

GCSE (9-1)

Combined Science A (Gateway)

Unit **J250/06**: Physics

General Certificate of Secondary Education

Mark Scheme for June 2018

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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.

© OCR 2018

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 Combined Science 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.

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

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
11	(a)		Same element / atoms with same atomic number/number of protons ✓ but different mass numbers / different numbers of neutrons ✓	2	2 × 1.1	IGNORE any mention of electrons
	(b)	(i)	Prevents (gamma) radiation escaping /To reduce exposure of pupils or himself to radiation ✓	1	1.2	ALLOW (gamma) radiation only goes in one direction ALLOW Blocks radiation/gamma DO NOT ALLOW just waves or energy
		(ii)	Gamma ✓ Any two from: - No drop with paper – so not alpha ✓ - No significant drop with Al – so not beta ✓ - Significant drop with Pb / radiation passes through Al ✓ - Count rate reached background reading ✓	3	2.1 2 × 3.1a	ALLOW small drop in count rate with Al may be due to random nature of radiation ALLOW gamma is only stopped by thick lead/goes through paper and Aluminium (some through lead) absorbers
12	(a)		No ✓ Any one from as P increases, R decreases / as P decreases, R increases ✓ Correct use of data from the table e.g. hair dryer has larger power than heater but lowest resistance ✓	2	2 × 3.1b	ALLOW Alternative wording

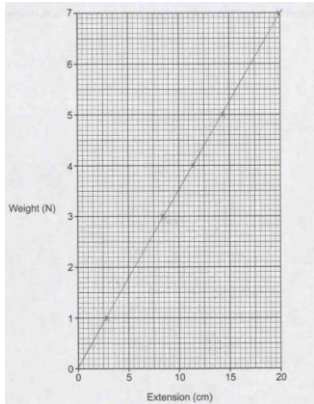
Question			Answer	Marks	AO element	Guidance
	(b)		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 150 000 (J) award 3 marks Recall of $E = P \times t$ OR energy = power $\times$ time / AW ✓ $E = 2500 \times 60$ ✓ $E = 150\,000$ (J) ✓	3	1.2 2.1 2.1	
	(c)	(i)	1.8 (kW) ✓	1	1.2	
		(ii)	Numbers would be too large / total energy transferred too large / time of use too large / unit of J too small / AW ✓	1	2.2	ALLOW easier to calculate/use because numbers are smaller DO NOT ALLOW just easier calculation
	(d)		Trend: Electricity consumption has decreased (over the years) / less electricity used in 2015 than 2008 / AW ✓ Explanation: People are using more energy saving measures e.g. energy saving lightbulbs / solar panels / wind turbines / generating electricity themselves / improved insulation in homes / double glazing/use of smart meters ✓	2	2 x 3.1a	ALLOW graph has a negative correlation IGNORE mention of rise at 2012 ALLOW modern devices use less energy/are more efficient/ ALLOW people more aware of environmental impact of overuse of electrical power ALLOW use of power instead of energy
13	(a)		Should be step down transformer before homes not step up / second transformer should be step down ✓ Should be high voltage power lines/not low voltage power lines ✓	2	2 x 1.1	ALLOW (if no other mark awarded) There should only be one step up transformer/AW
	(b)		Increasing voltage decreases current ✓ less power / energy / heat loss (in transmission wires) ✓	2	2 x 1.2	IGNORE more efficient (given in question)
	(c)		AC: Voltage or current changes direction / becomes + and – / graph showing voltage or current + and – / electrons	2	2 x 1.1	

