

# Higher

## GCSE

### Combined Science B Twenty First Century Science

#### J260/08: Combined science (Higher Tier)

General Certificate of Secondary Education

### Mark Scheme for June 2022

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.

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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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**MARKING INSTRUCTIONS****PREPARATION FOR MARKING****RM ASSESSOR**

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are available in RM Assessor.
3. Log-in to RM Assessor and mark the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

**MARKING**

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the RM Assessor messaging system.

**5. Crossed Out Responses**

Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

**Rubric Error Responses – Optional Questions**

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

**Multiple Choice Question Responses**

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).

*When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.*

**Contradictory Responses**

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

**Short Answer Questions** (requiring only a list by way of a response, usually worth only **one mark per response**)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

**Short Answer Questions** (requiring a more developed response, worth **two or more marks**)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

**Longer Answer Questions** (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:

- there is nothing written in the answer space.

Award Zero '0' if:

- anything is written in the answer space and is not worthy of credit (this includes text and symbols).

Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM Assessor **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

If you have any questions or comments for your Team Leader, use the phone, the RM Assessor messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.

Once the level is located, award the higher or lower mark:

**The higher mark** should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

**The lower mark** should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.















**In summary:**

**The skills and science content determines the level.**

**The communication statement determines the mark within a level.**

Level of response questions on this paper are **X** and **X**

## 11. 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

12. 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



### 13. 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.

Question		Answer	Marks	AO element	Guidance	
1	(a)	<p><b>Any one from:</b>            (wear) goggles / safety glasses ✓            Screen ✓            Lab coat/apron ✓            Gloves ✓</p>	1	1.2	<p>Glasses must be qualified</p> <p><b>ALLOW</b> tweezers or tongs</p>	
	(b)	(i)	(B) C E A D ✓✓✓	3	3.1a	<p>C before E = 1 mark            E before A = 1 mark            A before D = 1 mark</p>
		(ii)	<p><b>(No)</b>            (to test for hydrogen, they need to) use a lighted/lit splint/do not blow out the splint ✓</p> <p>idea that the positive test for hydrogen will give a (squeaky) pop ✓</p>	2	3.3b	<p><b>ALLOW</b> a glowing splint is the test for oxygen</p> <p><b>ALLOW</b> positive test for oxygen given (relights the glowing splints)</p>
	(c)	<p>2[Na] ✓            2[HCl] ✓            2[NaCl] ✓</p>	3	2.1		

Question			Answer	Marks	AO element	Guidance												
2	(a)	(i)	<table border="1"> <tr><td>Greenfly</td><td></td></tr> <tr><td>Hedgehog</td><td>✓</td></tr> <tr><td>Lettuce</td><td></td></tr> <tr><td>Owl</td><td></td></tr> <tr><td>Rabbit</td><td></td></tr> <tr><td>Spider</td><td>✓</td></tr> </table>	Greenfly		Hedgehog	✓	Lettuce		Owl		Rabbit		Spider	✓	1	3.2b	Both required for the mark
Greenfly																		
Hedgehog	✓																	
Lettuce																		
Owl																		
Rabbit																		
Spider	✓																	
		(ii)	Five ✓	1	3.1a													
		(iii)	<p><b>Either:</b>            Snails would increase ✓            Because less competition for food ✓</p> <p><b>Or:</b>            Snails would decrease ✓            Because hedgehogs would eat more snails ✓</p>	2	3.2b	<p><b>ALLOW</b> more lettuce / food (for them to eat)</p> <p><b>IGNORE</b> blackbirds  <b>ALLOW</b> stays the same with a suitable explanation of both ideas of increase and decrease</p>												
	(b)		<p><b>FIRST CHECK THE ANSWER ON ANSWER LINE</b>  <b>If answer = 0.375 (kg) award 2 marks</b></p> <p><math>37.5 / 10 = 3.75</math> ✓  <math>3.75 / 10 = 0.375</math> ✓</p>	2	2.2	<b>ALLOW</b> 3.75 by other methods for 1 mark												

