AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.5.4.1.4

The distance–time relationship

Past-paper questions

Tier	**Foundation**
Question groups	**4**
Available paper years	**2020–2025**

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.

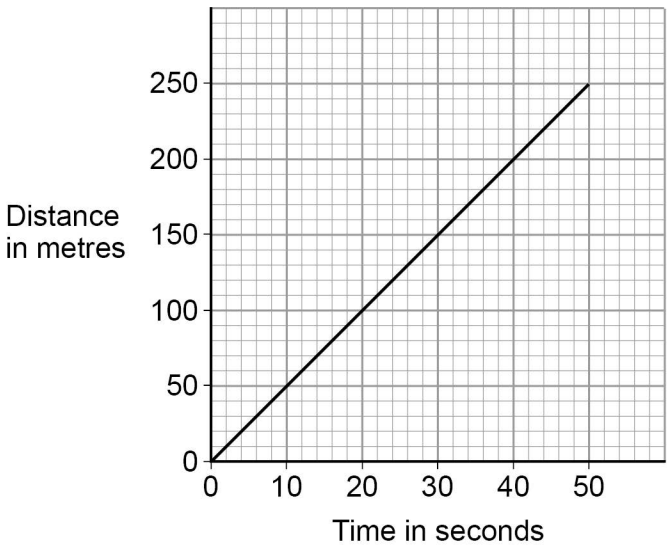
6.5.4.1.4 The distance–time relationship

Question 01

November 2020 | 8464/P/2F | Original Q4

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

6.5.4.1.4 The distance–time relationship

Question 01 · continued

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 ☐

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 box.

[3 marks]

J	**kg**	**m**

Work done = _____ Unit _____

6.5.4.1.4 The distance–time relationship

Question 01 · continued

0 4 . 4 The bicycle travels at a constant speed.

Complete the sentences.

Choose answers from the box.

[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.

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6.5.4.1.4 The distance–time relationship

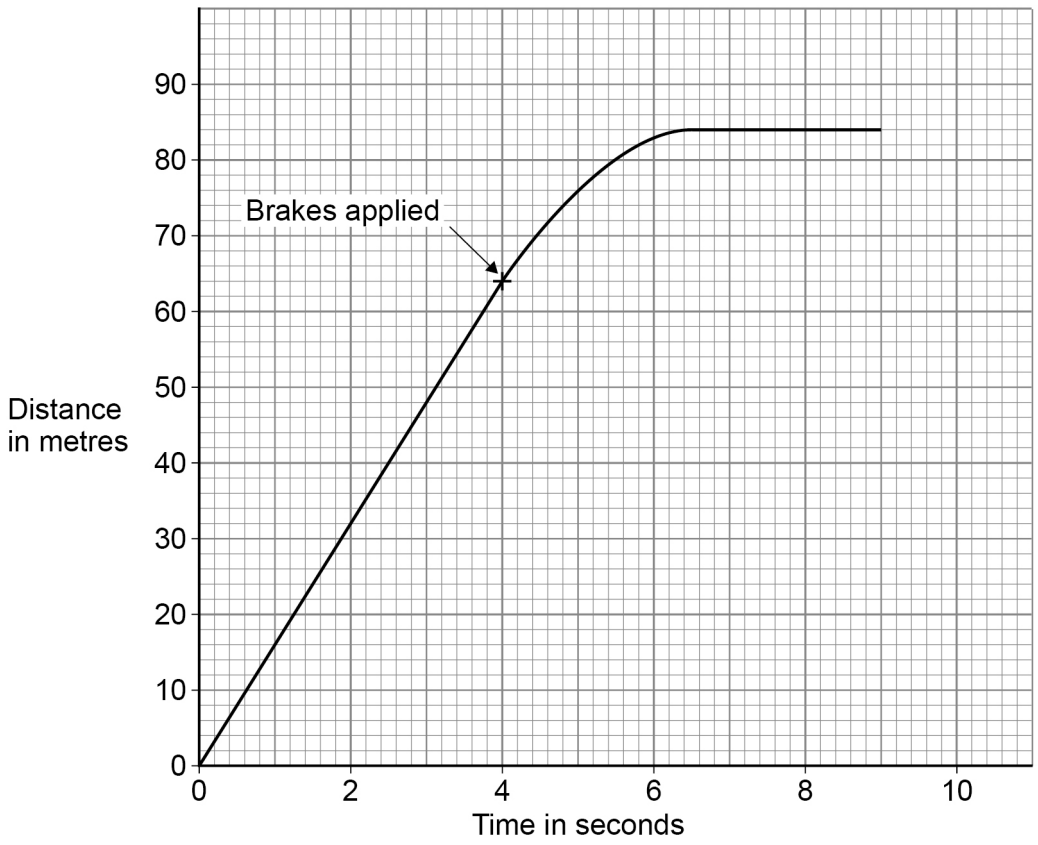
Question 02

June 2023 | 8464/P/2F | Original Q2

0 2 A car contains a device called a black box. The black box records the distance travelled and the time taken for each journey.

