OCR
Oxford Cambridge and RSA

GCSE (9-1)

Physics A (Gateway)

Unit **J249F/01**: Foundation Tier – Paper 1

General Certificate of Secondary Education

Mark Scheme for June 2018

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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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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

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**.

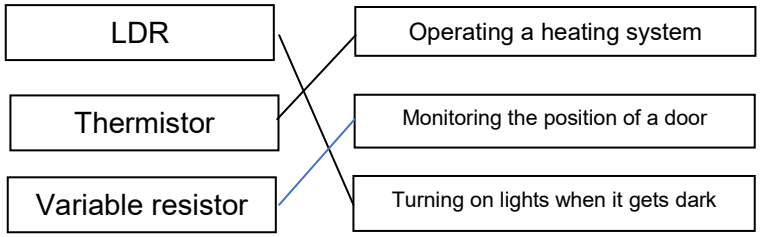
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

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

	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.

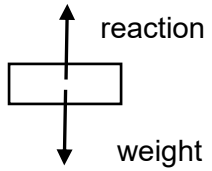
Question			Answer	Marks	AO element	Guidance
1			A ✓	1	1.1	
2			D ✓	1	2.2	
3			C ✓	1	2.2	
4			B ✓	1	1.1	
5			C ✓	1	1.2	
6			D ✓	1	2.1	
7			B ✓	1	2.2	
8			B ✓	1	2.1	
9			B ✓	1	2.1	
10			C ✓	1	2.1	
11			D ✓	1	1.2	
12			B ✓	1	1.2	
13			C ✓	1	2.1	
14			C ✓	1	1.2	
15			B ✓	1	1.2	

Question			Answer	Marks	AO element	Guidance
16	(a)	(i)	TV ✓	1	3.2b	
		(ii)	Light bulb ✓	1	3.2b	
	(b)			2	2 x 2.1	1 mark for each correct link
	(c)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 10 000 000 (J) award 4 marks** Rearrange to energy = charge × potential difference ✓ 44 000 × 230 ✓ 10 120 000 ✓ 10 000 000 (2 sf) (J) ✓ **OR** Substitute correctly 44 000 (C) = energy ÷ 230 (V)✓ Rearrange to energy = 44 000 (C) × 230 (V) ✓ = 10 120 000 (J) ✓ = 10 000 000 (2 sf) (J) ✓	4	2.1 2.1 2.1 1.2	Fourth mark is for correct rounding If answer line has 10 120 000 (J) award 3 marks m.p.2 can include m.p.1 if equation not written m.p.2 can include m.p.1 as above
	(d)	(i)	**Error**: only positive charges can move ✓ **Correction:** negative charges/electrons can move ✓	2	3.2a 1.2	**ALLOW** indication on the student's notebook
	(d)	(ii)	4A ✓	1	1.2	

Question			Answer	Marks	AO element	Guidance
17	(a)	(i)	**Any two from:** The old model has no protons / ORA ✓ The old model has no neutrons / ORA ✓ There is no nucleus in the old model / ORA ✓ The electrons are in fixed positions in the old model / ORA ✓ The positive particles are in a nucleus in the current model ✓ The negative particles/electrons are outside / surround the nucleus in the current model ✓	**2**	2 x 1.1	
		(ii)	**Any two from:** new evidence ✓ more experiments completed ✓ previous model couldn't explain new observations ✓	**2**	2 x 1.1	**ALLOW** mention of Rutherford, Geiger/Marsden
	(b)	(i)	All points correctly plotted ✓ line of best fit drawn correctly ✓	**2**	2 x 1.2	± 0.5 small squares e.c.f. plotting errors
		(ii)	As the mass increases/goes up the density increases ✓ (Direct) proportionally ✓	**2**	2 x 3.1a	ORA Needs word 'proportion(al)' or equivalent e.g. density ÷ mass is same

Question			Answer	Marks	AO element	Guidance
18	(a)	(i)	5250 (J/kg°C) ✓	1	1.2	
		(ii)	**Any three from:** specific heat capacity increases with temp rises ✓ specific heat capacity increases with energy supplied ✓ temp rise increases with energy supplied ✓ different amounts of energy were supplied ✓ all of the s.h.cs. are close together (within 5%) / within the range 5000 – 5500 ✓ the experiment was repeated / done 3 times ✓	3	3 x 3.2b	**ALLOW** other reasonable observation, e.g. s.h.c. increases with longer heating
	(b)	(i)	**Any two from:** more energy (than expected) heated the water ✓ energy losses must have occurred/not all the energy went into the water ✓ energy transferred to environment /AW ✓	2	2 x 3.2b	**ALLOW** heat for energy
		(ii)	**Any two linked answers from:** part of the immersion heater is out of the water ✓ make sure the heater is fully in the water/use a larger/deeper beaker ✓ beaker is not lagged/insulated ✓ lag/insulate the beaker ✓ there is no lid on the beaker ✓ put a lid on the beaker ✓ the temperature rises are quite small ✓ apply more energy to the water ✓ insufficient data ✓ take more readings ✓	4	3.3a 3.3b 3.3a 3.3b 3.3a 3.3b 3.3a 3.3b 3.3a 3.3b	

