

Cambridge International AS & A Level

PHYSICS

9702/22

Paper 2 AS Level Structured Questions

October/November 2025

MARK SCHEME

Maximum Mark: 60

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the October/November 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **15** printed pages.












Annotations guidance for centres




Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
	Information missing or insufficient for credit
	Arithmetic error
	Benefit of the doubt given
	Contradiction in response, mark not awarded
	Incorrect point or mark not awarded
	Error carried forward applied
	Ignore the response
	Mandatory mark not awarded
	Power of ten error
	Blank page seen
	Error in number of significant figures

Annotation	Meaning
 TE	Transcription error
	Correct point or mark awarded
 XP	Incorrect physics

PUBLISHED**Abbreviations**

/	Alternative and acceptable answers for the same marking point.
()	Bracketed content indicates words which do not need to be explicitly seen to gain credit but which indicate the context for an answer. The context does not need to be seen but if a context is given that is incorrect then the mark should not be awarded.
—	Underlined content must be present in answer to award the mark. This means either the exact word or another word that has the same technical meaning.

Mark categories

B marks	These are <u>independent</u> marks, which do not depend on other marks. For a B mark to be awarded, the point to which it refers must be seen specifically in the candidate's answer.
M marks	These are <u>mandatory</u> marks upon which A marks later depend. For an M mark to be awarded, the point to which it refers must be seen specifically in the candidate's answer. If a candidate is not awarded an M mark, then the later A mark cannot be awarded either.
C marks	These are <u>compensatory</u> marks which can be awarded even if the points to which they refer are not written down by the candidate, providing subsequent working gives evidence that they must have known them. For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct working which shows the candidate knew the equation, then the C mark is awarded. If a correct answer is given to a numerical question, all of the preceding C marks are awarded automatically. It is only necessary to consider each of the C marks in turn when the numerical answer is not correct.
A marks	These are <u>answer</u> marks. They may depend on an M mark or allow a C mark to be awarded by implication.

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Question	Answer	Marks
1(a)	air temperature: K and air pressure: $\text{kg m}^{-1} \text{s}^{-2}$	B1
	scalar only ticked for both air temperature and air pressure	B1
1(b)(i)	upthrust = $1.1 \times 9.81 \times (4\pi \times 0.90^3 / 3)$	C1
	= 33 N	A1
1(b)(ii)	(due to difference in height / depth there is a) difference in pressure between top and bottom (of balloon)	B1
	(due to pressure difference, upwards) force on bottom of balloon is greater (than downwards force on top of balloon, so resultant force is upwards)	B1
1(b)(iii)	$(\Sigma)F = 33 - 19$ (= 14 N)	C1
	$m = 19 / 9.81$ (= 1.94 kg)	C1
	$a = (33 - 19) / (19 / 9.81)$ = 7.2 m s^{-2}	A1
1(c)	$5 + 3 + (2 \times 4)$ (= 16%)	C1
	absolute uncertainty in $c = 1.8 \times 0.16$ = $(\pm) 0.3$	A1

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Question	Answer	Marks
2(a)(i)	$60 \times 1.6 (= 96 \text{ N m})$ or $220 \times 0.40 (= 88 \text{ N m})$	C1
	resultant moment = $96 - 88$ $= 8.0 \text{ N m}$	A1
2(a)(ii)	the resultant force (of A and C) is not zero or forces (from A and C) are not parallel or forces (from A and C) are not equal (magnitude) or forces (from A and C) are not opposite (direction) or forces (from A and C) act through the same point so (they are) not a couple	B1
2(b)	line with a positive gradient from $(t_1, 0)$ to t_2	B1
	line with increasing positive gradient from t_1 to t_2	B1
2(c)(i)	$\frac{\text{sum}}{\text{total}}$ momentum before = $\frac{\text{sum}}{\text{total}}$ momentum after or $\frac{\text{sum}}{\text{total}}$ momentum (of a system of objects) is constant	M1
	if no (resultant) external force / for an isolated system	A1

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Question	Answer	Marks
2(c)(ii)	$(\Delta)p = F(\Delta)t$	C1
	$m = Ft / (\Delta)v$ $(m =) 5500 \times 0.36 / 8.5 = 230 \text{ (kg)}$	A1
	or	
	$F = ma$ and $a = (\Delta)v / (\Delta)t$	(C1)
	$(m =) 5500 / (8.5 / 0.36) = 230 \text{ (kg)}$	(A1)
2(c)(iii)	$(\Delta p =) 5500 \times 0.36 (= 1980 \text{ N s})$ or $(\Delta p =) 230 \times 8.5 (= 1955 \text{ N s})$	C1
	$1980 = (2.5 \times 10^3 - 230)\Delta v$ or $1955 = (2.5 \times 10^3 - 230)\Delta v$	C1
	$\Delta v = 0.87 \text{ m s}^{-1}$ or 0.86 m s^{-1}	A1
	or	
	$a = 5500 / (2.5 \times 10^3 - 230)$ $(= 2.42 \text{ m s}^{-2})$	(C1)
	$\Delta v = 2.42 \times 0.36$	(C1)
	$\Delta v = 0.87 \text{ m s}^{-1}$ or 0.86 m s^{-1}	(A1)

