OCR
Oxford Cambridge and RSA

GCSE (9-1)

Combined Science A (Gateway)

Unit **J250/11**: Physics

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.

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:

	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**	**2.1**	
2			B ✓	**1**	**1.1**	
3			C ✓	**1**	**1.2**	
4			B ✓	**1**	**1.1**	
5			A ✓	**1**	**2.2**	**ALLOW** B ✓
6			A ✓	**1**	**1.1**	
7			A ✓	**1**	**2.1**	
8			C ✓	**1**	**2.1**	
9			B ✓	**1**	**1.1**	
10			D ✓	**1**	**2.1**	

BLANK PAGES MUST BE ANNOTATED TO SHOW THEY HAVE BEEN SEEN

Question			Answer	Marks	AO element	Guidance
11	(a)	(i)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 0.05 (J) award 3 marks** (work done) = force x distance ✓ 0.05 x 1(.0) ✓ = 0.05 (J) ✓	**3**	 1.2 2.1 2.1	 **ALLOW** correct symbol equation e.g. (w) = fxd **IGNORE** triangle style equations
		(ii)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 0.01 W award 4 marks** (power) = work done ÷ time ✓ 0.05 ÷ 5 ✓ = 0.01 ✓ W / watts ✓	**4**	 1.2 2.1 2.1 1.1	**ALLOW ECF from 11ai** e.g.1 W if answer to 11ai is 5 (J) ✓✓✓✓ 4 W if answer to 11ai is 20 (J) ✓✓✓✓ **ALLOW** correct symbol equation e.g. (p) =w/t **IGNORE** triangle style equations **ALLOW** 0.01 with no units or incorrect units ✓✓✓ Unit mark is independent **ALLOW** J/s
	(b)	(i)	3 (V)	**1**	2.1	
		(ii)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 0.5 (A) award 3 marks** (current) = potential difference ÷ resistance ✓ 3 ÷ 6.0 ✓ = 0.5 (A) ✓	**3**	 1.2 2.1 2.1	**ALLOW ECF from 11bi** **ALLOW** correct symbol equation e.g. (I) =V/R **IGNORE** triangle style equations

Question			Answer	Marks	AO element	Guidance
	(c)		**Any one from** remove one of the cells ✓ add mass (to the toy car) ✓ add a resistor (to the electrical circuit to reduce current)✓	**1**	3.3a	**IGNORE** references about how to increase the speed rather than the time taken **IGNORE just** reduce p.d. / reduce power **ALLOW** add weight (to the toy car) **IGNORE just** reduce current **ALLOW specific** changes to the motor e.g. use a lower current motor / use less powerful motor **IGNORE** just reduce voltage to motor / increase the resistance of the motor

Question			Answer	Marks	AO element	Guidance
12	(a)			4	4 x 1.2	**ALLOW** electrons for charges throughout the answer **BUT DO NOT ALLOW** positive electrons / references to magnetism
			charge is transferred (to/from the dome or containers) ✓			**ALLOW e.g.** dome or containers becomes negatively charged / ORA
			charge is distributed (evenly) across the dome or the containers / containers are conductors ✓			**ALLOW** containers are not insulators / electrons pass through the foil containers
			idea that like charges repel ✓			
			charges on a container repel charges on the one below or on the dome ✓			**ALLOW** containers repel / container and dome repel **ALLOW** (for marking points 3 and 4) containers have the same charge so they repel ✓✓
	(b)		**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 200 (s) award 4 marks**	4		
			(time) = charge (flow) ÷ current ✓		1.2	**ALLOW** correct rearranged symbol equation e.g. t = C/A
			(25 mA) = 25 x 10^{-3} **or** 0.025 (A) ✓		1.2	**ALLOW** correct conversion from mA to A seen anywhere in the answer
			= 5.0 ÷ (25 x 10^{-3}) **or** = 5.0 ÷ 0.025 ✓		2.1	
			= 200 (s) ✓		2.1	**ALLOW** power of 10 error due to incorrect conversion to A e.g.0.002 or 0.2 or 2 or 20 or 2000 or 200000 ✓✓✓

Question			Answer	Marks	AO element	Guidance
13 (*)			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 explanation of the graph including explanation of the change of state AND/OR description of the rate of temperature increase at different points. Conclusions drawn about the material's properties.** *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 explanation of the graph including explanation of the change of state AND/OR description of the rate of temperature increase AND/OR conclusions drawn about the material's properties.** *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 graph including change of state AND/OR conclusions drawn about the material's properties.** *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	1 x 3.1a 2 x 3.2a 3 x 3.2b	**AO3.1a Analyse information to interpret the graph** • graph levels out at - 7 °C **and** 58 °C • temperature increases at different rates as gradient of graph is not constant / rapidly at first **and** after each level **AO3.2a Analyse information to make judgements about what the graph shows** • graph shows three states of matter / graph shows solid, liquid **and** gas • material is not water • material is liquid at room temperature • graph is horizontal **because** the temperature is constant when energy is being used to change the state of the material **AO3.2b Analyse information from the graph to draw conclusions about the material** • material is solid below - 7 °C • material is liquid between - 7 °C and 58 °C • material is a gas above 58 °C • melting point is - 7 °C • boiling point is 58 °C

