physicsUK
Smarter practice. Stronger understanding

WORKSHEETS
ATTEMPT | CHECK | CORRECT | IMPROVE

Motion graphs worksheet

AQA AS 7407 and first-year A Level 7408 | OCR A AS H156 and A Level H556

35–40 minutes independent practice + 15–20 minutes review | 38 marks

Specification points covered

AQA 7407 / 7408: 3.4.1.3 selected graph skills — gradients, signed areas and motion descriptions.
OCR A H156 / H556: 3.1.1(a)–(d) selected graph skills — displacement, velocity, speed and acceleration.

Scenario

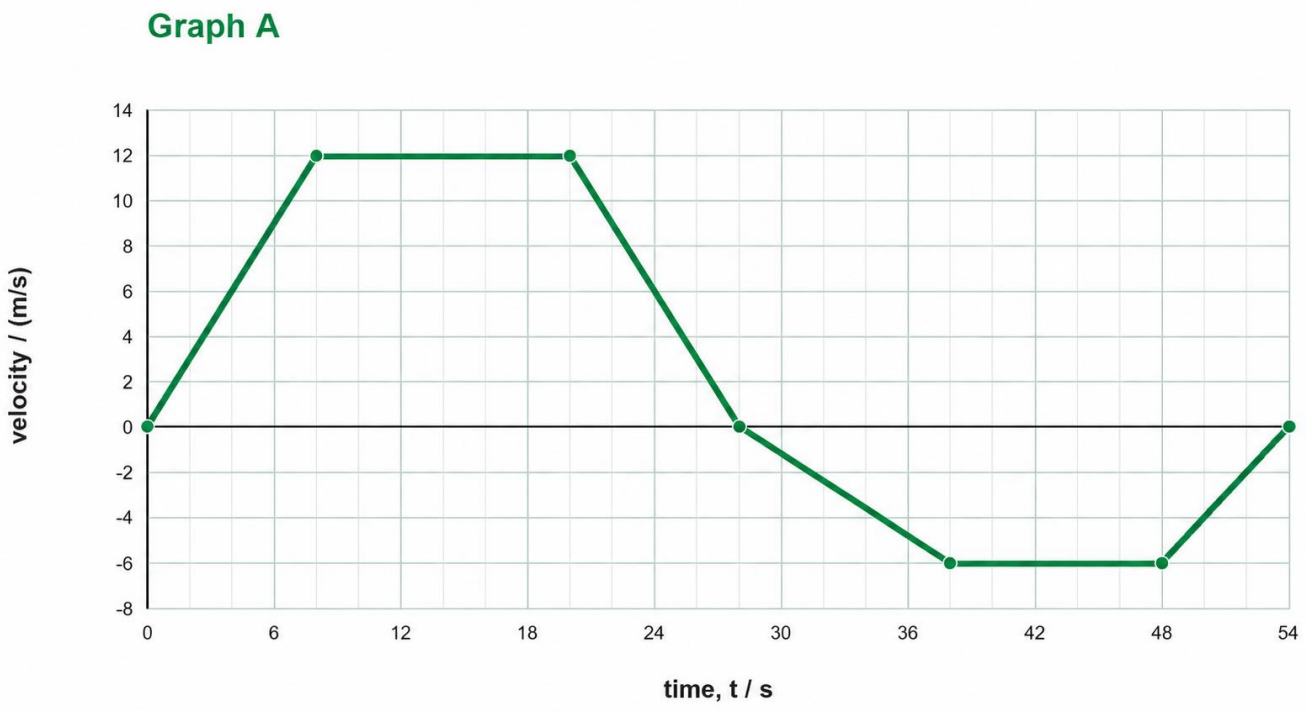
An autonomous electric shuttle carries equipment between a loading bay and a test hall.
Use positive direction as loading bay → test hall. Graph B is a later, shorter calibration run measured from a marker.

Describing motion precisely

Name the quantity, then its trend: increases, decreases or stays the same. Say whether a change is linear or non-linear.

Use gradient or area to explain the motion. Write “velocity decreases”, not “velocity is accelerating”.

Graph A: velocity–time



Continue your physics journey
Videos, practice and support for your next step
www.physicsuk.co.uk

Read values and gradients carefully from the scale. Areas below the time axis are negative displacement.

1. Graph A is a velocity–time graph. State what (i) its gradient and (ii) its signed area between the graph and the time axis represent. [2 marks]

2. At t = 33 s, state the shuttle's (i) velocity and (ii) speed. [2 marks]

3. State the maximum speed reached on Graph A and the time interval during which it is reached. [2 marks]

Graph A: calculation and description

4. Calculate the acceleration during the first 8.0 s of the run. [1 mark]

5. During 28 s to 38 s, calculate the acceleration. Then describe the shuttle's direction of travel and what happens to its speed. [3 marks]

Continue your physics journey
Videos, practice and support for your next step
www.physicsuk.co.uk

Graph A: areas and precise language

6. Describe the motion in each interval using the quantity–trend–linearity language: (a) 8–20 s, (b) 20–28 s and (c) 28–38 s. Do not say "the velocity is accelerating". [4 marks]

