

Higher

GCSE

Biology B Twenty First Century Science

J257/03: Breadth in Biology (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2024

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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. Work crossed out:
- where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
 - if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.
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. There is a NR (No Response) option. Award NR (No Response)
- if there is nothing written at all in the answer space
 - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
 - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.
- Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).
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.

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)	(i)	Idea that the distance between the lamp and pondweed/(boiling) tube is altered ✓ (Count) the number of bubbles produced by the plant over a set/stated period of time ✓ Any one from Idea that will control or keep the same:- (Piece/type/species/size/length) pondweed ✓ External light sources ✓ Temperature ✓ Carbon dioxide concentration ✓ Volume/stated volume of water ✓ pH of water ✓	3	1.2	ALLOW stated distances ALLOW change the intensity of the bulb/lamp/light source IGNORE amount of light ALLOW time how long it takes to count stated number of bubbles IGNORE ref to rate unqualified IGNORE record the speed of the bubbles ALLOW use same mass/volume/concentration of sodium hydrogen carbonate ALLOW use the same light bulb/lamp if this is not what has been changed
		(ii)	Any two from Idea that bubbles/gas/oxygen enters/is collected in the syringe/equipment OR bubbles/gas/oxygen can't escape ✓ Idea that syringe/equipment measures volume (of gas/oxygen) ✓ Bubbles have different sizes/vary in volume ✓ Idea of counting errors of bubbles ✓ Rate can be calculated as volume over time ✓	2	3.3b	IGNORE references to reliable / accurate / precise Must be clear that that the gas is going into the syringe/equipment not the boiling tube IGNORE air/names of gas if incorrect ALLOW the syringe measures the volume of gas/oxygen = 2 marks

Question			Answer	Marks	AO element	Guidance
	(b)		Section A ✓	1	3.1a	

Question			Answer	Marks	AO	Guidance
2	(a)		A population ✓	1	1.1	
	(b)		2 ✓ 3 ✓ 3 ✓	3	2.1	
	(c)		First check the answer in table / on answer line If answer = 91.5% award 3 marks $75 \div 82 / 0.914(63415)$ ✓ $0.91463415 \times 100 / 91.4(63415)$ ✓ to 3 sig figs = 91.5% ✓	3	2.1	ALLOW 91.4 (and any correct evaluated number) for 2 marks ALLOW if MP1 is not awarded, credit any number below 1 multiplied by 100. ALLOW an incorrect evaluated number correctly rounded to 3 sig figs
	(d)	(i)	Biuret ✓	1	1.2	ALLOW sodium hydroxide and copper sulfate
		(ii)	Fatty acids ✓ Glycerol ✓	2	1.1	
		(iii)	Ratio of 67.5:50 / $50 \div 50 = 1$ ✓ $67.5 \div 50 = 1.35$ ✓	2	1.2	ALLOW $50 \div 1 = 50$ ALLOW $1 \times 50 = 50$ ALLOW $1.35 \times 50 = 67.5$ ALLOW $67.5 \div 1.35 = 50$

Question			Answer	Marks	AO	Guidance
3	(a)	(i)	receptors ✓ hypothalamus ✓ muscles ✓ shivering ✓	4	1.1	
	(b)		(Method) Sweating ✓ (Explanation) Any two from (Humid environment) idea that the air is moist/there is lots of water (vapour) ✓ Less water/sweat will evaporate/won't evaporate as fast/will evaporate slower ✓ Less heat from skin (transferred) ✓	3	2.1	IGNORE use of water to cool the body ALLOW idea of making skin wet IGNORE no water/sweat will evaporate ALLOW idea of less diffusion of water into the surroundings
	(c)		Enzymes ✓ Any one from (Enzymes) require an optimum temperature for (chemical) reactions ✓ (Enzymes) denature at high temperature ✓ (Enzymes) enzymes are less active at low temperature ✓	2	1.1	ALLOW named reactions e.g respiration, digestion ALLOW enzymes work best at 37°C(in the human body) in place of optimum temperature IGNORE enzymes denature at low temperatures

