physicsUK
Smarter practice. Stronger understanding

WORKSHEETS
ATTEMPT | CHECK | CORRECT | IMPROVE

OCR A A Level Linear Motion 2 worksheet

35–40 minutes independent practice + 15–20 minutes review

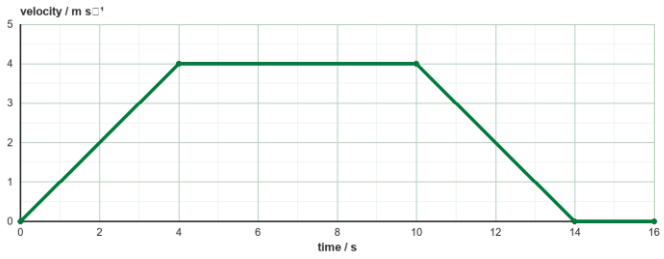
Specification points covered

• 3.1.1(a) Define and use displacement, instantaneous speed, average speed, velocity and acceleration.
• 3.1.1(b) Interpret graphical representations of displacement, speed, velocity and acceleration.
• 3.1.1(c) Use displacement-time graphs to determine velocity as the gradient.
• 3.1.1(d) Use velocity-time graphs to determine acceleration as the gradient and displacement as the area under the graph, including estimation for non-linear graphs.

Graph language reminders
For a displacement-time graph: velocity = gradient. For a velocity-time graph: acceleration = gradient and displacement = area under the graph.
A quantity can increase, decrease or stay the same. When it changes, state whether the change is linear or non-linear. Do not write 'the velocity accelerates'.

1. Velocity-time graph: delivery cart

Context
A robotic delivery cart moves east along a straight warehouse aisle. East is the positive direction.



1. State the velocity of the delivery cart at t = 2.0 s. [1 mark]

2. From t = 0 to t = 4.0 s, describe the cart's velocity and acceleration. Use precise scientific language. [2 marks]

3. State the time at which the cart starts to slow down. [1 mark]

1. Velocity-time graph: delivery cart continued

4. Calculate the acceleration of the cart from t = 10 s to t = 14 s. [1 mark]

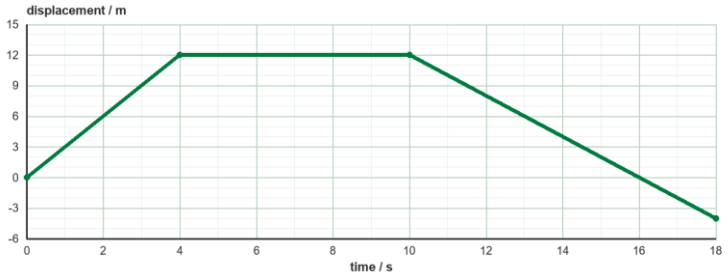
5. Calculate the displacement of the cart from t = 0 to t = 14 s. [3 marks]

6. State the displacement of the cart from t = 14 s to t = 16 s. [1 mark]

2. Displacement-time graph: safety trolley

Context

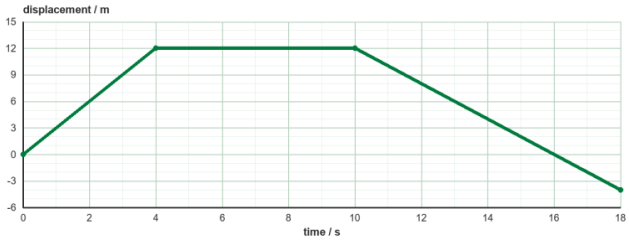
The safety trolley travels on the same straight aisle. East is positive. It returns past its starting point during the final section.



7. Use the graph to calculate the velocity of the safety trolley from t = 0 to t = 4.0 s. [1 mark]

8. From t = 4.0 s to t = 10 s, describe the trolley's displacement and velocity. [2 marks]

2. Displacement-time graph: safety trolley continued



9. Use the graph to calculate the velocity of the safety trolley from t = 10 s to t = 18 s. [1 mark]

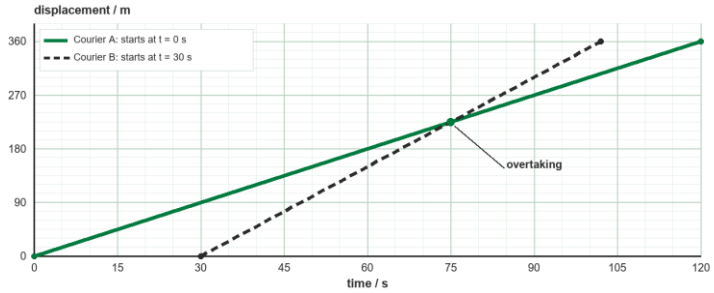
10. From t = 10 s to t = 18 s, describe the trolley's motion. Include the direction of travel. [2 marks]

11. Calculate the total distance travelled by the trolley from t = 0 to t = 18 s. [2 marks]

3. Comparing journeys: overtaking and equal distance

Context

Two bicycle couriers travel from the same gate to a marker 360 m away. Courier A starts at t = 0 s. Courier B starts at t = 30 s.



12. At t = 30 s, calculate how far ahead of Courier B Courier A is. [1 mark]

13. Use the graph to determine (i) the time at which Courier B overtakes Courier A and (ii) their displacement then. [2 marks]

14. Each courier reaches the marker at a displacement of 360 m. Determine the time each courier spends moving from the gate to the marker. [2 marks]

15. Calculate the gradient of each courier's displacement-time line. State what each gradient represents. [2 marks]

16. Explain why Courier B overtakes Courier A even though Courier B starts later. [2 marks]

Review and improve

□ I can use the gradient of a displacement-time graph to find velocity.
□ I can use the gradient and area of a velocity-time graph correctly.
□ I can explain overtaking using displacement, gradient and velocity.