

GCE

Physics A

H156/01: Breadth in physics

AS Level

Mark Scheme for June 2026

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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MARKING INSTRUCTIONS**PREPARATION FOR MARKING
RM ASSESSOR**

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal <http://www.rm.com/support/ca>
3. Log-in to RM Assessor and mark the **required number** of practice responses (“scripts”) and the **number of required** standardisation responses.

YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM Assessor messaging system, or by email.
5. **Crossed Out Responses**
Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

Rubric Error Responses – Optional Questions

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the

highest mark from those awarded.
necessary in the time allowed.)

(The underlying assumption is that the candidate has penalised themselves by attempting more questions than

Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).

When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add a tick to confirm that the work has been seen.
7. Award No Response (NR) if:
 - there is nothing written in the answer space

Award Zero '0' if:

- anything is written in the answer space and is not worthy of credit (this includes text and symbols).

Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RMAssessor **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
If you have any questions or comments for your team leader, use the phone, the RM Assessor messaging system, or e-mail.
9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/markscheme is also appreciated.
10. **Level of response (LoR)**
Read through the whole answer from start to finish, concentrating on features that make it a stronger or weaker answer using the indicative scientific content as guidance. The indicative scientific content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.

Using a 'best-fit' approach based on the science content of the answer, first decide which set of level descriptors, Level 1 (L1), Level 2 (L2) or Level 3 (L3), **best** describes the overall quality of the answer using the guidelines described in the level descriptors in the mark scheme.

Once the level is located, award the higher or lower mark.

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met. **The lower mark** should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

In summary:

- the **science** content determines the **level**
- the **communication statement** determines the **mark within a level**.

There are no Levels of response questions on this paper.

11. Annotations

Annotation		Meaning
	Correct response	Used to indicate the point at which a mark has been awarded (one tick per mark awarded).
	Incorrect response	Used to indicate an incorrect answer or a point where a mark is lost.
AE	Arithmetic error	Do not allow the mark where the error occurs. Then follow through the working/calculation giving full subsequent ECF if there are no further errors.
BOD	Benefit of doubt given	Used to indicate a mark awarded where the candidate provides an answer that is not totally satisfactory, but the examiner feels that sufficient work has been done.
BP	Blank page	Use BP on additional page(s) to show that there is no additional work provided by the candidates.
CON	Contradiction	No mark can be awarded if the candidate contradicts himself or herself in the same response.
ECF	Error carried forward	Used in ~~numerical answers only~~ , unless specified otherwise in the mark scheme. Answers to later sections of numerical questions may be awarded up to full credit provided they are consistent with earlier ~~incorrect answers~~ . Within a question, ECF can be given for AE, TE and POT errors but not for XP.
L1	Level 1	L1 is used to show 2 marks awarded and L1^ is used to show 1 mark awarded.
L2	Level 2	L2 is used to show 4 marks awarded and L2^ is used to show 3 marks awarded.
L3	Level 3	L3 is used to show 6 marks awarded and L3^ is used to show 5 marks awarded.
POT	Power of 10 error	This is usually linked to conversion of SI prefixes. Do not allow the mark where the error occurs. Then follow through the working/calculation giving ECF for subsequent marks if there are no further errors.
SEEN	Seen	To indicate working/text has been seen by the examiner.
SF	Error in number of significant figures	Where more SFs are given than is justified by the question, do not penalise. Fewer significant figures than necessary will be considered within the mark scheme. Penalised only once in the paper.

Annotation		Meaning
TE	Transcription error	This error is when there is incorrect transcription of the correct data from the question, graphical read-off, formulae booklet or a previous answer. Do not allow the relevant mark and then follow through the working giving ECF for subsequent marks.
		Used in numerical answers only, unless otherwise specified in the mark scheme. Use of an incorrect equation is wrong physics even if it happens to lead to the correct answer.
XP	Wrong physics or equation	Used to indicate where more is needed for a mark to be awarded (what is written is not wrong but not enough).
^	Omission	

Abbreviations, annotations and conventions used in the detailed Mark Scheme(to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
□	Separates marking points
Not	Answers which are not worthy of credit
Ignore	Statements which are irrelevant
Allow	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

12. Subject Specific Marking Instructions

CATEGORISATION OF MARKS

The marking schemes categorise marks on the MACB scheme.

