

COMPONENT 4 – Applications in Science**FOUNDATION TIER****MARK SCHEME****GENERAL INSTRUCTIONS**Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (except for the extended response questions).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statements.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao	=	correct answer only
ecf	=	error carried forward
bod	=	benefit of doubt

SECTION A

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			Thermometer	1			1		1
	(b)			27 °C/Celsius/Centigrade	1			1		1
	(c)			Ref to inappropriate scale/not able to measure temperature above 33 °C			1	1		1
				Question 1 total	2	0	1	3	0	3

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)		Neutralisation	1			1		1
	(b)		Tick in third box i.e. More copper(II) oxide than can react has been added to use up all the sulfuric acid If two or more boxes ticked award no marks		1		1		1
	(c)		Copper(II) sulfate		1		1		1
	(d)		[Blue] crystals are formed (1) The solution could be heated to remove some water/reduce the volume of water (1) Do not accept: boil all the water off		2		2		2
	(e)	(i)	carbon dioxide (1) water (1)	2			2		2
		(ii)	lead sulfate – no and lead nitrate - yes. Both must be correct to award the mark (1) lead sulfate cannot be separated from lead carbonate because both are insoluble (1)			2	2		2
			Question 2 total	3	4	2	9	0	9

GCSE COMBINED SCIENCE Sample Assessment Materials 252

Question			Marking details					Marks Available						
								AO1	AO2	AO3	Total	Maths	Prac	
3	(a)	(i)	1 mark for each correct row						3		3	3	3	
			Sample number	Height above ground (m)	Number of leaves	Total number of spines	Mean number of spines on each leaf to one decimal place							
			1	1.0	5	36	7.2							
			2	1.5	8	47	5.9							
		(ii)	I	Linear scale exceeding half of vertical axis						1		1	1	1
			II	All three points plotted accurately						1		1	1	1
		(iii)		Spine number per leaf decreases with increasing height						1		1		1
		(iv)		[To compensate for] variation in leaf number between samples							1	1		1
		(v)		Any three × (1) from: <ul style="list-style-type: none"> • Sample at all heights • Increase sample size/ use more leaves • Take leaves at random [not from one stem] • Same age/ length/ size 							3	3		3
	(b)			Protect from herbivores/being eaten						1		1		
				Question 3 total					0	7	4	11	5	10

Question				Marking details	Marks available						
					AO1	AO2	AO3	Total	Maths	Prac	
4	(a)			<ul style="list-style-type: none"> Heat proof mat Tripod Gauze Beaker All 4 correct = 3 marks 3 correct = 2 marks 2 correct 1 mark	3			3			3
	(b)			Risk: Bunsen burner flame could ignite ethanol (1) Control measure: Turn off Bunsen burner/no naked flame before using ethanol (1)	2			2			2
	(c)			Chlorophyll soluble in ethanol	1			1			1
	(d)	(i)		Soften leaf	1			1			1
		(ii)		So the colour [change] can be seen	1			1			1
	(e)	(i)		With chlorophyll: blue/black Without chlorophyll: brown Both needed for the mark		1		1			1
		(ii)		Starch resulting from <u>photosynthesis</u> (1) Chlorophyll needed for photosynthesis, so only present where there had been chlorophyll (1)		2		2			2
				Question 4 total	8	3	0	11	0		11

GCSE COMBINED SCIENCE Sample Assessment Materials 254

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)		Measuring its length, breadth and height using a ruler (1) Multiplying these dimensions together (1) Alternative solution: (by displacement) Totally immerse it in a measured volume of water in a measuring cylinder (1) Take the new reading and subtract the two (1)	2			2		2
	(b)	(i)	54 [g]	1			1		1
		(ii)	Substitution: $\frac{54(\text{ecf})}{20}$ (1) Density = 2.7 [g/cm ³] (1)	1	1		2	1	2
	(c)	(i)	2.7 [g/cm ³] ecf from (b)(ii)		1		1		1
		(ii)	108 [g] ecf from (b)(i)	1			1		1
			Question 5 total	5	2	0	7	1	7

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)			Burette	1			1		1
	(b)			Indicators	1			1		
	(c)			Allows mixing to make sure that acid reacts		1		1		1
	(d)			Completion of table: 12.5 (in first box) and 13.5 (in second box) (1) Both must be correct for mark 11.0 (in third box) (1) Do not accept 11 Y – best tablet (1) Neutralises more acid (1)		1 1	1 1	4		4
	(e)			The experiment could be repeated and mean values used (1) this would take operator errors into account (1)			2	2		2
				Question 6 total	2	3	4	9	0	8

GCSE COMBINED SCIENCE Sample Assessment Materials 256

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			Equal to	1			1		1
	(b)	(i)		All 6 points plotted correctly award 2 marks 5 points plotted correctly award 1 mark only Straight line through the points (1)		3		3	3	3
		(ii)		0.5[0 A]		1		1		1
		(iii)		Recall of: $R = \frac{V}{I}$ (1) Substitution: $\frac{1}{0.25}$ (or any matching pair of values) (1) Resistance = 4 [Ω] (1)	1 1	1		3	2	3
	(c)			Straight line from the origin (1) Passing through / towards coordinate (10,1) (1)		2		2	2	2
	(d)			Ohm's law gives a straight line graph but this is not a straight line so the pupil's conclusion is wrong. Mark is for the reason not just 'no'			1	1		1
				Question 7 total	3	7	1	11	7	11

