Physics Paper 1 Mark Scheme

Sample assessment 2026–27

Time allowed: 2 hours Total marks: 85

STAFF ONLY

Credit valid equivalent scientific responses where they meet the approved set-specific marking criteria. Reconcile every maximum mark to the candidate paper and answer booklet.

Section A · Multiple-choice questions

Award 1 mark for each correct answer.

Question	Correct answer
A1	B · Unequal impacts by randomly moving air molecules change the particles' motion. Brownian motion provides indirect evidence of random molecular motion.
A2	D · 4900 Pa. $\Delta p = \rho g \Delta h = 1000 \times 9.8 \times 0.50$.
A3	A · Temperature. Equal temperature gives no net thermal energy transfer between them.
A4	C · It increases molecular potential energy as attractions are overcome. Temperature and mean molecular kinetic energy remain constant during the ideal change of state.
A5	A · 3.01×10^{23}. $N = nN_a$.
A6	D · Collisions transfer momentum to the wall. The rate of momentum transfer produces a force per unit area.
A7	B · 1.50. At constant n and V, p is proportional to absolute temperature.
A8	C · A straight line through the origin. Force is proportional to extension within this region.
A9	D · 10 N. Resultant magnitude is $\sqrt{(6^2 + 8^2)}$.
A10	A · Displacement. Integrating velocity over time gives displacement.
A11	C · The downward force exerted by the book on the table. A third-law pair acts on different bodies in the same interaction.
A12	B · 70%. Efficiency = useful output / input = 350/500.
A13	A · Total momentum and total kinetic energy are conserved. Momentum conservation follows isolation; kinetic energy is also conserved in an elastic collision.
A14	C · 6.0 N m. Moment = force × perpendicular distance.

Question	Correct answer
A15	B · It points towards the centre. Velocity changes direction, producing centripetal acceleration.
A16	D · At maximum displacement from equilibrium. For $a = -\omega^2 x$, acceleration magnitude is proportional to displacement magnitude.
A17	C · Energy. The medium oscillates while energy propagates.
A18	A · 1.50. $n = c/v$.
A19	D · Microwaves. Microwaves have longer wavelengths than visible, ultraviolet and X-rays.
A20	B · +2.0 mm. Superposition adds signed displacements.
A21	C · A constant phase difference and the same frequency. A stable phase relationship gives a stable interference pattern.
A22	D · When the opening width is comparable to the wavelength. The ratio of wavelength to opening width controls spreading.
A23	A · 0.40 m. Adjacent nodes are separated by half a wavelength.
A24	B · It is opposite to conventional current. Conventional current follows the direction positive charge would move.
A25	C · Its metal filament heats and its resistance increases. A changing filament temperature gives non-ohmic behaviour.

Section B · Extended-response marking map

Question B1 · 10 marks

(a) 2 marks
1 mark: Energy needed per unit mass of a substance.
1 mark: To increase its temperature by one kelvin, without a change of state.
Mapping: LO4; AO1 2

(b) 2 marks
1 mark: $c = E/(m\Delta T) = 9000/(0.50 \times 20)$.
1 mark: $c = 900$ J kg^{-1} K^{-1}.
Mapping: LO4; AO2 2

(c) 3 marks
1 mark: Uses $pV = nRT$ and rearranges $V = nRT/p$.
1 mark: Substitutes $V = 0.200 \times 8.31 \times 300/(1.00 \times 10^5)$.
1 mark: $V = 4.99 \times 10^{-3}$ m^3.
Mapping: LO7; AO2 3

(d) 2 marks
1 mark: The inferred specific heat capacity is too high.
1 mark: The full heater energy exceeds energy absorbed by the block; dividing this larger energy by the measured $m\Delta T$ overestimates c.
Mapping: LO4; AO3 2

(e) 1 mark
1 mark: They have the same temperature, with no net thermal energy transfer between them.
Mapping: LO3; AO1 1

Alternative valid responses / allocation: A correct value and units earn the accuracy mark; award the method mark only when sufficient relevant working is shown.
(c) Accept 0.004986 m^3 or appropriately rounded value. Correct value and units earn the accuracy mark; award method marks only when sufficient relevant working is shown.

