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WORKSHEETS
ATTEMPT | CHECK | CORRECT | IMPROVE

Linear motion 1 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 | 40 marks

Specification points covered

AQA 7407 / 7408: 3.4.1.3 selected content — signed motion quantities, uniform-acceleration equations and free fall. Graph analysis and the free-fall practical are covered in separate worksheets.
OCR A H156 / H556: 3.1.1(a); 3.1.2(a)(i), (b)(i), (c) — kinematics, constant-acceleration motion, free fall and stopping distance.

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.

Studio checks

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 camera glider starts from rest and accelerates at 0.60 m s^{-2} for 10 s. The unobstructed studio track is 28 m long. Calculate its displacement and decide whether the whole accelerating run fits on the track. [2 marks]

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4. A camera trolley changes velocity uniformly from 3.0 m s^{-1} to 11 m s^{-1} in 4.0 s. The actor marker is 30 m ahead of its initial position. Calculate the trolley displacement and state whether it has reached the marker after 4.0 s. [2 marks]

5. A dolly enters a 24 m shot section at 5.0 m s^{-1} and accelerates uniformly at 2.0 m s^{-2}. The camera stabiliser must not exceed a speed of 10 m s^{-1}. Calculate its speed at the end and decide whether the stabiliser limit is met. [2 marks]

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]

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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]

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End of shot checks

16. At the end of a shot the dolly travels east at 6.0 m s^{-1}. Its controller waits 0.40 s at this constant velocity before braking with constant acceleration −1.5 m s^{-2} until rest. There is 14.0 m of clear track ahead. Calculate the braking time and the total stopping distance, including the controller delay. Decide whether the dolly stops within the clear track. [4 marks]

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17. For the same 6.0 m s^{-1} initial velocity, 0.40 s controller delay and 14.0 m clear track, determine the magnitude of constant braking acceleration that would stop the dolly exactly at the boundary. The two available presets have magnitudes 1.5 m s^{-2} and 1.8 m s^{-2}. Which preset should be selected to stop within the clear track? [3 marks]

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Checking the calibration

18. In a separate calibration run, the dolly starts from rest and moves 18.0 m in 6.00 s with constant acceleration. Determine its acceleration and final speed. Explain why the value 18.0/6.00 = 3.00 m s^{-1} is not its final speed. [3 marks]

19. During a warm-battery check, measured eastward velocities at 0 s, 1 s, 2 s and 3 s are 0 m s^{-1}, 1.0 m s^{-1}, 3.0 m s^{-1} and 6.0 m s^{-1}. Calculate the average acceleration in the first and last one-second intervals. Explain whether one constant-acceleration SUVAT calculation is justified for the whole three seconds. [3 marks]

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.

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