

Foundation

GCSE

Physics A Gateway

J249/02: Paper 2 (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for June 2025

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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 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 available in RM Assessor.
3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

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, email or via the RM Assessor messaging system.

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. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

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 the annotation 'SEEN' to confirm that the work has been seen and mark any responses using the annotations in section 11.
7. There is a NR (**No Response**) option. Award NR (No Response):
 - if there is nothing written at all in the answer space
 - OR if there is a comment which does not in any way relate to the question (e.g., 'can't do', 'don't know')
 - OR if there is a mark (e.g., a dash, a question mark) which is not an attempt at the question.

Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The RM Assessor **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.**
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/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column 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 skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.

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 skills and science content determines the level.

The communication statement determines the mark within a level.

Level of response question on this paper is **21b**

11. Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore

12. 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
DO NOT ALLOW	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

13. Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9-1) in Physics A:

	Assessment Objective
AO1	Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.

For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

Question	Answer	Marks	AO element	Guidance
1	B	1	1.1	
2	B	1	2.1	
3	D	1	1.1	
4	A	1	2.1	A: $3.0 \times (2.0 - 1.6)$ B: 1.6×2.0 C: 3.0×1.6 D: 3.0×2.0
5	C	1	2.1	
6	B	1	2.1	
7	C	1	1.1	
8	B	1	1.1	
9	C	1	1.1	
10	D	1	2.2	
11	A	1	1.1	
12	A	1	2.1	
13	C	1	1.2	

Question	Answer	Marks	AO element	Guidance
14	A	1	1.1	
15	D	1	2.1	A: $80 \div 4$ B: $80 \div 2$ C: 80×2 D: 80×4

Question			Answer	Marks	AO element	Guidance
16	(a)	(i)	Any one from: hydroelectric ✓ solar ✓ tidal ✓ wind ✓	1	1.1	IGNORE sources not on the list
		(ii)	Any one from: coal ✓ oil ✓ nuclear ✓	1	1.1	IGNORE sources not on the list
	(b)	(i)	Smooth curve drawn with balance of points about the line ✓	1	2.2	DO NOT ALLOW straight line DO NOT ALLOW curve with all points above or below
		(ii)	(electricity generated has) increased (over time) ✓ at an increasing rate ✓	2	2 × 3.1a	ALLOW idea of increasing more in later years
		(iii)	Any two from: demand for electricity / energy is increasing ✓ reduce the need to use non-renewables ✓ renewables do not emit greenhouse gases ✓	2	2 × 3.2a	IGNORE climate change / better for the environment IGNORE using more renewable sources ALLOW non-renewables will run out ALLOW idea of reducing impact on global warming / greenhouse effect / carbon emissions / acid rain / nitrogen oxide / sulphur oxide IGNORE pollution unqualified

Question			Answer	Marks	AO element	Guidance
16	(b)	(iv)	First check the answer on the answer line If answer = 720 award 3 marks Read off from 2012 = 240 ✓ Read off from 2022 = 960 ✓ (change in electricity = $960 - 240 =$) 720 ✓	3	3×2.2	ALLOW read off from line ± 20 if not 240 ALLOW read off from line ± 20 if not 960 ALLOW correct calculation using candidate's values for the read off IGNORE sign “–”
		(v)	First check the answer on the answer line If answer = 72 award 2 marks $720 \div 10$ ✓ (average change per year =) 72 (TWh/year) ✓	2	2×2.2	ALLOW ECF from (iv) for both marks

Question			Answer	Marks	AO element	Guidance
17	(a)		visible (light) ✓	1	1.1	
	(b)		First check the answer on the answer line If answer = 5.7×10^{14} award 3 marks Rearrange: frequency = wave speed $\div$ wavelength ✓ substitution: (frequency =) $3.0 \times 10^8 \div 5.3 \times 10^{-7}$ ✓ evaluation: 5.7×10^{14} (Hz) ✓	3	1.2 2 $\times$ 2.1	ALLOW 5.66 for 5.7 ALLOW standard symbols ALLOW correct substitution into un rearranged equation for this mark ALLOW any answer that rounds to 5.7×10^{14} ALLOW 5.7×10^n for 2 marks
	(c)		absorb ✓ higher and lower ✓ emit ✓	3	3 $\times$ 2.1	In this order only

