CAMBRIDGE
International Education

# Cambridge International AS & A Level

**PHYSICS** **9702/23**

Paper 2 AS Level Structured Questions **May/June 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 May/June 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 |
|---|---|
|  | 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 |

**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 method 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.<br>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 displacement | **B1** |
| 1(b) | For object A:<br>$s = ut + \frac{1}{2}at^2$<br>so $t = \sqrt{\frac{2\times 10}{9.81}}$<br>=1.4 | **C1** |
| | Then for object B:<br>$s = ut + \frac{1}{2}at^2$<br>$h = -(3\times 1.4) + (0.5 \times 9.81 \times 1.4^2)$ | **C1** |
| | = 5.7 m | **A1** |
| | OR<br>$h = -(3\times 1.4) + 10$ | **(C1)** |
| | = 5.7 m | **(A1)** |
| 1(c)(i) | time taken (to reach the ground is) same | **B1** |
| | The initial vertical (component of the) velocity is the same (as in part **(1b)**) | **B1** |
| 1(c)(ii) | The (total) initial energy is greater (than in part **(1b)**) | **B1** |
| | change in gravitational potential energy is same, so speed is greater | **B1** |

| Question | Answer | Marks |
|---|---|---|
| 2(a) | force × perpendicular distance (of line of action of force to / from the point) | **B1** |
| 2(b)(i) | $150 \times 9.81 \times 4.5$ **or** $90 \times 9.81 \times 4.5$ **or** $3.0 \times 9.81 \times m$ | **C1** |
| | $(150 \times 9.81 \times 4.5) = (90 \times 9.81 \times 4.5) + (3.0 \times 9.81 \times m)$ | **C1** |
| | $m = 90$ kg | **A1** |
| 2(b)(ii) | Young modulus = $\sigma / \varepsilon$ **or** $F / A\varepsilon$ **or** $FL / Ax$ | **C1** |
| | Area of wire = $\pi \times (1.8 \times 10^{-3} / 2)^2$<br>$= 2.5 \times 10^{-6}$ | **C1** |
| | So Young modulus = $((90 \times 9.81) / \pi \times (9.0 \times 10^{-4})^2) / 1.2 \times 10^{-3}$<br>$= 2.9 \times 10^{11}$ Pa | **A1** |
| 2(b)(iii) | Moment provided by B will decrease / moment due to wire will increase | **B1** |
| | So force acting on wire will increase (Young's modulus and area remain constant) and the strain will increase | **B1** |

| Question | Answer | Marks |
|---|---|---|
| 3(a) | $W = Fd$ | **B1** |
| | $P = Fd / t = Fv$ **or** $P = Fvt / t = Fv$ | **B1** |
| 3(b)(i) | $(\Delta)E_{(P)} = mg(\Delta)h$ | **C1** |
| | increase of gravitational potential energy of car in 1.0 s<br>$= 1500 \times 9.81 \times 30 \times \sin 6.0 = 46\,000$ J | **A1** |

| Question | Answer | Marks |
|---|---|---|
| 3(b)(ii) | (Power to overcome total resistive forces) = 1600 × 30<br>= 48 000 W | **C1** |
| | power = 48 000 + 46 000<br>= $9.4 \times 10^4$ W | **A1** |
| 3(c)(i) | Air resistance is the same, as the speed is the same | B1 |
| 3(c)(ii) | Mass / weight has increased so (power will) increase | **B1** |

| Question | Answer | Marks |
|---|---|---|
| 4(a) | sum / total momentum (of a system of bodies) is constant<br>**or**<br>sum / total momentum before = sum / total momentum after | **M1** |
| | for an isolated system / no (resultant) external force | **A1** |
| 4(b)(i) | $p = mv$ **or** $4.0 \times 6.0$ or $2.0 \times 3.0$<br>$(4.0 \times 6.0) + (2.0 \times 3.0) = 6.0 \times v$ | **C1** |
| | so $v = 5.0\ \text{m s}^{-1}$ | **A1** |

