

Foundation

GCSE

Biology B Twenty First Century Science

J257/02: Depth in Biology (Foundation 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.

Level of response questions on this paper are **5(d)(ii)** and **7(e)**.

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)	heart ✓	1	1.1	
	(b)	one correct line ✓ two or three correct lines ✓	2	1.1	Artery -- Has a thick, muscular wall to hold high pressure blood Capillary -- Has a very thin wall only one cell thick Vein -- Has a thin elastic wall that enables the vessel to be squashed IGNORE any box with more than one line joined to it IGNORE branching lines
	(c)	Any 2 from: (dissolved) food (molecules) / named example ✓ second named example of a molecule from food ✓ water ✓ vitamins ✓ minerals ✓	2	1.1	Any order ALLOW example, e.g. amino acids, protein(s), "sugar(s)" or named sugar (e.g. glucose), carbohydrate(s), fat(s)/lipid(s), fatty acids, glycerol DO NOT ALLOW named insoluble substances (e.g. starch, cellulose, fibre) ALLOW named vitamin ALLOW named mineral, e.g. iron, calcium

Question		Answer	Marks	AO element	Guidance
	(d)	<p>Any 2 from:</p> <p>oxygen ✓</p> <p>carbon dioxide ✓</p> <p>other named gas in air ✓</p>	2	1.1	<p>Any order</p> <p>ALLOW molecular and elemental formulae</p> <p>ALLOW nitrogen / argon / water (vapour)</p> <p>DO NOT ALLOW “air” unqualified</p> <p>DO NOT ALLOW particulates (as these are not gases) or “pollution” unqualified but ALLOW carbon monoxide / nitrogen oxide(s) / sulfur dioxide</p>

Question		Answer	Marks	AO element	Guidance
2	(a)	an individual ✓ a population ✓ a community ✓ an ecosystem ✓	4	1.1	Must be in correct order
	(b)	apple / tree ✓	1	2.1	
	(c)	apple / tree ✓	1	2.1	
	(d)	4 ✓	1	2.1	
	(e)	mouse OR owl OR fox ✓	1	2.1	

Question		Answer	Marks	AO element	Guidance
3	(a)	antibiotics do not work against viruses ✓ Beth's influenza was caused by a virus ✓	2	1.1 2.1	three ticks = max. 1 mark four or more ticks = 0 marks
	(b)	Any 2 from: cardiovascular disease is not caused by bacteria ✓ antibiotics only work on bacteria ✓ idea that it can be inherited / caused by genes/alleles/information in the genome ✓ it is caused by <u>lifestyle</u> / named example of lifestyle factor ✓	2	2.1	DO NOT ALLOW ref. to "antibodies" DO NOT ALLOW ref. to other ways to cure CVD DO NOT ALLOW "infection(s)" unless qualified with a bacterial example e.g. smoking, high fat diet, high salt diet, being overweight/obese/high BMI, lack of exercise, high cholesterol, high blood pressure DO NOT ALLOW "diet" or "unhealthy diet" without mention of fat or salt DO NOT ALLOW ref. to changing lifestyle (as an alternative treatment)
	(c)	the antibiotics no longer work / do not kill the bacteria ✓ idea that we will not be able to treat/cure/prevent spread of infections/diseases caused by the resistant bacteria / the resistant bacteria could become fatal OR idea of increased risk from e.g. surgery/injuries ✓	2	1.1 2.1	ALLOW bacteria cause disease(s) / are harmful

