

Higher

GCSE

Biology B Twenty First Century Science

J257/03: Breadth in Biology (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 a 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).

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 Biology 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)		auxins ✓ more ✓ shade ✓	3	1.1	ALLOW auxins ALLOW less light DO NOT ALLOW dark
	(b)		gravitropism / (positively) gravitropic ✓	1	1.1	ALLOW geotropism IGNORE negatively phototropic DO NOT ALLOW negatively gravitropic

Question			Answer	Marks	AO element	Guidance																							
2	(a)		<table><thead><tr><th rowspan="2">Event in the cactus life cycle</th><th colspan="3">Number of chromosomes</th></tr><tr><th>11</th><th>22</th><th>44</th></tr></thead><tbody><tr><td>At the end of interphase during meiosis</td><td></td><td></td><td>✓</td></tr><tr><td>At the end of interphase during mitosis</td><td></td><td></td><td>✓</td></tr><tr><td>In the cells produced by mitosis as the cactus grows</td><td></td><td>✓</td><td></td></tr><tr><td>In the pollen produced by meiosis</td><td>✓</td><td></td><td></td></tr></tbody></table> ✓✓✓✓	Event in the cactus life cycle	Number of chromosomes			11	22	44	At the end of interphase during meiosis			✓	At the end of interphase during mitosis			✓	In the cells produced by mitosis as the cactus grows		✓		In the pollen produced by meiosis	✓			4	2.2	More than 1 tick in a row = 0 marks for that row
Event in the cactus life cycle	Number of chromosomes																												
	11	22	44																										
At the end of interphase during meiosis			✓																										
At the end of interphase during mitosis			✓																										
In the cells produced by mitosis as the cactus grows		✓																											
In the pollen produced by meiosis	✓																												
	(b)		Active transport ☐ Cellular respiration ☐ Photosynthesis ☒ Transpiration ☐ ✓	1	1.1	More than 1 box ticked = 0 marks																							
	(c)		xylem ✓	1	1.1	IGNORE phloem																							

Question			Answer	Marks	AO element	Guidance															
3	(a)		sex determination in humans is not determined by temperature/environment ✓ AND any one from: sex determination in humans is determined genetically / inherited / by chromosomes/genes/alleles ✓ (the chromosomes that determine sex) are X and Y / males are XY and females are XX ✓	2	2.1	DO NOT ALLOW males are XX and females are XY ALLOW in humans sex determination is at fertilisation, in turtles it is after fertilisation															
	(b)	(i)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 17841 or 17846 or 17847 or 17864 award 3 marks 18 000/117 = 153.846 ✓ 153.846 x 116 = 17 846.136 ✓ = 17 846 ✓	3	2.2	For candidates using different numbers of decimal places following the 18000/117 calculation <table><tr><th>answer first marking point</th><th>answer 2nd marking point</th><th>final answer</th></tr><tr><td>154</td><td>17864</td><td>17864</td></tr><tr><td>153.85</td><td>17846.6</td><td>17847</td></tr><tr><td>153.846</td><td>17,846.136</td><td>17846</td></tr><tr><td>153.8</td><td>17840.8</td><td>17841</td></tr></table> ALLOW 1 mark for any number correctly rounded to the nearest whole number where no working or value is incorrect	answer first marking point	answer 2 nd marking point	final answer	154	17864	17864	153.85	17846.6	17847	153.846	17,846.136	17846	153.8	17840.8	17841
answer first marking point	answer 2 nd marking point	final answer																			
154	17864	17864																			
153.85	17846.6	17847																			
153.846	17,846.136	17846																			
153.8	17840.8	17841																			

Question			Answer	Marks	AO element	Guidance
		(ii)	(sea turtle) population will decrease / number of males have decreased ✓ AND any one from: not enough males to breed / fewer matings / more competition for male mates ✓ fewer females fertilised / laying eggs / less offspring ✓ OR (sea turtle) population will increase ✓ AND any one from: more breeding females ✓ more females fertilised / laying eggs ✓	2	2.1	ALLOW there will be too many females ALLOW sea turtles could become endangered/go extinct ALLOW less reproduction
		(iii)	incubate the eggs at lower temperatures / temperature of 31(°C) or below (so more males hatch) ✓ decrease global warming/reverse climate change ✓ protect beaches where more males seem to hatch ✓ relocate nests that are in warmer/too warm sand ✓ control sand temperature through shade or irrigation ✓	1	3.2a	ALLOW any named temperature below 31(°C) ALLOW incubating between 27 and 31 (°C) (produces males and females) ALLOW keep/breed the turtles at 31(°C) or below/lower temperature ALLOW stop climate change

