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 2022

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It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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 a tick to confirm that the work has been seen.

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 question on this paper is **19.**

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

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.

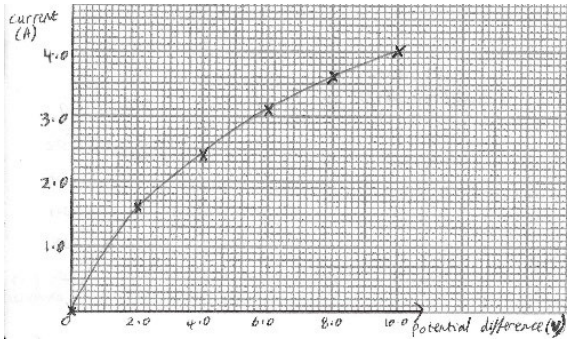
The breakdown of Assessment Objectives for GCSE (9-1) in Physics A:

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

Question			Answer	Marks	AO element	Guidance
16	(a)	(i)	Nucleus ✓	1	1.1	
		(ii)	Proton ✓ Neutron ✓	2	2 x 1.1	In either order
		(iii)	Electron ✓	1	1.1	
		(iv)	Neutral ✓	1	1.1	**ALLOW** 0 / no charge /AW
	(b)		**Any two from:** More/new information available ✓ More experiments completed ✓ New models/theories ✓ Better equipment / new technology✓ Collaboration between scientists ✓ Peer-review ✓	2	2 x 1.2	

Question			Answer	Marks	AO element	Guidance
17	(a)		(Ammeter position) J ✓ (Voltmeter position) K ✓	2	2 x 2.2	
	(b)		A ✓ D ✓	2	2 x 3.2a	
	(c)	(i)	Both points correctly plotted ✓ Appropriate curved line of best fit drawn ✓  	2	2 x 1.2	**ALLOW** points plotted within +/- half a small square **ECF** candidates own curve from incorrectly plotted points Must be curved and agree reasonably with the first 4 points. Allow ± 1 small square for the line paths near the last two points provided that the curve is smooth.
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 14 (W) award 2 marks** 5 x 2.8 ✓ 14 (W) ✓	2	2 x 2.1	 **ALLOW** ECF for incorrect reading/plotting of current from graph within +/- half a small square
		(iii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1680 (J) award 3 marks** 2 minutes = 120 seconds ✓ 14 x 120 ✓ = 1680/1700 (J) ✓	3	 **1.2** **2.1** **2.1**	**ALLOW** ECF from (c)(ii) **ALLOW** 2 marks for 28 (J) (no unit conversion) **ALLOW** 3 marks for 1.68/1.7 k(J) if k inserted

Question			Answer	Marks	AO element	Guidance
18	(a)		**Any two from:** (Same) size/area of paper (sheets) ✓ (Same) thickness/type/mass of paper (sheets) ✓ (Same) amount of paper under the magnet (see Fig.) ✓ (Same) size/area of (fridge) magnets ✓ (Same) fridge ✓	**2**	**2 x 3.3a**	
	(b)		(Magnet C no mark) (It is the one which) held the most (paper) sheets / AW ✓	**1**	**3.2b**	
	(c)	**(i)**	A ✓	**1**	**3.2a**	
		(ii)	(direction of the) arrow ✓	**1**	**1.1**	
	(d)		3 – 4 – 2 – 5 – 1 ✓✓	**2**	**2 x 1.2**	**ALLOW** 1 mark for any three consecutive numbers in correct order (e.g. 3 – 4 – 2, 4 – 2 – 5, 2 – 5 – 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)** Detailed description of the trend shown with use of data **AND** detailed suggestions to improve the accuracy [A] **AND** precision [P] of the 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)** Basic description of the trend shown and suggestions to improve the accuracy / precision of the results. **OR** Detailed description of the trend shown with use of data . *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, e.g. resistance goes up with distance. **OR** Basic suggestion to improve the accuracy or precision of the results, e.g. repeat readings. *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.*	**6**	**4 x 3.1a** **2 x 3.3b**	**AO3.1a Analyses the results to interpret the trend shown by the graph.** For example • as distance (from the lamp) increases, resistance increases or the inverse • as light intensity increases, resistance decreases • relationship is not linear • rate of increase of resistance is higher further from / lower closer to the lamp • resistance increases at an increasing rate • at 0cm from the lamp the resistance is 100Ω • at 20cm from the lamp the resistance is 240Ω • at 40cm from the lamp the resistance is 400Ω • at 60cm from the lamp the resistance is 600Ω • at 80cm from the lamp the resistance is 1000Ω **AO3.3b Analyses the information to improve experimental procedures.** For example • put the lamp directly in line with the LDR [A] • measure from the bulb directly to the LDR [A] • use a digital meter [P] • use resistance meter with higher resolution [P] • reduce other light sources, e.g. close blinds [A] • repeat readings (and calculate a mean) [P] • reduce the interval between readings/take readings every 10cm [P] • repeat readings and discard anomalies [A]

Question			Answer	Marks	AO element	Guidance
20	(a)		125 (cm^3) ✓	1	2.1	
	(b)	(i)	Pine bar drawn to the incorrect height / pine bar drawn to 440 kg/m^3 / AW	1	2.2	
		(ii)	Water bar drawn to correct height of 1000 kg/m^3 ✓	1	2.2	**ALLOW** correct height drawn to ± ½ small square
		(iii)	Pine ✓ It has the lowest density / density is less than the density of water / less than 1000 (kg/m^3) / AW ✓	2	1 x 3.2b 1 x 2.1	**ALLOW** oak **ALLOW** (oak) as its density is less than the density of water / less than 1000 (kg/m^3) / AW
	(c)		Particle arrangement ✓ Mass of particles ✓	2	2 x 1.1	

