

**F****GCSE (9–1)****Combined Science B (Twenty First Century Science)****J260/04: Combined Science (Foundation Tier)**

General Certificate of Secondary Education

**Mark Scheme for November 2020**

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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

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).

<b>Annotation</b>	<b>Meaning</b>
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
<b>DO NOT ALLOW</b>	Answers which are not worthy of credit
<b>IGNORE</b>	Statements which are irrelevant
<b>ALLOW</b>	Answers that can be accepted
( )	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
<b>ECF</b>	Error carried forward
<b>AW</b>	Alternative wording
<b>ORA</b>	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 B:

	<b>Assessment Objective</b>
<b>AO1</b>	<b>Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.</b>
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
<b>AO2</b>	<b>Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.</b>
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
<b>AO3</b>	<b>Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.</b>
<b>AO3.1</b>	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
<b>AO3.2</b>	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.
<b>AO3.3</b>	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.

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Question			Answer	Marks	AO element	Guidance
1	(a)	(i)	Plant cell ✓	1	1.2	<b>ALLOW</b> palisade cell / palisade mesophyll cell <b>IGNORE</b> eukaryotic cell alone
		(ii)	Cell membrane ✓	1	2.1	
		(iii)	4.7 ✓	1	2.2	
	(b)		magnify ✓ electron ✓ resolution ✓ light ✓	4	1.1	
	(c)	(i)	<b>(D) A E B C</b> ✓✓✓	3	2.2	A before E (1 mark) E before B (1 mark) B before C (1 mark)
		(ii)	x10 x40 ✓	1	2.2	

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Question			Answer	Marks	AO element	Guidance
2	(a)	(i)	Any <b>one</b> from: (significantly) different from all the other values ✓ outside range of other values ✓	1	3.2a	<b>ALLOW</b> it is not near/close to the others <b>DO NOT ALLOW</b> it is not more than 1
		(ii)	Any <b>one</b> from: Rate of photosynthesis ✓ Some water used up in photosynthesis ✓ Conditions not constant ✓  Water lost from parts of potometer that are not well sealed ✓  Measurement error (time/distance) ✓	1	3.2a	<b>DO NOT ALLOW</b> references to number of leaves/rate of water uptake <b>ALLOW</b> seal has been breached <b>ALLOW</b> not resetting the reservoir <b>ALLOW</b> length/not giving 15 minutes
		(iii)	1.225 ✓	1	1.2	<b>ALLOW</b> 1.12
		(iv)	<b>increase</b> wind/ airflow/use a fan ✓ <b>raise</b> temperature/use a heater ✓ <b>increase</b> light intensity/use a lamp/ move to a sunnier place ✓	3	3.3a	<b>DO NOT ALLOW</b> references to humidity/increasing number of leaves/changing plant size/different plant/changing the time



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Question			Answer	Marks	AO element	Guidance
3	(a)	(i)	LDPE ✓	1	3.2a	
		(ii)	aluminium ✓	1	3.2a	
	(b)		Aluminium is more likely to bend without breaking than LDPE – FALSE LDPE is nine times less dense than STEEL – TRUE Steel is the strongest material – TRUE ✓ ✓	2	3.2a	1 or 2 correct = 1 mark 3 correct = 2 marks
	(c)		<b>IF ALUMINIUM OR STEEL CHOSEN THEN ZERO MARKS</b> LDPE has the lowest melting point ✓ therefore least energy needed to melt it ✓	2	3.2b	Answers must be comparative – lower/lowest/least/less