Question			Answer	Marks	AO element	Guidance
18	(a)		Similarity: (same) number of protons Difference: (different) number of neutrons	2	2 × 1.1	ALLOW same number of electrons ALLOW carbon-12 has 6 protons ALLOW atomic number DO NOT ALLOW same number of neutrons for carbon-12 ALLOW mass number ALLOW different number of nucleons ALLOW carbon-12 has 6 neutrons DO NOT ALLOW different number of protons for carbon-12 or different number of protons and neutrons (unclear as to meaning)
	(b)		Mass: stays the same / unchanged ✓ Charge: increases ✓	2	2 × 1.1	IGNORE 14 ALLOW +1
	(c)	(i)	<u>Beta</u> particles cannot penetrate metal / container ✓ <u>Beta</u> particles do not reach technicians or technicians are not exposed to the <u>beta</u> particles ✓	2	1.1 2.1	ALLOW radiation for <u>beta</u> particles IGNORE particles unqualified / “it” ALLOW metal / container absorbs <u>beta</u> particles / radiation
		(ii)	Radioactive material / carbon-14 / gas does not come into contact (with technicians) ✓	1	2.1	DO NOT ALLOW beta particles / radiation coming into contact (with technicians)
		(iii)	GM tube / radiation detector ✓ AND any one from: Stopwatch / stop clock / timer / data logger ✓ counter ✓	2	2 × 1.1	ALLOW any recognisable spelling of Geiger-muller ALLOW Geiger counter for two marks

Question			Answer	Marks	AO element	Guidance
19	(a)	(i)	Any one from: cause cell mutation / damage ✓ cause cancer ✓	1	1.1	ALLOW death of tissue / kill cells
		(ii)	X-rays absorbed / stopped by lead / barrier OR X-rays do not reach radiographer / penetrate lead ✓	1	2.1	ALLOW less exposed
	(b)	(i)	First check the answer on the answer line If answer = $9.39(3) \times 10^{-6}$ (m) award 2 marks $((9.36+9.42+9.40) \div 3) = 9.39(3) \text{ (}\mu\text{m)} \checkmark$ Conversion to m: $9.39(3) \times 10^{-6}$ (m) ✓	2	2×1.2	ALLOW 9.393 for 9.39 IGNORE 9.4 ALLOW $9.39(3) \times 10^n$ for 1 mark ALLOW 9.4×10^{-6} for 1 mark
		(ii)	To check for anomalies / outliers ✓	1	3.3a	ALLOW to make results more precise IGNORE accurate
		(iii)	Any two from: Idea of measurement 3 being an anomalous result ✓ Discard measurement 3 ✓ Re-take measurement 3 ✓	2	3.3a	ALLOW outlier for anomalous / not similar to measurements 1 and 2
	(c)		Toaster / oven / heater / motion detector / (tv) remote / infra red thermometer / thermal imaging camera ✓	1	1.2	IGNORE night vision ALLOW security beams

Question			Answer	Marks	AO element	Guidance
20	(a)		(transferred by) electric current ✓	1	2.1	ALLOW transferred by electrical working / electrically IGNORE electricity / voltage
	(b)	(i)	First check the answer on the answer line If answer = 1.0×10^5 award 2 marks $5.2 \times 10^5 - 4.2 \times 10^5$ ✓ (energy wasted) = 1.0×10^5 (J) ✓	2	2×2.1	ALLOW 1×10^5 or 100 000 ALLOW 5.2 – 4.2 (expression needed)
		(ii)	(it is transferred to) thermal / heat (store) ✓ BUT (it is transferred to) thermal / heat (store) (of) power cord / air / console / transformer ✓✓	2	1.1 2.1	IGNORE not 100% efficient ALLOW surroundings
		(iii)	First check the answer on the answer line If answer = 0.81 award 3 marks substitution: (efficiency =) $4.2(\times 10^5) \div 5.2(\times 10^5)$ ✓ (efficiency =) 0.8(0769)... ✓ (efficiency to 2sf =) 0.81 ✓	3	 2.1 2.1 1.2	ALLOW 81 <u>%</u> for three marks ALLOW 80(.769) <u>%</u> for two marks ALLOW any answer given to 2sf for this mark if processing attempted
	(c)	(i)	step-down ✓	1	1.1	
		(ii)	First check the answer on the answer line If answer = 9.7 award 3 marks Select and substitute: $230 \times 0.51 = 12.1 \times \text{current}$ ✓ Rearrangement: $\text{current} = (230 \times 0.51) \div 12.1$ ✓ evaluation: 9.7 (A) ✓	3	3×2.1	ALLOW substitution and rearrangement in any order ALLOW 9.69421.....

Question			Answer	Marks	AO element	Guidance
21	(a)		First check the answer on the answer line If answer = 3.1×10^{19} award 3 marks unit conversion: $1.0\text{GW} = 1 \times 10^9 \text{ W}$ ✓ substitute: (number =) $1.0(\times 10^9) \div 3.2 (\times 10^{-11})$ ✓ evaluation: $3.1(25) \times 10^{19}$ ✓	3	1.2 2.1 2.1	ALLOW $3.1(25) \times 10^n$ for 2 marks (missing or incorrect conversion)