Question			Answer	Marks	AO element	Guidance
21	(a)	(i)	Steady/uniform/constant speed/velocity ✓	1	2.1	**ALLOW** no acceleration/deceleration
		(ii)	Accelerates / increases in speed ✓ because forces are unbalanced / forwards force > resistive force ✓	2	2 x 2.1	**ECF** (a)(i) **ALLOW** until resistive force reaches new forward force
	(b)	(i)	P ✓	1	2.2	
		(ii)	Y✓	1	2.2	
	(c)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 750 (N) award 3 marks** Gravitational field strength / g = 10 (N/kg) ✓ 75 x 10 ✓ 750 (N) ✓	3	1.1 2.1 2.1	**ALLOW** 735 (N) as g = 9.8 has been used **ALLOW** g = 9.8 (N/kg) or 9.81 (N/kg) **ALLOW ECF** for maximum of 2 marks if incorrect value for g used

Question			Answer	Marks	AO element	Guidance
22	(a)		Mistake: Extension for 20 N recorded to different number of / only one significant figures ✓ Correction: Record all data to the same number of significant figures/decimal places ✓	2	3.1a 3.3b	**ALLOW** different number of decimal places **ALLOW** specific corrections, e.g. 0.30 for both marking points **ALLOW** also any 2 s.f. measurement which rounds to 0.3
	(b)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 67 (N/m) award 4 marks** (Spring constant =) force / extension ✓ 40 / 0.6 ✓ 66.7 (N/m) ✓ 67 (N/m) ✓	4	 1.2 2.1 2.1 1.2	 **ALLOW** *F* / *e* **ALLOW** Any two values correctly used from the table, e.g. 30÷0.45 / 20÷0.30 / 10÷0.15 **IGNORE** evaluation resulting from incorrect equation or incorrect substitution **ALLOW** 66.6/66.67/66.6 recurring for **3** marks **ALLOW** any previously calculated answer correctly rounded to 2 s.f.
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 12 (J) award 2 marks** $0.5 \times 67 \times (0.60)^2$ ✓ 12.(06) (J)✓	2	 2.1 2.1	**ALLOW** ECF from 22(b)(i) No evaluation mark unless substitution is correct
		(iii)	3 (.0) (m)	1	3.1a	ECF from (b)(i) value of *k* **ALLOW** extra precision e.g. 2.99 (m)
	(c)		**Any two from:** Plastic deformation occurs ✓ Rope will not return to its original length/shape (when force is removed) ✓ Energy used/work done in making permanent changes to the rope ✓	2	2 x 1.1	 **ALLOW** Force and extension relationship is non-linear / no longer linear

Question			Answer	Marks	AO element	Guidance
23	(a)		**Any four from:** Mark two points (a distance apart / along the road) ✓ Measure distance (between those two points) ✓ Instrument to measure distance (between those two points) using tape measure / trundle wheel ✓ Measure time (between those two points) ✓ Instrument to measure time taken (between those two points) using a stopwatch / stop clock / timer / AW ✓	4	4 x 1.2	**ALLOW** set distance **IGNORE** ruler **ALLOW** metre rule **IGNORE** speed guns / camera **IGNORE** mobile phone on its own **IGNORE** light gates **IGNORE** calculations of mean speed
	(b)	(i)	A Because it has the steepest gradient / line / slope or greatest increase in speed in same time / smallest time for same increase in speed ✓	1	2.1	No mark for just A **ALLOW** A = 0.13 m / s^2 **and** B = 0.08 m / s^2 **ALLOW** velocity increases quicker
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.08 award 3 marks** Acceleration = gradient ✓ 2.0 / 25 ✓ 0.08 (m/s^2) ✓	3	 1.2 2.1 2.1	 **ALLOW** acceleration = change in velocity / time **ALLOW** any two suitable numbers from the graph **ALLOW** 2 marks for an answer of 0.13(33) – candidate mistakenly calculated acceleration of car A.
		(iii)	(Motor in Car A) is more powerful / transfers energy faster / has a motor which supplies a larger force / ORA ✓	1	1.2	**ALLOW** idea that there is more drag / friction (acting on car B) / car A is more streamlined / has tyres with better grip **ALLOW (**Car A has) a larger / different current / p.d. / (driving) force **ALLOW** ECF choice of car from (b)(i) **IGNORE** bigger battery

Question			Answer	Marks	AO element	Guidance
24	(a)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.6 award 3 marks** current = potential difference / resistance ✓ 6.0 / 10 ✓ 0.6 (A) ✓	3	 **1.2** **2.1** **2.1**	 **ALLOW** p.d. / pd for potential difference
		(ii)	3 (V)	1	2.2	
	(b)	(i)	Current increases ✓ (Because total) resistance (in the circuit) decreases ✓	2	3.1a 2.2	 **ALLOW** Current has alternative path / round the lamp / does not pass through lamp **ALLOW** lamp is short-circuited **ALLOW** p.d. across lamp has decreased **ALLOW** two marks for correct calculation of 1.2 A
		(ii)	Potential difference increases ✓ **Any one from:** (Because) current through the resistor has increased ✓ (Because) the p.d. from the cells is not split across two components / not shared with the lamp / AW ✓	2	3.1a 2.2	**ALLOW** ECF for current decreases in (b)(i) one mark for potential difference decreases and one mark for current in resistor has decreased
		(iii)	0 (V)	1	2.2	**ALLOW** 3 (V) if answer to (a)(ii) = 0 (V)

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