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 and comparison of the motion of all four students in terms of distance and time relating speed to distance run **AND** Calculates the speed of all four students. *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 and comparison of the motion of three students of distance and time **OR** Calculates the speed of at least three students. *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)** Brief description of the motion of at least three students. **OR** Calculates the speed of at least one student. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*	**6**	2 x 1.1 2 x 2.2 1 x 3.1a 1 x 3.2b	**AO1.1 Demonstrate knowledge and understanding of the correct formulae** • speed = distance ÷ time • v = s ÷ t • evidence of calculation **AO2.2 Apply knowledge and understanding of the motion of the four students** • Race B is a longer distance than race A • Race B and C are the same distance • Students B & C take different amounts of time • Student D takes the longest time • Race D is the longest distance • Race A is the shortest distance • Student A speed = 15÷6 = 8.3m/s • Student B speed = 100÷15 = 6.7m/s • Student C speed = 100÷14 = 7.1m/s • Student D speed = 200÷31 = 6.5m/s **AO3.1a & AO3.2b Analyse information to interpret and draw conclusions about the motion of the four students** • Race B is twice the length of race A, but time is more than twice that of race A • C is faster than B as the time is shorter (for the same distance) • As race length increases, average speed decreases

Question			Answer	Marks	AO element	Guidance
20	(a)		**Any one from:** electrostatics ✓ gravity/weight ✓ magnetism ✓ (normal) contact force ✓ friction ✓	**1**	1.1	Allow 'static electricity' but not just 'static' **ALLOW** reaction force **ALLOW** drag/air resistance
	(b)		Two arrows drawn of equal length ✓ One up and one down ✓ The downwards arrow labelled weight/gravity ✓ The upwards arrow labelled contact/reaction force ✓	**4**	4 x 2.1	e.g. 
	(c)		**Any two from:** (glider) accelerates during the push ✓ (then has) constant/steady/uniform speed/velocity ✓ (because) there are no other/horizontal/external (unbalanced) forces acting on it / AW ✓ there is (slight) deceleration due to air resistance ✓	**2**	2 x 1.2	
	(d)	(i)	*F* = *ma* / force equals mass times acceleration ✓ so reducing mass means the same engine force will cause greater acceleration ✓	**2**	1.2 2.2	Must start with Newton II NOT less force for same acceleration
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 5 (m/s^2) award 3 marks** change in speed = 25-5 = 20 (m/s) ✓ acceleration = 20 ÷ 4 (m/s^2) ✓ = 5 (m/s^2) ✓	**3**	2.1 2.1 2.1	e.c.f. incorrect change in speed if subtraction attempted

Question			Answer	Marks	AO element	Guidance
21	(a)	(i)	moment = force x distance ✓ clockwise moment = 800 (Nm) ✓ anti-clockwise moment = 1000 (Nm) ✓	3	1.2 2.1 2.1	**ALLOW** 2 marks (total) if clockwise and anti-clockwise moments are reversed Correct calculation of either moment implies correct equation so gets m.p.1 also
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1.6 (m) award 3 marks** (anti-clockwise moment) 500 (N)×distance = 800 (N m) ✓ distance = 800 ÷ 500 ✓ = 1.6 (m) ✓	3	1.2 2.2 2.2	E.c.f. clockwise moment from (a)(i) for 800 (N m) If child B chosen, giving 1000 ÷ 400 = 2.5 (m), award 2 marks (loses m.p.1)
	(b)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 100 (Pa) award 3 marks** pressure = force ÷ area ✓ = 10 ÷ 0.1 ✓ = 100 (Pa) ✓	3	1.2 2.1 2.1	
		(ii)	at right angles/perpendicular/90° (to the plunger)	1	1.1	**ALLOW** to the left opposite to the force from the plunger

Question			Answer	Marks	AO element	Guidance
22	(a)	(i)	variable resistor ✓	1	1.2	**ALLOW** rheostat **IGNORE** potentiometer
		(ii)	Control / change / vary / increase / decrease / AW the resistance / current in the circuit ✓	1	1.2	**DO NOT ALLOW** merely 'changes the voltage or changes p.d.' **BUT ALLOW**: changes the potential difference or voltage **across (component) X** ✓
	(b)	(i)	(filament) bulb / lamp ✓	1	3.2a	
		(ii)	gradient / slope (of graph) changes (as potential difference / voltage changes) ✓ idea of increasing resistance (with more p.d.) / ORA ✓ idea of increasing temperature / AW ✓	3	3.1a 1.2 2.2	**ALLOW** 'graph / line / slope levels off' ✓ Resistance increases with greater temperature ✓✓
	(c)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 4 (V) award 2 marks** 0.25 x 16 ✓ 4 (V) ✓	2	 2.1 2.1	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1 (W) award 3 marks** P = IV ✓ P = 0.25 x 4 ✓ P = 1 (W) ✓ **OR** P = I^2R ✓ P = 0.25^2 x 16 ✓ P = 1 (W) ✓	3	 1.2 2.1 2.1 1.2 2.1 2.1	**ALLOW e.c.f. from part ci**

Question			Answer	Marks	AO element	Guidance
23	(a)	(i)	Any three from: place the compass onto the card or near to the wire (and turn on the current) ✓ plot / observe the direction of the compass / needle ✓ repeat idea of tip-to-tail / plotting onto the card ✓ repeat at different distances from the centre ✓	3	3 x 1.2	
		(ii)	one or more circles around wire ✓ clockwise arrow(s) ✓	2	2 x 2.2	**DO NOT ALLOW** a spiral BUT **ALLOW** if clockwise direction shown by an arrow on the spiral then ✓
	(b)		**always** points to North / South ✓✓ **OR** Points to (magnetic) North / South ✓ line up with the magnetic field lines of the Earth ✓ **OR** Compass needle shows (an angle of) dip ✓ Dip (angle) changes (from equator) ✓	2	2 x1.1	**ALLOW** Points North/South wherever you are ✓✓

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