Question B2 · 10 marks

(a) 4 marks
1 mark: $v = u + at = 0 + 1.5 \times 2.0$.
1 mark: $v = 3.0\ m\ s^{-1}$.
1 mark: $s = ut + \frac{1}{2}at^2 = \frac{1}{2} \times 1.5 \times 2.0^2$.
1 mark: $s = 3.0\ m$.
Mapping: LO11; AO2 4

(b) 3 marks
1 mark: Initial momentum $= 0.40 \times 3.0 = 1.2\ kg\ m\ s^{-1}$.
1 mark: Uses conservation: $1.2 = (0.40 + 0.60)v$.
1 mark: $v = +1.2\ m\ s^{-1}$.
Mapping: LO12, LO14; AO2 3

(c) 2 marks
1 mark: Before: $\frac{1}{2} \times 0.40 \times 3.0^2 = 1.8\ J$; after: $\frac{1}{2} \times 1.00 \times 1.2^2 = 0.72\ J$.
1 mark: Decrease = 1.08 J.
Mapping: LO13, LO14; AO2 2

(d) 1 mark
1 mark: Energy is transferred to other forms, such as internal energy/deformation or sound.
Mapping: LO13, LO14; AO1 1

Alternative valid responses / allocation: (a) Award method marks only where sufficient relevant working is shown. Award the accuracy mark for each correct result with units; an unsupported answer earns accuracy only where its result is correct.(b) Follow through the speed from (a). Award method marks for valid momentum/conservation working; award the accuracy mark for the correct signed velocity with units. Follow through carried error where subsequent physics is valid; an incorrect final value does not earn the accuracy mark.(c) First mark requires both energies or an equivalent single expression. Follow through valid velocities from earlier parts.

Question B3 · 10 marks

(a) 2 marks
1 mark: Tensile stress is tensile force divided by original cross-sectional area.
1 mark: Tensile strain is extension divided by original length.
Mapping: LO8; AO1 2

(b) 4 marks
1 mark: Cross-sectional area = $\pi(0.500 \times 10^{-3})^2/4 = 1.9635 \times 10^{-7}$ m².
1 mark: Stress = $20.0/(1.9635 \times 10^{-7}) = 1.019 \times 10^{8}$ Pa.
1 mark: Strain = $1.02 \times 10^{-3}/2.00 = 5.10 \times 10^{-4}$.
1 mark: Young modulus = stress/strain = 2.00×10^{11} Pa.
Mapping: LO8; AO2 4

(c) 1 mark
1 mark: The deformation was elastic, with no permanent extension.
Mapping: LO8; AO1 1

(d) 3 marks
1 mark: Repeating extension measurements does not remove a systematic or unrepresentative diameter error.
1 mark: Measure diameter with a suitable micrometer at several positions and orientations, checking its zero/calibration.
1 mark: Use the representative mean and spread/resolution to estimate diameter uncertainty; area depends on diameter squared, so diameter error has a substantial effect on inferred modulus.
Mapping: LO8; AO3 3

Alternative valid responses / allocation: (b) Accept an equivalent combined calculation $FL/(A\Delta L)$. A correct result with units earns all four marks only when sufficient relevant working is shown; retain method credit after arithmetic errors where the method is valid.
(d) Credit a different valid procedure with a linked evaluation. Do not award the third point for averaging without considering diameter representativeness or uncertainty.

Question B4 · 10 marks

(a) 3 marks
1 mark: Five fringe intervals: $x = 24.0/5 = 4.80$ mm $= 4.80 \times 10^{-3}$ m.
1 mark: Uses $\lambda = ax/D = (0.250 \times 10^{-3})(4.80 \times 10^{-3})/2.00$.
1 mark: $\lambda = 6.00 \times 10^{-7}$ m.
Mapping: LO22; AO2 3

(b) 2 marks
1 mark: The measured distance is larger while endpoint reading uncertainty is approximately unchanged.
1 mark: Dividing by the number of intervals therefore gives a smaller fractional uncertainty in fringe spacing/wavelength.
Mapping: LO22; AO3 2

(c) 2 marks
1 mark: Uses $\sin\theta = \lambda/d = 0.300$ for first order.
1 mark: $\theta = 17.5°$.
Mapping: LO23; AO2 2

