

Higher

GCSE

Physics A Gateway

J249/03: Paper 3 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2024

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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 50% 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.
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 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.**

If you have any questions or comments for your Team Leader, use the phone, the RM Assessor messaging system, or email.

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 **19**.

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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

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

12. 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.

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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	D	1	2.1	
2	C	1	1.2	
3	C	1	2.2	ALLOW S
4	D	1	2.2	
5	A	1	1.1	
6	D	1	1.1	
7	D	1	1.1	
8	A	1	1.1	
9	B	1	2.2	
10	A	1	1.1	
11	A	1	2.1	
12	A	1	1.1	
13	A	1	1.1	
14	B	1	2.1	
15	C	1	2.1	

Question			Answer	Marks	AO element	Guidance
16	(a)	(i)	(The needle) is horizontal / 0° / 180° at/near the equator ✓ (The needle) is vertical / 90° / 270° at/near the poles ✓	2	1.2 x2	ALLOW 2 marks for needle changes from horizontal to vertical ALLOW 1 mark for needle changes from vertical to horizontal ALLOW parallel to the earth (at the equator) ALLOW perpendicular / at right angles (at the pole(s)) IGNORE changes position unqualified.
		(ii)	(The Earth's core) is magnetic ✓	1	1.1	ALLOW (bar) magnet / (core is) electromagnetic
	(b)	(i)	Any three from: Place the plotting compass onto the cardboard sheet ✓ Mark the direction of the compass needle (with a dot) ✓ Move the plotting compass to another of these marks / dots / arrows and repeat ✓ Connect the marks / dots / arrows together to show the field ✓	3	3.3a x3	ALLOW 1 mark for using the plotting compass to show the magnetic field if no other marking points scored
		(ii)	One (or more) circles drawn around the current-carrying wire ✓ Correct direction of the field shown (clockwise) ✓	2	2.2 x2	DO NOT ALLOW crossing lines. accept <u>small</u> gaps in circles. ALLOW 2 marks for a minimum of 3 circles drawn with increasing distance between the field lines (with no arrows)

Question			Answer	Marks	AO element	Guidance
17	(a)	(i)	2.2 ✓	1	1.2	ALLOW 2.17 IGNORE 2.16666666, $\frac{13}{6}$, 2.16̇, 2.17̇
		(ii)	Point correctly plotted (within ½ a small square) ✓ Suitable straight line of best-fit drawn ✓	2	1.2 x2	ECF from part (a)(i) Line must cover 100 to 500 (or 200-500 if plot missing) DO NOT ALLOW thick (more than a square) or multiple lines
		(iii)	First check the answer on the answer line If answer = 45 - 48 (N / cm) award 2 marks Gradient = $\frac{\text{change in y-axis}}{\text{change in x-axis}}$ OR Suitable triangle drawn against line on graph OR Two values clearly indicated on the graph ✓ Gradient = 46 (N/cm) ✓	2	2.1 x2	ALLOW recognisable attempt at calculating a gradient (e.g., triangle drawn against line, values successfully taken from the graph) ✓ Δ extension ≥ 4 (cm) or two large squares ALLOW ECF for correctly calculated gradient from candidate's line
		(iv)	Same answer as candidate's answer to (a)(iii)	1	2.1	ALLOW correct conversion to N/m if unit (N/m) is written by candidate ALLOW rounding to a minimum of 2sf
	(b)		Any two from: The experiment has not been completed by someone else (who obtained similar values)✓ The experiment has not been completed using different equipment (and obtained similar values)✓ The experiment has not been completed using a different method (and obtained similar values)✓	2	3.2a x2	IGNORE Not checked on its own

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Question			Answer	Marks	AO element	Guidance
	(c)		Hazard: The springs could fly off / break / snap ✓ Precaution: Wear face/eye protection or complete the experiment behind a safety screen ✓ OR Hazard: Falling / heavy load ✓ Precaution: stand away from the experiment / protective shoes ✓	2	3.3a x2	Mark response as a whole IGNORE gets hurt unqualified ALLOW any reasonable injury e.g., spring flicks into eye. IGNORE “be careful with” / “protective equipment”