Figure 3 shows the distance–time graph for part of a journey.

Figure 3



0 2 . 1 Which feature of **Figure 3** shows that the car travels at a constant speed for the first 4 seconds?

[1 mark]

Tick (✓) **one** box.

The line becomes horizontal. ☐

The line goes through the origin. ☐

The line is straight. ☐

6.5.4.1.4 The distance–time relationship

Question 02 · continued

0 2 . 2 After 4 seconds the driver applied the brakes and the car slowed down and stopped.

The distance the car travelled after the brakes were applied is called the braking distance.

Determine the braking distance of the car.

Use **Figure 3**.

[2 marks]

Braking distance = _____ m

The black box also records the deceleration of the car.

0 2 . 3 As the car decelerates, the velocity of the car changes by 16 m/s.

The car decelerates for 2.5 seconds.

Calculate the deceleration of the car.

Use the equation:

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

[2 marks]

Deceleration = _____ m/s^2

6.5.4.1.4 The distance–time relationship

Question 02 · continued

0 2 . 4 If the black box records large decelerations, it identifies that the driving may be dangerous.

Why can large decelerations be dangerous?

[2 marks]

Tick (✓) **two** boxes.

- The brakes on the car can overheat. ☐
- The driver may lose control of the car. ☐
- The force applied by the brakes is very small. ☐
- The reaction time of the driver increases. ☐
- The thinking distance is very short. ☐

0 2 . 5 The black box monitors the speed of the car.

Describe how speed affects braking distance.

[1 mark]

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6.5.4.1.4 The distance–time relationship

Question 03

June 2025 | 8464/P/2F | Original Q3

0 3 A student went on a cycling journey that lasted for three days.

The student recorded information about the journey using a cycling app on a mobile phone.

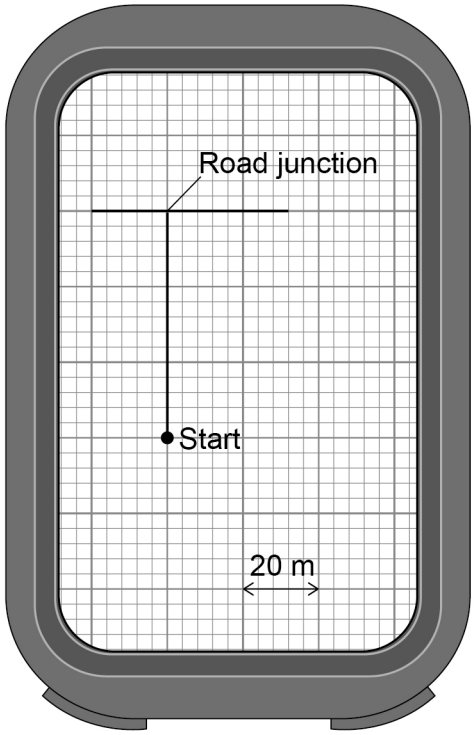
0 3 . 1 At the start of the journey, the student travelled along a straight road to a road junction.

A map on the cycling app showed the road.

Figure 5 shows the map.

The scale of the map is 1 cm **:** 20 m

Figure 5



6.5.4.1.4 The distance–time relationship

Question 03 · continued June 2025 | 8464/P/2F | Original Q3

Calculate the distance travelled by the student between the start and the road junction.

Use **Figure 5**.

[2 marks]

Distance travelled = _____ m

0 3 . 2 The bicycle had a mass of 15 kg.

gravitational field strength = 9.8 N/kg

Calculate the weight of the bicycle.

Use the equation:

weight = mass × gravitational field strength

[2 marks]

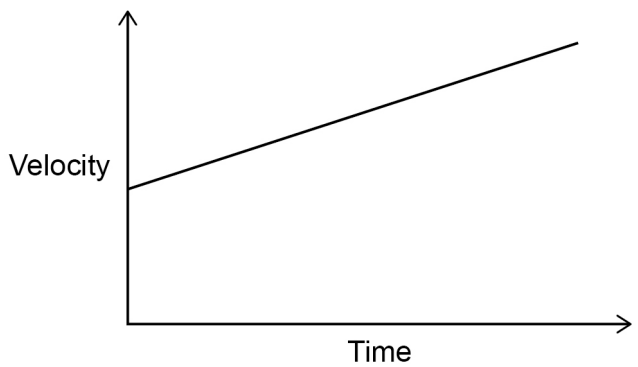
Weight = _____ N

Question 3 continues on the next page

6.5.4.1.4 The distance–time relationship

0 3 . 3 **Figure 6** shows a velocity–time graph for a downhill part of the journey.

