



Oxford Cambridge and RSA

Foundation

GCSE

Biology A Gateway

J247/04: Paper 4 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2023

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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:
 - a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
 - b. 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 the annotation SEEN to confirm that the work has been read.
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.

Level of response questions on this paper is **19(c)**.

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:

	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.

For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

Question	Answer	Marks	AO element	Guidance
1	A	1	1.1	
2	A	1	1.1	
3	B	1	2.2	
4	C	1	1.1	
5	B	1	1.1	
6	B	1	1.1	
7	B	1	2.1	
8	C	1	1.1	
9	A	1	1.1	
10	B	1	2.1	
11	A	1	2.1	
12	D	1	1.1	
13	C	1	1.1	
14	B	1	1.1	
15	D	1	2.1	

Question		Answer	Marks	AO element	Guidance
16	(a)	Bacteria / fungi ✓ Respiration ✓ (Re)cycled ✓	3	3 x 1.1	ALLOW saprophytes DO NOT ALLOW detritivores IGNORE aerobic/anaerobic ALLOW AW e.g., reused/reabsorbed/released/absorbed IGNORE conserved/stored
	(b) (i)	Microorganisms give off heat when they decompose waste ✓	1	1.2	DO NOT ALLOW more than 1 tick
	(ii)	The higher the nitrogen content compared to carbon, the faster the rate of decomposition ✓	1	3.2b	DO NOT ALLOW more than 1 tick
	(iii)	Any one from: External temperature ✓ Water ✓ Oxygen ✓	1	2.2	DO NOT ALLOW just temperature ALLOW room temperature ALLOW moisture/humidity/rain IGNORE time/soil
	(c)	Plant material: Horse manure ✓ Reason: Lower ratio of carbon to nitrogen / higher nitrogen content compared to carbon ✓ Fruit Waste: 40:1 Horse Manure: 30:1 Straw: 600:1 ✓	3	3.2a 3.1a 2.2	If horse manure is not selected only evidence of correct calculations for all plant material can be awarded ALLOW it has the most nitrogen ALLOW evidence of alternative correct calculations

Question		Answer	Marks	AO element	Guidance																
17	(a)	A and B/parents do not have the syndrome ✓ But they have children/D or/and F/offspring that are affected/have the syndrome ✓	2	2 x 2.1	ALLOW the disorder skips a generation ALLOW parents/A and B are heterozygous/carriers ALLOW not all the children have the syndrome																
	(b)	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td></td> <td></td> <td colspan="2">Person B</td> </tr> <tr> <td></td> <td></td> <td>G</td> <td>g</td> </tr> <tr> <td>Person A</td> <td>G</td> <td>GG</td> <td>Gg</td> </tr> <tr> <td></td> <td>g</td> <td>Gg</td> <td>gg</td> </tr> </table> Gametes ✓ Correct cross ✓ Probability = 0.25 / 25% ✓			Person B				G	g	Person A	G	GG	Gg		g	Gg	gg	3	2 x 2.1 3.2b	Alternative upper and lower case letters used instead of Gg penalise gametes mark only DO NOT ALLOW correct offspring from incorrect gametes ALLOW ¼ / 1:3 / 1 in 4 ALLOW correct interpretation of probability from diagram shown
		Person B																			
		G	g																		
Person A	G	GG	Gg																		
	g	Gg	gg																		
	(c)	(Person D) has (Gillespie) syndrome ✓ They have their iris missing and damage to their cerebellum ✓ Iris can reduce the amount of bright light entering the eye/pupil ✓ Cerebellum controls balance/co-ordination ✓	4	2.1 1.1 1.1 1.1	ALLOW iris controls the amount of light entering the eye/pupil																

