AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.5.1.1

# Scalar and vector quantities

## Past-paper questions

| | |
|---|---|
| Tier | **Higher** |
| Question groups | **5** |
| Available paper years | **2018–2023** |

## 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.

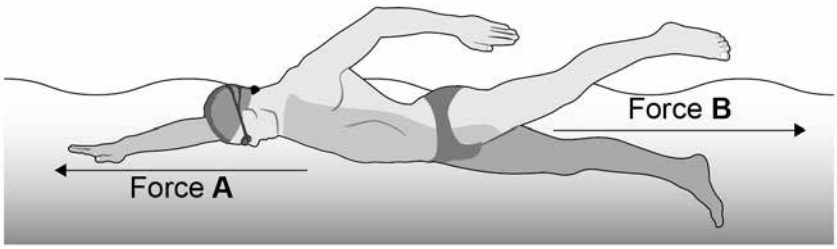
### 6.5.1.1 Scalar and vector quantities

**Question 01**

June 2018 | 8464/P/2H | Original Q7

**0 7** **Figure 10** shows the horizontal forces acting on a man swimming in the sea.

**Figure 10**




**0 7 . 1** Describe the movement of the man when the resultant horizontal force is 0 N

**[1 mark]**

**0 7 . 2** The man increases Force **A**.

Explain what happens to Force **B** and to the movement of the man.

**[4 marks]**

6.5.1.1 Scalar and vector quantities

Question 01 · continued



**0 7 . 3** A boat moves through the sea.

There is a 3000 N force to the west on the boat.

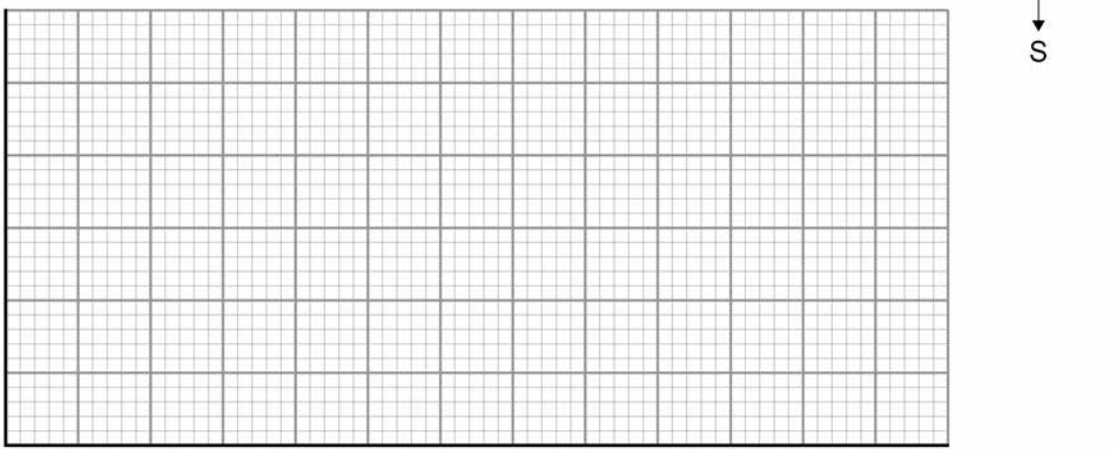
There is a 1000 N force to the south on the boat.

Determine the magnitude and direction of the resultant force on the boat.

Draw a vector diagram of these forces to scale on **Figure 11**

**[3 marks]**

**Figure 11**




Magnitude of resultant force = _____ N

Direction of resultant force = _____ °

**0 7 . 4** The force to the south on the boat increases.

What effect does this have on the resultant force on the boat?

**[2 marks]**

_____

_____

_____

_____

### 6.5.1.1 Scalar and vector quantities

**Question 02**

June 2019 | 8464/P/2H | Original Q3

**0 3** Some quantities are scalars and some are vectors.

**0 3 . 1** Which of the following quantities are scalars?

**[2 marks]**

Tick (✓) **two** boxes.

- Displacement ☐
- Distance ☐
- Force ☐
- Speed ☐
- Velocity ☐

**0 3 . 2** Give the difference between a vector quantity and a scalar quantity.

**[1 mark]**

**Question 3 continues on the next page**

6.5.1.1 Scalar and vector quantities

Question 02 · continued

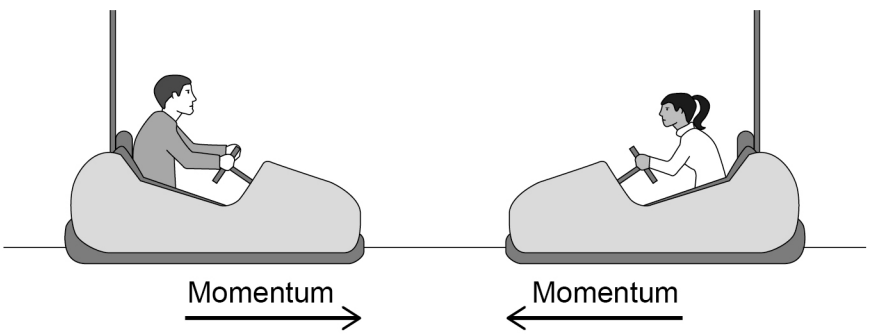


Bumper cars are a fairground ride and are designed to bump into each other.