Question		Answer	Marks	AO element	Guidance
21	(b)*	Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks) A detailed description of differences between fission and fusion reactions AND a detailed description of the benefits of fusion. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) A clear description of differences between fission and fusion reactions AND a clear description of the benefits of fusion. OR A detailed description of differences between fission and fusion reactions AND a basic description of the benefits of fusion. OR A basic description of differences between fission and fusion reactions AND a detailed description of the benefits of fusion. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) A basic description of a difference between fission and fusion reactions OR a basic description of the benefits of fusion.	6	2 × 1.1 2 × 3.1a 2 × 3.2b	AO1.1– Demonstrate knowledge and understanding of difference between fission and fusion reactions • fission is splitting (of nucleus) • fusion is combining two (nuclei) • fission is (splitting) large nucleus • fusion is (combining) small nuclei AO3.1a– Analyse information from the table and interpret and make a comparison • fusion power station will (likely) output more power ORA • fission fuel is mined • fission fuel is non-renewable • fusion fuel is available from water. • fission waste products are more radioactive ORA. • fission waste products have a longer half-life ORA. AO3.2b– Analyse information from the table and interpret to draw conclusions • (fusion power station will (likely) output more power ORA) so fewer needed / can be smaller / don't need to use other resources • (fission fuel is mined), which damages the environment, • (fusion fuel extracted from water) is readily available • (fission waste products are more radioactive), which makes them more dangerous • (Fission waste products have a longer half life) so they stay dangerous for longer

Question			Answer	Marks	AO element	Guidance
			<i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit.</i>			

Question			Answer	Marks	AO element	Guidance
22	(a)			4	4 × 1.1	ALLOW in same direction for parallel ALLOW at right angles/90° for perpendicular IGNORE left to right / side to side / up and down / vertical If no other marks awarded: ALLOW 1 mark for identifying transverse as having perpendicular vibrations if linked to sound and/or ALLOW 1 mark for identifying longitudinal as having parallel vibrations if linked to water ripples
	(b)	(i)	Any two from: Rock has more energy in its gravitational store ✓ Rock has more energy in its kinetic store (when it hits the water) ✓ Rock transfers more energy (to the water) ✓	2	2 × 2.1	ALLOW rock has more gravitational/potential energy / (G)PE ALLOW rock has more kinetic energy / KE / moving faster / accelerating for a longer time If no other marks awarded: ALLOW rock hits the water harder/with more force OR ALLOW rock has more energy

Question			Answer	Marks	AO element	Guidance
22	(b)	(ii)	(Idea of use of metre ruler) to measure a (set) distance the ripple travels ✓ (Idea of use of stop clock) to measure the time for a ripple to travel the (set) distance ✓ (speed =) distance (travelled) ÷ time (taken) ✓ OR (Idea of use of metre ruler) to measure distance between (many) ripples/crests/troughs ✓ (Idea of use of stop clock) to obtain frequency using sensible method ✓ (speed =) wavelength x frequency ✓	3	3 × 3.3a	ALLOW either method but if methods are mixed only award the marks scored from the highest scoring method IGNORE measuring drop height / distance travelled by falling rock IGNORE time travelled by falling rock ALLOW measure the distance travelled by a ripple in a (set) time for 2 marks ALLOW measure the time it take for a ripple to travel a (set) distance for 2 marks ALLOW words or symbols ALLOW e.g. measure distance between 10 crests and divide by 9 / measure length of 10 waves and divide by 10 ALLOW e.g. 1 ÷ time for 1 wave / count number of waves in 10 s and divide by 10 ALLOW words or symbols

Question			Answer	Marks	AO element	Guidance
23	(a)		friction / air resistance / drag ✓ (friction) does work on pendulum / energy transferred to thermal (store of surroundings) ✓	2	2 × 2.2	ALLOW force of air ALLOW energy lost to surroundings / energy dissipated (to surroundings/thermal store) IGNORE pendulum loses energy IGNORE KE decreases
	(b)	(i)	Any two from: difficult to read the ruler at the right time / while bob is moving/swinging ✓ ruler might not be vertical ✓ reading might not be taken perpendicularly/at eye level to the ruler/scale ✓	2	2 × 3.1b	IGNORE human error unqualified ALLOW difficult to see where the bottom of the bob is / bob is moving too fast / hard to tell exactly when bob is at its highest point ALLOW ruler held at an angle ALLOW there is parallax error when reading scale ALLOW if the ruler is behind the pendulum it is hard to see the values
		(ii)	Any two from: Record the motion on a video and playback in slow motion ✓ (Idea of) mark a point (on piece of card) behind the bob (at end of swing) or use a grid/graph paper behind bob ✓ Clamp the metre ruler/card/graph paper in place ✓ (Idea of) Use a set square/plumb line/spirit level to ensure metre ruler is vertical ✓	2	2 × 3.3b	IGNORE repeat and average ALLOW record/video it (and playback) / take photo(s) at end of swing

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Question			Answer	Marks	AO element	Guidance
23	(c)		First check the answer on the answer line If answer = 21 (%) award 3 marks Read value from graph for 6 swings= 4 (cm) ✓ $4 \div 19 (\times 100)$ ✓ (percentage of initial release height =) 21 (%) ✓	3	3×1.2	ALLOW tolerance ± 0.25 (cm) ALLOW ECF for last two marks for incorrect value read from graph