OCR
Oxford Cambridge and RSA

GCSE (9-1)

Combined Science A (Gateway)

Unit **J250/05**: 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.

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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

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.

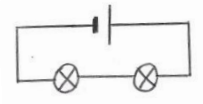
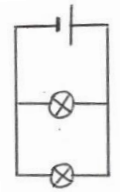
The breakdown of Assessment Objectives:

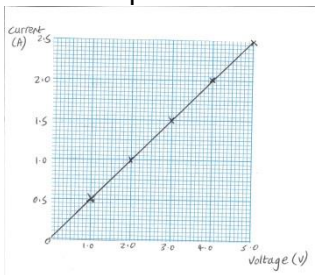
	Assessment Objective
AO1	**Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.**
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	**Apply knowledge 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			A ✓	1	2.2	
2			B ✓	1	1.2	
3			C ✓	1	1.1	
4			B ✓	1	1.1	
5			C ✓	1	1.2	
6			B ✓	1	2.1	
7			B ✓	1	1.1	
8			A ✓	1	2.1	
9			B ✓	1	2.1	
10			C ✓	1	2.1	

BLANK PAGES MUST BE ANNOTATED TO SHOW THEY HAD BEEN SEEN

Question			Answer	Marks	AO element	Guidance
11	(a)		Correct symbols used for cell and lamps ✓	3	1.2	**ALLOW** 
			Complete working circuit with two lamps and one cell ✓		2.2	**ALLOW** switches, voltmeters and ammeters if connected correctly. **ALLOW** very small gaps in the circuit
			Lamps are in parallel ✓		2.2	**ALLOW** For example:  ✓✓  ✓✓✓

Question			Answer	Marks	AO element	Guidance
	(b)	(i)	2 or 3 points correctly plotted ✓ **OR** 4 points correctly plotted ✓✓ Appropriate single line of best fit drawn through all of **their** points✓	**3**	3 x 2.2	**IGNORE** any extrapolation **ALLOW** a good freehand straight line through all of their points **DO NOT ALLOW** feathered lines For example:  ✓✓✓
		(ii)	As voltage increases current increases / constant resistance / V and I (directly) proportional ✓	**1**	3.1b	**IGNORE** positive correlation / linear relationship / constant gradient / stronger current
		(iii)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 2 (ohms) award 2 marks.** 1 ÷ 0.5 **OR** 2 ÷ 1 **OR** 3 ÷ 1.5 **OR** 4 ÷ 2 **OR** 5 ÷ 2.5 ✓ = 2 (ohms) ✓	**2**	 2.2 2.2	 **ALLOW ECF** from incorrect **straight** line of best fit

Question			Answer	Marks	AO element	Guidance
12	(a)	(i)	Distance: ruler / tape measure / metre stick ✓ Time: stopclock / stopwatch / phone **timer** / light gates✓	**2**	1.2 1.2	 **IGNORE just** datalogger **IGNORE just** timer
		(ii)	(average speed) = distance ÷ time / divide the distance by the time / AW ✓	**1**	1.2	**ALLOW** correct symbol equation s ÷ t or d ÷ t
	(b)	(i)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 0.60 (m/s) award 3 marks** (speed) = distance ÷ time or 1.2 ÷ 2.0✓ = 0.6 (m/s) ✓ = 0.60 (m/s) (to 2 sig figs) ✓	**3**	 1.2 2.1 2.1	If there is no answer on the answer line, check the table **ALLOW** correct symbol equation s ÷ t or d ÷ t **IGNORE** triangle style equations
		(ii)	**Yes** - because the 30°/biggest angle has the fastest speed **OR** the 30°/biggest angle has a faster speed than 10° or 20° ORA ✓ **OR** **No** - because the 20°/middle angle has the slowest speed **OR** the 10°/smallest angle does not have the lowest speed **OR** the 20°/middle angle has a slower speed than the 10° ORA✓	**1**	3.2a	Judgement must be linked to correct explanation using data **IGNORE just** bigg**er** angle has fast**er** speed ORA **IGNORE just** as angle increases the speed increases ORA
	(c)		No repeats (have been taken) ✓ Take more readings (for each angle) ✓ Calculate average✓ **OR** Only three angles (of ramp) have been used ✓ (Do the experiment with) extra angle(s) ✓ Less than 90°✓ **OR** It is difficult to measure the time (accurately) ✓ Use light gates (and data logging equipment) ✓ At start and end of the ramp / to start and stop the timer✓ **OR** It is difficult to measure the time (accurately) ✓	**3**	3.3a 3.3b 3.3b 3.3a 3.3b 3.3b 3.3a 3.3b 3.3b 3.3a	**ALLOW** idea that no averages have been calculated **ALLOW** example(s) of extra angle(s) less than 90° **ALLOW** ideas about human error in timing / reaction time **ALLOW** ideas about human error in timing /

