AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.5.1.1

Scalar and vector quantities

Past-paper questions

Tier	**Foundation**
Question groups	**4**
Available paper years	**2018–2025**

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.

6.5.1.1 Scalar and vector quantities

Question 01

June 2018 | 8464/P/2F | Original Q1

0 1 . 1 Which of these is a scalar quantity?

[1 mark]

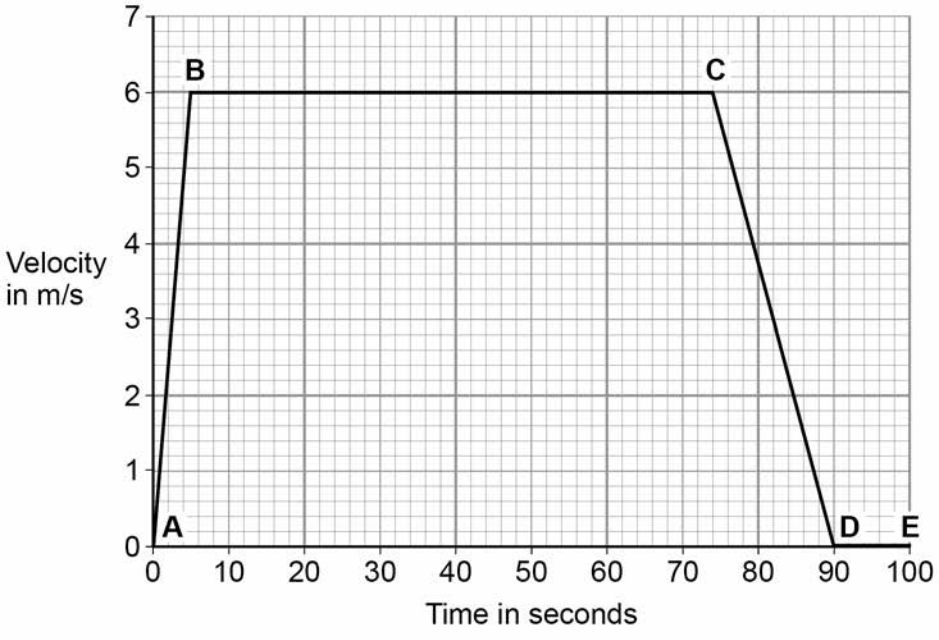
Tick **one** box.

- displacement ☐
- distance ☐
- force ☐
- velocity ☐

0 1 . 2 A woman cycled along a straight flat road.

Figure 1 shows how the woman's velocity changed with time.

Figure 1



Which part of the graph shows the woman moving at constant velocity?

[1 mark]

Tick **one** box.

BC ☐ **CD** ☐ **DE** ☐

6.5.1.1 Scalar and vector quantities

Question 01 · continued

0 1 . 3 Which part of the graph shows the woman stationary?

[1 mark]

Tick **one** box.

BC ☐ **CD** ☐ **DE** ☐

Between points **A** and **B** the woman was accelerating.

0 1 . 4 Use **Figure 1** to determine the total time for which she was accelerating.

[1 mark]

Time = _____ s

0 1 . 5 Use **Figure 1** to determine her increase in velocity between points **A** and **B**.

[1 mark]

Increase in velocity = _____ m/s

0 1 . 6 Calculate her acceleration between points **A** and **B**.

Use the equation:

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

[2 marks]

Acceleration = _____ m/s^2

Question 1 continues on the next page

6.5.1.1 Scalar and vector quantities

Question 01 · continued

0 1 . 7 Estimate how a typical cycling speed of 6 m/s compares with a typical walking speed.

[1 mark]

Tick **one** box.

about twice as fast ☐

about four times faster ☐

about eight times faster ☐

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6.5.1.1 Scalar and vector quantities

Question 02

November 2020 | 8464/P/2F | Original Q1

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. ☐

6.5.1.1 Scalar and vector quantities

Question 02 · continued

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

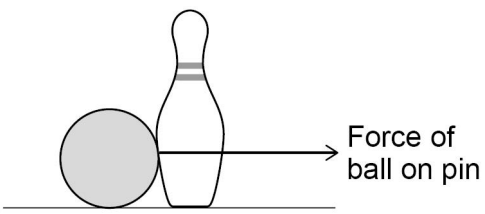
Question 1 continues on the next page

6.5.1.1 Scalar and vector quantities

Question 02 · continued

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

6.5.1.1 Scalar and vector quantities

Question 02 · continued

0 1 . 6 When the pin is struck it accelerates.

Complete the sentences.

Choose answers from the box.

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 _____ .

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Turn over for the next question

6.5.1.1 Scalar and vector quantities

Question 03

November 2021 | 8464/P/2F | Original Q7

0 7 Professional rugby players wear a tracking device that measures their velocity and acceleration.

Figure 9 shows a player wearing a tracking device.