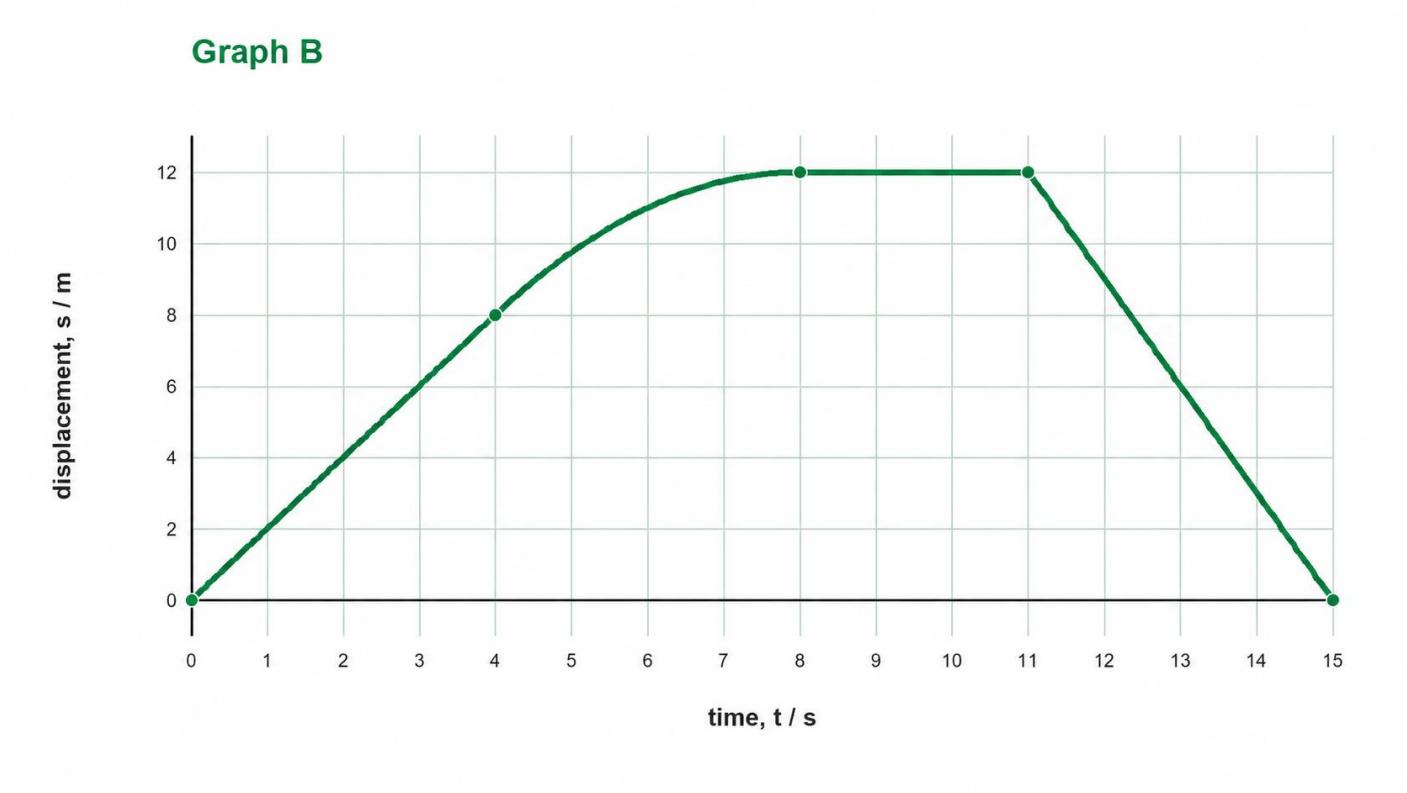
7. Use areas to calculate the shuttle's displacement from t = 0 s to t = 28 s. [3 marks]

8. Calculate (i) the resultant displacement and (ii) the total distance travelled during the whole 54 s journey. [4 marks]

Continue your physics journey
Videos, practice and support for your next step
www.physicsuk.co.uk

9. Explain why the total distance travelled is not equal to the magnitude of the resultant displacement for this journey. [2 marks]

Graph B: displacement–time



For a displacement–time graph, the gradient gives velocity. A flat section has zero gradient.

10. State what the gradient of Graph B represents. [1 mark]

11. Describe the motion in each interval on Graph B using precise graph language: (a) 0–4 s, (b) 4–8 s, (c) 8–11 s and (d) 11–15 s. [4 marks]

Continue your physics journey
Videos, practice and support for your next step
www.physicsuk.co.uk

Graph B: calculation and precise language

12. Use gradients of the straight sections of Graph B to calculate the velocity in 0–4 s and in 11–15 s. Hence state the maximum speed in the calibration run. [3 marks]

13. At t = 6 s, the data logger gives an instantaneous velocity of +1.0 m s^{-1}. Explain why this is consistent with the 4–8 s part of Graph B and why this velocity is lower than during the first 4 s. [2 marks]

14. Using Graph B, calculate (i) the total distance travelled and (ii) the resultant displacement from 0 s to 15 s. [2 marks]

15. A pupil writes: “The displacement accelerates from 4 s to 8 s, then the velocity is stationary from 8 s to 11 s.” Rewrite both parts so that the quantities and their changes are described correctly. [3 marks]

Review and improve

- □ I can distinguish displacement, velocity and speed.
- □ I can use a gradient or an area with the correct physical meaning.
- □ I can describe a graph without saying that a quantity ‘accelerates’.

Continue your physics journey

Videos, practice and support for your next step

www.physicsuk.co.uk