Question		Answer	Marks	AO element	Guidance
18	(a)	<p>(Invading cells/pathogens) broken down/engulfed by phagocytes/white blood cells ✓</p> <p>AND</p> <p>(White blood cells/lymphocytes) produce antibodies ✓</p>	2	2 x 1.1	<p>ALLOW phagocytosis</p> <p>DO NOT ALLOW antibodies/lymphocytes engulf (invading cells)</p> <p>IGNORE references to barriers to defence</p> <p>IGNORE antitoxins</p> <p>DO NOT ALLOW phagocytes produce antibodies</p>
	(b)	<p>Any two from:</p> <p>Idea treatment would attack/damage own immune system/white blood cells ✓</p> <p>This would leave the body open to infections ✓</p> <p>Cannot be treated with antibiotics/antivirals ✓</p>	2	2 x 2.1	<p>ALLOW stop/prevent immune system working</p> <p>ALLOW body will not attack/damage own immune system/white blood cells</p> <p>ALLOW will weaken the immune system / become immunocompromised/immunosuppressed</p> <p>IGNORE effects on nerves</p>

Question			Answer	Marks	AO element	Guidance
19	(a)	(i)	Axes- even scales occupying more than half of the grid ✓ Plotting -all points correctly plotted ✓✓	3	3 x 2.2	0-2 points correctly plotted = 0 marks 3 points correctly plotted = 1 mark ALLOW +/- half a square
		(ii)	Line of best fit through most points ✓	1	2.2	DO NOT ALLOW dot to dot line ALLOW line of best fit their plotting IGNORE any extrapolation of line
	(b)		Allow idea they live longer than would be predicted by their mass ✓ (A rodent/mole rat) of 60g should live about 1.6 years ✓	2	2 x 3.2b	ALLOW rodents of their mass should not live so long AW size for mass ALLOW lifespan should be similar to gerbil of 1.5 years ALLOW age which matches line of best fit ALLOW range 1.5-1.7 years ALLOW live 16.5 years longer than they should

Question	Answer	Marks	AO element	Guidance
(c)*	<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) Gives a detailed explanation how each of the features allows the mole rats to survive in the tunnels.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks) Partially explains how the features allow the mole rats to survive in the tunnels.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) Gives a limited explanation of how a feature allows the mole rats to survive in the tunnels.</p> <p><i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks <i>No response or no response worthy of credit</i></p>	6	3 x 1.1 3 x 2.1	<p>AO1.1 Demonstrates knowledge and understanding of scientific ideas to describe the features.</p> <ul style="list-style-type: none"> • oxygen required for aerobic respiration • haemoglobin in red blood cells transports oxygen to tissues • lactic acid produced during anaerobic respiration <p>AO2.2 Applies knowledge and understanding to explain how the features allow the rats to survive.</p> <ul style="list-style-type: none"> • (a low respiration rate) will reduce the need for oxygen • (haemoglobin that binds oxygen more easily) will allow the oxygen to be picked up at the lungs from the low concentration in the air • (haemoglobin that binds oxygen more easily) more oxygen will be carried to the tissues/cells • less oxygen so anaerobic respiration is more likely • increased production of lactic acid • (lack of pain receptors) will prevent the lactic acid from causing pain and/or reducing movement

Question		Answer	Marks	AO element	Guidance
	(d)	<p>(Slowing down the cell cycle) will slow down cell division/mitosis / less likely to divide uncontrollably</p> <p>OR</p> <p>Cancer is caused by rapidly dividing cells/mitosis ✓</p> <p>AND</p> <p>Prevent tumours ✓</p>	2	2 x 1.1	<p>AW cell replication/multiplication for cell division</p> <p>IGNORE reproduction</p> <p>IGNORE stops/prevents cell division/mitosis/cells dividing uncontrollably</p> <p>IGNORE any process slowing down that occur during interphase</p> <p>ALLOW cancer cells carry out uncontrolled cell division/multiply quickly</p> <p>IGNORE tumour cells</p> <p>IGNORE cancer growing</p> <p>IGNORE tumours spread slowly</p>

