OCR
Oxford Cambridge and RSA

GCSE (9-1)

Combined Science A (Gateway)

Unit **J250/06**: 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 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 x 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

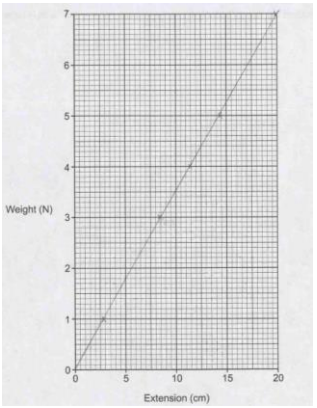
Question			Answer	Marks	AO element	Guidance
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 150 000 (J) award 3 marks** Recall of E = P × t **OR** energy = power × time / AW ✓ E = 2500 × 60 ✓ E = 150 000 (J) ✓	**3**	 **1.2** **2.1** **2.1**	
	(c)	**(i)**	1.8 (kW) ✓	**1**	**1.2**	
		(ii)	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 × 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 × 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 × 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 × 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 × 9.0 ✓ P = 34.2 (W) ✓	**2**	**2 × 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 ✓ E = 0.15 × 4200 × 10 ✓ E = 6300 (J) ✓	**3** **1.2** **2.1** **2.1**		**ALLOW** ecf in conversion e.g. 150g to 1.5kg X 1.5 x 4200 x 10 ✓ ecf E= 63000 ✓ two marks awarded **when working shown** (63000 on its own scores 0) **ALLOW No conversion** E=150 x 4200 x 10 ✓ E= 6 300 000 (J) ✓✓ 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.** *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)**	**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.** *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)** **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.** *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.*			• 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 × λ **OR** speed = frequency × 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 ÷ 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 ÷ time ✓ Use frequency = speed ÷ wavelength ✓ Repeat and take average values ✓	**2**	**2 × 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/λ

Question			Answer	Marks	AO element	Guidance
17	(a)		All 5 points correctly plotted to within ± ½ a square ✓	1	2.2	Ignore line but if line covering plotting assumes plots are under the line  plots are: 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 **IGNORE** extra marks and dots on the grid as they may be from answering the next question
	(b)		F = k × e **OR** k = F ÷ 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

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td></td><td></td><td></td><td>Correct numbers from table or graph to calculate k ✓

Correct conversion from cm to m (to give k) ✓</td><td></td><td>2.1

2.1</td><td>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 ✓✓✓</td></tr>
<tr><td></td><td>(c)</td><td></td><td>FIRST CHECK THE ANSWER ON ANSWER LINE
If answer = 0.7 (J) award 2 marks

E = 0.5 × 35 × 0.2^2 ✓
E = 0.7 (J) ✓</td><td>2</td><td>2 × 2.1</td><td>

ALLOW 7000 (J) ✓</td></tr>
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