**Figure 5** shows two bumper cars moving towards each other.

The momentum of each bumper car is shown by an arrow.

**Figure 5**




**0 3 . 3** Give **two** factors that affect the momentum of each bumper car.

**[2 marks]**

1 _____

2 _____

**0 3 . 4** The bumper cars crash into each other and stop.

Explain why both bumper cars stop after the crash.

**[4 marks]**

_____

_____

_____

_____

_____

_____

_____

_____

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6.5.1.1 Scalar and vector quantities

Question 03

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

**0 4** **Figure 8** shows a girl bowling a ball along a ten-pin bowling lane.

**Figure 8**




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

**0 4 . 1** Velocity is a vector quantity, speed is a scalar quantity.

Describe what is meant by a vector quantity and a scalar quantity.

**[2 marks]**

Vector quantity _____

_____

Scalar quantity _____

_____

**0 4 . 2** The bowling lane is horizontal.

Explain why the bowling ball decelerates as it travels along the lane.

**[2 marks]**

_____

_____

_____

_____

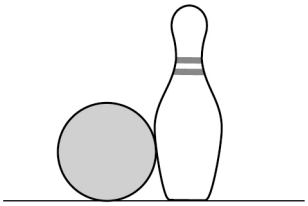
6.5.1.1 Scalar and vector quantities

Question 03 · continued



**Figure 9** shows the bowling ball hitting one of the pins.

**Figure 9**



**0 4 . 3** Write down the equation that links mass ($m$), momentum ($p$) and velocity ($v$).

**[1 mark]**

**0 4 . 4** The bowling ball has a velocity of 5.0 m/s when it hits the pin.

The momentum of the bowling ball is 26 kg m/s

Calculate the mass of the bowling ball.

**[3 marks]**

Mass = _____ kg

**Question 4 continues on the next page**

6.5.1.1 Scalar and vector quantities

Question 03 · continued



**0 4 . 5** Explain why the bowling ball slows down when it hits the pin.

You should use ideas about momentum in your answer.

**[3 marks]**

11

### 6.5.1.1 Scalar and vector quantities

**Question 04**



**0 2** Professional rugby players wear a tracking device that measures their velocity and acceleration.

**Figure 2** shows a player wearing a tracking device.

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

**Figure 2**




**0 2 . 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 04 · continued**



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

**[1 mark]**

Tick (✓) **one** box.