Question			Answer	Marks	AO element	Guidance
3	(a)	(i)	<p><b>FIRST CHECK THE ANSWER ON ANSWER LINE</b>  <b>If answer = 7.9 (%) award 3 marks</b></p> <p>6 cells undergoing mitosis ✓  <math>6 / 76 = 0.078947</math> ✓  <math>\times 100 = 7.9\%</math> ✓</p>	3	3.1a 2.2 x 2	<p><b>ALLOW</b> 7.8 for 2 marks  <b>ALLOW</b> any correct rounding</p> <p><b>ALLOW</b> ECF for incorrect number of cells identified</p>
		(ii)	(tips are where) growth is taking place ✓	1	2.1	
		(iii)	<p>Differentiation</p> <p>Interphase</p> <p>Meristem Cells</p> <p>Tissue</p> <p>Cells in the bean plant that can form any type of cell</p> <p>A group of bean cells that have the same function.</p> <p>The stage in the cell cycle before the bean cells begin mitosis.</p> <p>The process of newly formed bean cells becoming root hair cells.</p> <p style="text-align: right;">✓✓✓</p>	3	1.1	<p>4 correct lines = 3 marks                      3 or 2 correct lines = 2 marks                      1 correct line = 1 mark</p>
	(b)		<p>twice ✓                      gametes ✓                      23 ✓</p>	3	1.1	

Question	Answer	Marks	AO element	Guidance
4	<p data-bbox="371 240 1108 304">Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p data-bbox="371 341 645 373"><b>Level 3 (5–6 marks)</b></p> <p data-bbox="371 376 833 408">Calculations of both momenta <b>AND</b></p> <p data-bbox="371 411 1104 507">Explains how the difference in momentum of the two lorries affects the time taken to stop the lorry and relates this to the stopping distance</p> <p data-bbox="371 510 1117 606"><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 data-bbox="371 643 645 675"><b>Level 2 (3–4 marks)</b></p> <p data-bbox="371 678 768 710">Calculations of momenta <b>AND</b></p> <p data-bbox="371 713 1099 777">Explains the effect of momenta on the stopping distance of the two lorries</p> <p data-bbox="371 780 1046 876"><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p data-bbox="371 912 645 944"><b>Level 1 (1–2 marks)</b></p> <p data-bbox="371 948 1104 1011">Evidence of some calculations e.g. Fully laden mass <b>OR</b></p> <p data-bbox="371 1015 1046 1110"><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p data-bbox="371 1147 483 1179"><b>0 marks</b></p> <p data-bbox="371 1182 958 1214"><i>No response or no response worthy of credit.</i></p>	6	<p data-bbox="1267 240 1373 272">2 x 1.1</p> <p data-bbox="1267 276 1373 308">2 x 2.2</p> <p data-bbox="1267 311 1373 343">2 x 3.2a</p>	<p data-bbox="1402 240 2000 304"><b>AO1.1 recall of information about stopping distances/change in momentum</b></p> <ul data-bbox="1402 308 2051 777" style="list-style-type: none"> <li data-bbox="1402 308 2022 371">• Stopping distances include thinking distance and braking distance</li> <li data-bbox="1402 387 2040 451">• Thinking distance/reaction time is the same in a loaded or unloaded lorry</li> <li data-bbox="1402 467 2051 617">• Change in momentum is force x time (from the data sheet)– the greater the change in momentum, for the same braking force, the longer the time to stop.</li> <li data-bbox="1402 633 2051 697">• A greater stopping time from the same velocity will cause a greater stopping distance.</li> <li data-bbox="1402 713 2051 777">• Named factors affecting stopping distance e.g. road conditions, weather</li> </ul> <p data-bbox="1402 809 1816 841"><b>AO2.2 application of equation</b></p> <p data-bbox="1402 844 1933 876">Total laden mass of the lorry = 44 000 kg</p> <p data-bbox="1402 879 1995 911">Momentum of unladen lorry = 362 500 kg m/s</p> <p data-bbox="1402 914 2047 946">Momentum of fully laden lorry = 1 100 000 kg m/s</p> <p data-bbox="1402 949 1957 981">Difference in momentum = 737 500 kg m/s</p> <p data-bbox="1402 1013 2051 1045"><b>AO 3.2a judgements about stopping distances</b></p> <ul data-bbox="1402 1048 2018 1319" style="list-style-type: none"> <li data-bbox="1402 1048 2018 1160">• Momentum in the fully laden lorry is much greater (approximately 3 times greater) than the unladen lorry.</li> <li data-bbox="1402 1176 2018 1240">• More time will be needed to stop the loaded lorry, meaning greater distance</li> <li data-bbox="1402 1256 2002 1319">• The same (braking) force will take a longer time to stop the loaded lorry.</li> </ul>

