

OCR • GCSE PHYSICS J249

Higher Tier — Paper 3

June 2025 exam series

MARK SCHEME

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Higher

GCSE

Physics A Gateway

J249/03: Paper 3 (Higher 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 isn't 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 **22**.

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.

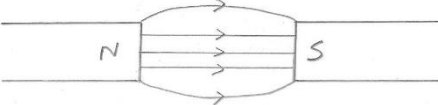
Question	Answer	Marks	AO element	Guidance
1	B	1	1.1	
2	D	1	2.1	A: $(500/10) \times 50$ B: 10×500 C: 50×500 D: $500 \times 50 \times 10$
3	C	1	2.1	A: $80 \div 10$ B: $80 \div 1.6$ C: 80×1.6 D: 80×10
4	A	1	2.2	
5	D	1	2.2	
6	C	1	1.2	
7	A	1	1.1	
8	D	1	1.1	
9	A	1	2.1	
10	C	1	2.2	
11	A	1	1.1	
12	B	1	1.2	

Question	Answer	Marks	AO element	Guidance
13	C	1	1.1	
14	C	1	2.1	A: 4×1000 B: $3 \times 10 \times 1000$ C: $4 \times 10 \times 1000$ D: $7 \times 10 \times 1000$
15	A	1	2.1	A: 210×0.4 B: 210×0.6 C: $(210 \times 0.4) \div 0.6$ D: vertically balanced forces

Question			Answer	Marks	AO element	Guidance
16	(a)	(i)	Correct circuit symbols for voltmeter AND ammeter ✓ Ammeter correctly positioned ✓ Voltmeter correctly connected in parallel ✓	3	1.1	Voltmeter and ammeter can be anywhere in the circuit for this mark
					3.3a	Ammeter in series with the components
					3.3a	Voltmeter is in parallel with the thermistor (and ammeter) only
		(ii)	To change the current in the circuit ✓	1	2.2	
		(iii)	To stop the components/circuit becoming hot / to keep the components at room temperature / AW ✓	1	3.3b	ALLOW To get accurate readings. IGNORE to save energy
	(b)	(i)	As the potential difference increases, the current increases / ORA ✓ at a faster rate ✓	2	2 × 3.1a	ALLOW voltage/V/p.d. for potential difference and A or I for current. (Not C) IGNORE (positive) correlation IGNORE proportional unspecified DO NOT ALLOW directly/inversely proportional ALLOW non-linear ALLOW As the current increases the potential difference increases at a slower rate for 2 marks
		(ii)	It decreases ✓			
		(iii)	0.02 (A) ✓			
		(iv)	First check the answer on the answer line If answer = 400 (Ω) award 3 marks (V=IR) $R = \frac{V}{I}$ ✓ $R = \frac{8}{0.02}$ ✓ $R = 400 (\Omega)$ ✓	3		Substitution and rearrangement can be in any order
					1.2	ALLOW values substituted correctly into equation in any form e.g. $8.0 = 0.02 \times \text{resistance}$ (MP2)
					2.2	ECF part (b)(iii)
					2.2	

Question			Answer	Marks	AO element	Guidance
17	(a)		(Measure the mass of the block using a mass) balance ✓ AND any two from: Measure three dimensions of the block ✓ Using a (metre)ruler/tape measure ✓ (Multiply) length x width x height / LxWxH / AW ✓	3	3 × 3.3a	ALLOW scales IGNORE weigh(ing) ALLOW three of: height, depth, base, width, breadth, length throughout IGNORE Displacement methods e.g. Eureka can
	(b)		First check the answer on the answer line If answer = 0.012 (m³) award 3 marks Density = mass ÷ volume ✓ Volume = $\frac{0.60}{50}$ ✓ = 0.012 (m ³) ✓	3	1.2 2.1 2.1	ALLOW equation in any form e.g. Volume = $\frac{\text{mass}}{\text{density}}$ MP2 is rearrange AND substitute ALLOW 1.2 x 10 ^x for 2 marks

