OCR
Oxford Cambridge and RSA

Foundation

GCSE

Physics A Gateway

J249/01: Paper 1 (Foundation 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.

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 **22**.

11. Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
BOD	Benefit of doubt given
CON	Contradiction
RE	Rounding error
SF	Error in number of significant figures
ECF	Error carried forward
L1	Level 1
L2	Level 2
L3	Level 3
NBOD	Benefit of doubt not given
SEEN	Noted but no credit given
I	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.

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	C	**1**	**1.1**	
2	C	**1**	**2.2**	**ALLOW** 2 / 2A
3	D	**1**	**1.2**	
4	D	**1**	**2.2**	
5	D	**1**	**1.2**	
6	A	**1**	**2.2**	
7	D	**1**	**2.1**	
8	D	**1**	**2.1**	
9	B	**1**	**1.1**	
10	B	**1**	**2.1**	**ALLOW** 80
11	B	**1**	**2.1**	
12	D	**1**	**1.1**	
13	A	**1**	**1.1**	
14	B	**1**	**2.1**	
15	D	**1**	**2.1**	

Question			Answer	Marks	AO element	Guidance
16	(a)		temperature ✓ speed ✓ force ✓ increases ✓	4	1.1 x4	Answers must be in the correct order
	(b)		It covers the Earth to a height of about 700 km ✓ The atmospheric pressure decreases as you move away from the Earth's surface ✓ Density is uniform ✓	3	1.1 x3	One mark for each correct box ticked
	(c)		**First check the answer on the answer line** **If answer = 7500 (Pa m^3) award 2 marks** (constant = PV) constant = 5000 x 1.5 ✓ constant = 7500 ✓	2	2.1 x2	

Question			Answer	Marks	AO element	Guidance
17	(a)		A and B ✓	1	2.2	Both A and B are required for this mark
	(b)		A and C ✓	1	2.2	Both A and C are required for this mark
	(c)		Both lamps have the same brightness ✓	1	2.2	
	(d)		Any **ONE** from: They have the same resistance ✓ Both lamps have the same current ✓ Both lamps have the same potential difference/voltage ✓ Both lamps have the same current and potential difference ✓	1	2.2	**ALLOW** lamps are in parallel **IGNORE** The lamps are identical (repeat of question stem) **DO NOT ACCEPT** current/resistance/voltage is the same throughout the circuit
	(e)		increases ✓ electrons ✓ thermal ✓	3	1.2 x3	Words must appear in the correct order **ALLOW** heat

Question			Answer	Marks	AO element	Guidance
18	(a)	(i)	Rub the balloon (against the cloth) ✓	1	1.2	**ALLOW** rubbing them together
		(ii)	(There is a) transfer of electrons from the balloon / to the cloth/ **AW** ✓	1	1.2 x1	**ALLOW** it loses electrons / negative charges. **DO NOT ACCEPT** transfer of protons / neutrons / positive charges.
		(iii)	Opposite charges attract / **AW** ✓	1	2.1 x1	**ALLOW** opposites attract. **ALLOW** negatives attract to positives **ORA**
	(b)		**First check the answer on the answer line** **If answer = 15 (C) award 3 marks** Q = E / V ✓ Q = $7.5x10^9$ / $5.0x10^8$ ✓ Q = 15 (C) ✓	3	 1.2 2.1 2.1	**ALLOW** substituting into original equation for 1 mark. $7.5x10^9 = Q \times 5.0x10^8$
	(c)		**First check the answer on the answer line** **If answer = 1800 (C) award 3 marks** (Q = It) t = 2 x 60 = 120 (s) ✓ Q = 15 x 120 ✓ Q = 1800 (C) ✓	3	 1.1 2.1 2.1	**ALLOW** 2 marks for an answer of 30 (C) – conversion of time not completed

Question			Answer	Marks	AO element	Guidance
19	(a)	(i)	Upwards force = normal contact force ✓ Downwards force = weight ✓	2	1.1 x2	
		(ii)	**Any two from:** The water pushes on the rocket and the rocket pushes on the water ✓ The forces act in opposite directions ✓ The forces are the same size (and type) ✓ Each force acts on a different object ✓	2	2.1 x2	**ALLOW** 2 marks for Forces are equal and opposite **ALLOW** Upwards and downwards forces **ALLOW** Forces are equal **ALLOW** 1 mark for stating 'For every action there is an equal and opposite reaction' if no other mark has been awarded
		(iii)	The upwards force needs to be greater/stronger than the downwards force / **AW** /**ORA**✓	1	2.1	**ALLOW** the thrust needs to be greater/stronger than the weight/force due to gravity **IGNORE** pressure
	(b)	(i)	**First check the answer on the answer line** **If answer = 2250 (J) award 2 marks** E = 5x10x45 ✓ E = 2250 (J) ✓	2	 2.1 2.1	
		(ii)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 2500 W award 3 marks** (P = E / t) P = 12500 / 5 ✓ P = 2500 ✓ W or watts ✓	3	 2.1 2.1 1.2	 Unit mark is an independent mark **ALLOW** J/s

