

Higher

GCSE

Combined Science B Twenty First Century Science

J260/05: Biology (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2022

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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.

The level of response question on this paper is Q3.

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).

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

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.

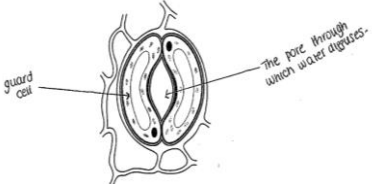
You should ensure that you have copies of these materials.

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:

	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)		lost ✓ water ✓ xylem ✓	3	1.1	
	(b)		Pore labelled/label 1 AND any part of either guard cell labelled/label 2 ✓ 	1	2.1	Both required for mark. IGNORE other labels
	(c)		x4 lowest stage ✓✓	2	2.1	All three correct = 2 marks One or two correct = 1 mark
	(d)	(i)	Distance (moved between the markers) ✓ Time taken (for bubble to move between markers) ✓	2	2.2	IGNORE number of bubbles
		(ii)	Any two from: When the tap is open ✓ Water from reservoir pushes bubble back to first marker/reset the bubble ✓ Allows repeat readings ✓	2	2.2	ALLOW idea that water can be added from the reservoir
	(e)	(i)	0.75 is/could be an outlier ✓ Idea to discard outliers only if there is a reason to reject it ✓	2	3.1b 3.2a	ALLOW description of an outlier ALLOW the reading should be repeated

	(ii)	FIRST CHECK THE ANSWER IN TABLE / ON ANSWER LINE If answer = 3.16 award 3 marks $(4.55 + 4.17 + 0.75) / 3$ OR $9.47/3 \quad \checkmark$ $= 3.156666666666 \quad \checkmark$ $= 3.16 \quad \checkmark$	3	 2.2 x 2 1.2	 ALLOW ECF from marking point one ALLOW ECF from marking point two for correct rounding
	(f)	wind speed and temperature are the same in A and B/only light is different in A and B $\checkmark$	1	3.2b	DO NOT ALLOW “it’s not a fair test” without further explanation ALLOW C and D have different temperatures and wind speed/ idea that in experiments C and D other factors/variables (in addition to light level) changed / were not controlled $\checkmark$

Question			Answer	Marks	AO element	Guidance
2			active transport ✓ ATP ✓ aerobic ✓	3	2.1 1.1 x 2	

Question			Answer	Marks	AO element	Guidance
3*			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) Explains in detail the function of the reflex arc AND Explains in detail the structure of a reflex arc <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Explains the function of the reflex arc AND Explains the structure of a reflex arc <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Gives a basic explanation of the function of the reflex arc OR Gives a basic explanation of the structure of a reflex arc <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit.</i>	6	3 x 2.1 3 x 1.1	AO2.1 Applying knowledge to explain the function of this particular reflex arc - This is a pain reflex - Pain is caused by the sharp object - This reflex arc enables a rapid response to the pain - No conscious control required/automatic response/brain not involved. - Response is to pull away from the pain stimulus/sharp object - Response prevents damage//limits damage - This response has a survival advantage AO1.1 Demonstrating knowledge by explaining the general structure of a reflex arc - Receptor detects pain/stimulus - Correct ref. to peripheral nervous system PNS - Correct ref. to central nervous system CNS - Sensory neuron carries an impulse/message from receptor to spinal cord/CNS - Relay neuron carries impulses from the sensory neuron to the motor neuron - Synapses (in CNS) allow impulses to pass from one neuron to another - Neurotransmitter takes message across synapse - Motor neuron carries an impulse/message from spinal cord/CNS to effector/muscles in arm - Effector/muscle contracts / moves - Myelin sheath speeds up impulses (improves conduction)

Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	Any one from: Modifying the maize genome ✓ Moving a gene from one organism to another (beans to maize) ✓ Introduction of a desirable characteristic (production of folic acid) ✓	1	2.1	ALLOW Transferring the gene from one species to another/change genes
		(ii)	Any three from: Isolate the folic acid gene in beans ✓ Replicate the folic acid gene in beans ✓ put the folic acid gene into a vector/plasmid ✓ use the vector/plasmid to insert the folic acid gene into maize cells ✓ identify and select maize cells that have been genetically modified successfully ✓	3	2.1	ALLOW Extract / cut out ALLOW DNA
	(b)		(Grow cells into adult plants) test engineered cells/plants for the presence of folic acid ✓	1	3.3a	ALLOW idea of testing folic acid levels in people who have eaten the maize
	(c)		<i>Benefit</i> (Increase folic acid in maize so) less disease associated with lack of folic acid in diet ✓ <i>Risk</i> Spread of antibiotic resistance from the new genes ✓	2	2.1	ALLOW idea of better nutrition ALLOW idea of the new genes having unintended effects in the maize or in other organisms that eat maize/unknown long-term side effects.

Question			Answer	Marks	AO element	Guidance
5	(a)	(i)	35 (small cordgrass) and 28 (smooth cordgrass) ✓	1	1.1	Both needed and in correct order
		(ii)	(Supports the hypothesis because) Gametes/sex cells fuse at fertilisation ✓ Idea that $35 + 28 = 63$ ✓	2	3.2b	
	(b)		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 78 (%) award 2 marks $(156/200) * 100$ ✓ $= 78 (\%)$ ✓	2	1.2	ALLOW ECF
	(c)		Biodiversity is a measure of the species/populations/genetic diversity of a habitat. ✓	1	1.1	
	(d)		Max two from benefits of maintaining biodiversity: More plant species/populations produce more food for a variety animal species. ✓ More open mudflat means more species of birds/bigger bird populations ✓ Idea that these birds will be prey for other species ✓ Max two from challenges: Labour and time needed to remove common cordgrass ✓ Digging it up could damage other species ✓ Use of poisonous chemicals may damage/destroy other plant and or animal species. ✓	3	2.1	ALLOW Sensible suggestions
	(e)	(i)	Zygote ✓	1	1.1	
		(ii)	X between unspecialised and specialised cells ✓	1	2.1	
		(iii)	All of the cells except the two gametes ✓	1	2.1	

Question			Answer	Marks	AO element	Guidance
6	(a)		Any two from: Reduction in alcohol consumption ✓ Reduce/stop smoking ✓ Exercise (more) ✓ Reduction in BMI/body mass/weight ✓ Reduction in fat/salt in the diet ✓ Less stress ✓	2	1.1	DO NOT ALLOW get more sleep
	(b)		Idea that all medicines have a risk of side effects ✓ but for individuals with high blood pressure and cholesterol levels the risk of CVD is much greater ✓	2	1.1	IGNORE references to lowering blood pressure and cholesterol.
	(c)	(i)	Any one from: Sex/gender ✓ Ethnicity ✓ Other medical conditions ✓ Other medications ✓ Family history ✓ Lifestyle ✓ Healthy weight/ obese ✓	1	3.3b	
		(ii)	Any two from: (although) placebo is not an effective medicine/has no effect on BP or cholesterol ✓ As the people in the study are not ill, medicine is not being withheld/this doesn't matter as the people in the study are not ill ✓ The people in the study only have average blood pressure (not high), so are at average (not high) risk of CVD ✓ Withholding medicine from ill people just for a study would not be ethical ✓	2	2.2	

	(d)	(i)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = £3800 award 3 marks $4\,291\,500\,000 / 1\,140\,665 \checkmark$ $= 3762.27902 \checkmark$ $= 3800 \text{ to 2 sig fig } \checkmark$	3	2.2 x 2 1.2	ALLOW one mark for the correct number of significant figures.
		(ii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 14 award 3 marks $5\% - 3.6\% = 1.4\% \checkmark$ $1.4 \times 1000/100 \checkmark$ $= 14 \checkmark$ Or $5\% \text{ of } 1000 = 50 \checkmark$ $3.6\% \text{ of } 1000 = 36 \checkmark$ $50 - 36 = 14 \checkmark$	3	3.1a 2.2 x 2	
		(iii)	Idea that they are at risk of side effects $\checkmark$ AND any two from: Most people who take them will not benefit/only 1.4% benefitted in study $\checkmark$ Idea that it is cheaper to prevent CVD (using statins and ACE inhibitors than to treat it in hospital) $\checkmark$ Idea of importance for individuals and their families of the people who are saved $\checkmark$	3	1.1 3.2a x 2	