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Question	Answer	Marks
3(a)	an arrow horizontally on the page to the left labelled F	B1
	two arrows horizontally on the page to the right each labelled T	B1
3(b)(i)	$T = 110 / 2$ $= 55 \text{ N}$	A1
3(b)(ii)	$x = F / k$	C1
	$= 110 / 250$ $= 0.44 \text{ m}$	A1
3(c)(i)	extension = $55 / 250$ or $110 / (2 \times 250)$	C1
	extension = 0.22 m	A1
3(c)(ii)	$E = \frac{1}{2} Fx$ or $E = \frac{1}{2} kx^2$ or $E = \frac{1}{2} F^2 / k$	C1
	$E_1 / E_2 = (\frac{1}{2} \times 110 \times 0.44) / (2 \times (\frac{1}{2} \times 55 \times 10.22))$ or $E_1 / E_2 = (\frac{1}{2} k \times 0.44^2) / (2 \times (\frac{1}{2} k \times 0.22^2))$ or $E_1 / E_2 = (\frac{1}{2} \times 110^2 / k) / (2 \times (\frac{1}{2} \times 55^2 / k))$ $E_1 / E_2 = 2.0$ (no ECF from 3(b)(ii) and 3(c)(i))	A1

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Question	Answer	Marks
4(a)	light diffracts / spreads (at slit(s))	B1
	light (from each slit) superposes / interferes (at screen)	B1
	when phase difference is 0 / path difference is $n\lambda$ (where n is an integer) a bright fringe is formed or when phase difference is 180° / path difference is $(n + 1)\lambda / 2$ (where n is an integer) a dark fringe is formed	B1
4(b)	$\lambda = ax / D$	C1
	$\lambda = 1.0 \times 10^{-3} \times 3.3 \times 10^{-3} / 4.8$ (= 6.875×10^{-7} m)	C1
	$f = v / \lambda$	C1
	= $3.0 \times 10^8 / 6.875 \times 10^{-7}$ = 4.4×10^{14} Hz	A1
4(c)	the light / beams (have different frequencies so) are not coherent / do not have constant phase difference	B1

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Question	Answer	Marks
5(a)	<u>sum of</u> current(s) into junction = <u>sum of</u> current(s) out junction or (algebraic) sum of current(s) at a junction is zero	B1
5(b)(i)	$(V=) E - Ir$	C1
	$(V=) 5.0 - (38 \times 10^{-3} \times 4.7) = 4.8 \text{ (V)}$	A1
5(b)(ii)	$R_{(Z)} = 120 \ \Omega$	C1
	$I_2 = 38 \times 10^{-3} - (4.8 / (100 + 120))$	C1
	$I_2 = 0.016 \text{ A}$	A1
	or	
	$R_{(Z)} = 120 \ \Omega$	(C1)
	$R_{(EXT)} = 4.8 / 38 \times 10^{-3}$ $(= 126 \ \Omega)$ $1 / R_{(Y)} = 1 / 126 - 1 / (120 + 100)$ $(R_{(Y)} = 297 \ \Omega)$ $I_2 = 4.8 / 297$	(C1)
	$I_2 = 0.016 \text{ A}$	(A1)

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Question	Answer	Marks
5(b)(iii)	$P = IV$ or $P = I^2R$ or $P = V^2 / R$	C1
	$P = 0.016 \times 4.8$ or $P = 0.016^2 \times (4.8 / 0.016)$ or $P = 4.8^2 / (4.8 / 0.016)$ $P = 0.077 \text{ W}$	A1
5(b)(iv)	resistance of the LDR / Z increases (as light intensity decreases)	B1
	<u>total</u> resistance (of the circuit) increases or current <u>in the battery</u> decreases	M1
	(potential difference across the internal resistor decreases so) the terminal potential difference increases	A1

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Question	Answer	Marks
6(a)	(a particle that) cannot be divided / subdivided (into smaller particles)	B1
6(b)(i)	any combination of one quark and one antiquark	C1
	up / charm / top and antiup / anticharm / antitop or down / strange / bottom and antidown / antistrange / antibottom	A1
6(b)(ii)	$E_{(K)} = \frac{1}{2} mv^2$	C1
	$2.1 \times 10^{-16} = \frac{1}{2} \times 0.67 \times 1.66 \times 10^{-27} \times v^2$	C1
	$v = 6.1 \times 10^5 \text{ m s}^{-1}$	A1
6(c)(i)	number of electrons = 88	A1
6(c)(ii)	(number of nucleons = $228 - 5 \times 4 = 208$) number of protons = $88 - (5 \times 2) + 4$ = 82	A1
	number of neutrons = $208 - 82 = 126$ = 126	A1