

GCSE Physics

Worksheet: Distance and displacement

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Distance and displacement

NAME

CLASS

DATE

- 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.

01

A robot arm moves a component 15 cm to the left, then 15 cm back to the right, returning exactly to its starting position.

01.1

Calculate the total distance moved by the component.

Distance = cm

[2 marks]

01.2

State the displacement of the component, and explain your answer.

[1 mark]

0 2

A runner completes exactly one lap of a 400 m running track and finishes where they started.

0 2 . 1

What is the distance travelled by the runner?

.....

.....

.....

Distance = m

[1 mark]

0 2 . 2

What is the displacement of the runner at the end of the lap?

.....

.....

.....

Displacement = m

[1 mark]

0 2 . 3

Which statement describes displacement?

Tick (✓) **one** box.

- The total length of the path travelled ☐
- The distance in a straight line from the start point to the finish point, and its direction ☐
- The speed of an object in a given direction ☐
- The distance travelled in one second ☐

[1 mark]

0 2 . 4

Is displacement a scalar quantity or a vector quantity?

.....

.....

.....

.....

[1 mark]

0 3

0 3 . 1

Which of these correctly describes displacement?

Tick (✓) **one** box.

The total length of the path travelled

☐

The distance in a straight line from the start point to the finish point, together with its direction

☐

The speed of an object in a given direction

☐

The total time taken for a journey

☐

[1 mark]

0 3 . 2

Is distance a scalar quantity or a vector quantity?

.....

.....

.....

[1 mark]

0 3 . 3

Is displacement a scalar quantity or a vector quantity?

.....

.....

.....

[1 mark]

0 4

0 4 . 1

A dog runs 25 m due east to fetch a ball, then runs 10 m due west.
Calculate the total distance the dog runs.

.....

.....

.....

Distance = m

[1 mark]

0 4 . 2

Give the displacement of the dog from its starting point.

.....

.....

.....

.....

Displacement = m

[2 marks]

0 4 . 3

A hiker walks 3.0 km due north and then 4.0 km due east.
Use a scale drawing to determine the magnitude of the hiker's displacement
from the starting point.

.....

.....

.....

.....

Displacement = km

[2 marks]

0 4 . 4

Use your scale drawing to determine the direction of the hiker’s displacement as a bearing (an angle measured clockwise from north).

.....

.....

.....

Bearing = °

[1 mark]

0 5

A delivery drone flies 40 m due east, then 30 m due north, then a further 10 m due east.

0 5 . 1

Calculate the total distance flown by the drone.

.....

.....

.....

Distance = m

[1 mark]

0 5 . 2

Determine the size of the drone’s displacement from its starting point. You may use a scale drawing or Pythagoras.

.....

.....

.....

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.....

Displacement = m

[3 marks]

0 6

A satellite navigation system calculates that the driving distance to a destination, following the roads, is 12 km. The straight-line distance to the destination is 8.5 km.

0 6 . 1

Which of these two values is the size of the car's displacement when it reaches the destination?

.....

.....

[1 mark]

0 6 . 2

The journey takes 15 minutes.
Calculate the average speed of the car, in km/h.

.....

.....

.....

.....

Average speed = km/h

[2 marks]

0 6 . 3

Explain why the size of the car's average velocity for the journey is less than its average speed.

.....

.....

.....

.....

[2 marks]

0 7

A student drives a remote-controlled toy car along a curved path across a school playground, from point A to point B.

0 7 . 1

Describe how the student could determine the distance travelled by the car and the displacement of the car from A to B.

Explain why the two values are different.

.....

.....

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.....

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.....

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.....

.....

[6 marks]

END OF QUESTIONS

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

Mark scheme

GCSE Physics · Worksheet: Distance and displacement · 31 marks

Question 1 (3 marks)

01.1 [2 marks]

Answer: 30 cm

- 15 + 15 (1)
 - 30 (cm) (1)
-

01.2 [1 mark]

Answer: Zero: it returns to its starting point.

