OCR
Oxford Cambridge and RSA

Higher

GCSE

Physics A Gateway

J249/01: Paper 1 (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for June 2023

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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. Work crossed out:

   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks

   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

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 read.

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.**

   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 questions on this paper is **20(a)**.

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.

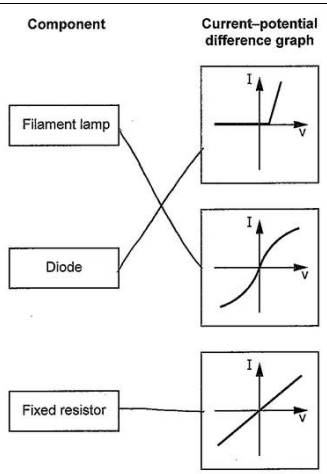
The breakdown of Assessment Objectives for GCSE (9-1) in Physics A:

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

Question			Answer	Marks	AO element	Guidance
16	(a)	(i)	Ruler / metre rule / tape measure ✓	1	1.2	**ALLOW** metre stick / rule
		(ii)	Stop clock / stopwatch / (mobile phone) timer ✓	1	1.2	**ALLOW** light gates
	(b)	(i)	1 (s) ✓	1	2.2	
		(ii)	4.5 (s) ✓	1	2.2	
		(iii)	Increase ✓	1	3.1a	**ALLOW** (accelerate) quicker/faster / more/higher (acceleration)
		(iv)	Line drawn with increased slope ✓	1	3.2b	**IGNORE** any lines on the graph after the increased gradient **ALLOW** line starting from anywhere on the x-axis
	(c)		Magnitude ✓ Direction ✓	2	2 x 1.1	Answers can be in either order

Question			Answer	Marks	AO element	Guidance
17	(a)	(i)	 ✓✓	2	2 x 1.2	All 3 correct = 2 marks 1 or 2 correct = 1 mark
	(b)	(i)	Ammeter ✓	1	1.2	**IGNORE** Ampmeter / Anmeter **ALLOW** phonetic spellings
		(ii)	Correct symbol for ammeter ✓ Placed in series (anywhere in the circuit) ✓	2	1.1 2.2	**ALLOW** incorrect symbol for this mark
		(iii)	Voltmeter ✓	1	1.2	**ALLOW** phonetic spellings
		(iv)	Correct symbol for voltmeter ✓ Placed in parallel with the resistor ✓	2	1.1 2.2	**ALLOW** incorrect symbol for this mark
	(c)		**First check the answer on answer line** **If answer = 24 (V) award 3 marks** (V=) IR ✓ (V=) 4 x 6 ✓ (V=) 24 (V) ✓	3	 1.2 2.1 2.1	 **ALLOW** V=IR in any form

Question			Answer	Marks	AO element	Guidance
18	(a)	(i)	**Any two from:** Same (size/mass/weight/type of) paperclips ✓ Current (passing through wire) / voltage/potential difference (across turns) ✓ (Same) nail (throughout) ✓ Turns same distance apart ✓	2	2 x 3.3a	 **ALLOW** type/material/diameter/length/resistance of wire **ALLOW** diameter of turns Size of turns is insufficient
		(ii)	As the number of turns increases the number of paperclips picked up increases ✓ **BUT** (they are) directly proportional ✓	2	3.1a 3.1b	Every 4 turns picks up 5 more paperclips gains 2 marks Double the number of turns picks up double the number of paperclips gains 2 marks **IGNORE** (positive) correlation
		(iii)	35 ✓	1	3.2a	
	(b)	(i)	Arrows drawn N to S on at least 1 field line and no contradicting arrows ✓	1	1.2	
		(ii)	**X** labelled inside the solenoid or close to the either end of the electromagnet (where field lines are closer together) ✓	1	2.2	Centre of the **X** anywhere within the space between the field lines and between the ends of the central 5 field lines on the diagram
		(iii)	**W** labelled at either side of the electromagnet (where the field lines are further apart) ✓	1	2.2	The **W** anywhere outside the space between the 5 central field lines on the diagram