Figure 6



The gradient of the graph represents acceleration.

How does **Figure 6** show that the acceleration was constant?

[1 mark]

0 3 . 4 As the student accelerated downhill, the forward force on the student was 250 N.

The work done by the forward force was 4500 J.

Calculate the distance travelled as the student accelerated downhill.

Use the equation:

$$\text{distance travelled} = \frac{\text{work done}}{\text{force}}$$

[2 marks]

Distance travelled = _____ m

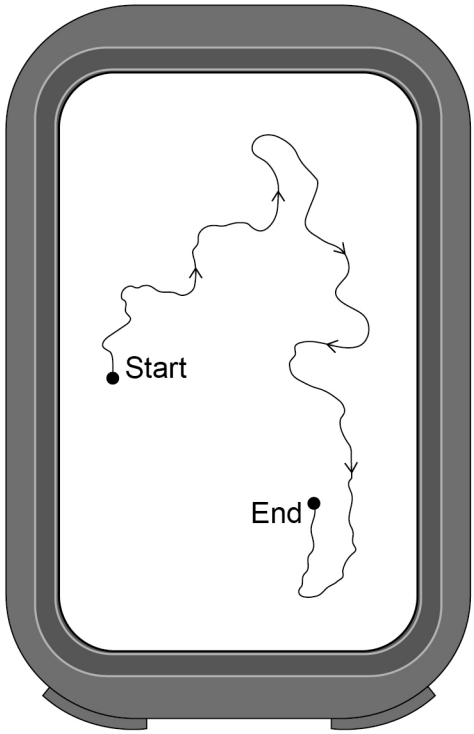
6.5.4.1.4 The distance–time relationship

Question 03 · continued

0 3 . 5 Most of the roads on the journey were not straight.

Figure 7 shows a map of the route taken for the whole journey.

Figure 7



The line in **Figure 7** represents the total distance travelled when the student reached the end of the journey.

How does the total distance travelled compare with the magnitude of the displacement of the student from the start?

[1 mark]

Tick (✓) **one** box.

Total distance travelled is less than the displacement. ☐

Total distance travelled is equal to the displacement. ☐

Total distance travelled is greater than the displacement. ☐

6.5.4.1.4 The distance–time relationship

Question 03 · continued

0 3 . 6 Why is distance a scalar quantity?

[1 mark]

Tick (✓) **one** box.

Distance has direction only. ☐

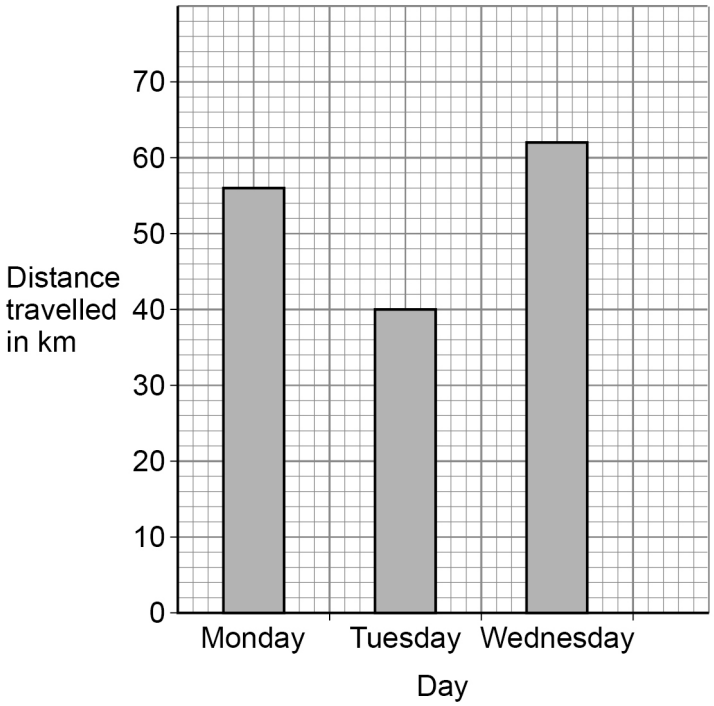
Distance has magnitude only. ☐

Distance has direction and magnitude. ☐

6.5.4.1.4 The distance–time relationship

0 3 . 7 **Figure 8** shows the distance travelled by the student each day.