Question			Answer	Marks	AO element	Guidance
3	(d)	(i)	D ✓ 5 (years) ✓	2	3.1a	ALLOW correct number even if letter is incorrect
		(ii)	B ✓ took long(est) time/37 years for resistance to develop originally / less likely to change/mutate quickly/soon ✓	2	3.2a	ALLOW A if the stated reason is that resistance appeared most recently (so will be less widespread)
	(e)	(i)	bar for 2016 plotted at 14 800 ✓	1	1.2	ALLOW bar height anywhere between 14 750 and 14 850 (i.e. half a grid line down or up) IGNORE width of bar, provided it does not extend outside the 2016 column
		(ii)	Amit ✓ Plus any 2 from: general statement that Amit's prediction fits the trend / AW ✓ idea that the number has increased each year (so most likely to increase again from 2018 to 2019) ✓ idea that the number has (only) increased by around 1100-1400 each year (so Amit's prediction is in keeping with this) ✓ Alex/23000 incorrect because it would be too much of an increase / there is no evidence that the increase is accelerating ✓ Taylor/17500 incorrect because it would be a plateau / there is no evidence to suggest a plateau OR Ling/16000 incorrect because it would be a decrease / there is no evidence to suggest a decrease ✓	3	3.2a 2 x 3.1a	ALLOW idea that 18600 would be "expected" or the "best fit" given the trend/pattern in previous years' results

Question			Answer	Marks	AO element	Guidance
3	(f)	(i)	<p>Any 4 from:</p> <p>work next to/near a (lit) Bunsen burner / use a Bunsen burner to create an updraft / work in an extractor hood ✓</p> <p>sterilise dropper (before use) (instead of wiping it with tissue) / using flame / antibacterial cleaner / autoclave / high temperature/pressure / alcohol ✓</p> <p>pass the (neck/mouth of the) bottle through a flame (before taking the drop of bacteria) ✓</p> <p>only open/remove bottle/dish lid immediately before use ✓</p> <p>only open bottle/dish lid partially / do not fully remove ✓</p> <p>close/replace bottle/dish lid (quickly/immediately) ✓</p> <p>secure/tape the dish lid closed (after adding bacteria) ✓</p> <p>sterilise work surface (before starting) (using antibacterial cleaner/alcohol) ✓</p> <p>wear gloves / use hand sanitiser ✓</p>	4	3.3b	<p>ALLOW “disinfect / sanitise / decontaminate” instead of “sterilise”, but DO NOT ALLOW “clean / wash” without reference to something that would definitely kill/remove bacteria/microorganisms</p> <p>DO NOT ALLOW ref. to Bunsen burner without the idea that they should be next to/near it</p> <p>DO NOT ALLOW “seal”</p>
		(ii)	<p>FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 78.5 (mm²) award 2 marks</p> <p>3.14 × 25 ✓ = 78.5 (mm²) ✓</p>	2	1.2	

Question			Answer	Marks	AO element	Guidance
3	(f)	(iii)	the bacteria were able to grow/survive / there is a bacterial culture in A, B and D ✓ the bacteria did not grow/survive / there is no bacterial culture in C ✓	2	3.1b	

Question		Answer	Marks	AO element	Guidance															
4	(a)	<table border="1"> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>leaf / stomata ✓</td> <td></td> </tr> <tr> <td></td> <td></td> <td>respiration ✓</td> </tr> <tr> <td>water ✓</td> <td></td> <td></td> </tr> <tr> <td></td> <td>root (hair cells) ✓</td> <td></td> </tr> </table>					leaf / stomata ✓				respiration ✓	water ✓				root (hair cells) ✓		4	1.1	<p>ALLOW hair cells DO NOT ALLOW hair</p>
	leaf / stomata ✓																			
		respiration ✓																		
water ✓																				
	root (hair cells) ✓																			
	(b)	<p>Any 2 from: chloroplasts contain chlorophyll ✓ absorb light ✓ for photosynthesis ✓ to make food/carbohydrate/glucose/sugar(s) (for respiration/growth) ✓</p> <p>Plus any 2 from: mitochondria break down glucose/sugar/food (and oxygen) ✓ for (aerobic / cellular) respiration ✓ to provide/release ATP/energy ✓ for synthesis of other molecules / for life processes / for active transport ✓</p>	4	2.1	<p>DO NOT ALLOW make/produce/contain energy</p>															