Question			Answer	Marks	AO element	Guidance
19	(a)	(i)	P ✓	1	1.2	**ALLOW** A to B
		(ii)	P ✓	1	1.2	**ALLOW** A to B
		(iii)	B ✓	1	1.2	
		(iv)	Q ✓	1	1.2	**ALLOW** B to C
	(b)		2 ✓	1	1.1	
	(c)	(i)	**First check the answer on answer line** **If answer = 4.2 (N) award 2 marks** (F =) 28 x 0.15 ✓ (F =) 4.2 (N) ✓	2	 2.1 2.1	
		(ii)	**First check the answer on answer line** **If answer = 0.315 (J) award 2 marks** (E =) 0.5 x 28 x 0.15^2 ✓ (E =) 0.315 (J) ✓	2	 2.1 2.1	**ALLOW** 0.32 (J)

Question			Answer	Marks	AO element	Guidance
20	(a)		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 by the graph **and** detailed suggestions to improve the experimental method. *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)** Description of the trend shown by the graph **and** some simple suggestions to improve the experimental method. **OR** Detailed description of the trend shown by the graph. **OR** Detailed suggestions to improve the experimental method. *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)** Simple description of the trend indicated. **OR** Some simple suggestions to improve the experimental method.	**6**	**3 x 3.1a** **3 x 3.3b**	**AO3.1a Analyses the results to interpret the trend shown by the graph.** For example, • as temperature increases, resistance decreases / **ORA** • relationship is not linear • rate of increase/decrease/change of resistance is higher at lower temperatures / **ORA** • resistance decreases at a decreasing rate • two points from graph to illustrate a change e.g. at 10˚C the resistance is 900Ω / at 25˚C the resistance is 400Ω / at 40˚C the resistance is 200Ω **AO3.3b Analyses the information to improve experimental procedures.** For example, • Stir water (to ensure even temperature) • Use a water bath • Repeat readings and take a mean / ignore anomalies • Use a digital meter / Use a digital thermometer / temperature probe • Take additional temperature readings (3 is not enough) • Use a wider range of temperatures / Use temperatures over 50˚C / Use temperatures below 10˚C • Only submerge the actual thermistor / Don't submerge the crocodile clips/electrical connections • Check ohmmeter for zero error

Question			Answer	Marks	AO element	Guidance
			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.*			• Thermometer should not touch the sides/bottom of the beaker Thermometer closer to thermistor
	(b)		C ✓ **And any one from:** (Idea that) ammeters A and B cannot measure up to 300 mA ✓ (Idea that) on ammeter D, 300 mA is between marks on the ammeter (so cannot be measured accurately) / smaller resolution ✓	**2**	**2.2** **3.2a**	**ALLOW** the smallest scale that goes to 300 (mA) **ORA** (idea that) ammeter C has a mark at 300 mA **ORA** (idea that) ammeter C has higher resolution
	(c)		Streetlights / phone/screen brightness / automatic (head)lights / security lights / alarm clocks / light meter / smoke detector / digital camera / motion detector ✓ (Light) turns on when it is dark / turns off/dims in dim light / motion is detected when light levels change ✓	**2**	**1.1** **1.2**	**ALLOW** any sensible suggestion that uses a light sensor **ALLOW** function controlled by change in light level (for suggested use)

