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Smarter practice. Stronger understanding

WORKSHEETS
ATTEMPT | CHECK | CORRECT | IMPROVE

OCR A A Level Linear Motion 1 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.
• 3.1.2(a)(i) Apply equations of motion for constant acceleration in a straight line, including motion in a uniform gravitational field without air resistance.

Constant-acceleration equations

Use an appropriate equation only where acceleration is constant.

$v = u + at$ $s = ut + 0.5at^2$ $s = 0.5(u + v)t$ $v^2 = u^2 + 2as$

Use s for displacement, u for initial velocity, v for final velocity, a for acceleration and t for time.

Quick substitution practice

1. A trolley has initial velocity 4.0 m s^{-1} and accelerates at 1.5 m s^{-2} for 6.0 s. Calculate its final velocity. [1 mark]

2. A test cart has initial velocity 18 m s^{-1} and acceleration -2.0 m s^{-2} for 4.0 s. Calculate its final velocity. [1 mark]

3. A glider starts from rest and accelerates at 0.60 m s^{-2} for 10 s. Calculate its displacement. [1 mark]

4. A trolley changes velocity uniformly from 3.0 m s^{-1} to 11 m s^{-1} in 4.0 s. Calculate its displacement. [1 mark]

5. An object has initial velocity 5.0 m s^{-1} and acceleration 2.0 m s^{-2} over a displacement of 24 m. Calculate its final velocity. [1 mark]

Worded scenarios: a camera dolly

Context
A camera dolly moves on a straight studio track. Take east as the positive direction for Questions 6–9.

6. A camera dolly starts from rest and accelerates east at 0.80 m s^{-2} for 7.5 s. Calculate (i) its final velocity and (ii) its displacement. [2 marks]

7. For a second shot, the dolly already moves east at 2.5 m s^{-1}. It accelerates east at 1.2 m s^{-2} for 6.0 s. Calculate (i) its final velocity and (ii) its displacement. [2 marks]

8. The dolly approaches a stop marker at 12 m s^{-1} and has constant acceleration -3.0 m s^{-2} for 3.0 s. Calculate (i) its final velocity and (ii) its displacement in this interval. [2 marks]

9. In Question 8, explain why -3.0 m s^{-2} does not mean that the dolly has negative speed. [1 mark]

More basic constant-acceleration contexts

10. A battery-powered crate mover has initial velocity 2.0 m s^{-1}. Its velocity becomes 14 m s^{-1} after moving 48 m with constant acceleration. Show that its acceleration is 2.0 m s^{-2}. [2 marks]

11. A rail-mounted lift carrier travels at 8.0 m s^{-1} and slows uniformly to rest with acceleration -1.6 m s^{-2}. Calculate (i) the time taken to stop and (ii) the displacement while stopping. [2 marks]

12. Two test runs each last 4.0 s. Run A starts from rest and has acceleration 1.0 m s^{-2}. Run B starts at 2.0 m s^{-1} and has acceleration 0.50 m s^{-2}. Calculate both final velocities and state whether either run has the greater final speed. [3 marks]

13. A small tool falls from rest for 1.2 s. Air resistance is negligible. Use g = 9.81 m s^{-2} to calculate (i) its speed and (ii) the distance it falls. [2 marks]

14. The tool in Question 13 is brought to rest uniformly in 0.30 s by a safety catch. Take downward as positive. Calculate its acceleration and state the direction of this acceleration. [2 marks]

15. A pupil writes $s = ut + at^2$ for a trolley moving with constant acceleration. Identify the error in the equation. [1 mark]

Review and improve

- □ I can choose a constant-acceleration equation for the quantities given.
- □ I can use the sign of velocity and acceleration correctly.
- □ I can use g for free fall when air resistance is negligible.