

GCSE Combined Science: Trilogy

Worksheet: Scalar and vector quantities

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Scalar and vector quantities

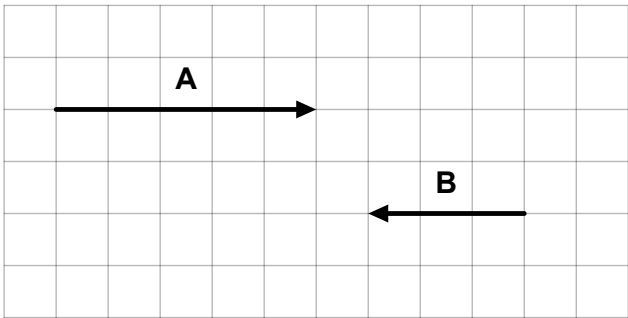
NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

Figure 1 shows two forces, A and B, drawn as arrows on a square grid. Both arrows are drawn to the same scale.

Figure 1



0 1 . 1

What does the length of each arrow represent?

.....

.....

[1 mark]

0 1 . 2

What does the direction of each arrow represent?

.....

.....

[1 mark]

0 1 . 3

The scale is 1 square = 2 N.
Determine the size of force A.

.....

.....

.....

Force A = N

[1 mark]

0 1 . 4

Give the size and the direction of force B.

.....

.....

.....

.....

[2 marks]

0 2

0 2 . 1

Which of these is a vector quantity?

Tick (✓) **one** box.

Energy

☐

Mass

☐

Temperature

☐

Velocity

☐

[1 mark]

0 2 . 2

Which **two** of these are scalar quantities?

Tick (✓) **two** boxes.

Acceleration

☐

Displacement

☐

Distance

☐

Force

☐

Time

☐

[2 marks]

0 2 . 3

Describe the difference between a scalar quantity and a vector quantity.

.....

.....

.....

.....

[2 marks]

0 3

A car's dashboard display shows a speed of 60 km/h. At the same instant, a satellite navigation (sat-nav) system displays the car's velocity as 60 km/h due north.

0 3 . 1

Which display shows a vector quantity?

Tick (✓) **one** box.

The dashboard display

The sat-nav display

Both displays

Neither display

☐

☐

☐

☐

[1 mark]

0 3 . 2

Explain your answer to the previous part.

.....

.....

.....

.....

[2 marks]

0 3 . 3

The car's speed stays at 60 km/h but the car turns a corner.
Has the car's velocity changed? Explain your answer.

.....

.....

.....

.....

[2 marks]

0 4

A weather forecast states:

'Winds today will reach speeds of up to 50 km/h, blowing from the southwest.'

0 4 . 1

The forecast gives both a size and a direction for the wind.
What vector quantity is being described?

.....

.....

.....

[1 mark]

0 4 . 2

If the forecast had only said 'winds of up to 50 km/h', with no direction given,
what quantity would this describe?

.....

.....

.....

[1 mark]

0	4	.	3
---	---	---	---

A hot-air balloon drifts with a steady wind of 50 km/h for 2.0 hours.

Explain why knowing only the speed of the wind is not enough to predict where the balloon will be after 2.0 hours.

[2 marks]

0	5
---	---

Here is a list of physical quantities:

acceleration displacement distance energy force mass speed velocity

0	5	.	1
---	---	---	---

Explain the difference between scalar quantities and vector quantities. Use examples from the list in your answer.

Describe, using an example, how a vector quantity can be represented on a diagram.

[illegible]

[6 marks]

0 6

Table 1 shows four quantities that describe a delivery drone at one instant as it rises vertically.

Table 1

Quantity	Value
Speed of the drone	5.0 m/s
Resultant force on the drone	12 N upwards
Kinetic energy of the drone	75 J
Acceleration of the drone	2.0 m/s ² upwards

0 6 . 1

Identify the **two** vector quantities in Table 1.

.....

.....

.....

.....

[2 marks]

0 6 . 2

Explain how you identified the vector quantities in the previous part.

.....

.....

.....

.....

[2 marks]

0 6 . 3

A student says:

‘Speed cannot be a vector quantity because it is never negative.’

Explain why this reasoning is incorrect.

.....

.....

.....

.....

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Scalar and vector quantities · 31 marks

Question 1 (5 marks)

01.1 [1 mark]

Answer: The magnitude (size) of the force.

- the magnitude / size of the force (1)
-

01.2 [1 mark]

Answer: The direction of the force.