Question			Answer	Marks	AO element	Guidance
5	(a)	(i)	<p>Diode</p> <p>Light dependent resistor (LDR)</p> <p>Thermistor</p> <p>Variable resistor</p>	3	1.1	<p>4 correct lines = 3 marks</p> <p>3 or 2 correct lines = 2 marks</p> <p>1 correct line = 1 mark</p>
		(ii)	<p>Idea that one of the cells needs to be turned around in the battery / cells are facing the same way ✓</p> <p>Voltmeter needs to be connected in parallel / across (the thermistor/resistor) ✓</p>	2	3.3b	<p><b>ALLOW</b> correct drawings on the circuit diagram for either marking point</p> <p><b>ALLOW</b> a description of the voltmeter correctly connected to the thermistor/resistor</p>
		(iii)	<p>All points plotted correctly within ½ small square ✓ ✓</p> <p>Line of best fit ✓</p>	3	2.1	<p><b>ALLOW</b> 4 correct plotted points for 1 mark</p> <p><b>IGNORE</b> extrapolations beyond the points</p> <p><b>ALLOW</b> lines of best fit drawn through the origin as 0,0 would be a correct point.</p>
	(b)			1	2.1	

Question			Answer	Marks	AO element	Guidance
6	(a)	(i)	Diamond <input type="checkbox"/> Graphite <input type="checkbox"/> Lead bromide <input checked="" type="checkbox"/> Potassium chloride <input checked="" type="checkbox"/> Silicon dioxide <input type="checkbox"/>	2	3.2a	
		(ii)	<b>Any two from:</b> fill the test tubes with sodium chloride solution ✓ Place the test tubes over the electrode ✓ test tubes (open end) must be under the solution surface ✓ use shorter electrodes / top of electrodes under surface of the solution / add more sodium chloride solution to the beaker ✓	2	3.3a	<b>DO NOT ALLOW</b> use a.c. power supply
		(iii)	(anode) chlorine ✓ (cathode) hydrogen ✓	2	2.1	<b>ALLOW</b> oxygen at the anode <b>ALLOW</b> Cl <sub>2</sub> and H <sub>2</sub> in that order If no other mark is awarded then allow chlorine/oxygen and hydrogen at the opposite electrodes for 1 mark
	(b)		2e <sup>-</sup> ✓ 2Na ✓	2	2.1	<b>DO NOT ALLOW</b> Na <sup>+</sup> <b>ALLOW</b> correct formulae of e and Na for 1 mark



Question			Answer	Marks	AO element	Guidance
7	(a)	(i)	<p><b>FIRST CHECK THE ANSWER ON ANSWER LINE</b>  <b>If answer = 671 (women) award 2 marks</b></p> <p>55.4% used in calculation ✓  <math>0.554 \times 1212 = 671(.448)</math> ✓</p>	2	3.1b 2.2	<p><b>ALLOW</b> 672</p> <p><b>ECF</b> with correct process from 54.5 or 45.5 to give 660(.54) or 551(.46) respectively</p>
		(ii)	Iceland ✓	1	3.2b	
		(iii)	<p><b>Any three from:</b>            In this study no women in the Iceland sample have BRCA1 ✓</p> <p>Only Finland is close to a 1:1 ratio ✓</p> <p>idea of a difference in percentages (about 10%) in most countries ✓</p> <p>Italy has a 60:40 ratio / % which is very different / not equal ✓</p> <p>idea that there are 3 countries have a higher BRCA1 than BRCA2 ✓</p> <p>This study only represents 5 countries / small number of countries ✓</p> <p>The sample size of each country is unknown/small ✓</p>	3	3.1b	<p><b>ALLOW</b> the calculation of mean % of those with BRCA1 (44%) compared to BRCA2 (56%)</p>