Question			Answer	Marks	AO element	Guidance
			Make a video of the experiment ✓ With a stopwatch visible ✓ **OR** Distance is not long enough ✓ Use a longer distance ✓ Measure the time (over the longer distance) ✓		3.3b 3.3b 3.3a 3.3b 3.3b	reaction time

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 the change of state and EITHER the rate of temperature decrease at different points OR conclusion 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 which may include EITHER change of state OR rate of temperature decrease at different points OR conclusion 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 OR explanation of the graph which may include change of state OR the temperature change for two sections of the graph OR some conclusion 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.*	6	1x3.1a 4x3.2a 1x3.2b	**PLEASE CHECK GRAPH AS STATEMENTS ON THE GRAPH NEED TO BE CONSIDERED AS PART OF THE MARKING** **AO3.1a Analyse information to interpret the graph** • Graph is horizontal / levels out at 42°C +/- 2°C • Temperature decreases (rapidly) at first and at the end • The rate of temperature decrease falls prior to the change of state / after the change of state **AO3.2a Analyse information to make judgements about what the graph shows** • Graph shows two states of matter • Material could be changing from liquid to solid • Material could be changing from gas to liquid • The temperature is constant when energy is being used to change the state of the material • Material gives out energy as it cools • Material does not release energy when it changes state (or higher level answers in terms of latent heat) • Material cools more rapidly when there is a greater temperature difference between it and the surroundings **AO3.2b Analyse information from the graph to draw conclusions about the material's properties.** • the melting / boiling / freezing / condensing point is 42 °C • Material is not water

Question			Answer	Marks	AO element	Guidance
			0 marks *No response or no response worthy of credit.*			

Question			Answer	Marks	AO element	Guidance
14	(a)		Calculate the volume / measure the three dimensions of the cube / find the volume by displacement / use a Eureka can ✓ Find its mass / use a balance ✓ Density = mass ÷ volume ✓	3	1.2 1.1 1.2	**IGNORE** references to weighing
	(b)		In solids the atoms/molecules are close together/in a lattice structure ✓ In liquids atoms/molecules are closer than in a gas BUT more spread out than in a solid ✓ In gases the atoms/molecules are spread out ✓ solids are denser than liquids **AND** liquids are denser than gases / ORA ✓	4	1.1 1.1 1.1 1.1	**ALLOW** correct particle model drawing of a solid **ALLOW** correct particle model drawing of a liquid **ALLOW** correct particle model drawing of a gas **ALLOW** correct ideas of particles moving closer together or further apart when changing state **ALLOW** correct higher level ideas about kinetic energy of particles or forces of attraction between particles
15	(a)	(i)	(upwards force) thrust / engine force / AW ✓ (downwards force) weight / drag / air resistance ✓	2	1.2 1.2	**DO NOT ALLOW** upthrust / engine power **ALLOW** gravity / gravitational force **IGNORE** mass
		(ii)	2000(N)	1	2.1	
		(iii)	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 2.5 (m/s^2) award 3 marks** (acceleration) = force ÷ mass ✓ = 2000 ÷ 800 ✓ = 2.5 (m/s^2) ✓	3	 1.2 2.1 2.1	**ALLOW ECF from 15aii** **ALLOW** correct symbol equation e.g (a =) F ÷ m **IGNORE** triangle style equations

Question			Answer	Marks	AO element	Guidance
16	(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 16ai** e.g.1 W if answer to 16ai is 5 (J) ✓✓✓✓ 4 W if answer to 16ai 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 16bi** **ALLOW** correct symbol equation e.g. (I) =V/R **IGNORE** triangle style equations
	(c)		**Any one from** remove one of the cells ✓	**1**	3.3a	**IGNORE** references about how to increase the speed rather than the time taken **IGNORE just** reduce p.d. / reduce power

Question			Answer	Marks	AO element	Guidance
			add mass (to the toy car) ✓ add a resistor (to the electrical circuit to reduce current)✓			**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

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