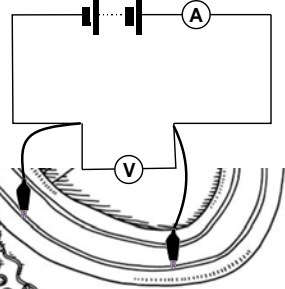
Question		Answer	Marks	AO element	Guidance
3	(d)	<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p><b>Level 3 (5–6 marks)</b> Gives two advantages for use of carbon fibre <b>AND</b> gives one disadvantage of using carbon fibre <b>AND</b> at least two calculations</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (3–4 marks)</b> Gives two advantages for use of carbon fibre <b>OR</b> two disadvantages for use of carbon fibre <b>OR</b> gives one advantage and one disadvantage of using carbon fibre. <b>ORA</b> <b>AND</b> at least one calculation</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and substantiated.</i></p> <p><b>Level 1 (1–2 marks)</b> Gives two advantages for use of carbon fibre <b>OR</b> two disadvantages for use of carbon fibre <b>OR</b> gives one advantage and one disadvantage of using carbon fibre. <b>ORA</b></p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p><b>0 marks</b> <i>No response or no response worthy of credit.</i></p>	6	3.1b	<p><b>AO3.1b Analyse information and ideas to evaluate</b></p> <p>Advantages</p> <ul style="list-style-type: none"> <li>• Carbon fibre has a lower density/ is lighter (than the other materials)</li> <li>• Carbon fibre has a higher strength (than the other materials)</li> </ul> <p>Disadvantages</p> <ul style="list-style-type: none"> <li>• Carbon fibre is more brittle (than the other materials)</li> <li>• Carbon fibre is more expensive (than steel and aluminium)</li> </ul> <p>Carbon fibre is:</p> <ul style="list-style-type: none"> <li>• 4.5 x lighter than steel</li> <li>• 1.5 x lighter than aluminium</li> <li>• 2.5 x lighter than titanium</li> <li>• 3.7 x stronger than titanium</li> <li>• 5.5 x stronger than aluminium</li> <li>• 1.6 x stronger than steel</li> <li>• 0.8 x the cost of titanium</li> <li>• 1.6 x the cost of aluminium</li> <li>• 2.3 x the cost of steel</li> </ul>

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Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	Nina ✓	1	3.2a	
		(ii)	Jack ✓	1	3.2a	
	(b)	(i)	<p>Step 1: pieces same size/length/surface area ✓</p> <p>Step 3: same volumes of solutions/ensure solutions are same temperature ✓</p> <p>Step 4: same length of time/stated length of time ✓</p>	3	3.3b	<p><b>DO NOT ALLOW</b> reference to volume or mass for step 1</p> <p><b>ALLOW</b> references to using different salts e.g. NaCl KCl</p> <p><b>ALLOW</b> references to specifying concentration/masses of salt in solutions/same salt content</p> <p><b>DO NOT ALLOW</b> 'overnight' or vague times</p>
		(ii)	<p><b>FIRST CHECK THE ANSWER ON ANSWER LINE</b></p> <p><b>If answer = 10.8 (%) award 3 marks</b></p> <p><math>(20.4 - 18.2 =) 2.2</math> ✓</p> <p><math>(2.2/20.4 =) 10.78(431373)</math> ✓</p> <p><math>= 10.8</math> (%) (3sf) ✓</p>	3	<p>2.2</p> <p>2.2</p> <p>1.2</p>	<b>ALLOW</b> 1 mark for incorrect answer correctly rounded to 3 sig figs.

