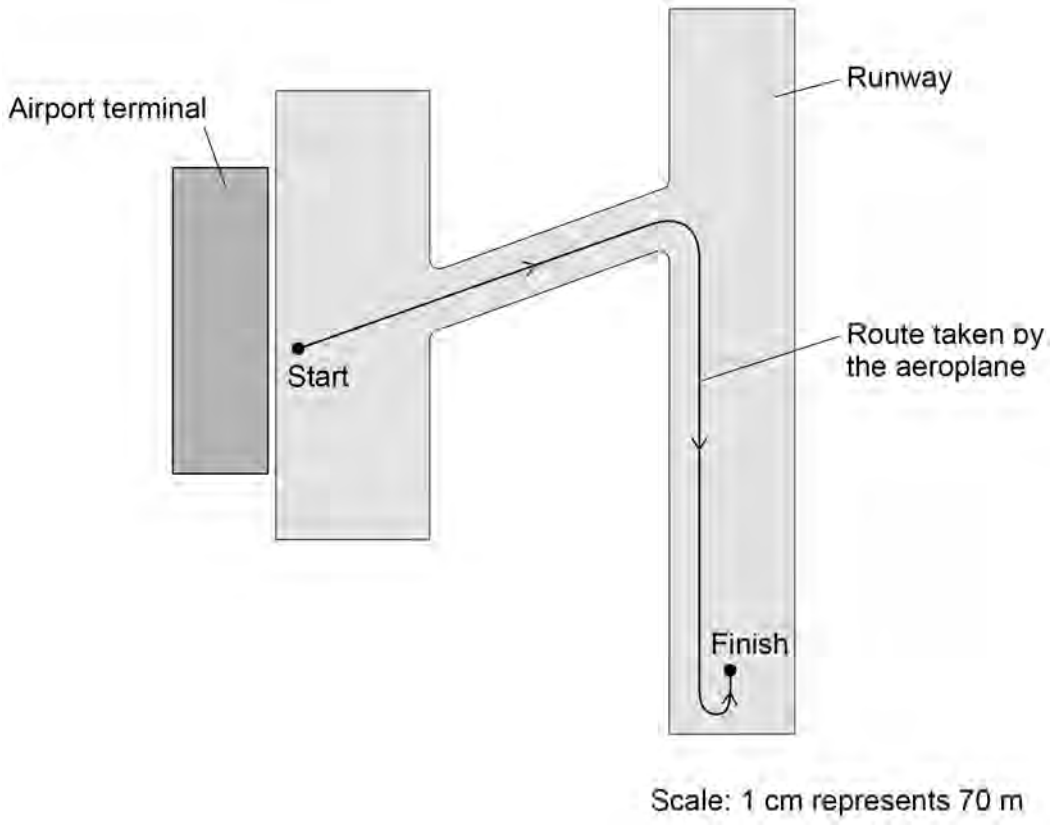
Question 19

June 2023 | 8463/2F | Original Q10

1 0 **Figure 25** shows the route an aeroplane takes as it travels from an airport terminal to the runway.

Figure 25 has been drawn to scale.

Figure 25



1 0 . 1 Determine the magnitude of the aeroplane's displacement from the start point to the finish point on **Figure 25**.

[2 marks]

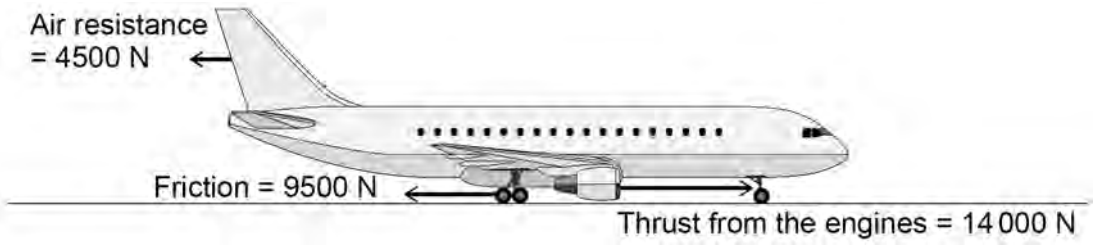
Displacement = _____ m

4.5.6.1.4 The distance–time relationship

Question 19 · continued

Figure 26 shows the direction of the horizontal forces acting on the aeroplane as it moves in a straight line towards the runway.

Figure 26



1 0 . 2 Determine the magnitude of the resultant horizontal force on the aeroplane.

[1 mark]

Resultant horizontal force = _____ N

1 0 . 3 Describe the motion of the aeroplane as it moves towards the runway.