Question			Answer	Marks	AO element	Guidance
18	(a)		B (no mark) AND Any two from: Stronger (electric) field ✓ Larger/greater charge ✓ More (electric) field lines ✓ (Electric) field lines are closer together ✓ Greater (electric) field density ✓	2	2.2x2	DO NOT ALLOW A (CON) DO NOT ALLOW reference to magnet / magnetic field / line(s) (zero marks - CON)
	(b)		closed circuit open circuit source of potential difference source of resistance ☒ ☐ ☒ ☐ One correct tick ✓ Two correct ticks ✓✓	2	1.1x2	DO NOT ALLOW three or four ticks
	(c)		Mistake: filament lamp ✓ Correction: diode ✓ AND Mistake: thermistor ✓ Correction: light dependent resistor / LDR ✓ OR Mistake: light intensity ✓ Correction: temperature ✓	4	3.2a 1.1 3.2a 1.1	ALLOW light emitting diode or LED ALLOW Thermistor changes with temperature not with light ✓✓ ALLOW light for light intensity ALLOW thermal energy for temperature

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Question			Answer	Marks	AO element	Guidance
	(d)		First check the answer on the answer line If answer = 15 (A) award 3 marks (P = IV) (I =) $P \div V$ ✓ (I =) $180 \div 12$ ✓ (I =) 15 (A) ✓	3	1.2 2.1 2.1	ALLOW 1 mark for correct substitution into unarranged equation
	(e)		First check the answer on the answer line If answer = 240 (J) award 3 marks (Energy transferred =) VQ ✓ (E =) 12×20 ✓ (E =) 240 (J) ✓	3	1.2 2.1 2.1	

Question			Answer	Marks	AO element	Guidance
19			Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks) Description of the trend shown in the results and detailed suggestions with reasoning to improve the experimental procedure. OR Detailed description of the trend shown in the results and suggestions to improve the experimental procedure <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) Detailed description of the trend shown in the results OR Detailed suggestions to improve the experimental procedure OR Description of the trend shown in the results and suggestions to improve the experimental procedure <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 of the trend shown in the results. OR Basic suggestions to improve the experimental procedure.	6	3.1a x 2 3.3b x 4	AO3.1a Analyses the results to interpret the trend shown by the results. For example, - as the area increases, time to fall increases ORA - the relationship is not linear / proportional - numerical analysis justifying non-linear AO3.3b Analyses the information to improve experimental procedures. For example, - Repeat readings more than twice (and take a mean) - Take more values for the area (4 values is not enough) - Record acceleration data to a consistent number of decimal places/significant figures - Use the same number of strings on the parachutes - Drop over a longer distance - Drop over an exact distance, not 'about' 2m - Measure drop height to the nearest cm using a ruler - Improve timing method e.g., video the drop and calculate time more accurately - Use the same mass/weight/size load on the parachutes – it varies - Use the same shape of parachute – some of these are circular and others are square - Use a wider range of areas - Sensible description of method to determine the area of the parachute - Ignore anomalous data points

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Question			Answer	Marks	AO element	Guidance
			<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>			IGNORE constant intervals

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Question			Answer	Marks	AO element	Guidance
	(c)		Any three from: Work is being done on the gas ✓ Average/mean speed of the particles increases ✓ Kinetic energy of the particles increases ✓ Energy from the kinetic store of the gas is transferred to the thermal store (of the gas) ✓ Energy from the thermal store of the gas is transferred to the thermal store of the pump ✓ Temperature is a measure of the average/mean kinetic energy ✓ Friction between piston and the side of the pump ✓	3	1.1x3	IGNORE Heat transfer from tyre ALLOW faster ALLOW kinetic energy for kinetic store and thermal energy / heat for thermal store