Question		Answer	Marks	AO element	Guidance
20	(a)	<p>Any two from:</p> <p>(More) competition ✓</p> <p>(Competition) for water/minerals/light/space ✓</p> <p>(Buddleia) produce large quantities of small seeds ✓</p>	2	2 x 2.1	
	(b)	<p>Any three from:</p> <p>(Capture butterflies using) nets ✓</p> <p>Capture some butterflies, mark, and release them ✓</p> <p>Capture some again and count how many are marked ✓</p> <p>Use formula/equation to (estimate the number) ✓</p>	3	3 x 1.2	<p>ALLOW credit for reference to a formula used</p> <p>Last three marking points can be awarded for a correct written formula</p> <p>Award 'capture – recapture' one mark if none of the last three MP are scored</p>
	(c)	<p>Community is the total number (of butterflies) in an area ✓</p> <p>Biodiversity takes into account how many different species (of butterflies) are present ✓</p>	2	2 x 1.1	<p>ALLOW large community means lots of butterflies</p> <p>ALLOW Butterflies may be of the same/few species which means low biodiversity</p> <p>If no worthy answer allow lots of butterflies but few/same species (of butterflies) for one mark</p>

Question		Answer	Marks	AO element	Guidance
	(d) (i)	(Larger seeds) will not be spread by the wind ✓ (New buddleia) less likely/will not spread to other habitats ✓	2	2 x 3.1a	ALLOW (larger seeds) mean less seed dispersal by wind ALLOW (larger seeds) will not be spread by other insects/butterflies IGNORE less seeds ALLOW ORA for smaller seeds ALLOW less/no colonisation IGNORE damage to habitats
	(ii)	(Uneven numbers of chromosomes will) prevent gametes being made (by meiosis) ✓ Buddleia will slow down/not be able to produce seeds/reproduce ✓	2	2 x 3.1a	AW ovule and/or pollen for gametes ALLOW prevent haploid cells being made IGNORE prevents meiosis/replicate ALLOW slow down/stop fertilisation ALLOW number of seeds reduce

Question		Answer	Marks	AO element	Guidance
21	(a)	<p>Any three from: (Chemical first produced) by a mutation ✓</p> <p>(Idea these seeds/plants) less likely/not eaten by birds/people / ORA ✓</p> <p>These seeds are more likely to survive and reproduce / ORA ✓</p> <p>Pass on allele/gene (for making the chemical) / ORA ✓</p>	3	1.1 2 x 2.1	<p>If selective breeding described award no marks</p> <p>ALLOW these seeds/plants are better adapted (by less being eaten) ORA</p> <p>AW produce offspring for reproduction</p> <p>ALLOW pass on advantageous allele/gene ORA IGNORE pass on traits/characteristics</p>
	(b)	<p>Any two from: (Select/choose plants/organisms) with less bitter chemical/show desired characteristics ✓</p> <p>Breed these (plants/organisms together) ✓</p> <p>Select/choose (offspring) with less bitter chemical/desired characteristic and repeat the process ✓</p>	2	2 x 1.1	<p>If genetic engineering/cloning described award no marks</p> <p>DO NOT ALLOW (select) seeds/sorghum with no bitter chemical</p> <p>ALLOW cross breed/pollinated (together)</p>
	(c)	<p>In areas where there are many birds there are higher levels of the bitter chemical / ORA ✓</p> <p>(More bitter chemical) less likely to be eaten by the birds / ORA ✓</p>	2	3.1a 3.1b	<p>IGNORE sorghum evolves to not be eaten</p> <p>If no worthy answer allow birds have evolved to no longer taste the bitter chemical</p>