Question			Answer	Marks	AO element	Guidance
4	(a)		(communicable disease) caused by pathogens and is spread in bodily fluids/on surfaces/in food or water ✓ OR spread from organism to organism by pathogens ✓ (non-communicable disease) due to genetic/environmental/lifestyle factors ✓ gives an example of a communicable AND a non-communicable disease ✓	3	1.1	ALLOW bacteria, viruses, fungi, protist for pathogen ALLOW transmissible for spread from organism to organism ALLOW named examples of transmission e.g air, physical contact, named fluids IGNORE not transmissible ALLOW any correct examples of communicable and non-communicable diseases
	(b)		Any two from: low incidence of liver disease in under 45 /cases increase after age 30✓ incidence of liver disease increases with age in both males and females✓ rate of increase is greater for males than females✓ greater number of cases in males than females (for all ages) ORA ✓ number of cases peaks at 87/ incidence decreases after 87 (for both male and females)✓ difference in incidence between male and female is less after 87/falls more rapidly for males after 87 than females✓	2	3.2b	ALLOW any correct conclusion ALLOW any number between 30- 48 ALLOW 86/88
	(c)	(i)	viral (diseases) ✓	1	2.1a	
		(ii)	having one disease can, affect the risk of having another disease/effect the development/severity of a disease✓	1	1.1	ALLOW a correct named example

Question			Answer	Marks	AO element	Guidance
5	(a)		chromosomes gene/allele(s) alleles variants genotype phenotype ✓✓✓✓✓	5	1.1	6 correct = 5 marks 5 correct = 4 marks 4 or 3 correct = 3 marks 2 correct = 2 marks 1 correct = 1 mark
	(b)		D A B C ✓✓	2	1.1	ALLOW 1 mark for 2 /3 letters in the correct position ALLOW 1 mark for ABCD or CDAB

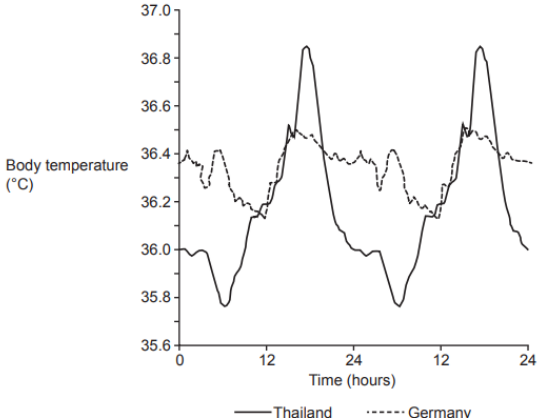
Question			Answer	Marks	AO element	Guidance
6	(a)		measure the distance the bubble moves ✓ over a set/same/stated time period/time taken for the bubble to move ✓ OR measure the time it takes for a bubble to move ✓ over a set distance ✓	2	1.2	IGNORE procedural statements that does not refer to how to measure rate. ALLOW volume uptake instead of distance
	(b)		Any three from: make sure the number of leaves is the same ✓ take the cutting from the same part of the plant ✓ try to make sure the size/surface area leaves are the same ✓ keep environmental conditions the same e.g (room) temperature, light intensity, humidity, wind ✓	3	3.3b	ALLOW size of shoot/length of stem/mass of shoot ALLOW how turgid or flaccid plant cells/shoot is
	(c)		Any two from: put the slide on the stage and use lowest (objective) lens/magnification ✓ adjust the coarse focus (until the image is as clear as possible) /adjust using the fine focus ✓ then use the medium/high (objective) lens ✓ AND idea of counting the number of stomata in a stated area e.g in 1cm² ✓	3	2 x 1.2 1 x 2.2	IGNORE count number of stomata per cm² as in the stem ALLOW in field of view/within the frame