Question			Answer	Marks	AO element	Guidance
7	(a)		breakdown and synthesis of molecules ✓ muscle contraction ✓	2	1.1	
	(b)		red blood cells OR plasma ✓ plasma ✓ plasma ✓ red blood cells ✓	4	1.1	
	(c)	(i)	(Steep) increase in lactic acid ✓	1	3.1b	
		(ii)	Lactic acid (changes/lowers pH) causing muscle pain/cramp/fatigue/cell or enzyme damage ✓	1	1.1	ALLOW Nausea
		(iii)	Increase in heart rate reaches a maximum/levels off ✓ so (rate of delivery of) oxygen to the muscles also reaches maximum/levels off ✓ running faster than at X requires more ATP ✓ this extra ATP comes from anaerobic respiration ✓	4	3.1b 1.1 x 3	
	(d)		Idea that more movement from athlete/muscle contraction requires more cellular respiration (to provide ATP) ✓ Cellular respiration reactions are exothermic / increase the temperature of their surroundings, i.e. athlete's core body temperature ✓	2	2.1	
	(e)		Any two from: Correct reference to homeostasis ✓ Normal/ optimum body temp is 37°C ✓ Chemical reactions are controlled by enzymes ✓ Enzymes are denatured at temperatures above normal ✓	2	1.1	ALLOW Active site changes shape

Question			Answer	Marks	AO element	Guidance
8	(a)		Any two from: Most mutations do not affect phenotype ✓ Mutation may not change amino acids in lactase ✓ Mutation may not change the order of the amino acids in lactase ✓ Mutation may not change the shape of the (active site) of lactase ✓	2	2.1	
	(b)		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 4.095 award 3 marks $1 - 0.3 = 0.7$ ✓ $0.7 \times 5.85 \text{ billion} =$ ✓ 4.095 billion ✓	3	1.2	ALLOW ECF if incorrect calculation of 0.7 from MP1 ALLOW Any correct alternative approach E.g. $30/100 \times 5.85 \text{ billion} = 1.755 \text{ billion}$ 5.85 billion - 1.755 billion ALLOW 4 / 4.1 / 4.10
	(c)		Any two from: Change in environment / increase in availability of milk because of farming ✓ idea that the mutation/ability to digest milk provided a (competitive/selective) advantage / people with this mutation/characteristic were more likely to survive ✓ people with the mutation/gene were more likely to reproduce/have more children to whom they pass on the mutation/gene ✓ the mutation/characteristic became more common over generations/time ✓	2	3.1b	

Question			Answer	Marks	AO element	Guidance
9	(a)		Pancreas (top left and bottom right both needed) ✓ Insulin (top left) ✓ Glucagon (bottom right) ✓ Cells (top right) ✓	4	2.1	
	(b)		Any four from: Secreted by (adrenal) gland ✓ At times of stress ✓ Adrenaline transported in the blood (plasma) ✓ Increases the heart/breathing rate ✓ Causes liver to (break down carbohydrate to) release glucose ✓ Stimulates muscle contraction ✓ Idea of “flight or fight response”/preparing body for physical activity/ increased respiration ✓	4	1.1	ALLOW alternative wording.
	(c)		Thyroxine regulates metabolism ✓ Any three from: (Negative feedback) reverses the changes in a system ✓ Returns the system to steady/normal state ✓ Pituitary gland produces thyroxine stimulating hormone/TSH ✓ TSH stimulates the production/secretion of thyroxine ✓ Thyroxine inhibits/switches off the production of TSH ✓ This keeps levels of Thyroxine in the body at a steady level ✓	4	1.1	ALLOW Other correct answers

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