	<b>(b)</b>	<p><b>Any two from:</b>  make better lifestyle choices ✓</p> <p>idea of informing relatives so they can make their own informed decisions ✓</p> <p>idea to inform family planning ✓</p> <p>can make informed decisions about treatment e.g. preventative surgery based e.g. have mastectomy ✓</p> <p>can make informed decisions about treatment e.g. preventative medication ✓</p>	<b>2</b>	<b>2.1</b>	<p><b>ALLOW</b> reduce alcohol, not smoking, not being over weight, eat a healthy diet, exercise regularly and don't take the oral contraceptive combined pill</p> <p><b>ALLOW</b> ideas that you can make informed decisions about breast feeding your child to reduce BRCA allele incidence</p>
	<b>(c)</b>	<b>(i)</b> Beth ✓	<b>1</b>	<b>3.1b</b>	
		<b>(ii)</b> Jamal ✓	<b>1</b>	<b>3.1b</b>	

Question			Answer	Marks	AO element	Guidance
8	(a)	(i)	<p><b>FIRST CHECK THE ANSWER ON ANSWER LINE</b>  <b>If answer = 7850 nm<sup>2</sup> or 7854 nm<sup>2</sup> award 3 marks</b></p> <p>radius = <math>50/2 = 25</math> ✓  <math>4 \times 3.14 \times 25^2 = 7850</math> <b>OR</b> <math>4 \times \pi \times 25^2 = 7854</math> ✓</p> <p>nm<sup>2</sup> ✓</p>	3	1.2	<p><b>ALLOW</b> calculator value of 7853.98 or correct rounding for. 3 marks</p> <p><b>ALLOW</b> ECF for use of diameter instead of radius in calculation 31 400 <b>OR</b> 31416 (if <math>\pi</math> is used)  <b>ALLOW</b> 7850 or 7854 in the working for 1 mark if further working leads to an incorrect answer</p> <p><b>ALLOW</b> alternative units if correct conversion is given</p>
		(ii)	<p>Gold is very valuable <input type="checkbox"/></p> <p>Gold has the smallest diameter <input type="checkbox"/></p> <p>Gold is very unreactive <input checked="" type="checkbox"/></p> <p>Gold only contains one element <input type="checkbox"/></p>	1	3.2a	
	(b)		<p>Large(er) SA:V ✓  (increased rate of reaction because) there are more collisions per second / more frequent collisions / more particles are exposed/on the surface (to react with) ✓</p>	2	2.2	<p><b>IGNORE</b> comments about diameter / size</p> <p><b>ALLOW</b> ideas of there being less inaccessible /wasted silver oxide in the catalyst</p>
	(c)		<p><b>Any one from:</b>  Nanoparticles are very small ✓  Idea that people wear sunscreen ✓  <b>AND</b>  <b>Any three from:</b>  Idea that sunscreen washes off into the ecosystem ✓  Nanoparticles may end up in tissue (of organisms) ✓  Nanoparticles may enter the food chain/food web ✓  Idea of bioaccumulation ✓  TiO<sub>2</sub> nanoparticles might damage marine organisms ✓</p>	4	2.1  3.2b x 3	<p><b>ALLOW</b> named examples of organisms</p>

Question		Answer	Marks	AO element	Guidance	
9	(a)	$  \begin{array}{ccc}  234 & & \dots 230 \dots \\  \text{U} & \longrightarrow & \text{Th} + \alpha \\  92 & & \dots 90 \dots  \end{array}  $ <p>230 ✓ 90 ✓ <math>\alpha</math> ✓</p>	3	2.1	<p>ALLOW He or see below</p> $  \begin{array}{c}  4 \\  \text{He} \\  \dots 2 \dots  \end{array}  $ <p>DO NOT ALLOW incorrect nucleon numbers for He</p>	
	(b)	(i)	<b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> If answer = 11460 / 1.15 x 10 <sup>4</sup> / (years) award 3 marks	3	2.2	
		(ii)	<p>1/4 is equal to 1/2 x 1/2 - so 2 half lives ✓ 2 x 5.73 x 10<sup>3</sup> ✓ 1.15 x 10<sup>4</sup> / 11460 (years) ✓</p>	1	3.2b	
			<p><b>Any one from:</b> Radioactive decay happens randomly ✓ Background radiation may cause errors ✓ Only 2 half-lives have been used ✓</p>			

## Need to get in touch?

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