

AS Physics 9702

Unit 2 · Kinematics

Original worksheet

Name: _____ Date: _____

Suggested marks: 82. Work through the questions over more than one study session if needed. Use additional paper for extended working and graph paper where requested.

Show equations, substitutions, units and reasoning. Use the constants specified in each question. The questions are original practice, not an official Cambridge examination or mark scheme.

Scope: Cambridge International AS Physics 9702, 2025–2027 learning outcomes. The published 2028–2030 AS scope has been checked separately and is substantively unchanged. Version: 11 October 2026.

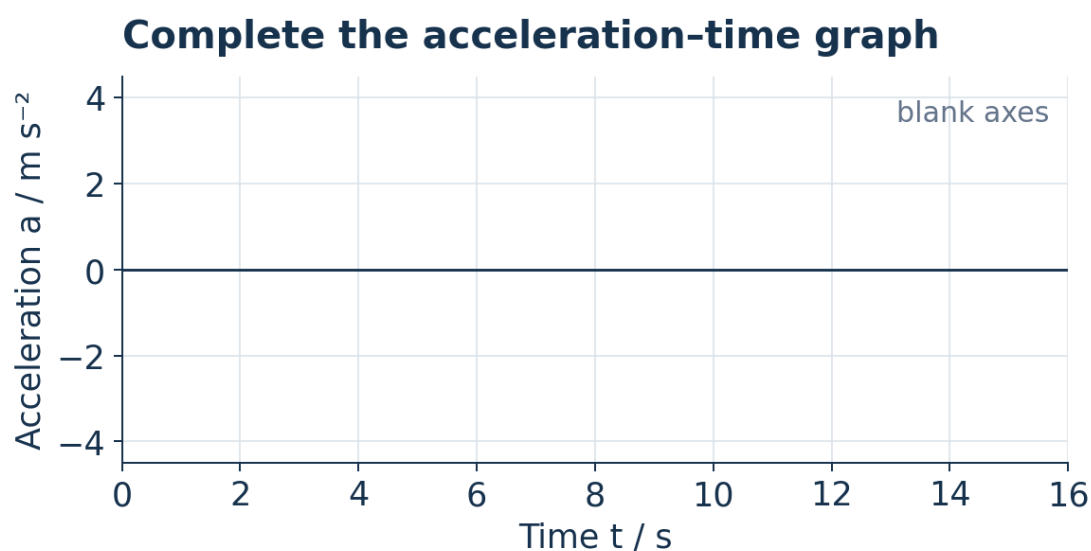
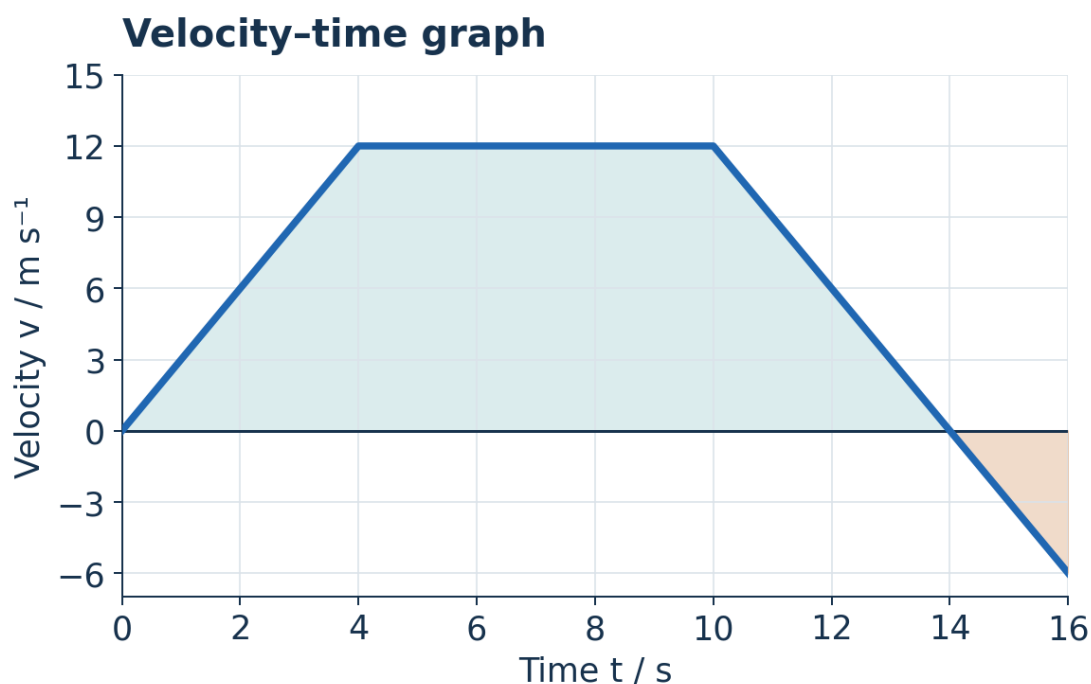
U2-Q1 · 6 marks

A student runs 40 m east, then 30 m west, in 14 s. (a) Find distance and displacement. (b) Find average speed and average velocity. (c) Explain why an object travelling west can have an eastward acceleration.