Question			Answer	Marks	AO element	Guidance
21	(a)	(i)	Moves clockwise / student B goes down / student A goes up ✓ More turning force/moment on the right-hand side / student B provides more turning force/moment ✓	2	1.2 2.2	**ALLOW** down on the right / up on the left **ALLOW** heavier (student) goes down / lighter student goes up **ALLOW** student A is heavier than student B **AND** is sitting the same distance from the pivot.
		(ii)	**First check the answer on answer line** **If answer = 0.48 (m) award 3 marks** (LHS/anticlockwise moment = 400 x 0.6 =) 240 (Nm) / (RHS/clockwise moment =) 500 x d ✓ LHS moment = RHS moment / 240 = 500d ✓ (d=) 0.48 (m) ✓	3	 2.1 2.1 2.1	 **ALLOW** 240 ÷ 500 = d ✓
	(b)	(i)	**First check the answer on answer line** **If answer = 40 (kg) award 3 marks** (W = mg) g = 10 (N/kg) ✓ (m =) W ÷ g / 400 ÷ 10 ✓ (m =) 40 (kg) ✓	3	 1.1 2.1 2.1	 **ALLOW** 9.8 / 9.81 (N/kg) **ALLOW** (m =) 400 ÷ 9.8 / 9.81 **ALLOW** 40 to 40.82 (kg)
		(ii)	**First check the answer on answer line** **If answer = 16 000 (Pa) award 3 marks** (P =) F ÷ A ✓ (P =) 400 ÷ ($2.5x10^{-2}$) ✓ (P =) 16 000 ✓ (Pa)	3	 1.2 2.1 2.1	 **ALLOW** equation in any form

Question			Answer	Marks	AO element	Guidance
22	(a)		**First check the answer on answer line** **If answer = 3.5 (m/s) award 3 marks** (average) speed = distance travelled ÷ time ✓ 2.1 ÷ 0.6 ✓ 3.5 (m/s) ✓	3	 **1.2** **2.1** **2.1**	 Correct rearrangement **IGNORE** triangles 2.1 ÷ 0.6 gains 2 marks
	(b)	(i)	Upwards force arrow: <u>air</u> resistance / drag ✓ Downwards force arrow: weight / (force due to) gravity / gravitational force ✓	2	**2 x 1.2**	**ALLOW** friction of air / wind resistance **DO NOT ALLOW** upthrust **ALLOW** pull / attraction for force **IGNORE** Gravitational field strength
		(ii)	(There is a) net / resultant / overall / unbalanced force downwards ✓ **And any one from:** Ball accelerates / speeds up / gets faster ✓ Ball speeds up so air resistance increases ✓ **OR** Acceleration of ball reduces / velocity of ball increases <u>until</u> forces are balanced ✓✓	2	**3.2b** **3.2a**	**ALLOW** weight (force) is larger than the air resistance (force) **ALLOW** increase kinetic energy (store)
	(c)		**First check the answer on answer line** **If answer = 90 000 (N) award 3 marks** F = ma / force = mass x acceleration ✓ 30 000 x 3 ✓	3	 **1.2** **2.1**	

Question			Answer	Marks	AO element	Guidance
			90 000 (N) ✓		2.1	**ALLOW** 90 kN

Question			Answer	Marks	AO element	Guidance
23	**(a)**		One correct calculation is completed ✓ A second correct calculation is completed ✓ Conclusion from at least two calculations, e.g., P × V for two (or more) calculations gives the same / equal value (so the formula is true) ✓	**3**	**2.1** **2.1** **3.2b**	E.g., 300 x 250 = 75 000 / 500 x 150 = 75 000 / 625 x 120 = 75 000 / 1250 x 60 = 75 000 **ALLOW** 75 000 on at least two rows of the table **IGNORE** pressure × volume = constant (from question)
	(b)	**(i)**	Correct point plotted at (500, 150) ✓	**1**	**1.1**	Point plotted with ½ small square Diameter of point less than ½ small square
		(ii)	Best fit line drawn as a single unbroken curve (by eye) ✓	**1**	**2.2**	**DO NOT ALLOW** straight line **IGNORE** line before 300 kPa and after 1250 kPa
		(iii)	Value read from graph in the range 80 to 90 (cm^3) ✓	**1**	**3.1b**	**ALLOW ECF** from candidate's graph if outside range – volume value read to ½ small square.
	(c)		It decreases / reduces / goes down (with increased height) / **ORA** ✓ There is less atmosphere / air above (pushing down) ✓	**2**	**2 x 1.1**	 **ALLOW** fewer particles above it **IGNORE** gravity / density

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