Question			Answer	Marks	AO element	Guidance
	(c)		Mistake 1: (gravitational fields cause) repulsion ✓ Correct word 1: (gravitational fields cause) attraction ✓ Mistake 2: (More massive objects have a) smaller (gravitational field strength)✓ Correct word 2: (More massive objects have a) greater (gravitational field strength) / **AW**✓ OR Mistake 2: More (massive objects have a smaller gravitational field strength) ✓ Correct word 2: Less (massive objects have a smaller gravitational field strength) ✓	**4**	3.2a 1.1 3.2a 1.1	Mistakes can be listed in any order **ALLOW** smaller = less massive

Question			Answer	Marks	AO element	Guidance
20	(a)		**Any pair of answers from:** Insulate (the block) ✓ To reduce heat loss/energy being lost to the surroundings/ **AW** ✓ **OR** Make sure the heater is fully in the block ✓ To reduce energy being lost to the surroundings ✓ **OR** Wait until the thermometer stops rising before measuring the final temperature ✓ To account for the fact that there is a delay in the heat from the heater conducting to the thermometer / to ensure that the maximum temperature is recorded / **AW** ✓	**2**	3.3b x2	**IGNORE** (put a) lid (on it) **ALLOW** examples of appropriate insulation **ALLOW** Immersion heater in the middle More even heat distribution **ALLOW** Oil etc. in the hole To improve conduction **ALLOW** Temperature probe/digital thermometer Better resolution
	(b)		Copper ✓ It has the lowest/smallest specific heat capacity ✓	**2**	2.1 x2	No marks if copper is not chosen **ALLOW** it's the best conductor
	(c)		1kg of material ✓ (changes state) liquid to gas / gas to liquid ✓	**2**	1.1 x2	**ALLOW** liquid evaporating / gas condensing

Question			Answer	Marks	AO element	Guidance
21	(a)	(i)	90˚ (to the side of the bottle)	1	1.2	**ALLOW** perpendicular/at right angles/horizontally
		(ii)	Pressure causes a net force at right angles to any surface/ **AW** ✓	1	1.1	
	(b)	(i)	**First check the answer on the answer line** **If answer = 15 (Pa) award 3 marks** P = F / A ✓ P = 1.8 / 0.12 ✓ P = 15 ✓	3	 1.2 2.1 2.1	
		(ii)	doubles ✓	1	3.1b	**ALLOW** 2 x their answer to (b)(i) (e.g., 30) **IGNORE** increases

Question			Answer	Marks	AO element	Guidance
22			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)** Detailed description of the trend shown **AND** detailed suggestions to obtain more accurate or precise results. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Clear description of the trend shown **and** clear suggestions to obtain more accurate or precise results **OR** Detailed description of the trend shown **and** simple suggestions to obtain more accurate or precise results. **OR** Basic description of the trend shown **and** detailed suggestions to obtain more accurate or precise results *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Basic description of the trend shown. **OR**	**6**	3.1a x 3 3.3b x 3	**AO3.1a Analyses the results to interpret the trend shown by the graph.** For example • as the load increases, acceleration increases / as the load decreases, acceleration decreases • double the force you double the acceleration • Spots anomaly (3.12 vs 3.0) • 4x force gives 4x acceleration • the relationship is (approximately) linear /(directly) proportional (e.g., approx. 1.5m/s² increase per 2kg, 0.75m/s² per kg) • use of m = F/a / Newton's second law **AO3.3b Analyses the information to improve experimental procedures.** For example • Repeat readings (take a mean) • Take more readings (3 readings is not enough)/extend range / more (different) loads • Record acceleration data to a consistent number of decimal places/significant figures • Adjust the ramp height to eliminate friction • Use the full length of the ramp • Use a shorter piece of string/raise the table height/move ramp to the left to stop the load hitting the floor • Ensure the total of the trolley mass and mass of the load are the same throughout. • Weighing the load each time

			Simple suggestions to obtain more accurate or precise results. *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.* **0 marks** *No response or no response worthy of credit.*			• Make sure start at **exactly** same point • Closer intervals between loads

Question			Answer	Marks	AO element	Guidance
23	(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
24	(a)	(i)	2.2 ✓	1	1.2	**ALLOW** 2.17 **IGNORE** 2.16666666, $\frac{13}{6}$, $2.1\dot{6}$, $2.1\dot{7}$
		(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 = change in y-axis / 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) ✓ Δextension ≥ 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

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”

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