M marks	These are <u>method</u> marks upon which A -marks (accuracy marks) later depend. For an M -mark to be scored, the point to which it refers must be seen in the candidate's answers. If a candidate fails to score a particular M -mark, then none of the dependent A -marks can be scored.
A marks	These are accuracy or <u>answer</u> marks, which either depend on an M -mark, or allow a C -mark to be scored.
C marks	These are <u>compensatory</u> method marks which can be scored 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 it. 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 given.
B marks	These are awarded as <u>independent</u> marks, which do not depend on other marks. For a B -mark to be scored, the point to which it refers must be seen specifically in the candidate's answers.

SIGNIFICANT FIGURES

There is no paper-wide significant-figures penalty. Apply only the guidance given in the mark scheme for each question part.

SECTION A

Question	Answer	Marks	Guidance
1	A	1	
2	A	1	
3	D	1	
4	C	1	
5	B	1	
6	A	1	
7	C	1	
8	B	1	
9	B	1	
10	C	1	
11	C	1	
12	C	1	
13	C	1	
14	B	1	
15	C	1	
16	C	1	
17	D	1	
18	C	1	
19	B	1	
20	C	1	
		20	
	Total		

SECTION B

General rule: For substitution into an equation, allow any subject - unless stated otherwise in the guidance

Question			Answer	Mark	Guidance
21	(a)	(i)	Arrow drawn perpendicular (90°) to the ramp surface AND in correct direction (away from ramp) Arrow pointing upwards AND line of action passes through point of intersection of lines of actions of P and W	B1 B1	Ignore minor drawing inaccuracy, judge by eye Ignore length of line
		(ii)	$P = mg \sin \theta$ OR $P = 95 \times 9.81 \times \sin 5^\circ$ $= 81(.22479445\dots)$ $= 81 \text{ (N) (to 2sf)}$	C1 A1 B1	Resolves weight parallel to slope Allow $g = 9.8$ or 9.81 ms^{-2} Allow $g = 10$ for C1 NOT $95 \times 9.81 \times \tan 5^\circ = 81.5\dots \text{ N}$ Allow an incorrect answer correctly rounded to 2 significant figures provided evidence of working shown
	(b)	(i)	$(500 / 1.2 \times 10^7) = 4.2 \times 10^{-5} \text{ (m}^2\text{)}$	A1	Allow any number of significant figures (unrounded answer is $4.166666\dots$)
		(ii)	$420 \text{ cm min}^{-1} = 0.070 \text{ ms}^{-1}$ $500 \times 0.070 = 35 \text{ (W)}$	C1 A1	Conversion of 420 cm min^{-1} into ms^{-1} Allow answer consistent with candidate's converted speed (ECF) Alternative method $W = Fs = 500 \times 4.2 \text{ (1)}$ $P = \frac{W}{t} = \frac{2100}{60} = 35 \text{ (1)}$
			Total	8	

Question			Answer	Mark	Guidance
22	(a)		(elastic limit is the maximum force that) does not cause <u>plastic</u> deformation ORA	B1	Ignore references to Hooke's law
			(if elastic limit exceeded then) the spring will be damaged / not return to original length / unusable / AW	B1	Allow original size/shape for original length Ignore it breaks Ignore vague references to it stretches more Allow 70 (N m ⁻¹)
22	(b)	(i)	$(\frac{75}{1.1} =) 68(.181818...) \text{ (N m}^{-1}\text{)}$	A1	
22	(b)	(ii)	$\frac{1}{2} \times 68 \times 1.1^2 (= 41 \text{ J})$ OR $\frac{1}{2} \times 75 \times 1.1 (= 41 \text{ J})$	C1	Allow ECF From 22 (b)(i) Using k=70 gives 42.35 J
			$P = \frac{22 \times E}{60} = \frac{22 \times 41}{60}$	C1	Alternative: $P = \frac{W}{t} = \frac{41}{(60 \div 22)} (1)$
			$P = 15(.125) \text{ (W)}$	A1	Using k=68 gives 15.084666... W Using k=70 gives 15.528333... W or 16 W (2sf)
22	(c)		Springs in parallel, therefore effective spring constant = 2k / 480 (Nm ⁻¹)	C1	Allow use of 2kx Allow use of F=kx to calculate force in one spring, then total force = 2F
			$F = 2 \times 240 \times 0.55 = 264 \text{ (N)}$	A1	
			Total	9	

