

GCSE (9–1)

Combined Science B (Twenty First Century Science)

J260/01: Biology (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for Autumn 2021

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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 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
<u>—</u>	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 B:

	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	(a)	Homeostasis ✓	1	1.1																									
	(b)	Enzymes in the human body work best at 37°C ✓	1	1.1																									
	(c)	<table border="1"> <thead> <tr> <th>statement</th> <th>Type 1 only</th> <th>Type 2 only</th> <th>Both</th> </tr> </thead> <tbody> <tr> <td>The body no longer responds to insulin produced.</td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>Treated using a combination of diet and exercise.</td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>Can be treated with insulin injections.</td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>Diet should not contain too much sugar.</td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>The pancreas stops producing insulin.</td> <td>✓</td> <td></td> <td></td> </tr> </tbody> </table> <p style="text-align: right;">✓✓✓✓✓</p>	statement	Type 1 only	Type 2 only	Both	The body no longer responds to insulin produced.		✓		Treated using a combination of diet and exercise.		✓		Can be treated with insulin injections.			✓	Diet should not contain too much sugar.			✓	The pancreas stops producing insulin.	✓			5	1.1	One mark for each correct row
statement	Type 1 only	Type 2 only	Both																										
The body no longer responds to insulin produced.		✓																											
Treated using a combination of diet and exercise.		✓																											
Can be treated with insulin injections.			✓																										
Diet should not contain too much sugar.			✓																										
The pancreas stops producing insulin.	✓																												
	(d)	increases increase increases ✓ ✓	2	1.1	All three correct = 2 marks One or two correct = 1 mark																								

Question			Answer	Marks	AO element	Guidance
2	(a)	(i)	A ✓ D ✓	2	1.1	Answers can be in either order ALLOW written description rather than letter
		(ii)	B ✓ E ✓	2	1.1	Answers can be in either order ALLOW written description rather than letter
	(b)		less less less ✓✓	2	2.1	All three correct = 2 marks One or two correct = 1 mark
	(c)	(i)	FIRST CHECK THE ANSWER ON THE ANSWER LINE If answer = 31 000 award 2 marks 150 000 – (69 000 + 50 000) ✓ = 31 000 ✓	2	2.2	ALLOW for 31000 written in stroke cases box
		(ii)	FIRST CHECK THE ANSWER ON THE ANSWER LINE If answer = 46 (%) award 2 marks 69 000 ÷ 150 000 = 0.46 ✓ 0.46 x 100 = 46 (%) ✓	2	2.2	
		(iii)	FIRST CHECK THE ANSWER ON THE ANSWER LINE If answer = 480 award 2 marks 60 ÷ 3 = 20 ✓ OR 60 x 24 = 1440 ✓ 20 x 24 = 480 ✓ OR 1440 ÷ 3 = 480 ✓	2	2.2	

Question			Answer	Marks	AO element	Guidance
3	(a)	(i)	1 ✓	1	2.1	
		(ii)	2 ✓ OR 5 ✓ OR 7 ✓	1	2.1	
	(b)		Any two from: idea that enzymes catalyse/speed up the breakdown/digestion of food molecules/substances/chemicals ✓ idea that digestion/enzymes break down food molecules ✓ idea that smaller food molecules can be absorbed/cross the partially permeable membrane ✓	2	2.1	ALLOW any correct named example e.g proteins broken down into amino acids
	(c)		FIRST CHECK THE ANSWER ON THE ANSWER LINE If answer = 137.5 (billion tonnes) award 2 marks 550 x 25 / 100 ✓ OR 550 / 100 x 25 ✓ OR 550 x 0.25 ✓ = 137.5 (billion tonnes) ✓	2	2.2	

Question			Answer	Marks	AO element	Guidance												
4	(a)	(i)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="background-color: #cccccc;">2</td> <td>4</td> <td>6</td> <td>3</td> <td>5</td> <td>1</td> </tr> <tr> <td></td> <td></td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> <td style="text-align: center;">✓</td> </tr> </table>	2	4	6	3	5	1			✓	✓	✓	✓	4	3.3a	4 before 6 6 before 3 3 before 5 5 before 1
2	4	6	3	5	1													
		✓	✓	✓	✓													
		(ii)	idea that less breakable/ if broken less likely to cut ✓	1	2.2													
		(iii)	The larvae could respond to the heat ✓	1	2.2													
	(b)		sensory neuron before relay neuron ✓ relay neuron before motor neuron ✓	2	1.1													
	(c)		diffuse ✓ receptors ✓	2	1.1	Answers must be in the correct order												