Question			Answer	Marks	AO element	Guidance
18	(a)	(i)	Thomson ✓	1	1.1	
		(ii)	Thomson ✓	1	1.1	
		(iii)	Bohr ✓	1	1.1	
	(b)		1. (Most of the) <u>atom</u> is empty space / AW ✓ 2. Positively charged ✓ Nucleus ✓	3	3 × 1.1	ALLOW nucleus very small If no marks awarded, allow any correct answer in the wrong place for one mark maximum
	(c)		First check the answer on the answer line If answer = 4.0×10^{-9} (m) award 2 marks Molecule length = $2 \times 1.0 \times 10^{-10} \times 20$ ✓ Molecule length = $4(.0) \times 10^{-9}$ (m) ✓	2	2.1 2.1	ALLOW 2.0×10^{-9} (radius not doubled to diameter) for 1 mark ALLOW 0.000000004 / 40×10^{-10} for 1 mark

Question			Answer	Marks	AO element	Guidance
19	(a)	(i)	Using a (plotting) compass ✓	1	1.2	IGNORE iron filings, pencil ALLOW qualified extra magnet with method IGNORE unqualified magnet
	(a)	(ii)	A minimum of 2 lines connected between the poles ✓ A minimum of 4 lines correctly drawn between the poles with 2 straight and one each side curved ✓ Correct direction drawn on a minimum of one (not contradicted) field line (N to S) ✓	3	3 × 1.2	Typical answer for 3 marks: Straightness judged by eye  IGNORE lines drawn to unseen poles or the same magnet
	(b)	(i)	To avoid a short-circuit / current flow in <u>nail</u> / <u>nail</u> becoming live / AW ✓	1	3.3a	IGNORE unqualified safety / danger IGNORE heat / shock
	(b)	(ii)	Any one from: Length of wire ✓ Number of turns / coils ✓	1	1.1	ALLOW (cross-sectional) area, current or pd/voltage ALLOW change / removal of core material from iron

20	(a)	Any clockwise arrow ✓	1	2.1	ALLOW arrow indications anywhere
	(b)	A = B ✓	1	2.1	
	(c)	First check the answer on the answer line If answer = 13.5 C award 4 marks Q = It ✓ Q = 0.45 x 30 ✓ Q = 13.5 ✓ C ✓	4	1.2 2.1 2.1 1.1	ALLOW 14(.0) Unit mark is an independent mark ALLOW Coulombs for the unit
	(d)	Potential difference / p.d ✓	1	3.2a	Mark first quantity written ALLOW voltage / V ALLOW resistance / power

Question			Answer	Marks	AO element	Guidance
21	(a)		(C) D B A ✓✓	2	2 × 1.2	All 3 correct = 2 marks 1 or 2 correct = 1 mark
	(b)		The current only flows in one <u>direction</u> / AW ✓ Magnetic field remains steady / does not change / AW ✓	2	2 × 1.2	IGNORE electricity ALLOW voltage / p.d for current IGNORE magnetic field not induced
	(c)		First check the answer on the answer line If answer = 500 (turns) award 3 marks $N_s = N_p \frac{V_s}{V_p} \quad \checkmark$ $= \frac{25 \times 4600}{230} \quad \checkmark$ $= 500 \text{ (turns)} \quad \checkmark$	3	1.2 2.1 2.1	IGNORE unarranged formula $V_p/V_s = N_p/N_s$ ALLOW Any transformer equation <u>rearrangement</u> ALLOW All correctly substituted numbers
	(d)		(electric) shock ✓	1	3.2b	IGNORE unqualified can kill you / dangerous IGNORE heat / burns / fires ALLOW electrocution, cardiac arrest / AW