| Question | Answer | Marks |
|---|---|---|
| 4(b)(ii) | KE before = $(0.5 \times 4.0 \times 6.0^2) + (0.5 \times 2.0 \times 3.0^2)$<br>= 81 J | **C1** |
| | KE after = $(0.5 \times 6.0 \times 5.0^2)$<br>= 75 J | **(C1)** |
| | percentage transferred = $[(81 - 75) / 81] \times 100$<br>= 7% | **A1** |

| Question | Answer | Marks |
|---|---|---|
| 5(a) | sound waves are longitudinal / not transverse (and only transverse waves can be polarised) | **B1** |
| 5(b)(i) | A periodic curve of at least one period with minimum 0 and maximum $I_0$ | **B1** |
| | Smooth continuous $\sin^2\alpha$ curve | **B1** |
| | Peaks at 90° and 270° **and** troughs at 0, 180° and 360° | **B1** |
| 5(b)(ii) | $I \propto A^2$ | **C1** |
| | $I = I_0 \cos^2 \theta$ | **C1** |
| | At $\alpha = 20°$ the angle between the planes of polarisation of light and filter is 70° (or 110°)<br>$I = I_0 \cos^2 70$ **or** $I = I_0 \cos^2 110$<br>($I = 0.12\ I_0$) | **C1** |
| | amplitude = $0.34\ A_0$ | **A1** |

| Question | Answer | Marks |
|---|---|---|
| 6(a) | wave passes (through) an aperture and spreads<br>**or**<br>wave passes (by / through / around) an edge and spreads | B1 |
| 6(b)(i) | $v = f\lambda$ | **C1** |
| | $f = 3.00 \times 10^8 / 720 \times 10^{-9}$<br>$= 4.2 \times 10^{14}$ Hz | **A1** |
| 6(b)(ii) | $d = n\lambda / \sin\theta$ | **C1** |
| | $d = (2 \times 720 \times 10^{-9}) / \sin 26$ | **C1** |
| | $(= 3.3 \times 10^{-6}$ m)<br>number of lines per m $= 1 / (3.3 \times 10^{-6})$<br>$= 3.0 \times 10^5$ m$^{-1}$ | **A1** |
| 6(b)(iii) | $\lambda \times 3 = 720 \times 2$ **or** $\frac{1}{3.0 \times 10^5} \sin 26 = 3\lambda$ | **C1** |
| | $\lambda = 480$ nm | **A1** |

| Question | Answer | Marks |
|---|---|---|
| 7(a) | $R = \rho L / A$ | **C1** |
| | $= (1.12 \times 10^{-6} \times 1.5) / 2.45 \times 10^{-7}$ | **C1** |
| | $= 6.86\,\Omega$ | **A1** |
| 7(b)(i) | (A method where the) reading (on the galvanometer) is zero. | **B1** |

| Question | Answer | Marks |
|---|---|---|
| 7(b)(ii) | e.m.f. / 1.2 = 64 / 150 | **C1** |
| | e.m.f. = (64 / 150) × 1.2<br>= 0.51 V | **A1** |
| 7(b)(iii) | (the internal resistance will cause a) drop in p.d. across the wire / the terminal p.d. is lower | **B1** |
| | So the null point will move to the right | **B1** |

| Question | Answer | Marks |
|---|---|---|
| 8(a) | <table><tr><th>flavour</th><th>charge / e</th></tr><tr><td>up / u</td><td>$-\frac{2}{3}$</td></tr><tr><td>down / d</td><td>$(+)\frac{1}{3}$</td></tr><tr><td>down / d</td><td>$(+)\frac{1}{3}$</td></tr></table> | |
| | 3 correct quark flavours | **B1** |
| | Charge on anti-up quark –⅔(e) | **B1** |
| | Charge on anti-down quark (+)⅓(e) | **B1** |
| 8(b) | particle: (electron) neutrino | **B1** |
| | antiparticle: positron | **B1** |