Question			Answer	Marks	AO element	Guidance								
5	(a)	(i)	plant(s) ✓	1	2.1									
		(ii)	fungi/springtails/mites ✓	1	2.1									
		(iii)	soil ✓	1	2.1									
	(b)		<table border="0"> <tr> <td style="text-align: center;">Technical term</td> <td style="text-align: center;">Description</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">Ecosystem</td> <td style="border: 1px solid black; padding: 5px;">All the species present.</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">Community</td> <td style="border: 1px solid black; padding: 5px;">The number of individuals in a single species.</td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">Population</td> <td style="border: 1px solid black; padding: 5px;">All the species and all the abiotic components. ✓✓</td> </tr> </table>	Technical term	Description	Ecosystem	All the species present.	Community	The number of individuals in a single species.	Population	All the species and all the abiotic components. ✓✓	2	1.1	All three correct = 2 marks One or two correct = 1 mark
Technical term	Description													
Ecosystem	All the species present.													
Community	The number of individuals in a single species.													
Population	All the species and all the abiotic components. ✓✓													
	(c)	(i)	<p>FIRST CHECK THE ANSWER ON THE ANSWER LINE If answer = 9 award 2 marks</p> <p>$(6 + 12 + 9) = 27$ ✓ $27 \div 3 = 9$ ✓</p>	2	1.2	ALLOW for 9 written in the mean box								
		(ii)	<p>Any two from:</p> <p>when there are 3 mites they have plenty of prey/springtails/food (so they breed and their number increases) ✓</p> <p>when there are 15 mites there is not enough prey/springtails/food (so some starve, and the numbers decrease) ✓</p> <p>they both have 60 springtails/the same number of prey ✓</p>	2	2.1									

Question		Answer	Marks	AO element	Guidance
6	(a)	2 ✓	1	3.1a	
	(b) (i)	It had three features of modern birds/It had a beak, feathers and wings/it had more features in common with modern birds ✓	1	3.2a	IGNORE it has the same boxes ticked as modern birds
	(b) (ii)	It had a long bony tail and teeth/It had 2 features not seen in modern birds ✓	1	2.1	IGNORE it has the same boxes ticked as modern birds
	(c)	There are periods of time for which we have no fossils. ✓	1	2.1	
	(d)	DNA (analysis) ✓	1	1.1	

Question		Answer	Marks	AO element	Guidance										
7	(a)	Underground mosquitoes can no longer breed with above-ground mosquitoes ✓	1	2.1											
	(b)	<table border="1"> <tr> <td>1</td> <td>The individual mosquitoes trapped underground had different characteristics.</td> </tr> <tr> <td>3</td> <td>Mosquitoes that could feed on mammals were more likely to survive.</td> </tr> <tr> <td>2</td> <td>There was a limited supply of food types underground, so the trapped mosquitoes had to compete.</td> </tr> <tr> <td>5</td> <td>Over a long period of time the characteristics of the underground mosquito population changed.</td> </tr> <tr> <td>4</td> <td>The mosquitoes that survived could breed and pass on their alleles.</td> </tr> </table> <p style="text-align: right;">✓✓✓</p>	1	The individual mosquitoes trapped underground had different characteristics.	3	Mosquitoes that could feed on mammals were more likely to survive.	2	There was a limited supply of food types underground, so the trapped mosquitoes had to compete.	5	Over a long period of time the characteristics of the underground mosquito population changed.	4	The mosquitoes that survived could breed and pass on their alleles.	3	2.1	1 before 3 3 before 5 5 before 4
1	The individual mosquitoes trapped underground had different characteristics.														
3	Mosquitoes that could feed on mammals were more likely to survive.														
2	There was a limited supply of food types underground, so the trapped mosquitoes had to compete.														
5	Over a long period of time the characteristics of the underground mosquito population changed.														
4	The mosquitoes that survived could breed and pass on their alleles.														

Question		Answer	Marks	AO element	Guidance
8	(a)	FF ✓ Ff ✓	2	2.1	Answer can be in either order
	(b)	inherited ✓ phenotype ✓	2	1.1	Answers must be in the correct order
	(c)	(i) Similarity both can produce specialised/differentiated cells ✓ Difference idea that embryonic stem cells can produce any kind of specialised cell/adult stem cells can only produce a limited number of different types of specialised cell ✓	2	1.1	
		(ii) Advantage: may lead to a cure/treatment/save lives ✓ Disadvantage: kills embryo/destroys a life/embryo cannot give consent/embryonic stem cells may be rejected ✓	2	2.1	IGNORE ethical ideas without reference to killing embryos/destroying life
	(d)	(i) <u>cancer</u> ✓	1	1.1	DO NOT ALLOW named examples of cancers
		(ii) less oxygen can be carried (by the blood) ✓	1	2.1	IGNORE less blood

Question		Answer	Marks	AO element	Guidance
9	(a)	1.2 (ml) ✓	1	2.2	
	(b)	oxygen is still used by nongerminating corn seeds ✓ correct example of data from the graph for nongerminating corn seeds ✓	2	3.2b 2.2	ALLOW any data point above 0 up to and including 0.2ml
	(c)	0.04 (ml/min) ✓	1	2.2	
	(d)	$y = mx + c$ ✓	1	1.2	