Question		Answer	Marks	AO element	Guidance
4	(c)	<p>Maximum 3 from:</p> <p>became differentiated/specialised ✓</p> <p>switched genes on/off ✓</p> <p>(meristem cells) became/turned into root cells / root tissue ✓</p> <p>Maximum 2 from:</p> <p>idea that they respired / synthesised new biological molecules ✓</p> <p>went through mitosis ✓</p> <p>(to) divide / copied their DNA/chromosomes / make new cells ✓</p>	4	2.1	DO NOT ALLOW “make roots” unqualified because this is given in the question

Question		Answer	Marks	AO element	Guidance
5	(a)	protist ✓	1	1.1	
	(b)	mutations create new genetic variants ✓	1	1.1	More than one tick = 0 marks
	(c)	(i)	3	2.1	ACDB = 3 marks
		A before C ✓ C before D ✓ D before B ✓			
		(ii)	1	2.1	ALLOW evolution / adaptation DO NOT ALLOW mutation
	(d)	(i)	2	2.1	DO NOT ALLOW statements about modifying the spiders (rather than the fungus) ALLOW marks for candidates who demonstrate Higher Tier knowledge, i.e. <ul style="list-style-type: none"> spider gene isolated/replicated ✓ (and then) added into the fungus using a vector/plasmid ✓
		Any 2 from: the genome/DNA/genes of the fungus has been changed/modified ✓ gene(s)/DNA/genetic material (from a spider) added to the fungus ✓ so that the fungus has the (right) gene/DNA/code/instructions to make the spider protein ✓			

Question			Answer	Marks	AO element	Guidance
5	(d)	(ii)*	<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5–6 marks) Explains several benefits. AND Explains several risks/issues, including at least one level 3 idea. <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) Explains one or more benefits. AND Explains one or more risks/issues, without any level 3 ideas. <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) Explains only benefits. OR Explains only risks/issues. <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 <i>No response or no response worthy of credit.</i></p>	6	2.1	<p>AO2.1 Applying knowledge to explain benefits For example:</p> <ul style="list-style-type: none"> • killing the mosquitoes could reduce/prevent the spread of malaria • could save (many) human lives • could reduce medical costs • improve conditions in developing countries/areas • could also reduce/prevent the spread of other human/animal/plant diseases by the mosquitoes <p>AO2.1 Applying knowledge to explain risks/issues For example:</p> <p><i>Level 2 ideas</i></p> <ul style="list-style-type: none"> • ethical/moral objection to killing mosquitoes/animals (IGNORE “playing God” without further explanation) • the fungus/protein could kill/harm or have unknown/unpredictable effects on other organisms (other than the malaria mosquitoes) • food web effects / killing the mosquitoes could cause their predators to starve/die from lack of food <p><i>Level 3 ideas</i></p> <ul style="list-style-type: none"> • mosquitoes could become resistant to the fungus/protein • the fungus could be difficult to control/eradicate after release • the protein could bioaccumulate in the food chain / reach toxic levels in predators of the mosquitoes • the gene could be transferred to other organisms • the fungus/gene could mutate/change/evolve <p>ALLOW idea that benefits outweigh risks/issues (because malaria affects/kills so many people)</p>

Question			Answer	Marks	AO element	Guidance
6	(a)	(i)	RR ✓	1	2.1	ALLOW “homozygous dominant” DO NOT ALLOW “dominant” unqualified
		(ii)	white (flowers) ✓	1	2.1	DO NOT ALLOW “recessive”, as that is a genotype not a phenotype
		(iii)	1 ✓	1	2.2	
		(iv)	R allele is dominant ✓ r allele is recessive ✓	2	2.1	ALLOW explanation of the idea that it will always cause red flowers ALLOW explanation of the idea that it will only cause white flowers if there are two copies / homozygous
	(b)	(i)	red red white ✓	1	2.1	All correct for 1 mark
		(ii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 50 (%) award 2 marks $2 \div 4 = 0.5$ ✓ $\times 100 = 50 (\%)$ ✓	2	1.2	
		(iii)	3:1 ✓	1	3.2b	