Question			Answer	Marks	AO element	Guidance
22	(a)	(i)	They were adding different volumes of run-off (to each jar) ✓ Keep the total/overall volume the same ✓	2	2 x 2.2	ALLOW to see effect/change the concentration/ratio of run-off water IGNORE effect of run-off on growth of duckweed IGNORE change concentration of pond water ALLOW so the total volume of run-off and clean pond water remains the same ALLOW to keep contents to 250cm ³ IGNORE volume of water/solution kept the same
		(ii)	Add (excess) sodium/potassium hydrogen carbonate to the water ✓	1	1 x 3.3b	ALLOW sodium bicarbonate / carbonate solution IGNORE pH probe/CO ₂ probe/limewater test/soda lime
	(b)	(i)	Asexual (reproduction) ✓	1	1.1	ALLOW vegetative / cloning / budding DO NOT ALLOW mitosis
		(ii)	5 ✓	1	3.1a	ALLOW 4
	(c)		Run-off water contains minerals ✓ Increases the growth of the duckweed ✓ (They do not agree) because duckweed is not a submerged plant/floats on the surface so cloudiness/light would not affect photosynthesis ✓	3	3 x 3.2a	ALLOW named mineral/nitrogen compounds IGNORE nutrients IGNORE more/higher yield/biomass of duckweed IGNORE affects growth of duckweed
	(d)		Any one from: Measure the change in mass (during the experiment) Length of stem/root of the plant (during the experiment) ✓	1	3.3a	ALLOW length/height (of plant)

Question		Answer	Marks	AO element	Guidance
23	(a)	<p>Wrasse feed/eat/kill parasites (that would feed/eat the salmon) ✓</p> <p>More food / energy is available (for the salmon for growth) ✓</p>	2	2 x 2.1	<p>ALLOW wrasse are a predator of the parasite</p> <p>ALLOW wrasse may prevent the salmon developing diseases / wrasse are a cleaner species</p> <p>DO NOT ALLOW salmon eating wrasse</p>
	(b)	<p>Any three from:</p> <p>(Total) demand/supply for fish is increasing ✓</p> <p>Has increased from 20 to 220 million tonnes ✓</p> <p>Earlier (total) demand is mainly supplied by wild fish ✓</p> <p>From 1990 supply from aquaculture begins to increase ✓</p> <p>Demand/supply for wild fish has decreased since 2000 ✓</p> <p>Demand/supply by aquaculture is predicted to become greater than demand/supply for wild fish ✓</p> <p>(Demand/supply by aquaculture is predicted to become greater than demand/supply for wild fish) will happen between 2020 and 2030 ✓</p>	3	3 x 2.1	<p>ALLOW demand/supply for fish was lower in the past</p> <p>ALLOW increased by 200 million tonnes</p> <p>ALLOW earlier demand/supply by wild increased and aquaculture remains the same</p> <p>DO NOT ALLOW earlier demand/supply is increasing at a similar rate both wild and aquaculture</p> <p>ALLOW range between 1980-2010</p> <p>ALLOW range between 1996-2010</p>
	(c)	(i)	1	1.1	IGNORE restricting/restrictive
		(ii)	1	1.1	DO NOT ALLOW lipase

Question	Answer	Marks	AO element	Guidance
(iii)	<p>The gene will switch on the growth hormone gene ✓</p> <p>Growth hormone will be made continuously ✓</p>	2	2 x 2.1	<p>ALLOW growth hormone produced throughout the year</p> <p>If no marks awarded allow (gene inserted) will allow salmon to grow throughout the year for one mark</p>
(iv)	<p>First check the answer on answer line</p> <p>If answer to 2 significant figures is correct for accepted range award 3 marks</p> <p>$\frac{(13.0 - 7.3)}{7.3} \times 100$ ✓</p> <p>OR</p> <p>$\frac{(5.7)}{7.3} \times 100$ ✓</p> <p>PLUS</p> <p>78.08 (%) ✓</p> <p>78 (%) ✓</p>	3	<p>2.2</p> <p>1.2</p> <p>2.2</p>	<p>ALLOW mm instead of cm units</p> <p>ALLOW range 12.9-13.1cm for genetically engineered salmon</p> <p>ALLOW range 7.2-7.4cm for non-genetically engineered salmon</p> <p>ALLOW any correct rounding of 78.082191 8</p> <p>ALLOW correct answer from accepted range measured</p> <p>ALLOW ECF for incorrect measurements by correct equation</p> <p>ALLOW one mark for an incorrect answer if it is clearly shown that it has been correctly rounded to 2 significant figures</p>

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