Question	Answer	Marks	AO element	Guidance
10*	<p>Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5–6 marks)</p> <p>Detailed description of how they would use a double-blind trial AND detailed description of some improvements to method to collect valid data.</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>Level 2 (3–4 marks)</p> <p>Description of aspects of double-blind trial AND description of some improvements to method</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>Level 1 (1–2 marks)</p> <p>Description of aspects of double-blind trial OR Description of some improvements to method</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks</p> <p><i>No response or no response worthy of credit.</i></p>	6	1.2 x 2 3.3a x 2 3.3b x 2	<p>AO1.2 Demonstrating knowledge of double-blind trial</p> <ul style="list-style-type: none"> • Description of placebo • Investigator doesn't know who has taken placebo and who has taken active drug/caffeine • Subject doesn't know if they have taken placebo or active drug/caffeine • Idea that this eliminates bias/is more objective • Idea that means results are more accurate <p>AO3.3a Developing experimental procedures</p> <ul style="list-style-type: none"> • Use decaffeinated cola as a placebo • Amir will not know if fellow students have drunk caffeinated or decaffeinated cola • Nina won't know if they have drunk caffeinated or decaffeinated cola • Neither Amir nor Nina will have a bias/expectation • Repeat each trial with more people <p>AO3.3b Improving experimental procedures</p> <ul style="list-style-type: none"> • Amir must drop the ruler from the same height • Add a mechanism to drop ruler to remove Amir error • Nina's fingers must be the same distance apart • Wrist of Nina in the same place e.g. on edge of desktop • Always measure to the same place e.g. top of fingers • No distractions • Repeat readings

Question		Answer	Marks	AO element	Guidance															
11	(a)	<table border="1"> <thead> <tr> <th>Statement</th> <th>Communicable diseases</th> <th>Non-communicable diseases</th> </tr> </thead> <tbody> <tr> <td>They are caused by alleles</td> <td></td> <td>✓</td> </tr> <tr> <td>They are caused by lifestyle choices</td> <td></td> <td>✓</td> </tr> <tr> <td>They are caused by pathogens</td> <td>✓</td> <td></td> </tr> <tr> <td>They are caused by trauma</td> <td></td> <td>✓</td> </tr> </tbody> </table>	Statement	Communicable diseases	Non-communicable diseases	They are caused by alleles		✓	They are caused by lifestyle choices		✓	They are caused by pathogens	✓		They are caused by trauma		✓	2	1.1	Award one mark for each correct column
		Statement	Communicable diseases	Non-communicable diseases																
		They are caused by alleles		✓																
		They are caused by lifestyle choices		✓																
		They are caused by pathogens	✓																	
They are caused by trauma		✓																		
	✓	✓																		
	(b)	antibodies ✓ antigens ✓ digested ✓	3	1.1	Answers must be in the correct order															
	(c)	Mia more information Sam ethical decision Ali ethical decision Jamal more information ✓✓✓	3	3.1b	All 4 correct = three marks 3 correct = 2 marks 1 or 2 correct = 1 mark															

Question		Answer	Marks	AO element	Guidance
12	(a)	<p>Any four from: select the lowest/lower objective lens/lowest power ✓</p> <p>move the stage (towards the lens) up/until it reaches the top ✓</p> <p>description of focussing the slide using the (coarse) focussing knob ✓</p> <p>change the objective lens to a higher objective lens/higher power ✓</p> <p>idea of the repeat of the focussing process/refocus/use (fine) focussing knob (to make the image clearer) ✓</p>	4	1.2	<p>ALLOW smallest objective lens/smallest power/select the x4 lens</p> <p>ALLOW move the stage up until it reaches the lens</p> <p>ALLOW bigger objective lens/bigger power/select the x10 lens/select the x40 lens</p> <p>ALLOW any sensible order</p>
	(b)	<p>Any two from: dead cells ✓ strengthened/lignified walls ✓ no end walls/continuous tube ✓ pits to allow water to enter and leave ✓</p>	2	1.1	<p>ALLOW is one long tube/no cell contents or an example of cell content eg mitochondria</p>
	(c) (i)	<p>provides large surface area/surface area to volume ratio ✓ idea that transport/uptake will be (more) rapid/faster ✓</p> <p>OR has many/lots of mitochondria ✓ to release energy/ATP/ to carry out active transport ✓</p>	2	1.1	
	(ii)	<p>Any two from: respiration ✓ makes ATP/release energy ✓ ATP/energy is required for active transport ✓</p>	2	2.1	<p>DO NOT ALLOW produce energy</p>
	(d)	<p>Water ions can diffuse through the partially permeable membrane, but nitrate ions cannot. ✓</p>	1	2.1	

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