Question			Answer	Marks	AO	Guidance
4	(a)		Idea that water leaves through the stomata ✓	2	1 x 1.1	IGNORE water enters the leaf through the stomata
			(Applying grease to both sides of the leaf prevents wilting because it) reduces water loss / less evaporation/diffusion of water from the leaf ✓		1 x 2.1	ALLOW transpiration
	(b)		Any one from (Stomata are located on both surfaces of the leaf) Idea that wilting occurs when grease is applied to only the upper surface and only the lower surface ✓ most wilting occurs when no grease is applied to either surface ✓ no wilting when both surfaces covered, but wilting when leaf 1 and leaf 2 had one surface covered ✓ AND (More stomata are located on the lower surface of the leaf) There is more wilting when the upper surface is covered than when the lower surface is covered ✓	2	3.1b	ALLOW water loss for wilting ALLOW there is more wilting from Leaf 2 than Leaf 1 ALLOW When there was only grease on the lower surface the leaf only wilted slightly but when there was only grease on the upper surface the leaf wilted significantly = 2 marks
	(c)		Xylem ✓	1	1.1	IGNORE phloem, stem

Question			Answer	Marks	AO	Guidance
5	(a)		Gene mutation/mutation of DNA ✓	1	1.1	ALLOW change in nucleotide/base sequence (of DNA) ALLOW genetic mutation
	(b)		survive ✓ reproduce ✓ allele ✓	3	2.1	ALLOW reproduce if not used for the second space DO NOT ALLOW survive
	(c)		(Charles) Darwin AND (Alfred) Wallace ✓	1	1.1	
	(d)		Any one from Does not fit with their beliefs✓ Unaware of/do not understand of the evidence ✓ Interpret the evidence differently ✓ Idea that they cannot observe (evolution) in real time✓	1	1.1	ALLOW any sensible suggestion

Question			Answer	Marks	AO	Guidance
6	(a)		Any two from (Hormonal system response is...) Slower ✓ Longer lasting ✓ Idea of wider ranging/less targeted ✓ Via the blood not via nerves/neurons ✓ Via hormones not electrical/nerve impulses ✓	2	1.1	ALLOW ORA throughout ALLOW chemicals for hormones
	(b)		Pituitary gland ✓ Kidney tubules ✓	2	1.1	
	(c)		Water will move into cells ✓ By osmosis ✓ Idea that cells will swell/burst ✓	3	1.1	ALLOW water is absorbed by cells ALLOW lyse/lysis/bloated

Question			Answer	Marks	AO	Guidance
7	(a)	(i)	(Fine) focussing/refraction of light onto retina ✓	1	1.1	ALLOW fovea ALLOW converges light
	(b)	(i)	(The stem cells) differentiated/become specialised/switch genes on/off (to become lens cells) ✓ (Divided by) mitosis ✓	2	2.1	
		(ii)	Any one from Idea that the initial trial performed only used 12 babies/small sample size ✓ Idea that there is no information on how their sight was after 3 months/longer term ✓ Consequences if procedure doesn't work long term e.g cataracts may return/lens may not form/ trial procedure could cause long term damage ✓ Procedure was a trial – idea that this may carry a greater risk ✓ (Ethics) parents feel their babies are too young to be used in trials/to have trial procedures used on them ✓	1	2.1	ALLOW any sensible suggestion ALLOW idea that stem cells may differentiate into the wrong type of cells IGNORE general risks of surgery unless qualified as long term IGNORE harmful/side effects/dangerous if unqualified

Question			Answer	Marks	AO	Guidance
8	(a)	(i)	Any one from Vomit ✓ Faeces/stool/excrement ✓ Blood ✓	1	2.1	ALLOW saliva, mucus, (tissue/cell) sample from the digestive system or named digestive system organ IGNORE body fluid unqualified, urine, excretion
	(b)		Any one from Idea to increase the number of bacteria/ to grow colonies of bacteria ✓ To make sure there are sufficient bacteria (to test on)/ will not run out of bacteria to test on ✓ Any one from Idea that different/multiple/repeat tests may need to be carried out on the sample ✓ Idea that with more bacteria samples are easier to analyse ✓	2	1.1	IGNORE mitosis ALLOW reproduce, binary fission, produce clones ALLOW Idea that something may go wrong with original sample or testing method or additional samples from patient not needed
	(c)		Any two from Place the slide on the stage and select the lowest/smallest (magnification) objective lens ✓ Use the coarse/fine (focussing knob) to focus the image/make image clearer ✓ Change to higher (magnification) objective lens and refocus ✓ AND The bacteria/cells will be pink (if they are <i>Salmonella</i>) ORA ✓	3	2 x 1.2 1 x 3.2b	ALLOW x4 objective lens