The player is tackling another player who is running with the ball.

Figure 9



0 7 . 1 Velocity and acceleration are both vector quantities.

What is a vector quantity?

[1 mark]

Tick (✓) **one** box.

- A quantity with both magnitude and direction ☐
- A quantity with direction only ☐
- A quantity with magnitude only ☐

6.5.1.1 Scalar and vector quantities

Question 03 · continued

0 7 . 2 Which of the following is a vector quantity?

[1 mark]

Tick (✓) **one** box.

- Displacement ☐
- Distance ☐
- Time ☐
- Work done ☐

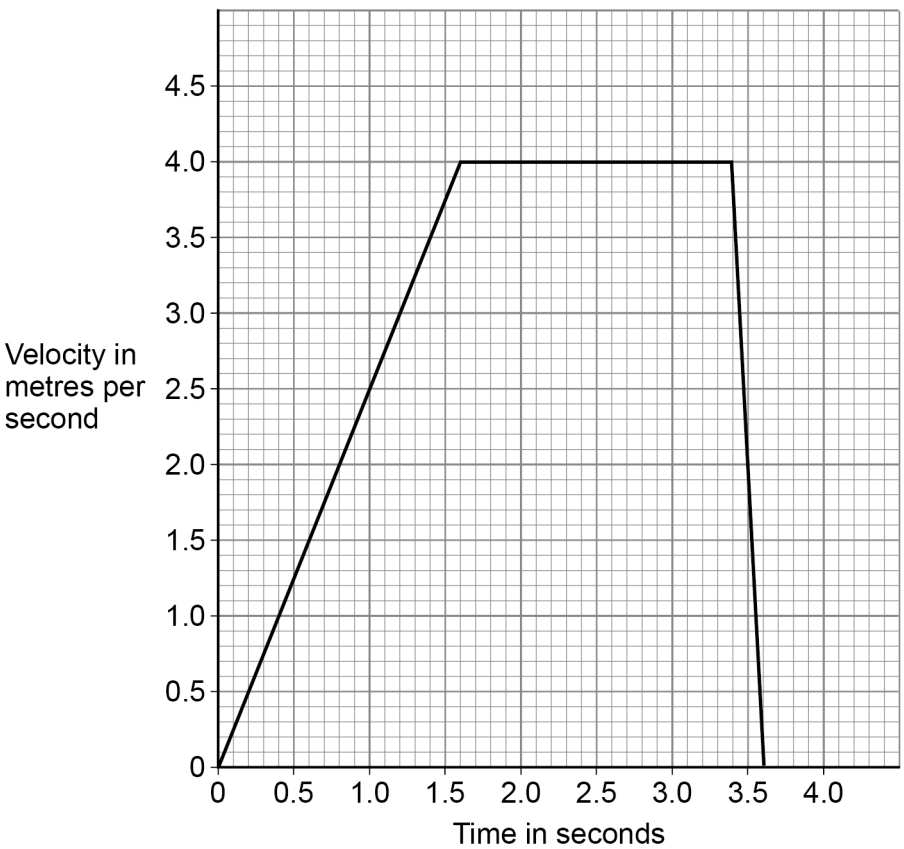
Question 7 continues on the next page

6.5.1.1 Scalar and vector quantities

Question 03 · continued

Figure 10 shows a velocity–time graph for the player running with the ball.

Figure 10



0 7 . 3 Determine the acceleration of the player between 0 and 1.6 s.

[2 marks]

Acceleration = _____ m/s^2

0 7 . 4 Describe the motion of the player between 3.4 s and 3.6 s.

[1 mark]

6.5.1.1 Scalar and vector quantities

Question 03 · continued

The force exerted on the player when she is tackled causes her to accelerate.

0 7 . 5 Write down the equation which links acceleration (*a*), mass (*m*) and resultant force (*F*).

[1 mark]

0 7 . 6 The player accelerates at 25 m/s^2 when a resultant force of 1800 N acts on her.

Calculate the mass of the player.

[3 marks]

Mass = _____ kg

0 7 . 7 The tracking device sends data to a computer during the game.

Suggest **one** advantage of the data being sent during the game.

[1 mark]

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6.5.1.1 Scalar and vector quantities

Question 04

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.

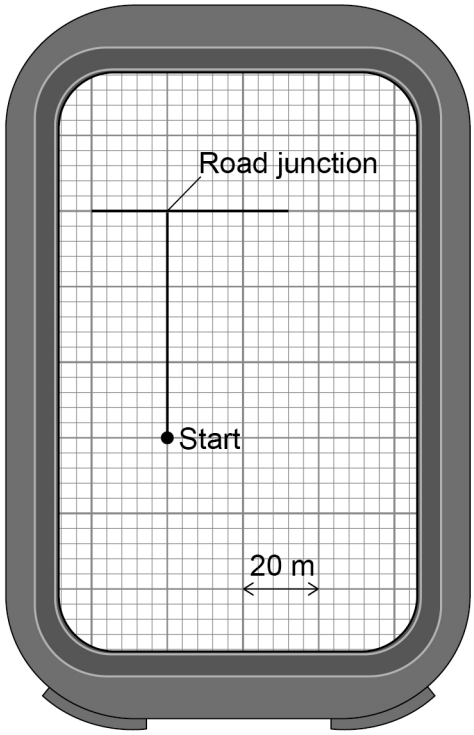
0 3 . 1 At the start of the journey, the student travelled along a straight road to a road junction.