Question			Answer	Mark	Guidance
23	(a)	(i)	$R = \frac{\rho l}{A}$ and $A = xd$ and $l = x$ Working shown leading to $R = \frac{\rho}{d}$	B1 A1	All three expressions must be individually stated for this mark, not just implied from substitution. Expect $R = \frac{\rho x}{xd}$ as intermediate step
		(ii)	$R = 28 \times \frac{\rho}{d}$ OR $R = 28 \times \frac{1.68 \times 10^{-8}}{3.5 \times 10^{-5}}$ $1.3(44) \times 10^{-2} (\Omega)$	C1 A1	
	(b)		Reduce the resistance of the track(s) (by making it) wider or shorter or thicker	B1 B1	Ignore change voltage/current/power supply Allow increase cross-sectional area Ignore change material Answer referring to putting lamps in series score 0 marks.

Question			Answer	Mark	Guidance
	(c)	(i)	Measure: the width of track and thickness of track Measure current in track Calculate $v = \frac{I}{nwt e}$ recognising that n is number density / charge carrier density and e is electron charge	B1 B1 B1	Must reference both dimensions Allow height / depth for thickness / width Allow x and d for width and thickness Reference to length alone is insufficient for width or thickness. Allow words Allow $v = \frac{I}{nAe}$ provided a cross-sectional area A has been calculated earlier in response. Not formula stated with no indication that other terms are known
		(ii)	The charge carriers have different (instantaneous) velocities (because are in fast random motion) There are a (very) large number of charge carriers in the conductor OR Net drift motion is (very) small compared with random motion, so representative value used	B1 B1	Ignore references to collisions of electrons 'changing velocity' is insufficient Allow idea that no single velocity is representative / typical of all charge carriers
	(d)		(for constant V) current increases (because there are more charge carriers) therefore resistance decreases (because $R = V/I$)	M1 A1	Allow more charge flow Allow smaller p.d. for same current Not conducts better
			Total	13	

Question			Answer	Mark	Guidance
24	(a)	(i)	λ Calculates $14/0.80 = 17.5 (\lambda)$ or $35 \frac{1}{2}$ Links half-integer wavelength or odd number of half wavelengths to destructive interference / minimum amplitude	B1 B1	Not nodes/antinodes Allow phase difference of $180^\circ/\pi$ rad if clearly linked to path difference. Reference to destructive interference or minimum amplitude still required.
		(ii)	Intensity/amplitude of wave decreases as distance (from source) increases (so) amplitudes of the two waves are not the same (at X)	B1 B1	Not loses energy without link to distance Must explicitly refer to unequal amplitudes Not phase explanation
	(b)	(i)	Sand collects where (air particle) displacement is zero/minimum OR Sand moved away from positions of max displacement Sand piles are at nodes / spaces are antinodes	B1 B1	Allow amplitude for displacement Allow pushed away from antinodes This mark can be awarded for clear and correct labels diagram. 'It' or 'they' may refer to the sand pile(s).

Question			Answer	Mark	Guidance
		(ii)	use a metre rule/ruler to measure the distance across several piles/spaces wavelength = 2 x distance between adjacent nodes/antinodes / AW speed = (measured) frequency × (calculated) wavelength	B1 B1 B1	Allow measuring over multiple node separations Allow tape measure for metre rule Allow symbolic form Alternative for first two marking points: measure length of tube with metre rule (1) divide by $\frac{9}{4}$ to calculate wavelength (1) This mark dependent on a reasonable attempt to measure wavelength from experimental set up. Not just $v=f\lambda$ without context
			Total	8	

Question			Answer	Mark	Guidance
	(c)	(i)	$(v =) 3.0 \times 10^7 \text{ ms}^{-1}$ $\lambda = \frac{6.63 \times 10^{-34}}{9.11 \times 10^{-31} \times 0.1 \times 3 \times 10^8} \text{ OR } 2.425906 \times 10^{-11} \text{ (m)}$ $= 2.4 \times 10^{-11} \text{ (m)}$	C1 A1 B1	 Allow an incorrect answer correctly rounded to 2 significant figures provided evidence of working shown
		(ii)	Separation / slit width needs to be the same order of magnitude as the wavelength (to produce an interference pattern / for significant diffraction) ORA Wavelength of electron $\ll$ separation of slits / AW	B1 B1	Allow wavelength comparable to slit separation or in symbolic form i.e. $\lambda \sim a$ or $\lambda \approx a$ Allow numerical comparison or reference to orders of magnitude smaller Not just wavelength of electron smaller than separation of slits.
			Total	12	

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