Question	Marking details	Marks Available					
		AO1	AO2	AO3	Total	Maths	Prac
8	<p>Indicative content: From 0 to 20 minutes, the ice and water mixture is heated but there is no rise in temperature. Heat energy is taken in and produces a change of state from solid (ice) to liquid (water). This provides the latent heat of fusion needed to melt the ice so this identifies the melting point of water as 0 °C. Between 20 and 120 minutes the temperature rises uniformly providing the specific heat needed to increase the water's temperature. At 120 minutes a second change of state begins from water to steam. The boiling point of water is 100 °C. Beyond 120 minutes the temperature remains constant again because heat is being taken in as the latent heat of vaporisation that is needed to change the state from water to steam.</p> <p>5 – 6 marks Detailed description of changes of state with clear reference to all significant aspects of the graph using scientific terminology. Melting and boiling temperatures clearly related to graph. Latent heat of fusion and vapourisation referred to. <i>There is a sustained line of reasoning which is coherent, substantiated and logically structured. The information included in the response is relevant to the argument.</i></p> <p>3 – 4 marks A description of changes of state provided with the melting and boiling points identified. <i>There is a line of reasoning which is partially coherent, supported by some evidence and with some structure. Mainly relevant information is included in the response but there may be some minor errors or the inclusion of some information not relevant to the argument.</i></p> <p>1 – 2 marks A basic description of the changes of state is given. Melting or boiling point is identified <i>There is a basic line of reasoning which is not coherent, supported by limited evidence and with very little structure. There may be significant errors or the inclusion of information not relevant to the argument.</i></p> <p>0 marks <i>No attempt made or no response worthy of credit.</i></p>	6			6	2	6
	Question 8 total	6	0	0	6	2	6

GCSE COMBINED SCIENCE Sample Assessment Materials 258

Question		Marking details		Marks available																														
				AO1	AO2	AO3	Total	Maths	Prac																									
9	(a)		Conical flask containing hydrochloric acid and marble chips (1) fitted with bung and connected by suitable tubing to gas syringe /inverted measuring cylinder over water (1) <i>Allow fully labelled diagram to earn marks</i> Measure time taken to collect 100 cm ³ using stopwatch (1)	3			3			3																								
	(b)		Construction of suitable table (1) Correct title and units in columns 2 & 3 (1) Correct data in columns 2 & 3. <i>Time must be in seconds</i> (1)		3		3	1		3																								
			<table border="1"> <thead> <tr> <th>Name of student</th> <th>Start temperature (°C)</th> <th>Time for reaction (seconds)</th> </tr> </thead> <tbody> <tr> <td>James</td> <td>21</td> <td>150</td> </tr> <tr> <td>Abigail</td> <td>30</td> <td>76</td> </tr> <tr> <td>Syra</td> <td>40</td> <td>38</td> </tr> </tbody> </table> <p>Alternative response:</p> <table border="1"> <thead> <tr> <th>Name of student</th> <th>James</th> <th>Abigail</th> <th>Syra</th> </tr> </thead> <tbody> <tr> <td>Start temperature (°C)</td> <td>21</td> <td>30</td> <td>40</td> </tr> <tr> <td>Time for reaction (seconds)</td> <td>150</td> <td>76</td> <td>38</td> </tr> </tbody> </table>	Name of student	Start temperature (°C)	Time for reaction (seconds)	James	21	150	Abigail	30	76	Syra	40	38	Name of student	James	Abigail	Syra	Start temperature (°C)	21	30	40	Time for reaction (seconds)	150	76	38							
Name of student	Start temperature (°C)	Time for reaction (seconds)																																
James	21	150																																
Abigail	30	76																																
Syra	40	38																																
Name of student	James	Abigail	Syra																															
Start temperature (°C)	21	30	40																															
Time for reaction (seconds)	150	76	38																															
	(c)		Any time estimate between 18 and 20 seconds (1) The reaction rate [approximately] doubles / time for the reaction [approximately] halves for every 10°C rise [in temperature] (1)			2	2	1		2																								
			Question 9 total	3	3	2	8	2		8																								

SECTION B

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
10	(a)	(i)		2 H ₂ O (1) + CO ₂ (1)	2			2		
		(ii)	I	100 × 21 (1) = 2 100 [kg CO ₂ eq] (1)		2		2	1	
			II	Carbon dioxide produced by burning has a greenhouse contribution of 275 [kg CO ₂ eq] (1) Which is less than that of methane (1)			2	2		
	(b)	(i)	I	Doesn't burn fossil fuels / produce CO ₂		1		1		
			II	280 × 27 (1) 7 560 [g] (1)		2		2	2	
		(ii)		32 × 0.45 (1) = 14.4 [kg] (1)		2		2	2	
		(iii)		Ignores carbon dioxide produced during charging (1) Which is equivalent to 72 g/km (1)			2	2		
	(c)			They are then cheaper so encourages us to buy electric vehicles (1) Meets [government] targets on CO ₂ production / decrease carbon footprint of user (1)	2			2		
				Question 10 total	4	7	4	15	5	0

COMPONENT 4 – Applications in Science**FOUNDATION TIER****SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES**

	Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
Section A	1	2	0	1	3	0	3
	2	3	4	2	9	0	9
	3	0	7	4	11	5	10
	4	8	3	0	11	0	11
	5	5	2	0	7	1	7
	6	2	3	4	9	0	8
	7	3	7	1	11	7	11
	8	6	0	0	6	2	6
	9	3	3	2	8	2	8
Section B	10	4	7	4	15	5	0
	TOTAL	36	36	18	90	22	73