	(e)	generator headphones microphone motor The movement of a wire in a magnetic field induces a potential difference across the wire. A current in a wire in a magnetic field causes rotation. Pressure variations in sound waves are converted into current variations in electrical circuits. Current variations in electrical circuits are converted into pressure variations is sound waves.	2	2 × 1.1	All 4 lines correct = 2 marks 2 or 3 lines correct = 1 mark
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Question	Answer	Marks	AO element	Guidance
22	Level 3 (5–6 marks) Detailed description and analysis of the v/t graph of the journey (including correct calculations of acceleration AND distance) <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) Clear description and analysis of the v/t graph of the journey AND calculation of acceleration OR distance <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) Basic description and analysis of the graph of the journey AND an attempt at a calculation OR correct calculations of acceleration or distance. <i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i> 0 marks <i>No response or no response worthy of credit.</i>	6	2 × 3.1a 2 × 2.2 2 × 2.1	AO 2.1: Description of the journey For example • as the time increases the velocity increases • the train accelerates/speeds up between the start and 40s • the train travels at a steady velocity from 40s to 100s • the train accelerates/speeds up between 100s and 140s • the train moves in one direction • the train does not change direction AO3.1a: Analysis of the journey For example • The train has a constant acceleration for the first and third stage • The train travels at a constant velocity/speed (zero acceleration) in the second stage • The acceleration in the first and third stage is the same AO 2.2: Calculations For example • The acceleration in the first and third stage is 0.25 m/s² • The distance in the first stage is 200m • The distance in the second stage is 600m • The distance in the third stage is 600m • Overall distance travelled is 1400m /1.4 km

Question			Answer	Marks	AO element	Guidance
23	(a)	(i)	48°C	1	3.2a	
		(ii)	12°C	1	3.2a	
		(iii)	First check the answer on the answer line If answer = 27,000 (J) award 4 marks $(E = mc\theta)$ 200 g = 0.2(00) kg ✓ $\theta = 48 - 12 = 36^\circ\text{C}$ ✓ $E = 0.2 \times 3750 \times (48 - 12)$ ✓ $E = 27,000 / 2.7 \times 10^4$ ✓	4	 1.2 1.2 2.2 2.2	 ALLOW 27 kJ for full marks ALLOW ECF from (a)(i) and (a)(ii) IGNORE -ve sign ALLOW 3 marks for $E = 2.7 \times 10^7$ J (did not convert g to kg)
	(b)	(i)	First check the answer on the answer line If answer = 150 (W) award 4 marks $(E = Pt)$ $P = E / t$ ✓ $E = 54 \times 1000 = 54000$ J ✓ $P = 54000 / 360$ ✓ $P = 150$ (W) ✓	4	 1.2 1.2 2.1 2.1	 ALLOW 1.5 x 10 ⁿ for 3 marks (no or incorrect conversion of kJ)
		(ii)	Any one from: Not 100% efficient / AW ✓ Energy is <u>gained</u> from the surroundings ✓ There is not enough insulation of the fridge ✓	1	3.2a	IGNORE energy is lost to surroundings (unless clearly related to the efficiency of the motor) ALLOW cooling fridge / other contents

Question			Answer	Marks	AO element	Guidance
	(c)		First check the answer on the answer line If answer = 17 (Ω) award 4 marks $P = I^2 R$ ✓ $(I =) \sqrt{(240 / 0.80)}$ ✓ $I = 17.32$ (A) ✓ $I = 17$ (A) ✓ (2 sig fig)	4		1.2 ALLOW equation in any form 2.1 ALLOW substitution into un rearranged equation for this mark 2.1 ALLOW any number of significant figures for this mark 1.2 ALLOW an incorrectly <u>calculated</u> value to 2 sig figs if working shown IGNORE unqualified 2 sig fig ALLOW 300 (A) for 2 marks (check correct equation used)

Question			Answer	Marks	AO element	Guidance
24	(a)		pressure in cylinder A = pressure in cylinder B ✓	1	3.2b	
	(b)		First check the answer on the answer line If answer = 5,000 (N) award 4 marks Pressure calc For cylinder A: $P_A = F/A = 1000 / 2.0 \times 10^{-4}$ ✓ $P_A = 5,000,000 / 5.0 \times 10^6$ Pa ✓ $(P_A = P_B)$ $F = AP_B = AP_A = 5.0 \times 10^6 \times 10 \times 10^{-4}$ ✓ $F = 5,000$ (N) ✓	4	2.1 2.1 2.1 2.1	ALLOW answers using ratios for full marks Force Ratios $10 \times 10^{-4} / 2.0 \times 10^{-4}$ ✓ =5 ✓ 5×1000 ✓ =5,000 (N) ✓ OR Equate $F_A / A_A = F_B / A_B$ ✓ $F_B = F_A A_B / A_A$ ✓ $F_B = (1000 \times 10 \times 10^{-4}) / 2.0 \times 10^{-4}$ ✓ $F_B = 5,000$ (N) ✓ ALLOW ECF from A to B

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