Figure 8



Calculate the total distance travelled by the student.

Use **Figure 8**.

[2 marks]

Total distance travelled = _____ km

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6.5.4.1.4 The distance–time relationship

Question 04

June 2025 | 8464/P/2F | Original Q6

0 6 In a dog-sled race, a team of dogs pull on a rope attached to a sled.

Figure 12 shows a dog-sled team.

Figure 12



Use the Physics Equations Sheet to answer questions **06.1** and **06.2**.

0 6 . 1 What equation links distance travelled, speed and time?

[1 mark]

Tick (✓) **one** box.

distance travelled = speed × time ☐

speed = time × distance travelled ☐

time = distance travelled × speed ☐

6.5.4.1.4 The distance–time relationship

Question 04 · continued

0 6 . 2 The longest dog-sled race in the world covers a distance of 1 500 000 m.

One team finished the race in a time of 670 000 s.

Calculate the average speed of this team during the race.

[3 marks]

Average speed = _____ m/s

0 6 . 3 At the start of the race, 6 dogs pulled on the rope.

The average forward force on the sled from **each** dog was 370 N.

The backwards force on the sled from friction was 520 N.

Calculate the resultant force on the sled.

[2 marks]

Resultant force = _____ N

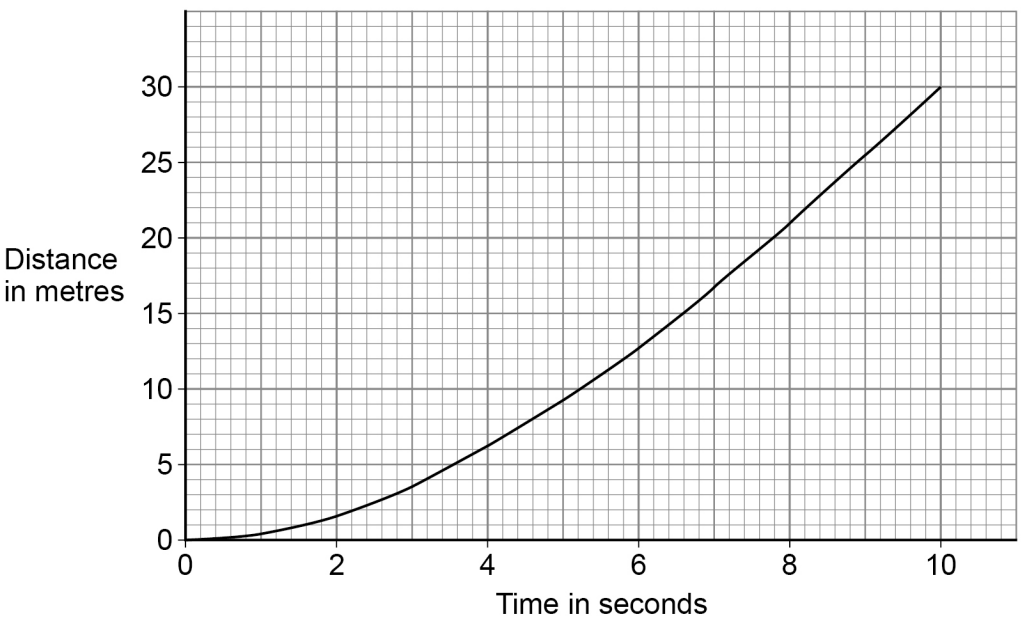
Question 6 continues on the next page

6.5.4.1.4 The distance–time relationship

Question 04 · continued

Figure 13 shows a distance–time graph for the sled at the start of the race.

Figure 13



0 6 . 4 What does the gradient of the graph in **Figure 13** represent?

[1 mark]

6.5.4.1.4 The distance–time relationship

Question 04 · continued June 2025 | 8464/P/2F | Original Q6

0 6 . 5 Later in the race, the sled moved at a constant speed along a flat, horizontal path.

What was the relationship between the size of the horizontal forces acting when the sled moved at a constant speed?

[1 mark]

Tick (✓) **one** box.

friction + air resistance < pull of the rope on the sled ☐

friction + air resistance = pull of the rope on the sled ☐

friction + air resistance > pull of the rope on the sled ☐

0 6 . 6 The rope exerted a force on the sled when the sled was moving.

What is the Newton's Third Law pair to the force of the rope on the sled?

[1 mark]

Tick (✓) **one** box.

The force of friction on the sled ☐

The force of the dogs on the rope ☐

The force of the sled on the rope ☐

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