Question			Answer	Marks	AO element	Guidance
7	(a)	(i)	✓✓✓	3	1.1	6 correct lines = 3 marks 5/4 correct lines = 2 marks 3/2 correct lines = 1 marks
		(ii)	Hypothalamus – involved in thermoregulation/temperature control/detecting water content of the blood✓ Pituitary – release of ADH/idea of controlling water balance✓	2	1.1	ALLOW 1 mark for two named parts ALLOW LH/FSH/any correct named hormone ALLOW osmoregulation for hypothalamus or pituitary ALLOW any correct additional part of the brain and function
	(b)		Any two from: from 2011/over time number of people with dementia in UK/England increased ✓ increase from 2014-2015/in 2015 was the biggest increase in UK/England✓ after 2015 increase in UK/England is not as big✓ idea of very little change in Scotland/Wale/Northern Ireland over time ✓ more people have dementia in England✓	2	3.2a	ALLOW any correct conclusion that can be drawn from the data.
	(c)	(i)	neuron ✓	1	1.1	IGNORE name of neuron

Question			Answer	Marks	AO element	Guidance
		(ii)	idea of transmitting the impulse from one neuron to the next / across a synapse ✓	1	1.1	ALLOW diffuses across a synapse IGNORE signal/message
		(iii)	less impulses/brain cells unable to communicate/ confusion/memory retrieval problems/ poor concentration/ forgetting/ mood changes/ memory loss, problems with speech and language/ reactions will be slower/slower movement ✓	1	2.1	ALLOW any correct suggestion
		(iv)	observe changes after 16 weeks/for a longer period ✓ to see if the effects are long lasting ✓ to see if there are (long term) side effects ✓ OR repeat the work/do the test on more mice ✓ to see if the results are repeatable ✓ OR try on different species ✓ to see if the same effect is observed (as in mice) ✓ it is safe ✓ to observe side effects ✓ OR test healthy humans ✓ to test for safety to observe side effects ✓	3	3.3a	max 2 for suggestion max 2 for justifications ALLOW any reasonable suggestion and justification ALLOW reproducible if other scientists are doing the work ALLOW for justification for using monkeys, they are more closely related to humans/it may give an idea as to how it would affect human brains ALLOW the following but only if one other suggestion is given first test on people with the disease to see if it works/efficacy

Question			Answer	Marks	AO element	Guidance
8	(a)	(i)	Any two from: idea of isolation/separation e.g. that they occupied different parts of the lake so didn't come into contact✓ no longer interbreed ✓ mutations that occur will be different✓ idea that the different environment/habitat drives the change✓ idea that different traits are more advantageous in different environments ✓	2	2.1	ALLOW correct descriptions of different selection pressures
		(ii)	Any three from: by natural selection ✓ idea that individuals (in a population) show variation /have genetic variants/ ref to mutation(s)✓ idea that some individuals are better adapted/better at competing/more likely to survive ORA ✓ reproduce and pass on genetic variants ✓	3	1.1	ALLOW alleles/mutation is passed on
		(iii)	idea of interbreeding/breed them together ✓ fertile offspring will be produced ✓ OR idea of using DNA/genome analysis or sequencing ✓ to look for similarities/differences in DNA/base sequences✓	2	2.1	ALLOW compare genes IGNORE genetic testing ALLOW comparing genomes/DNA
	(b)		fatty acid glycerol ✓	1	1.1	

Question		Answer	Marks	AO element	Guidance
9	(a)	✓ Elephants have a fast heart rate. ☐ Elephants have a large surface area to volume ratio. ☐ Elephants have a small surface area to volume ratio. ☐ Elephants move slowly. ☐	1	2.1	
	(b)	Any three from: Yes, in Thailand: data shows elephant temperature rising (above 35.9/normal body temperature) during the day ✓ Falls below normal 35.9/body temperature overnight ✓ During the day/night the rise/drop is continual (does not oscillate) ✓ Data point quote✓ No, in Germany: data shows during the day body temperature stays closer to 35.9/normal body temperature ✓	3	3.1b	No mark to be awarded for yes/no It must be clear which country is being described. ALLOW an answer containing a mix of yes and no points ALLOW stated times for day/night