Question			Answer	Marks	AO element	Guidance
			oscillate back and forth / AW ✓ DC: Voltage or current does not change direction / stays + or – / graph showing voltage or current + or – but not both / AW ✓			DO NOT ALLOW d.c. Voltage goes to only one place / goes to one thing/goes straight to destination (or similar for a.c.)
14	(a)		Any two from • Electronic balance/ measuring cylinder ✓ • Thermometer ✓ • Stopwatch /timer ✓ • Joulemeter / Wattmeter ✓ • Voltmeter ✓ • Ammeter ✓	2	2 x 3.3a	
	(b)	(i)	By insulating beaker / adding a lid ✓	1	3.3b	ALLOW a named insulation ALLOW Wrap in foil
		(ii)	heater only heats water / all water heated / hot water rises /less energy transferred/lost (to surroundings) ✓	1	3.3b	ALLOW to obtain accurate results DO NOT ALLOW heats water from top down to bottom
	(c)		Any two from • Chemical energy (in battery store) ✓ • Transferred by Electrical energy (in wires) ✓ • Transferred to Thermal/heat energy store / in (warm) water/heater/beaker ✓ • Idea of conservation of energy ✓	2	2 x 2.1	ALLOW marks to be obtained on diagram Eg. Energy in chemical store ✓ Electrical energy transferred ✓ → Energy in thermal store ✓ ALLOW for 2 marks Amount of energy gained by thermal store = amount of energy lost by chemical store ✓✓

Question			Answer	Marks	AO element	Guidance
	(d)	(i)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 34.2 (W) award 2 marks $P = 3.8 \times 9.0 \checkmark$ $P = 34.2 \text{ (W)} \checkmark$	2	2 x 2.1	
		(ii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 6300 (J) award 3 marks or 6 300 000 (J) award 2 marks Convert 150 g to 0.15 kg $\checkmark$ $E = 0.15 \times 4200 \times 10 \checkmark$ $E = 6300 \text{ (J)} \checkmark$	3	1.2 2.1 2.1	ALLOW ecf in conversion e.g. 150g to 1.5kg X $1.5 \times 4200 \times 10 \checkmark$ ecf $E = 63000 \checkmark$ two marks awarded when working shown (63000 on its own scores 0) ALLOW No conversion $E = 150 \times 4200 \times 10 \checkmark$ $E = 6\,300\,000 \text{ (J)} \checkmark\checkmark$ two marks awarded
15	*		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) Describes in detail the different ways the cars come to a stop using ideas about thinking and braking. AND Draws detailed conclusions from the graph about why the cars take different times to stop. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks)	6	2 x 1.1 2 x 2.1 1 x 3.2a 1 x 3.2b	AO1.1 Demonstrates knowledge and understanding of thinking, braking and stopping distance - Thinking distance is the time to starting to apply the brakes from the driver seeing the red light - Braking distance is the distance travelled while the force of brake is applied - Stopping distance is the total distance the car travels from the driver seeing the red light until the car is stationary - stopping distance = bd + td AO2.1 Applies knowledge and understanding of thinking, braking and stopping distance in relation to the details in the graph

Question			Answer	Marks	AO element	Guidance
			Describes the different ways the cars come to a stop using ideas about thinking and braking. AND Draws conclusions from the graph about why the cars take different times to stop. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Describes the different ways the cars come to a stop using ideas about thinking and/or braking. OR Draws conclusions from graph about why the cars take different times to stop. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit.</i>			• deceleration of B > deceleration of A / AW • because slope of graph B > slope of graph A / slope of graph B steeper / AW • thinking time for A < thinking time for B / AW • braking time for A > braking time for B / AW AO3.2b Analyses information to make judgements and draw detailed conclusions from graph • reaction time of driver B > driver A / AW • Driver B may have been drinking / may be ill / may be old / distracted • braking time for B < braking time for A / AW • Driver A may be driving in wet / ice / with worn tyres / worn brakes / with a heavier car
16	(a)		Distance between 2 points on a wave which are in phase or identical / distance between the peaks / distance between the troughs (is 6 m) ✓	1	2.1	ALLOW descriptions of peaks and troughs e.g. the distance between the highest parts of the wave / from maximum amplitude to maximum amplitude ALLOW one (complete) cycle of a wave (is 6 m) / the first wave starts at 0 m and ends at 6 m ALLOW descriptions together with annotations on the graph e.g. distance between points X and Y with the X and Y correctly positioned on the graph DO NOT ALLOW descriptions about the height or amplitude of the wave e.g. from 3 to -3 it is 6 m