Question			Answer	Marks	AO	Guidance
	(d)		Any one from Idea that aseptic technique will kill other bacteria ✓ To prevent culturing of/contamination (of the sample) by other pathogens/bacteria/microorganisms ✓ Idea that it prevents cross contamination between (patients') samples ✓ Idea that it will protect those working with the bacteria/undertaking the procedure ✓ Idea that results/diagnosis will not be affected by contamination ✓	1	1.1	ALLOW only the sample of bacteria you require is cultured
	(e)	(i)	Fast/quick ✓	1	1.1	ALLOW Only 1 parent needed / don't need to find a mate ALLOW requires less energy IGNORE genetically identical unqualified ALLOW idea that all offspring have advantageous trait
		(ii)	Lack of <u>genetic</u> variation/diversity ✓	1	1.1	ALLOW all genetically identical ALLOW idea that all offspring will be prone to the same disease ALLOW idea that all offspring have the same disadvantageous trait/inherited disease

Question			Answer	Marks	AO	Guidance
9	(a)	(i)	B E A D C ✓✓✓	3	1.1	E directly before A = 1 mark A directly before D = 1 mark D directly before C = 1 mark ALLOW BEDAC for 1 mark
	(b)	(i)	Disease Athletes foot HIV Influenza Malaria Pathogen Bacteria Fungus Protist Virus ✓✓✓	3	1.1	All 4 for 3 marks 3 correct for 2 marks 2/1 correct for 1 mark
	(c)	(i)	Eastern and Southern Africa ✓	1	2.2	
		(ii)	Any two from Less education/awareness on (HIV) transmission/prevention ✓ Less access to/use of (named) barrier contraception/more unprotected sex ✓ Higher population ✓ Idea of more infections from blood products ✓ Idea of less availability of HIV screening ✓	2	3.2a	ALLOW any sensible suggestion ALLOW sexual health screening ALLOW Idea of less access to pre exposure prophylaxis drugs e.g. PrEP IGNORE vaccination
		(iii)	Idea that some people may not have been tested/have no symptoms/ reluctant to be tested ✓ Idea that (reliable) data is not recorded/reported/regularly updated (by the country/government) ✓	2	3.2a	ALLOW people may lie about tests/don't want to share confidential information
		(iv)	More susceptible/likely to get (other/named) diseases/other (named) diseases may be more severe ✓	1	3.2b	ALLOW idea of reduced immune response/develop into AIDS

Question			Answer	Marks	AO	Guidance																											
10	(a)		Any two from Africa is now predicted to be higher than in previous prediction✓ Asia (without China and India)/India/China/Latin America/Europe/ are now predicted to fall, where they were previously predicted to level out✓✓ In 1975 no populations were predicted to fall but in 2020, 5 were predicted to fall ✓ North America is now predicted to be higher than in the previous prediction✓ Asia (without China and India) was predicted to be highest in 1975 but now its Africa ✓ Total population projection (for 2100) made in 2020 is higher than projection made in 1975 ✓	2	3.1a	ALLOW any correct differences <table><tr><td></td><td>1975</td><td>2020</td></tr><tr><td>Asia</td><td>2.50</td><td>2.25</td></tr><tr><td>Africa</td><td>2.20</td><td>4.25</td></tr><tr><td>India</td><td>1.90</td><td>1.45</td></tr><tr><td>China</td><td>1.45</td><td>1.10</td></tr><tr><td>L America</td><td>1.20</td><td>0.70</td></tr><tr><td>Europe</td><td>0.90</td><td>0.65</td></tr><tr><td>N America</td><td>0.35</td><td>0.50</td></tr><tr><td>Oceania</td><td>0.05</td><td>0.10</td></tr></table> ALLOW data quotes to identify differences ALLOW 0.1+/- for data quotes		1975	2020	Asia	2.50	2.25	Africa	2.20	4.25	India	1.90	1.45	China	1.45	1.10	L America	1.20	0.70	Europe	0.90	0.65	N America	0.35	0.50	Oceania	0.05	0.10
	1975	2020																															
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L America	1.20	0.70																															
Europe	0.90	0.65																															
N America	0.35	0.50																															
Oceania	0.05	0.10																															
	(b)		Any one from Development of new monitoring and recording methods✓ Changes in population data can happen regularly✓ Changes population data can be caused by medicine/healthcare/economics✓ Named events could affect populations ✓ Idea that it allows resource/future planning ✓	1	2.1	ALLOW any sensible suggestion ALLOW birth/death rate changes/additional data becomes available ALLOW food security if qualified by the needs/size of population																											