[1 mark]

1 0 . 4 Air resistance and friction are contact forces.

Give **one** other example of a contact force.

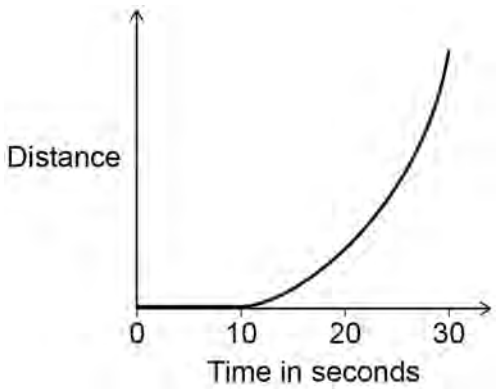
[1 mark]

4.5.6.1.4 The distance–time relationship

1 0 . 5 The aeroplane stops for a short time and then accelerates along the runway.

Figure 27 shows a distance–time sketch-graph for this stage of the journey.

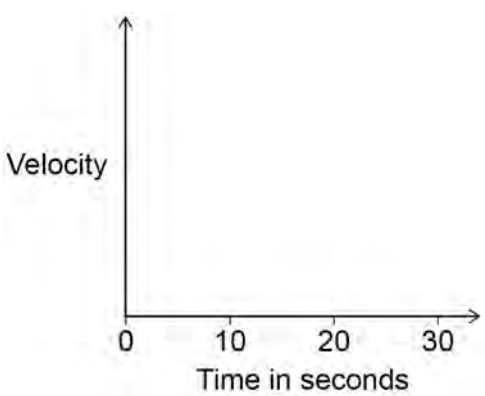
Figure 27



Draw the velocity–time sketch-graph for this stage of the journey on **Figure 28**.

[2 marks]

Figure 28



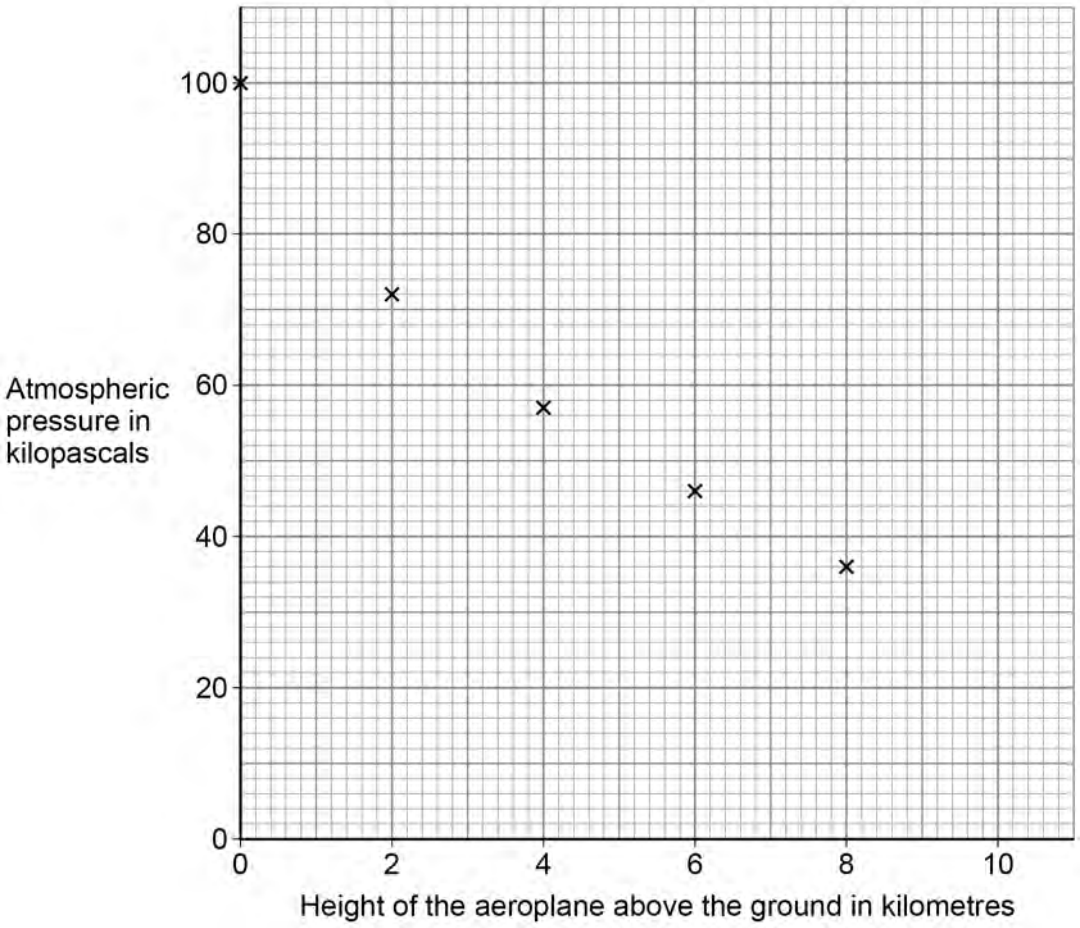
4.5.6.1.4 The distance–time relationship

