CAMBRIDGE
International Education

Cambridge International AS & A Level

PHYSICS **9702/21**

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.

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
A	Information missing or insufficient for credit
AE	Arithmetic error
BOD	Benefit of the doubt given
CON	Contradiction in response, mark not awarded
	Incorrect point or mark not awarded
ECF	Error carried forward applied
I	Ignore the response
MO	Mandatory mark not awarded
POT	Power of ten error
SEEN	Blank page seen
SF	Error in number of significant figures

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

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 independent 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 mandatory 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 compensatory 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 answer marks. They may depend on an **M** mark or allow a **C** mark to be awarded by implication.

Question	Answer	Marks
1(a)	rate of change of velocity	**B1**
1(b)(i)	acceleration = 320 / 20 = 16 m s^{-2}	**A1**
1(b)(ii)	$s = \frac{1}{2}((u) + v)t$ **or** distance = area under graph	**C1**
	(height) = $\frac{1}{2} \times 20 \times 320 = 3200$ m **or** 3.2 km	**A1**
1(c)(i)	$(\Delta E_P) = mg\Delta h$	**C1**
	$= 2.9 \times 10^6 \times 9.81 \times 3200$ $= 9.1 \times 10^{10}$ J	**A1**
1(c)(ii)	$(\Delta E_K) = \frac{1}{2} m\Delta(v^2)$	**C1**
	$= \frac{1}{2} \times 2.9 \times 10^6 \times 320^2$ $= 1.5 \times 10^{11}$ J	**A1**
1(c)(iii)	(power =) work done / time	**C1**
	power $= ((1.5 + 0.91) \times 10^{11}) / 20$ $= 1.2 \times 10^{10}$ W	**A1**

Question	Answer	Marks
2(a)(i)	(normal) force per (unit cross-sectional) area	**B1**
2(a)(ii)	(due to difference in depth there is a) difference in pressure between top and bottom (of ball)	**B1**
	(due to pressure difference, upwards) force on bottom of ball is greater (than downwards force on top of ball, so resultant force is upwards)	**B1**
2(b)(i)	arrow vertically downwards labelled 'weight'	**B1**
	arrow vertically upwards labelled 'upthrust'	**B1**
	arrow vertically upwards labelled '(viscous) drag'	**B1**
2(b)(ii)	SI base units of D: kg m s^{-2}	**C1**
	base units of η: kg m s^{-2} / (m × m s^{-1}) = kg m^{-1} s^{-1}	**A1**
2(c)(i)	upthrust = $920 \times (4 / 3) \times \pi \times (4.2 \times 10^{-3})^3 \times 9.81 = 2.8 \times 10^{-3}$ (N)	**A1**
2(c)(ii)	weight = drag + upthrust	**C1**
	$(2.4 \times 10^{-3} \times 9.81) = (2.8 \times 10^{-3}) + (6\pi \times 4.7 \times 4.2 \times 10^{-3} \times v)$	**C1**
	$v = 0.056$ m s^{-1}	**A1**

Question	Answer	Marks
3(a)	ratio of stress to strain	**B1**
3(b)(i)	$R_0 = \rho L / A$	**A1**
3(b)(ii)	$k = F / x$	**C1**
	$E = FL / Ax = ((F / x) \times (L / A)) = kL / A$ leading to $k_0 = EA / L$	**A1**
3(c)(i)	straight line with positive gradient starting at (0, R_0)	**B1**
3(c)(ii)	straight horizontal line starting at (0, k_0)	**B1**
3(d)(i)	$L = [0.034 \times \pi \times (0.80 \times 10^{-3})^2] / 1.8 \times 10^{-8} = 3.8$ (m)	**A1**
3(d)(ii)	$k = [1.3 \times 10^{11} \times \pi \times (0.80 \times 10^{-3})^2] / 3.8$ **or** $k = EA / [RA / \rho] = E\rho / R$ $= [1.3 \times 10^{11} \times 1.8 \times 10^{-8}] / 0.034$	**C1**
	$k = 6.9 \times 10^4$ N m^{-1}	**A1**

Question	Answer	Marks
4(a)	wave passing through gap / aperture	**B1**
	(wave) spreads (out)	**B1**
4(b)(i)	$n\lambda = d \sin\theta$	**C1**
	$\theta = \sin^{-1}[(540 \times 10^{-9}) / (5.0 \times 10^{-6})] = 6.2°$	**A1**
4(b)(ii)	$\theta = 12°$	**A1**
4(b)(iii)	peaks / maxima shown at $\theta = 0$, ±6° and ±12°	**B1**
	peaks / maxima and zero intensity in between	**B1**
	central peak / maxima at intensity I_0 and the other peaks all equal to or less than I_0	**B1**
4(c)	peaks / maxima all at the same angles (as before)	**B1**
	intensity (of all peaks / maxima) halved	**B1**

Question	Answer	Marks
5(a)	sum of current(s) into junction = sum of current(s) out junction **or** (algebraic) sum of current(s) at a junction is zero	**B1**
5(b)(i)	line with negative gradient	**C1**
	line from 0 °C to 100 °C, starting at (0, R_0) with negative gradient throughout and never reaching $R = 0$	**A1**
5(b)(ii)	(resistance of T decreases so) total resistance (of circuit) decreases	**B1**
	current in cell increases (so p.d. across internal resistance increases)	**B1**
	terminal p.d. decreases (and resistance of R is constant) so current in R decreases	**B1**
5(c)(i)	p.d. across r $= 1.50 - (6.00 \times 0.200)$ $(= 0.30\ \text{V})$	**C1**
	current in cell $= 0.30 / 0.12$ $= 2.5\ \text{A}$	**A1**
5(c)(ii)	current in thermistor $= 2.5 - 0.200$ $(= 2.3\ \text{A})$	**C1**
	resistance of T $= (6.00 \times 0.200) / 2.3$ $= 0.52\ \Omega$	**A1**

Question	Answer	Marks
6(a)(i)	numbers of protons and electrons both = 1	**A1**
	number of neutrons = 2	**A1**
6(a)(ii)	diagram shows 2 neutrons and 1 proton labelled and forming a nucleus	**B1**
	diagram shows 1 electron labelled and separated from the nucleus (not touching the proton and neutrons)	**B1**
6(b)(i)	helium nucleus: top line = 3 **and** bottom line = 2	**A1**
	beta particle: top line = 0 **and** bottom line = –1	**A1**
6(b)(ii)	(electron) antineutrino	**B1**
6(c)	proton: up up down **or** neutron: up down down	**C1**
	(tritium:) 4 up, 5 down	**A1**