

AS Physics 9702

Unit 1 · Physical quantities and units

Worked answers

Try the separate worksheet first. These worked answers explain methods as well as results. Equivalent valid reasoning and sensible rounding may also be correct. Suggested marks are RevisionTown practice guidance, not Cambridge marking instructions.

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.

U1-Q1 · 5 marks

(a) A unit is required; for example, 1.8 m supplies both magnitude and unit. (b) $t = 600/1.5 = 400 \text{ s} \approx 6.7 \text{ min}$. The proposed 2 s would require 300 m s^{-1} , far above walking speed. (c) Walking speed varies, and the route distance may itself be approximate. Credit a clear assumption rather than unjustified precision.

U1-Q2 · 8 marks

(a) kg, m, s, A and K respectively. (b) Acceleration has units m s^{-2} , so $\text{N} = \text{kg m s}^{-2}$. Dividing by m^2 gives $\text{Pa} = \text{kg m}^{-1} \text{s}^{-2}$. Multiplying force by m gives $\text{J} = \text{kg m}^2 \text{s}^{-2}$.

U1-Q3 · 6 marks

(a) $[k] = [F]/[v]^2 = (\text{kg m s}^{-2})/(\text{m}^2 \text{s}^{-2}) = \text{kg m}^{-1}$. (b) v^2 and u^2 have units $\text{m}^2 \text{s}^{-2}$; as has $(\text{m s}^{-2})\text{m} = \text{m}^2 \text{s}^{-2}$. All terms match. (c) Dimensional checks cannot establish dimensionless factors, signs, or whether the physical assumptions apply.

U1-Q4 · 10 marks

(a) $7.0 \times 10^{-12} \text{ s}$; (b) $3.2 \times 10^{-9} \text{ m}$; (c) $8.5 \times 10^{-6} \text{ A}$; (d) 0.042 V ; (e) 0.064 m ; (f) 0.30 m ; (g) 2700 N ; (h) $4.5 \times 10^6 \text{ W}$; (i) $1.8 \times 10^9 \text{ Hz}$; (j) $6.0 \times 10^{11} \text{ W}$. Each conversion multiplies the original number by the prefix factor.

U1-Q5 · 5 marks

$m = 0.0360 \text{ kg}$. $V = 30.0 \times 10^{-6} = 3.00 \times 10^{-5} \text{ m}^3$. Density = $m/V = 1200 \text{ kg m}^{-3}$. Each of the three length dimensions gains a factor 10^{-2} , so the volume factor is $(10^{-2})^3 = 10^{-6}$.

U1-Q6 · 7 marks

(a) Mean = $4.30/5 = 0.86$ mm; corrected mean = $0.86 - 0.04 = 0.82$ mm. (b) The $+0.04$ mm zero offset is systematic. The 0.85 - 0.87 mm spread is evidence of random variation. (c) Repetition can reduce the random contribution to the mean but leaves the offset unless corrected. Precision concerns small spread; accuracy concerns proximity to the true value. Small spread alone does not prove accuracy.

U1-Q7 · 5 marks

Length = $42.6 - 18.2 = 24.4$ cm. Worst-case absolute uncertainty = $0.1 + 0.1 = 0.2$ cm. Percentage uncertainty = $100 \times 0.2/24.4 = 0.820\% \approx 0.8\%$. Report (24.4 ± 0.2) cm. The two readings may err in opposite directions, making their difference too large or too small; uncertainty does not cancel merely because readings are subtracted.

U1-Q8 · 7 marks

$g = 4\pi^2 \times 0.800/1.80^2 = 9.7478 \text{ m s}^{-2}$. Fractional uncertainty = $0.002/0.800 + 2 \times 0.02/1.80 = 0.024722$. Percentage uncertainty = 2.47% . Absolute uncertainty = $9.7478 \times 0.024722 = 0.241 \text{ m s}^{-2}$. Report $g = (9.75 \pm 0.24) \text{ m s}^{-2}$. Timing contributes 2.22% , compared with 0.25% from length; reducing timing uncertainty is the priority.