Question			Answer	Marks	AO element	Guidance
21	(a)		Any one from: Objects float when upthrust is equal to weight ✓ Objects float when weight of liquid displaced equals the weight of the object ✓ Objects float when the density of the object is less than the density of the liquid ✓ Any one from: Objects sink when weight is greater than upthrust ✓ Objects sink when weight of liquid displaced is less than the weight of the object ✓ Objects sink when the density of the object is more than the density of the liquid ✓	2	1.1 x2	
	(b)		In the range 740 to 859 (kg / m ³) ✓	1	3.1a	
	(c)		treacle ✓	1	3.1b	
	(d)		First check the answer on the answer line If answer = 15000 (Pa) award 2 marks (P=hpg) P = 1.5 x 1000 x 10 ✓ P = 15000 (Pa) ✓	2	2.1 2.1	15 x 10 ³ or 1.5 x 10 ⁴ (Pa) OR 15 kPa (unit needed)

Question			Answer	Marks	AO element	Guidance
22	(a)		Any two from: Current (in the coil) causes a magnetic field ✓ magnetic field of the current-carrying wire <u>interacts</u> with magnetic field of the magnets AND causes a <u>force</u> (to act on the wire) ✓ the forces on either side of the coil are opposite / one side of the coil the force is up and the other is downwards / (idea that) these two forces work together to cause rotation around the axle ✓	2	1.2 x2	IGNORE statement of Fleming's left-hand rule
	(b)	(i)	Similarities: Both rotate a coil in a magnetic field / between magnets ✓ Both induce a (variable) pd / current when rotated ✓ Differences: Alternator <u>generates</u> ac / dynamo <u>generates</u> dc ✓ Dynamo uses split ring commutator / alternator uses slip rings ✓	4	2.1 x4	ALLOW voltage for pd DO NOT ALLOW both use electromagnetism DO NOT ALLOW reference to a.c. and/or d.c. ALLOW induces / creates / produces for generates
		(ii)	Any one from: Spin the coil faster ✓ More turns on the coil ✓ Increase the strength of magnetic field / use stronger magnets ✓	1	1.2	IGNORE bigger magnet, longer coil ALLOW more coils ALLOW flux density for field
22	(c)		First check the answer on the answer line If answer = 0.45 (m) award 3 marks (F = BIL) L = F / (IB) ✓ L = 0.81 / (1.2 x 1.5) ✓	3	1.2 2.1	ALLOW two marks for 9/20 ALLOW 1 mark for correct substitution into unarranged equation

Question			Answer	Marks	AO element	Guidance
			L = 0.45 (m) ✓		2.1	

Question			Answer	Marks	AO element	Guidance
23	(a)		Any three from: As velocity /speed increases air resistance increases ✓ (until) the weight balances the air resistance ✓ No net / resultant force ✓ No acceleration (so no further increase in velocity) ✓	3	1.2x3	ALLOW drag for air resistance ALLOW equal / equilibrium
	(b)		First check the tangent drawn and the answer on the answer line If appropriate tangent drawn and answer between 2.5 – 3.5 (m/s²) award 4 marks Tangent drawn at t = 1.0 s ✓ Triangle drawn on tangent OR <u>two</u> suitable points on tangent indicated OR Δx and Δy indicated ✓ Correct substitution of two data points into $\Delta y \div \Delta x$ ✓ Acceleration = 2.87 (m/s ²) ✓	4	2.1 2.1 1.1 2.1	ALLOW any attempt at tangent at 1.0s which does not pass below the curve (judge by lack of gap) IGNORE size of triangle (assessed in Q 17) e.g., $\frac{8.0-2.4}{1.95-0} = 2.87$ DO NOT ALLOW one data point e.g., (1.0, 5.3) ALLOW max three marks for answer expressed as a fraction
	(c)		First check the answer on the answer line If answer between 12 and 14 (m) award 3 marks Areas on graph indicated OR distance = area under graph/curve ✓ Clear evidence of use of appropriate readings taken from graph to determine area using a suitable method ✓ Distance between 12.0 and 14.0 (m) ✓	3	2.1 2.2 2.1	DO NOT ALLOW $2.5 \times 7 = 17.5$ or $7^2(-0^2) = 2as$ At least a minimum of three areas added Suitable methods include: counting squares (any size), dividing the area under the graph into triangles, rectangles or trapeziums

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Question			Answer	Marks	AO element	Guidance
						For example, finding a 1cm x 1cm square as 0.25 m ² or a 2 mm x 2mm square as 0.01m ² and then multiplying this by the number of squares counted

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