U2-Q2 · 10 marks

A trolley's velocity-time graph consists of straight segments through $(0 \text{ s}, 0 \text{ m s}^{-1})$, $(4 \text{ s}, 12 \text{ m s}^{-1})$, $(10 \text{ s}, 12 \text{ m s}^{-1})$ and $(16 \text{ s}, -6 \text{ m s}^{-1})$. (a) Find the acceleration in each interval. (b) Find when the trolley reverses. (c) Calculate total displacement and distance. (d) Describe the corresponding speed-time and acceleration-time graphs.

Figure for U2-Q2



U2-Q3 · 6 marks

A tangent to a displacement-time curve at $t = 2.0$ s passes through (1.0 s, 4.0 m) and (3.0 s, 26.0 m). (a) Find the velocity at 2.0 s. (b) Explain how to determine average velocity from 1.0 to 3.0 s if the actual curve positions are known. (c) State what horizontal and negative-gradient sections mean, and why a total distance-time graph cannot slope downward.

U2-Q4 · 7 marks

For one-dimensional motion with constant acceleration, derive (a) $v = u + at$; (b) $s = ut + \frac{1}{2}at^2$; (c) $v^2 = u^2 + 2as$. State why $s = \frac{1}{2}(u + v)t$ cannot generally be used when acceleration varies.

U2-Q5 · 5 marks

A vehicle travelling at 22.0 m s^{-1} brakes with constant acceleration -4.00 m s^{-2} . Find its stopping time and braking distance. Explain why the equations must not automatically be extended beyond the stopping time.

U2-Q6 · 7 marks

A ball is thrown vertically upwards at 18.0 m s^{-1} . Neglect air resistance and use $g = 9.81 \text{ m s}^{-2}$. Find (a) maximum height above release; (b) time to return to its release height; (c) velocity and acceleration at the highest point.

U2-Q7 · 5 marks

A small dense sphere is dropped from rest 45.0 m above the ground. Assuming negligible air resistance and $g = 9.81 \text{ m s}^{-2}$, calculate the fall time and impact speed. State one physical reason the measured result might depart from this model.

U2-Q8 · 8 marks

Describe an experiment using a released ball to determine g . Specify apparatus, measured quantities, how to obtain g from a graph, two ways to improve reliability or accuracy, and one safety precaution.

U2-Q9 · 6 marks

A free-fall graph of height h against t^2 has best-fit gradient $(4.91 \pm 0.05) \text{ m s}^{-2}$. (a) Calculate g and its absolute uncertainty. (b) A separate v - t graph rises by 1.96 m s^{-1} in 0.200 s. Find its acceleration. (c) Explain why a non-zero intercept on the h - t^2 graph should be investigated.

U2-Q10 · 8 marks

A ball leaves a horizontal platform at 8.00 m s^{-1} , 20.0 m above level ground. Use $g = 9.81 \text{ m s}^{-2}$ and neglect air resistance. Find (a) flight time; (b) horizontal range; (c) speed and direction immediately before impact. Compare its flight time with a ball dropped from rest at the same height.

U2-Q11 · 8 marks

A projectile is launched at 20.0 m s^{-1} at 30.0° above horizontal and lands at its launch height. Neglect drag and take $g = 9.81 \text{ m s}^{-2}$. Find the flight time, range and maximum height. State its velocity and acceleration at the highest point.

U2-Q12 · 3 marks

Diagnostic multiple choice. A projectile is launched at an angle above horizontal with non-zero horizontal speed. Air resistance is negligible. At its highest point, which statement is correct?

A: Velocity and acceleration are both zero. B: Velocity is horizontal and acceleration is downward. C: Velocity is horizontal and acceleration is zero. D: Velocity is zero and acceleration is horizontal. Choose one and explain the distractors.

U2-Q13 · 3 marks

Diagnostic multiple choice. A straight velocity-time line slopes from $+4 \text{ m s}^{-1}$ at 0 s to -4 m s^{-1} at 4 s . Which pair gives displacement and distance travelled? A: 0 m and 0 m . B: 8 m and 8 m . C: 0 m and 8 m . D: -8 m and 0 m . Choose one option and explain the distractors.

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