U1-Q9 · 4 marks

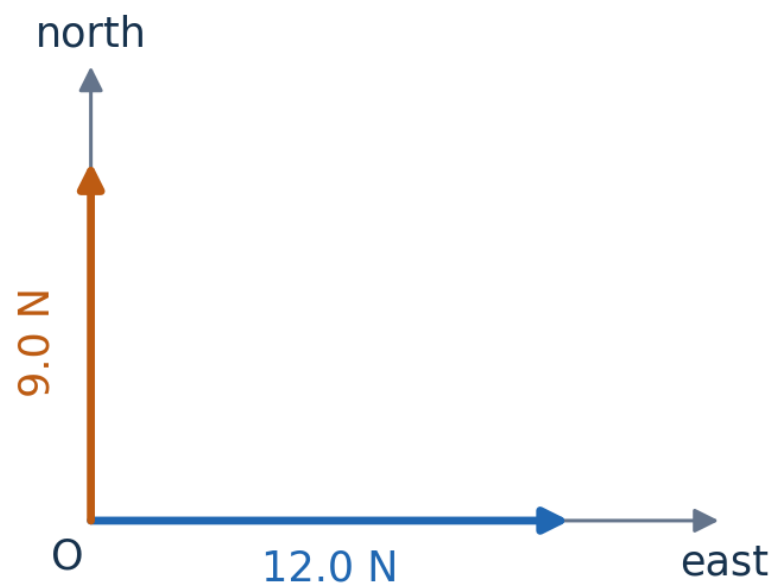
Energy and distance are scalars; momentum and acceleration are vectors. Distance counts the complete path length. Displacement is the directed change from initial to final position, so it is zero when these positions coincide, whatever path was followed.

U1-Q10 · 7 marks

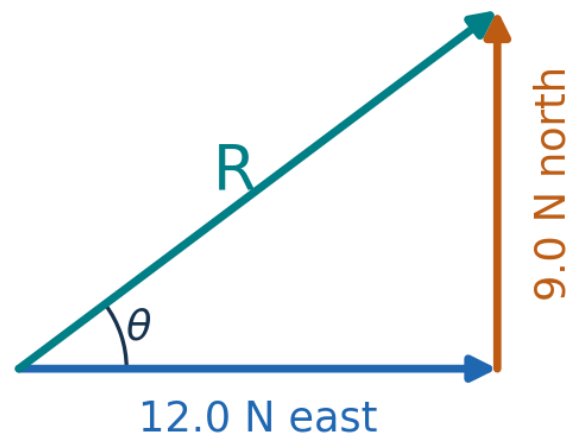
(a) Components are $(12.0, 9.0)$ N. Magnitude = $\sqrt{(12.0^2 + 9.0^2)} = 15.0$ N. Direction = $\tan^{-1}(9/12) = 36.9^\circ$ north of east. (b) The balancing force is $(-12.0, -9.0)$ N: 15.0 N at 36.9° south of west. (c) With 1 cm representing 3 N, draw 4 cm east followed head-to-tail by 3 cm north. The 5 cm diagonal from starting tail to final head represents 15 N.

Figure for U1-Q10 — worked answer

Forces acting at one point



Place vectors head-to-tail



Schematic only. Draw a separate scale diagram:
Example scale: 1 cm represents 3 N.

U1-Q11 · 6 marks

(a) Taking east positive, $\Delta v = -3.0 - (+4.0) = -7.0 \text{ m s}^{-1}$, or 7.0 m s^{-1} west. (b) $F_x = 20 \cos 30^\circ = 17.3 \text{ N}$; $F_y = 20 \sin 30^\circ = 10.0 \text{ N}$ upward. (c) To draw $A - B$, reverse B without changing its length and add $-B$ head-to-tail to A ; the resultant joins the first tail to the final head.

U1-Q12 · 3 marks

Correct option: C. The tight cluster indicates precision, while the persistent $+5.0 \text{ g}$ bias indicates a systematic error and poor accuracy. A ignores the bias. B calls a biased mean accurate and a tight cluster imprecise. D confuses the sign of an error with the spread of readings; a positive error does not itself imply poor precision.

U1-Q13 · 3 marks

Correct option: B. The unit conversion factor is squared: $2.0 \text{ cm}^2 = 2.0(10^{-2} \text{ m})^2 = 2.0 \times 10^{-4} \text{ m}^2$. A applies a length conversion to an area. C reverses the conversion direction and fails to square it. D squares the numerical area value 2.0 unnecessarily; only the conversion of the centimetre inside cm^2 is squared.

Use with the full notes

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