- the direction in which the force acts (1)
-

01.3 [1 mark]

Answer: 10 N

- 10 (N) (1)
-

01.4 [2 marks]

Answer: 6 N to the left.

- 6 (N) (1)
 - to the left / in the opposite direction to force A (1)
-
-

Question 2 (5 marks)

02.1 [1 mark]

Correct: Velocity

02.2 [2 marks]

Correct: Distance; Time

02.3 [2 marks]

Answer: A scalar has magnitude only; a vector has magnitude and direction.

- a scalar quantity has magnitude (size) only (1)
- a vector quantity has magnitude and (an associated) direction (1)

Notes: Allow 'size' for magnitude.

Question 3 (5 marks)

03.1 [1 mark]

Correct: The sat-nav display

03.2 [2 marks]

Answer: The sat-nav gives a direction as well as a size; the dashboard gives only a size.

- the sat-nav gives a direction (due north) as well as a size (1)
 - the dashboard only gives a size (magnitude), so it shows a scalar quantity (speed) (1)
-

03.3 [2 marks]

Answer: Yes: the direction has changed even though the speed has not.

- yes, the velocity has changed (1)
 - because the direction of travel has changed, even though the speed (magnitude) has not (1)
-

Question 4 (4 marks)

04.1 [1 mark]

Answer: Velocity.

- (wind) velocity (1)
-

04.2 [1 mark]

Answer: Speed.

- speed (1)
-

04.3 [2 marks]

Answer: Speed only gives the distance travelled (100 km); the wind's direction (its velocity) is needed to find the balloon's displacement.

- the wind speed only gives the distance the balloon travels (100 km), not the direction it travels in (1)
 - the direction of the wind (its velocity, a vector) is also needed to find the balloon's displacement / where it ends up (1)
-

Question 5 (6 marks)

05.1 [6 marks]

Answer: A scalar has magnitude only (distance, energy, mass, speed); a vector has magnitude and direction (acceleration, displacement, force, velocity). Speed and velocity, and distance and displacement, are scalar–vector pairs. A vector is drawn as an arrow: its length, to a scale, shows the magnitude and it points in the direction of the vector — e.g. a 30 N force to the left drawn as a 3 cm arrow pointing left, using 1 cm = 10 N.

Levels of response

- **Level 3 (5–6)** A detailed, coherent answer. Relevant points are accurate, linked in a logical sequence and use correct scientific terms.
- **Level 2 (3–4)** Several relevant points with some linking, but the answer has gaps, errors or lacks detail.
- **Level 1 (1–2)** Simple statements making one or two relevant points, with little or no linking.
- **No marks (0)** Nothing relevant or worthy of credit.

Indicative content

- a scalar quantity has magnitude (size) only
- a vector quantity has magnitude and an associated direction
- scalars in the list: distance, energy, mass and speed
- vectors in the list: acceleration, displacement, force and velocity
- some quantities form pairs: speed is a scalar and velocity is the matching vector (speed in a given direction); distance is a scalar and displacement is the matching vector
- a vector can be represented by an arrow; the length of the arrow, drawn to a scale, represents the magnitude
- the arrow points in the direction of the vector, e.g. a force of 30 N acting to the left drawn as an arrow 3 cm long pointing left, using a scale of 1 cm = 10 N

Notes: Level 3 (5–6 marks): correct definitions of both types, several quantities from the list classified correctly (including at least one scalar–vector pair), and a description of an arrow whose length represents the magnitude and whose direction represents the direction, with an example.

Level 2 (3–4 marks): correct definitions with some correct examples, or examples with a description of the arrow, but the answer is incomplete.

Level 1 (1–2 marks): one or two simple statements, e.g. ‘velocity has a direction’ or ‘use an arrow’.

Question 6 (6 marks)

06.1 [2 marks]

Answer: Resultant force and acceleration.

- resultant force (12 N upwards) (1)
 - acceleration (2.0 m/s^2 upwards) (1)
-

06.2 [2 marks]

Answer: Each has a stated direction as well as a size; the other two have no direction.

- each of these has a stated direction as well as a size (1)
 - the other two quantities (speed and kinetic energy) have a size only, with no direction, so they are scalars (1)
-

06.3 [2 marks]

Answer: Speed is a scalar because it has no direction, not simply because it cannot be negative.

- speed cannot be negative, but this is not the reason it is a scalar (the size of a vector, e.g. the 12 N force, is never negative either) (1)
 - speed is a scalar because it has no direction associated with it (not because of its sign) (1)
-