Question	Answer	Marks	AO element	Guidance						
5 (a) (i)	 <p>A and V in circles ✓ A in series and V in parallel ✓ Cell/battery symbol ✓</p>	3	2.2							
	<p>(ii) linear (positive) relationship/as length increases resistance increases ✓</p> <p>Uses data from the table to evidence the relationship of doubling. e.g. for 10cm, resistance is 2.5 Ohms, and for 20cm, resistance is 5.0 Ohms ✓</p>	2	3.1a	<p><b>ALLOW FOR 2 MARKS</b> As the length doubles resistance doubles or length is directly proportional to resistance</p>						
	<p>(iii) <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> <b>If answer = 0.24 award 2 marks</b> 3/12.5 ✓ =0.24 (A) ✓</p>	2	2.1	<p><b>ALLOW</b> equation correctly rearranged for 1 mark e.g. <math>V/R</math> or pd/resistance</p>						
(b)	<p>✓✓</p> <table border="1" data-bbox="421 1082 1176 1364"> <tr> <td>add switch to circuit</td> <td>greater accuracy of measurement</td> </tr> <tr> <td>only use straight sections of track</td> <td>increases the precision</td> </tr> <tr> <td>take several readings at each track length</td> <td>reduces the risk of overheating</td> </tr> </table>	add switch to circuit	greater accuracy of measurement	only use straight sections of track	increases the precision	take several readings at each track length	reduces the risk of overheating	2	3.3b	<p>1 or 2 correct = 1 mark 3 correct = 2 marks</p>
add switch to circuit	greater accuracy of measurement									
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Question		Answer	Marks	AO element	Guidance
6	(a)	gravitational potential ✓ decreases ✓ speed ✓ kinetic ✓	4	2.1	
	(b)	(i) Mass x gravitational field strength x height ✓	1	1.2	
		(ii) <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> <b>If answer = 560 000 J award 2 marks</b>  1400 x 10 x 40 = ✓ 560 000 ✓	2	2.1	<b>ALLOW</b> 560 kJ for 2 marks  <b>ALLOW</b> ECF for 2 marks for 5600 if the 4 <sup>th</sup> box is chosen in 6bi)  <b>ALLOW</b> ECF for 2 marks for 22,400,000 if the 3 <sup>rd</sup> box is chosen in 6bi)
	(c)	<b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> <b>If answer = 437 500 (J) award 4 marks</b>  Sight of 90 000(m) and 3600(s) ✓  90km/h = 25m/s ✓  0.5 x 1400 x 25 <sup>2</sup> ✓  = 437 500 J ✓	4	1.2x2  2.1x2	<b>ALLOW</b> 0.5 x 1400 x 90 <sup>2</sup> for one mark <b>DO NOT ALLOW</b> ECF from the incorrect substitution i.e. 5,670,000
	(d)	<b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> <b>If answer = 900 (kJ) award 3 marks</b>  360000 ÷ 0.40 ✓ 900000 ✓ = 900 (kJ) ✓	3	2.1x2  1.2	

Question		Answer	Marks	AO element	Guidance
7	(a)	absorbed ✓ infrared ✓ absorbed ✓ methane ✓	4	1.1	Must be in the correct order
	(b)	(i) Idea that (mass of) carbon released over time increases / Positive correlation ✓ <b>AND</b> Any <b>two</b> from; increased fossil fuel burning / consumption ✓ increased construction / industry ✓ increased deforestation ✓ increased electricity generation ✓ increased use of cars/transportation ✓	3	1 x 3.1a 2 x 3.2a	<b>ALLOW</b> increases from 1950  Must imply an increase
		(ii) Any <b>one</b> from: Idea that the mass of the gas was difficult to measure or quantify ✓ Scientists didn't/couldn't repeat their measurements ✓ Carbon dioxide only measured in millions of tonnes ✓ The technology or measuring equipment in the past didn't give accurate measurements ✓ The data released from each country may not be accurate ✓	1	3.2a	
		(iii) Any <b>two</b> from: global temperature will increase / climate change ✓ change in places crops can be grown ✓ more extreme weather will be seen ✓ sea level rise ✓ Idea that habitats may be changed e.g. desertification ✓	2	2.1	
	(c)	Any <b>two</b> from: Could lead to the continued use of fossil fuels ✓ Uses a large amount of energy ✓ Carbon could leak / escape ✓ Unknown effects on ecosystems / habitats / animals ✓	2	2.1	<b>IGNORE</b> cost arguments

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	<b>(d)</b>	<b>(i)</b>	Non-renewable is finite or will run out / renewable is infinite or can be replaced ✓	<b>1</b>	<b>2.1</b>	<b>DO NOT ALLOW</b> renewable can be used again or reused ORA
		<b>(ii)</b>	Plants take in CO <sub>2</sub> when they photosynthesise ✓ Burning plants releases the same mass of carbon dioxide they absorb. ✓	<b>2</b>	<b>2.1</b>	

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