Question			Answer	Marks	AO element	Guidance
14	(a)		arrow vertically upwards labelled air resistance/drag ✓ arrow vertically downwards labelled weight ✓ arrows are the same length ✓	3	3 x 2.1	**IGNORE** additional arrows unless they contradict **ALLOW** vertically upwards arrow by sight e.g. slightly off vertical and not drawn with a ruler **BUT DO NOT ALLOW** a curved arrow **ALLOW** wind resistance or friction for air resistance **IGNORE** label of **just** resistance / lift / upthrust **ALLOW** vertically downwards arrow by sight e.g. slightly off vertical and not drawn with a ruler **BUT DO NOT ALLOW** a curved arrow **IGNORE** label of gravity / gravitational force **ALLOW** same length by sight or by labels
	(b)		two lines of correct scale length drawn ✓ the two lines connected at 90° to each other ✓ resultant is 5.8 (N) ✓	3	3 x 2.1	**ALLOW** any two correct length lines by sight or proportion e.g. lines of 5 cm and 3 cm / lines of 10cm and 6 cm / lines of 5 inches and 3 inches **ALLOW** a stated scale if length not clear **IGNORE** arrows **ALLOW** 90° by sight **ALLOW** resultant in the inclusive range 5.6 - 6.0 (N) **ALLOW** correct resultant ✓✓✓
	(c)		because the **direction** is **changing** (and velocity depends on direction) ✓	1	1.1	**ALLOW** it is not going in one constant direction / (size and) direction change(s) **IGNORE just** velocity is a vector / it is going backwards / it is moving in a circle / moving in a direction / direction is circular / not going in a straight line

Question			Answer	Marks	AO element	Guidance
15	(a)	(i)	hold thumb, first finger and second finger at 90° or perpendicular to each other / AW ✓ **And any two from** first or index finger is (magnetic) field ✓ second or middle finger is current ✓ thumb is direction/motion/force ✓	**3**	3 x 1.1	**ALLOW** diagram showing the perpendicular positions (labels do not need to be correct for this mark) **DO NOT ALLOW** incorrect fingers e.g. ring finger is field / second finger is field **ALLOW** thumb shows the force of the field
		(ii)	**Any three from** flow of current creates a magnetic field (around the coil) ✓ magnetic fields (of coil and magnets) interact ✓ opposite sides of the coil experience forces in opposite directions / AW ✓ the split-ring commutator ensures that the current is always flowing in the right direction (for clockwise rotation) / the split-ring commutator reverses the (direction of) current every **half** turn ✓	**3**	3 x 1.1	**ALLOW** magnetic field overlap **IGNORE** magnetic fields touch
	(b)		**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 1.5 (T) award 3 marks** (magnetic flux density) = force ÷ [current x length] ✓ = 0.6 ÷ [0.8 x 0.5] **or** 0.6 ÷ 0.4 ✓ = 1.5 (T) ✓	**3**	 1.2 2.1 2.1	 **ALLOW** B = F ÷ [I x L] **IGNORE** triangle style equations

Question			Answer	Marks	AO element	Guidance
16	(a)	(i)	as the temperature increases the resistance decreases / ORA ✓ idea that the change in resistance is larger at lower temperatures / ORA ✓	2	2 x 3.1b	**ALLOW** temperature and resistance have an inverse relationship / negative correlation **ALLOW** the lower the temperature the higher the resistance / ORA **ALLOW** correct use of figures e.g. at 10 °C the mean resistance of 1900 is the **highest** **IGNORE** inversely proportional **ALLOW** non-linear
		(ii)	**Any two from** 763.3 (Ω) or mean at 20 °C should be 763 (Ω) ✓ 536 (Ω) or mean at 30 °C should be 537 (Ω) ✓ idea that 720 (Ω) or the second reading for 25 °C is an anomaly so should be repeated or disregarded / 720 (Ω) or the second reading for 25 °C is an anomaly so the mean should be 610 (Ω) ✓	2	2 x 3.2a	**Identification AND remedy required for each mark** **ALLOW** the mean at 20°C is recorded to too many sig figs, it should be three sig figs or 763 **ALLOW** 763.3 (Ω) or mean at 20 °C should have the number after the decimal point removed **ALLOW** 536 (Ω) or mean at 30 °C should be rounded up **ALLOW** the anomaly for trial 2 at 25 °C needs to be done again or ignored **ALLOW** description for an anomaly / outlier / anomalous

Question			Answer	Marks	AO element	Guidance
	(b)		**Any one from** increase the range (of temperatures) ✓ repeat/redo the anomalous readings ✓ decrease the interval (between temperature readings) ✓ stir the water (to ensure uniform temperature) ✓	**1**	3.3b	**ALLOW** examples of a larger range e.g. start the temperature at 0°C / start at a lower temperature **IGNORE** just repeat the readings **BUT ALLOW** repeat it as there are anomalous results **IGNORE** references to the thermometer / voltmeter / water bath
	(c)		**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 6.28 x10^{-3} or 6.3 x10^{-3} (A) award 3 marks** (I) = √ (P ÷ R) **or** in words ✓ **=** √ (75x10^{-3} ÷ 1900) **or** √ 3.95 x 10^{-5} ✓ = 6.28 x10^{-3} (A) or 6.3 x10^{-3} (A) ✓	**3**	 1.2 2.1 2.1	**ALLOW** answer to any number of decimal places **ALLOW** $I^2 = P/R$ **or** in words **ALLOW** 6.28 **mA** or 6.3 **mA** if unit indicated ✓✓✓ **ALLOW** 0.00628 (A) or 0.0063 (A) ✓✓✓ **ALLOW** 6 x10^{-3} (A) ✓✓ **ALLOW** any answer that rounds to 6.3 x10^{-3} (A) ✓✓✓

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