Question		Answer	Marks	AO element	Guidance
7	(a)	C iris ✓	1	1.1	
	(b)	relay (neuron) ✓ motor (neuron) ✓	2	2.1	ALLOW intermediate / inter (neuron) ALLOW response in either order
	(c) (i)	retina ✓ idea of losing ability to detect light / colour / creating a blind spot OR ref. to damage/destruction of rods / cones / (light) receptor cells ✓	2	2.1 1.1	ALLOW macula / rods / cones / (light) receptor cells ALLOW ref. to structure E (from diagram) ALLOW idea that they would be blinded ALLOW receptors
	(ii)	cornea ✓ idea of reduced/lost ability to focus / refract (light) OR blurred vision OR idea of artefacts in vision ✓	2	2.1 1.1	ALLOW ref. to structure B (from diagram) ALLOW infection/inflammation IGNORE refs. to the cornea being damaged/scratched without explanation of how this could affect vision
	(d) (i)	6.5 (mm) ✓	1	2.1	
	(ii)	3 (mm) ✓ no smaller diameter was measured / the pupil was 3 mm in the brightest light OR pupil diameter did not get any smaller as light brightness increased from 70/75% to 100% ✓	2	3.2b 3.1a	ALLOW ref. to the line being flat/plateaus at 3 mm (from 70/75% light brightness onwards)

Question			Answer	Marks	AO element	Guidance
7	(d)	(iii)	<p>FIRST CHECK THE ANSWER ON ANSWER LINE If answer = -0.004 OR -4×10^{-3} (mm/%) award 2 marks</p> <p>3.1 – 3.2 OR -0.1 ✓</p> <p>$\div 25 = -0.004$ OR -4×10^{-3} (mm/%) ✓</p>	2	1.2	<p>ALLOW 3.2 – 3.1 OR 0.1</p> <p>IGNORE sign in final answer</p> <p>IGNORE fraction of 1/250 as final answer if correct answer given elsewhere</p>

Question	Answer	Marks	AO element	Guidance
7 (e) *	<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5–6 marks) Describes how to change the light brightness to specific levels, and an appropriate way to measure pupil diameter AND Describes a way to increase the accuracy or safety. <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) Describes how to change/measure the light brightness OR an appropriate way to measure pupil diameter AND Describes a way to increase the accuracy or safety. <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) Describes how to change/measure the light brightness OR Describes an appropriate way to measure pupil diameter. OR Describes a way to increase the accuracy or safety <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 <i>No response or no response worthy of credit.</i></p>	6	3 x 2.2 3 x 3.3a	<p>AO2.2 Applying knowledge to describe a method to collect the data in the graph For example:</p> <ul style="list-style-type: none"> description of how to change light brightness in a coarse way, e.g. covering windows / closing blinds or curtains / using blackout material / switching ceiling lights on/off / going to different rooms description of how light level could be changed to specific levels/percentages, e.g. using specific numbers of lights/lamps / using precise dimmer / measure light level/intensity using light meter take a photograph of the person's eye in each light level and then measure pupil diameter on photograph <p>OR use a pupillometer to measure pupil diameter for each light level</p> <p>AO3.3a Developing procedures that will increase the accuracy or safety For example:</p> <ul style="list-style-type: none"> explicit reference to keeping light constant at each level (e.g. not outdoors with varying cloud cover) allow the person's eye to adjust to each light level before measuring, so that their pupil size is staying constant measure the same person each time measure the same eye (left/right) each time don't cast a shadow over the person's eye don't use flash on camera

Question	Answer	Marks	AO element	Guidance
				<ul style="list-style-type: none"> • position camera/pupillometer the same distance from eye / same zoom each time • include distance marker (e.g. dots on face) in photographs, so pupil diameters can be measured accurately / compared fairly • take repeat measurements

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