Question			Answer	Marks	AO element	Guidance
	(b)		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 3 (m/s) award 3 marks (v =) $f \times \lambda$ OR speed = frequency $\times$ wavelength ✓ (v =) 0.5×6 ✓ (v =) 3 (m/s) ✓	3	1.2 2.1 2.1	
	(c)		Either any two from: Count number of waves passing a point ✓ Measure time (for these waves) with a stopwatch ✓ (Use frequency =) number of waves $\div$ time or divide number of waves by time ✓ Repeat and take average values ✓ Or any two from: Measure length of n waves with ruler ✓ Divide by n to get wavelength ✓ Measure time (for these waves) with a stopwatch ✓ Use speed = distance $\div$ time ✓ Use frequency = speed $\div$ wavelength ✓ Repeat and take average values ✓	2	2 $\times$ 2.2	ALLOW count or measure the number of waves in a certain time ✓✓ DO NOT ALLOW frequency is measured using a stopwatch ALLOW measure the length of one wave with a ruler IGNORE measure how long the waves are ALLOW measure the length of waves in a certain amount of time with a stopwatch ALLOW $v = d/t$ ALLOW use speed from part (b) ALLOW $f = v/\lambda$

Question			Answer	Marks	AO element	Guidance												
17	(a)		All 5 points correctly plotted to within $\pm \frac{1}{2}$ a square ✓	1	2.2	Ignore line but if line covering plotting assumes plots are under the line  plots are: <table><thead><tr><th>Weight of cube (N)</th><th>Extension of spring (cm)</th></tr></thead><tbody><tr><td>1.0</td><td>2.9</td></tr><tr><td>3.0</td><td>8.4</td></tr><tr><td>4.0</td><td>11.4</td></tr><tr><td>5.0</td><td>14.4</td></tr><tr><td>7.0</td><td>20.0</td></tr></tbody></table> IGNORE extra marks and dots on the grid as they may be from answering the next question	Weight of cube (N)	Extension of spring (cm)	1.0	2.9	3.0	8.4	4.0	11.4	5.0	14.4	7.0	20.0
Weight of cube (N)	Extension of spring (cm)																	
1.0	2.9																	
3.0	8.4																	
4.0	11.4																	
5.0	14.4																	
7.0	20.0																	
	(b)		$F = k \times e$ OR $k = F \div e$ OR k is the slope or gradient ✓	3	1.2	Question asks candidates to show that the spring constant is 35 N/m so DO NOT credit an answer of 35 with no workings ALLOW evidence of gradient on graph												

Question			Answer	Marks	AO element	Guidance												
			Correct numbers from table or graph to calculate k ✓ Correct conversion from cm to m (to give k) ✓		2.1 2.1	Examples of correct numbers: 3.5 ÷ 10 ✓✓ 7 ÷ 20 ✓✓ any pair of numbers from the table <table><tr><th>Weight of cube (N)</th><th>Extension of spring (cm)</th></tr><tr><td>1.0</td><td>2.9</td></tr><tr><td>3.0</td><td>8.4</td></tr><tr><td>4.0</td><td>11.4</td></tr><tr><td>5.0</td><td>14.4</td></tr><tr><td>7.0</td><td>20.0</td></tr></table> Examples of correct conversion: 3.5 ÷ 0.1 ✓✓✓ 7 ÷ 0.2 ✓✓✓ ALLOW correct calculation using proportion Correct numbers from table and calculates extension per N e.g. 20 ÷ 7 = 2.857 (cm/N) ✓ Understanding of k = force to give one metre extension ✓ Calculate force needed for extension of 100cm 100 ÷ 2.857 = 35 ✓✓✓ or 2.857 x 35 = 100 ✓✓✓	Weight of cube (N)	Extension of spring (cm)	1.0	2.9	3.0	8.4	4.0	11.4	5.0	14.4	7.0	20.0
Weight of cube (N)	Extension of spring (cm)																	
1.0	2.9																	
3.0	8.4																	
4.0	11.4																	
5.0	14.4																	
7.0	20.0																	
	(c)		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.7 (J) award 2 marks E = 0.5 × 35 × 0.2² ✓ E = 0.7 (J) ✓	2	2 × 2.1	ALLOW 7000 (J) ✓												

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553

© OCR 2018