- zero, because it finishes at the same point where it started (1)
-

Question 2 (4 marks)

02.1 [1 mark]

Answer: 400 m

- 400 (m) (1)
-

02.2 [1 mark]

Answer: 0 m

- 0 / zero (1)
-

02.3 [1 mark]

Correct: The distance in a straight line from the start point to the finish point, and its direction

02.4 [1 mark]

Answer: Vector.

- vector (1)
-

Question 3 (3 marks)

03.1 [1 mark]

Correct: The distance in a straight line from the start point to the finish point, together with its direction

03.2 [1 mark]

Answer: Scalar.

- scalar (1)

03.3 [1 mark]

Answer: Vector.

- vector (1)
-

Question 4 (6 marks)

04.1 [1 mark]

Answer: 35 m

- 35 (m) (1)

04.2 [2 marks]

Answer: 15 m due east

- 15 (m) (1)
- (due) east (1)

04.3 [2 marks]

Answer: 5.0 km

- correct scale drawing: right-angled triangle with sides of 3.0 km (north) and 4.0 km (east) to a stated scale (1)
- 5.0 (km) (allow 4.8–5.2) (1)

Notes: Allow a correct Pythagoras calculation.

04.4 [1 mark]

Answer: 053°

- 053° (allow 050°–056°) (1)
-

Question 5 (4 marks)

05.1 [1 mark]

Answer: 80 m

- 80 (m) (1)

05.2 [3 marks]

Answer: 58 m (58.3 m; allow 57–59 m)

- total distance east = $40 + 10 = 50$ (m) and distance north = 30 (m) (1)
- scale drawing of 50 m east and 30 m north / displacement = $\sqrt{50^2 + 30^2}$ (1)
- 58 (m) (allow 57–59 m) (1)

Question 6 (5 marks)

06.1 [1 mark]

Answer: 8.5 km (the straight-line distance).

- 8.5 km (the straight-line distance) (1)

06.2 [2 marks]

Answer: 48 km/h

- 15 minutes = 0.25 h (1)
- $12 \div 0.25 = 48$ (km/h) (1)

06.3 [2 marks]

Answer: Average velocity uses the displacement (8.5 km), which is less than the distance along the roads (12 km).

- average velocity = displacement $\div$ time, but average speed = distance $\div$ time (1)
 - the displacement (8.5 km in a straight line) is less than the distance travelled along the roads (12 km), because the roads are not straight (1)
-

Question 7 (6 marks)

07.1 [6 marks]

Answer: Mark A, B and the car's path (e.g. with chalk). Distance: lay a string along the path and measure it, or push a trundle wheel along the path. Displacement: pull a tape measure straight from A to B and use a compass to find the direction (bearing) of B from A; give both, e.g. 8.5 m on a bearing of 040°. The distance is larger because the path is curved: distance is the length of the path (a scalar), while displacement is the straight line from start to finish with a direction (a vector).

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

- mark points A and B, and mark the path the car follows (e.g. with chalk, or by following the car's tracks)
- distance: measure along the actual curved path, e.g. lay a piece of string along the path and then measure the string with a tape measure, or push a trundle wheel along the path
- displacement (magnitude): measure the straight-line distance from A to B with a tape measure pulled tight
- displacement (direction): use a compass (or protractor and reference line) to find the direction of B from A, e.g. as a bearing
- give the displacement as the straight-line distance together with its direction, e.g. 8.5 m on a bearing of 040°
- the distance is greater than the magnitude of the displacement because the path is curved: distance is the length of the path travelled (a scalar), while displacement is the straight line from start to finish with a direction (a vector)
- repeat each measurement and calculate a mean

Notes: Level 3 (5–6 marks): a workable method for both measurements — the distance along the actual path, and the displacement as a straight-line distance with a measured direction — and an explanation of why the distance is greater.

Level 2 (3–4 marks): a workable method for one quantity with some description of the other, or both measured but the direction of the displacement omitted.

Level 1 (1–2 marks): simple statements, e.g. 'measure the path with a tape measure'.