Question			Answer	Marks	AO	Guidance
	(c)		Any two from Population changes ✓ Changing diets ✓ New pest / pest population changes ✓ New disease / disease outbreak / disease control ✓ Change in genetic variation ✓ Change in biodiversity ✓ Resistance/lack of resistance to insecticides/pesticides/fungicides ✓	2	1.1	ALLOW invasive species ALLOW competition ALLOW selective breeding/artificial selection IGNORE GM crops
	(d)	(i)	Genes code for proteins ✓ (If other genes/DNA are present) other proteins will be made by the plant ✓	2	2.1	ALLOW idea that inserting other genes/DNA could result in undesirable/unknown/unexpected characteristics/phenotypes/effects in rice ALLOW idea that inserting other genes/DNA could have unknown/undesirable effects on consumer/people
		(ii)	Any one from To get many/more/spare copies (of the gene) ✓ In case the gene does not insert into the plasmid/host ✓ Increase the chances of the plasmid taking the gene in ✓	1	2.1	ALLOW idea that repeated attempts to insert the plasmid may be needed
		(iii)	Plasmid/bacterium ✓	1	2.1	
		(iv)	Idea plant needs to be adapted/survive in the local environment/conditions ✓	1	3.2a	

Question			Answer	Marks	AO element	Guidance
11	(a)	(i)	The idea that (a condition caused by a dominant allele) will be more common (in population/kittens) / condition caused by a recessive allele will be less common (in population/kittens)✓ (Only) need one dominant allele/heterozygous (to have the condition)/a recessive disorder requires two recessive alleles/homozygous alleles / dominant when present will always be expressed (the phenotype)✓	2	2.1	ALLOW a dominant allele makes the condition more likely in a population DO NOT ALLOW a dominant allele makes an individual more likely to have a condition/ a dominant allele is more likely to be expressed ALLOW If one/both parent(s) is heterozygous for a condition then more kittens/offspring are likely to be born with the condition = 2 marks ALLOW If one parent is homozygous dominant for a condition then all kittens/offspring will be born with the condition ORA = 2 marks
	(b)	(i)	(Male) dd and (female) Dd gametes ✓✓ Offspring dd,dd, Dd and Dd in Punnett square ✓ Indication which of the offspring would have PKD ✓	4	3 x 2.1 1 x 2.2	If identifies male and female or uses XX and XY the gametes must be correct ALLOW another letter in place of D, d ECF for incorrect gametes in Punnett square ALLOW 50%/0.5 have PKD (or correct percentages from their Punnett square)
		(ii)	First check the answer in table / on answer line If answer = 0.25 award 2 marks 0.5 x 0.5 ✓ = 0.25 ✓	2	2.2	ALLOW ECF from their b(i) for both marking points if working shown. ALLOW correct fractions or 50% ALLOW any correct fractions or 25%

Question			Answer	Marks	AO element	Guidance
	(c)		Any one from So the cats can be treated✓ Idea to help prevent breeding cats with PKD in future✓ Financial reasons✓	1	3.1a	ALLOW Any sensible suggestion IGNORE ethical unqualified
	(d)		19✓	1	2.1	

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