Question	Answer	Marks	AO element	Guidance
	At night body temperature does not fall below 35.9/normal body temperature / body temperature never drops below normal/below 35.9 ✓ Body temperature oscillates during the day/this is evidence of constant regulation during the day✓ Data point quote✓			
(c) (i)	vasodilation/ blood vessels dilate/widen✓ increased blood flow to the surface/skin ✓ OR vasoconstriction/blood vessels constrict/narrow✓ decreased blood flow to the surface/skin ✓	2	2.1	DO NOT ALLOW capillaries dilate DO NOT ALLOW capillaries constrict ALLOW sweat evaporates from the skin = 2 marks ALLOW shivering/ muscle contractions generate heat = 2 marks IGNORE any ref to hair
	(ii) Any three from: (temperature) receptors ✓ (receptors)in the skin detect temperature of the air/environment ✓	3	1.1	DO NOT ALLOW temperature unqualified

Question			Answer	Marks	AO element	Guidance
			(receptors)hypothalamus detect blood temperature✓ idea that hypothalamus role also has a role in processing✓			ALLOW thermoregulatory centre of the brain

Question			Answer	Marks	AO element	Guidance
10	(a)		Any three from: the biological molecules/named biological molecule e.g. fat, protein, starch are the substrate ✓ the substrate/(biological) molecule fits into /complementary to the active site of the enzyme ✓ enzyme substrate complex forms✓ substrate/(biological) molecule is broken down into smaller molecules (to be absorbed)✓	3	2.1	ALLOW named biological molecules for substrate for MP 2 and 4
	(b)		Any two from: idea that you need many enzymes for the many biological molecules that need breaking down ✓	2	2.1	ALLOW example of different enzymes used to break down named biological molecules

Question			Answer	Marks	AO element	Guidance
			idea of specificity, that each enzyme is specific to one biological molecule/substrate ✓ idea that the active site of one type of enzyme will only fit /is complementary to one type (biological) molecule/substrate ✓			ALLOW named examples
	(c)		protein ✓ DNA ✓	2	1.1	
	(d)		$C_6H_{12}O_6 + 6 O_2 \xrightarrow{\quad} 6 CO_2 + 6 H_2O$ ✓	2	1.1	AWARD 1 mark for equation and 1 mark for balanced equation IGNORE word equation
	(e)		sexual (reproduction) ✓ (advantage) <u>genetic</u> variation/diversity ✓	2	2.1 1.1	ALLOW any correct advantage /adaptability to environmental change

Question			Answer	Marks	AO element	Guidance
11	(a)		Any three from: isolate the gene/cut out gene from the jelly fish ✓ replicate/make multiple copies of the gene ✓ put the gene into a vector ✓ use a vector to transfer/insert to fish eggs ✓	3	2.1	IGNORE use a plasmid throughout
	(b)		Method -place the fish in the water, see if the fish glow ✓ AND any one from (limitation): - it only tells you if the water is polluted, not by how much ✓. it doesn't tell you what the pollutant is ✓ needs to be carried out in the dark so the fish glow ✓ may not work for all pollutants ✓	2	2.1	ALLOW any sensible suggestion for the limitation IGNORE ref to harming the Zebra fish

Question			Answer	Marks	AO element	Guidance
	(c)	(i)	Any two from: stimulates the growth of/thickens the lining of the uterus ✓ inhibits the production of FSH ✓ inhibits the production of LH ✓	2	1.1	ALLOW female secondary sexual characteristics ALLOW oestrogen stimulates the production of LH
		(ii)	Any one from: excreted in urine ✓ from thrown away contraceptive pills ✓ idea that it is produced by other marine species ✓	1	2.1	ALLOW any sensible suggestion
	(d)		Any one from: concerns that the fish could be released into the wild ✓ genes could 'jump' species ✓ Zebra fish could have a competitive advantage / disadvantage ✓ idea of unknown consequences of inserted gene ✓	1	3.2a	ALLOW idea of animal cruelty – ethical argument ALLOW any sensible suggestion

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