

AS Physics 9702

Unit 5 · Work, energy and power

Original worksheet

Name: _____ Date: _____

Suggested marks: 60. 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.

U5-Q1 · 5 marks

A 60 N force pulls a crate 5.0 m horizontally at 40° above horizontal. A constant 18 N resistance acts. (a) Calculate work done by the pulling force. [2] (b) Calculate work done by resistance. [1] (c) State the work done by the normal reaction and find total work on the crate. [2]

U5-Q2 · 6 marks

A 1.5 kg parcel slides from rest down a track, losing 1.2 m in height. It reaches the bottom at 4.0 m s^{-1} . Use $g = 9.81 \text{ m s}^{-2}$. (a) Find gravitational potential energy lost. [2] (b) Find final kinetic energy. [1] (c) Calculate the energy transferred to other stores and explain why this does not violate conservation of energy. [3]

U5-Q3 · 5 marks

An electrically driven lift receives 48 kJ and delivers 33.6 kJ of useful mechanical energy. (a) Define and calculate its efficiency. [2] (b) Calculate energy transferred to unwanted stores. [1] (c) A separate transmission passes 85% of the useful mechanical energy to a load. Calculate the efficiency from electrical input to the load. [2]

U5-Q4 · 5 marks

A motor transfers 18.0 kJ of useful work in 12.0 s and has efficiency 75%. (a) Define power and calculate its useful average power. [2] (b) Calculate input power. [2] (c) Explain why the quoted useful average power need not be the useful power at every instant. [1]

U5-Q5 · 6 marks

A tow vehicle supplies a steady horizontal pulling force. (a) Starting with $W = Fs$, derive $P = Fv$ for motion parallel to the force. [2] (b) At 12 m s^{-1} , the pulling power is 9.6 kW. Find the pulling force. [2] (c) If the same power is supplied at 8.0 m s^{-1} , find the new force and state one practical limitation of extrapolating this relation to very small speeds. [2]

U5-Q6 · 6 marks

A 6.0 kg box is raised slowly in a uniform gravitational field, $g = 9.81 \text{ m s}^{-2}$. (a) Derive its change in gravitational potential energy using work done against its weight. [3] (b) It travels 4.0 m along a slope and rises vertically by 1.5 m. Calculate the increase in potential energy. [2] (c) State whether the same vertical rise by a different frictionless route changes that increase. [1]

U5-Q7 · 6 marks

(a) Use $F = ma$ and $v^2 = u^2 + 2as$ to derive $E_k = (1/2)mv^2$, taking kinetic energy as zero at rest. [3] (b) A 900 kg car speeds up from 10 to 16 m s^{-1} . Find its increase in kinetic energy. [2] (c) Explain the error in using $(1/2)m(16 - 10)^2$. [1]

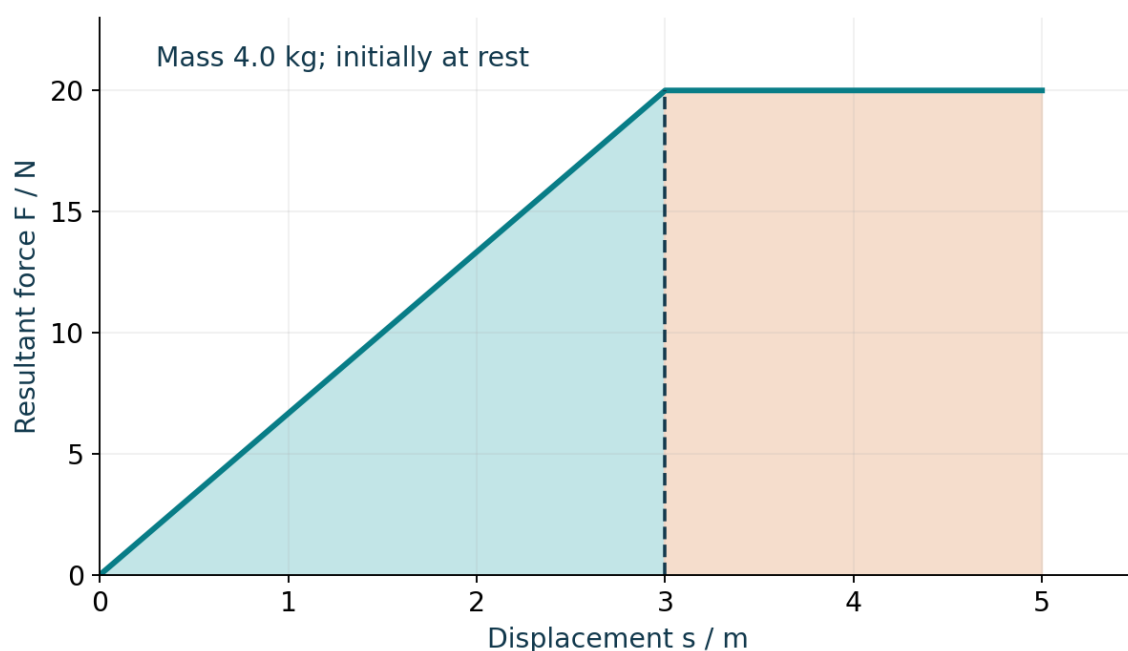
U5-Q8 · 6 marks

A 1000 kg vehicle climbs a slope at a steady 15 m s^{-1} . Its height increases by 1.0 m for every 20 m travelled along the slope. Resistance is 500 N. Take $g = 9.81 \text{ m s}^{-2}$. (a) Find its rate of increase of height. [1] (b) Calculate power needed to increase gravitational potential energy. [2] (c) Calculate total useful driving power and explain why kinetic energy remains constant. [3]

U5-Q9 · 5 marks

A resultant force along a straight track rises linearly from 0 to 20 N over the first 3.0 m and is then constant at 20 N for a further 2.0 m. A 4.0 kg trolley starts from rest. (a) Find total resultant work from the force-displacement graph. [3] (b) Calculate final speed. [2]

Figure for U5-Q9



U5-Q10 · 6 marks

In a motor test, a 2.00 ± 0.01 kg mass rises vertically by 1.20 ± 0.01 m in 3.00 ± 0.10 s. Electrical input power is 10.0 W with negligible uncertainty. Take $g = 9.81 \text{ m s}^{-2}$ as exact. (a) Calculate useful average output power and efficiency. [3] (b) Estimate maximum percentage uncertainty in output power. [2] (c) Suggest one change reducing the timing percentage uncertainty. [1]

U5-Q11 · 2 marks

Diagnostic multiple choice. A student carries a bag horizontally at constant height while exerting only an upward supporting force on it. Which statement about work done by that force is correct? Choose one option and explain. [2]

- A. Work is zero because force and displacement are perpendicular.
 - B. Work equals the upward force multiplied by horizontal distance.
 - C. Work is negative because weight acts downwards.
 - D. Work must be positive because the student uses metabolic energy.
-
-

U5-Q12 · 2 marks

Diagnostic multiple choice. A car's speed increases by 20% while its mass stays constant. By what percentage does its kinetic energy increase? Choose one option and justify it. [2]

- A. 20%
 - B. 40%
 - C. 44%
 - D. 144%
-
-

Use with the full notes

[revisiontown.com/as-level-physics-notes-and-worksheets/](https://www.revisiontown.com/as-level-physics-notes-and-worksheets/)

Independent educational resource. Cambridge International does not produce or endorse this resource. Syllabus reference: official Cambridge Physics 9702 syllabus, AS topics 1–11 and Paper 3 practical assessment.