(d) 3 marks
1 mark: Superposition of waves of the same frequency travelling in opposite directions.
1 mark: Nodes have zero resultant displacement at all times, with antinodes between them.
1 mark: Wavelength is twice adjacent-node spacing: 0.300 m.
Mapping: LO21, LO24; AO1 2, AO2 1

Alternative valid responses / allocation: A correct result with units earns all three marks only when sufficient relevant working is shown. Credit consistent working after miscounting intervals without re-awarding that first mark.(c) Follow through wavelength from (a) where physically possible. Award 1 method mark for relevant valid working and 1 accuracy mark for the correct angle; a correct unsupported angle earns the accuracy mark only.(d) The wavelength mark is a direct interpretation of node spacing; credit another clear account of destructive/constructive interference.

Question B5 · 10 marks

(a) 3 marks
1 mark: Current I = 6.0/(4.0 + 1.0) = 1.2 A.
1 mark: Terminal potential difference V = 6.0 − (1.2 × 1.0), or V = 1.2 × 4.0.
1 mark: V = 4.8 V.
Mapping: LO26, LO29; AO2 3

(b) 2 marks
1 mark: Uses $P = I^2r = 1.2^2 \times 1.0$.
1 mark: P = 1.44 W.
Mapping: LO26, LO29; AO2 2

(c) 2 marks
1 mark: V(out) = 6.0 × 4.0/(2.0 + 4.0).
1 mark: V(out) = 4.0 V.
Mapping: LO30; AO2 2

(d) 2 marks
1 mark: The NTC thermistor resistance decreases on warming.
1 mark: Its fraction of total series resistance decreases, so voltage across it and the output decrease.
Mapping: LO27, LO30; AO2 2

(e) 1 mark
1 mark: 1/2: length doubles while cross-sectional area increases by four.
Mapping: LO28; AO2 1

Alternative valid responses / allocation: (a) First mark for correct current with units; remaining two for method and terminal potential difference.
(b) Follow through current from (a). Correct result with units earns the accuracy mark. Award method marks only when sufficient relevant working is shown.
(c) Correct answer with units earns the accuracy mark. Award method marks only when sufficient relevant working is shown.

Question B6 · 10 marks

(a) 1 mark
1 mark: Stored charge per unit potential difference across the capacitor.
Mapping: LO31; AO1 1

(b) 4 marks
1 mark: $Q = CV$, with $C = 1.00 \times 10^{-3}$ F.
1 mark: $Q = 6.00 \times 10^{-3}$ C.
1 mark: $E = \frac{1}{2}CV^2 = \frac{1}{2} \times 1.00 \times 10^{-3} \times 6.0^2$.
1 mark: $E = 1.80 \times 10^{-2}$ J.
Mapping: LO26, LO31; AO2 4

(c) 3 marks
1 mark: $\tau = RC = (10.0 \times 10^3)(1.00 \times 10^{-3}) = 10.0$ s.
1 mark: For discharge $V = V_0\exp(-t/RC)$; at $t = \tau$, $V = 6.0/e$.
1 mark: $V = 2.21$ V.
Mapping: LO31; AO2 3

(d) 2 marks
1 mark: The effective parallel resistance is smaller, so the measured time constant is smaller.
1 mark: Using $C = \tau/10.0$ kΩ then underestimates the actual capacitance.
Mapping: LO27, LO31; AO3 2

Alternative valid responses / allocation: (b) Award method marks only where sufficient relevant working is shown. Award the accuracy mark for each correct result with units; credit $E = \frac{1}{2}QV$ with follow-through charge.(c) Credit equivalent taught exponential notation. One mark for the time constant and two for the voltage calculation.

Marking principles

Award one mark for the single correct MCQ option; otherwise award zero. No negative marking. If an answer is clearly replaced, mark the final unambiguous choice.

For Section B, use the stated point allocations and specific calculation rules. Credit equivalent scientifically correct responses; do not double-credit a repeated point.

Where a later calculation uses an earlier incorrect value correctly, credit the independent subsequent method unless this makes the task trivial. Do not award the final accuracy mark for an incorrect result.

Credit scientifically equivalent explanations and valid alternative calculations. Do not penalise spelling unless physical meaning becomes unclear.

All raw marks, marker identities, moderation decisions and release approvals must be recorded through the controlled pack processes.

Paper total: 85 marks. AO1, AO2 and AO3 are assessed.