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



6.5.1.1 Scalar and vector quantities

Question 04 · continued

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

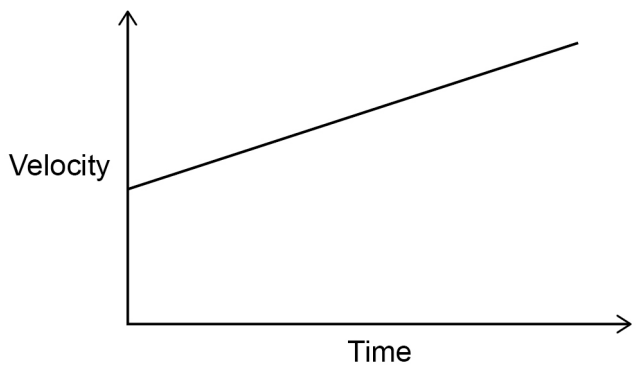
Question 3 continues on the next page

6.5.1.1 Scalar and vector quantities

Question 04 · continued

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:

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

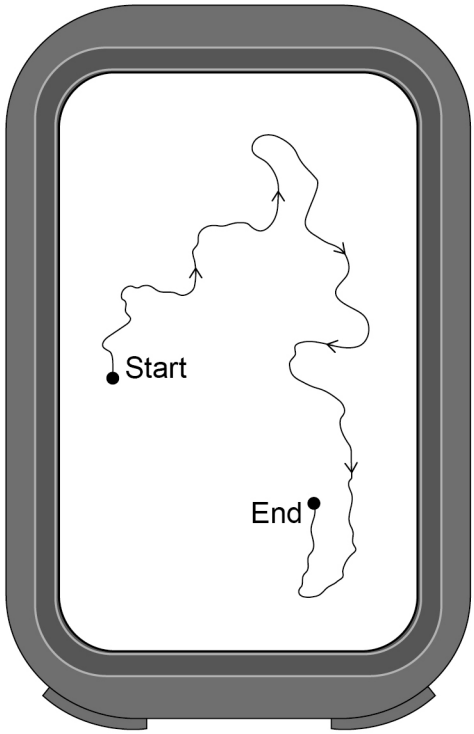
[2 marks]

Distance travelled = _____ m

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. ☐

6.5.1.1 Scalar and vector quantities

Question 04 · continued

0 3 . 6 Why is distance a scalar quantity?

[1 mark]

Tick (✓) **one** box.

Distance has direction only. ☐

Distance has magnitude only. ☐

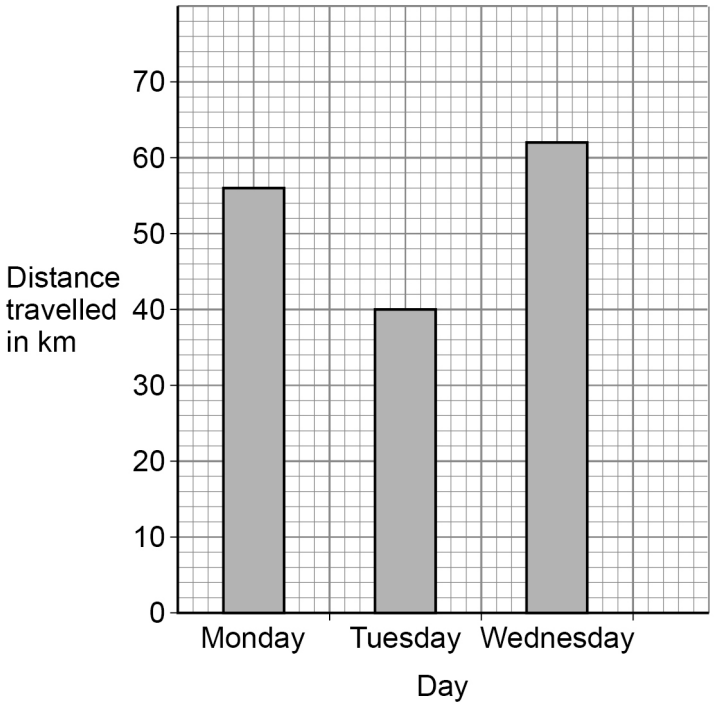
Distance has direction and magnitude. ☐

6.5.1.1 Scalar and vector quantities

Question 04 · continued

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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