Question 19 · continued

1 0 . 6 The aeroplane takes off from the runway, so its height above the ground increases.

Figure 29 shows how atmospheric pressure varies with the height of the aeroplane above the ground.

Figure 29



Estimate the atmospheric pressure when the height of the aeroplane above the ground is 10 km.

[2 marks]

Atmospheric pressure = _____ kPa

Question 10 continues on the next page

4.5.6.1.4 The distance–time relationship

Question 19 · continued

June 2023 | 8463/2F | Original Q10

1 0 . 7 What happens to the air surrounding the aeroplane as the height of the aeroplane above the ground increases?

[1 mark]

Tick (✓) **one** box.

- The average density of the air above the aeroplane decreases. ☐
- The mass of air above the aeroplane increases. ☐
- The temperature of the air increases. ☐
- The volume of air below the aeroplane decreases. ☐

10

4.5.6.1.4 The distance–time relationship

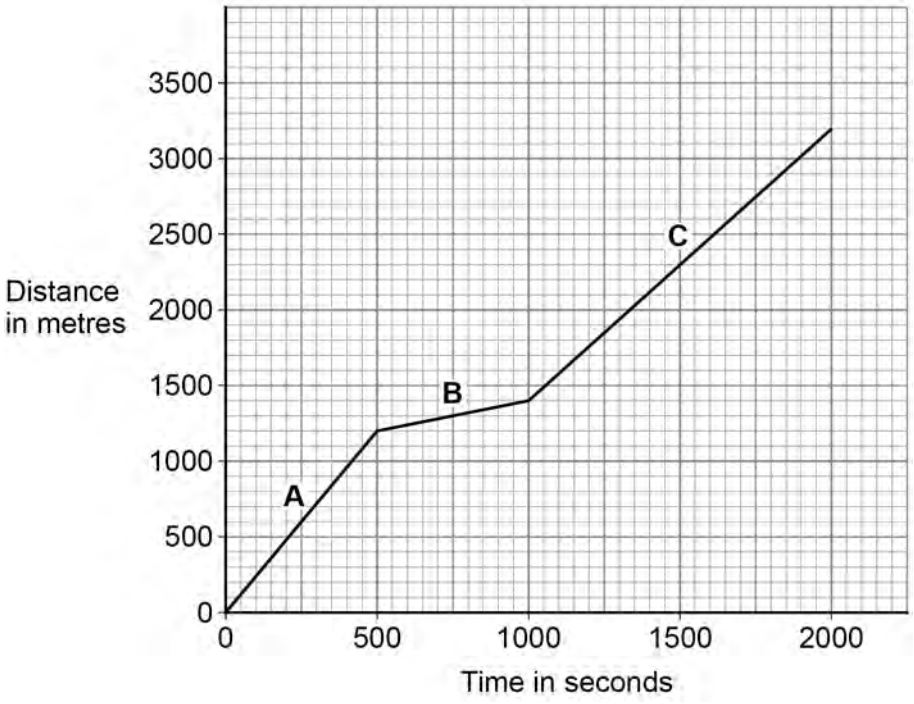
Question 20

June 2024 | 8463/2F | Original Q5

0 5 A person has been for a walk.

Figure 9 shows the distance–time graph for the walk.

Figure 9



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 ☐

4.5.6.1.4 The distance–time relationship

Question 20 · continued

0 5 . 2 What was the total distance walked by the person in 2000 seconds?

[1 mark]

Total distance = _____ m

0 5 . 3 Calculate the average speed of the person during the 2000 seconds.

Use your answer to Question **05.2**

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** shows the person walking the slowest?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐

Reason _____

_____

4.5.6.1.4 The distance–time relationship

Question 20 · continued June 2024 | 8463/2F | Original Q5

0 5 . 5 The person walked slowest when going up some steps.

Complete the sentence.

Choose the answer from the box.

[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 ☐

9