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

**Question 2 continues on the next page**

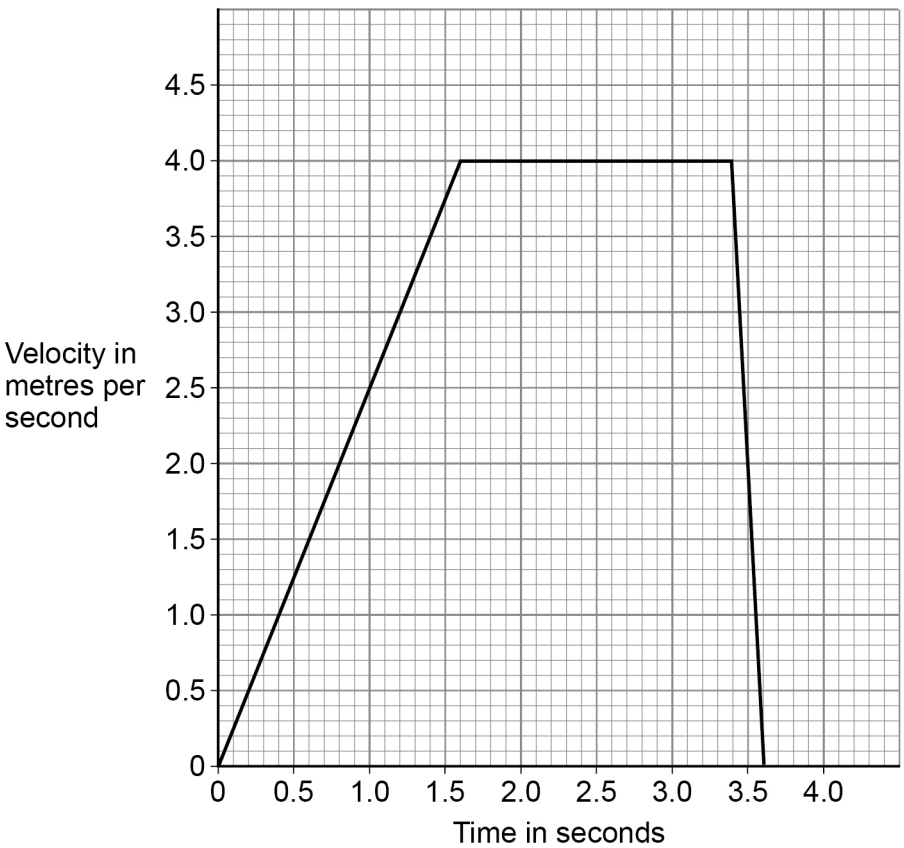
6.5.1.1 Scalar and vector quantities

Question 04 · continued



**Figure 3** shows a velocity–time graph for the player running with the ball.

**Figure 3**




**0 2 . 3** Determine the acceleration of the player between 0 and 1.6 s.

**[2 marks]**

Acceleration = _____ $m/s^2$

**0 2 . 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 04 · continued



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

**0 2 . 5** Write down the equation which links acceleration (*a*), mass (*m*) and resultant force (*F*).

**[1 mark]**

**0 2 . 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 2 . 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]**

**10**

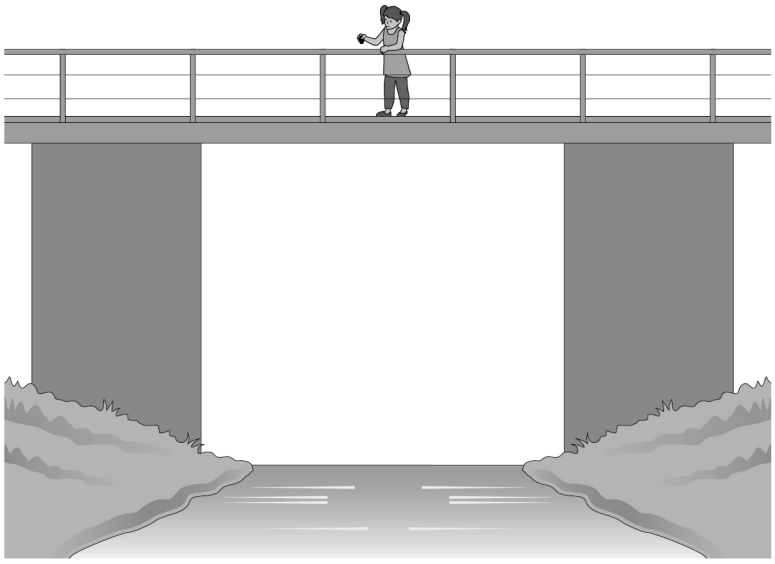
6.5.1.1 Scalar and vector quantities

Question 05

June 2023 | 8464/P/2H | Original Q6

**0 6** **Figure 9** shows a child dropping a stone into water.

**Figure 9**



**0 6 . 1** When the child drops the stone it passes the child's feet with a velocity of 3.1 m/s.

The child's feet are 6.3 m above the water.

acceleration due to gravity = 9.8 $m/s^2$

Calculate the velocity of the stone as it hits the water.

Use the Physics Equations Sheet.

Give your answer to 2 significant figures.

**[4 marks]**

Velocity (2 significant figures) = _____ m/s

6.5.1.1 Scalar and vector quantities

Question 05 · continued



**0 6 . 2** Velocity is a vector.

Describe the velocity of the stone as it falls through the air.

Assume there is no air resistance.

**[2 marks]**

**Question 6 continues on the next page**

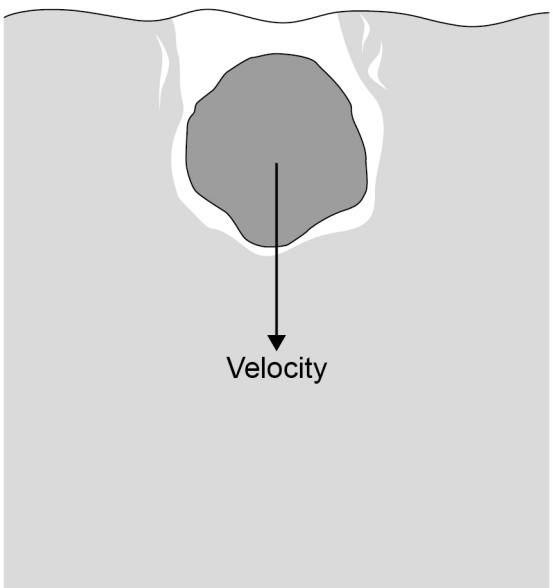
6.5.1.1 Scalar and vector quantities

Question 05 · continued



0 6 . 3 **Figure 10** shows the stone just after it has entered the water.

**Figure 10**




As the stone moves through the water, the stone slows to a constant velocity.

Explain why.

**[4 marks]**

10