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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It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

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
BOD	Benefit of doubt given
CON	Contradiction
RE	Rounding error
SF	Error in number of significant figures
ECF	Error carried forward
L1	Level 1
L2	Level 2
L3	Level 3
NBOD	Benefit of doubt not given
SEEN	Noted but no credit given
I	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

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>17</td><td>(a)</td><td></td><td>A and B/parents do not have the syndrome ✓

But they have children/D or/and F/offspring that are affected/have the syndrome ✓</td><td>2</td><td>2 x 2.1</td><td>ALLOW the disorder skips a generation
ALLOW parents/A and B are heterozygous/carriers
ALLOW not all the children have the syndrome</td></tr>
<tr><td></td><td>(b)</td><td></td><td><table><tr><td></td><td></td><td colspan="2">Person B</td></tr><tr><td rowspan="2">Person A</td><td></td><td>G</td><td>g</td></tr><tr><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% ✓</td><td>3</td><td>2 x 2.1

3.2b</td><td>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</td></tr>
<tr><td></td><td>(c)</td><td></td><td>(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 ✓</td><td>4</td><td>2.1

1.1

1.1

1.1</td><td>

ALLOW iris controls the amount of light entering the eye/pupil</td></tr>
</table>

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

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)*		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Gives a detailed explanation how each of the features allows the mole rats to survive in the tunnels. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Partially explains how the features allow the mole rats to survive in the tunnels. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Gives a limited explanation of how a feature allows the mole rats to survive in the tunnels. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant***.** **0 marks** *No response or no response worthy of credit*	**6**	**3 x 1.1** **3 x 2.1**	**AO1.1 Demonstrates knowledge and understanding of scientific ideas to describe the features.** • oxygen required for aerobic respiration • haemoglobin in red blood cells transports oxygen to tissues • lactic acid produced during anaerobic respiration **AO2.2 Applies knowledge and understanding to explain how the features allow the rats to survive.** • (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)		(Slowing down the cell cycle) will slow down cell division/mitosis / less likely to divide uncontrollably **OR** Cancer is caused by rapidly dividing cells/mitosis ✓ **AND** Prevent tumours ✓	**2**	**2 x 1.1**	**AW** cell replication/multiplication for cell division **IGNORE** reproduction **IGNORE** stops/prevents cell division/mitosis/cells dividing uncontrollably **IGNORE** any process slowing down that occur during interphase **ALLOW** cancer cells carry out uncontrolled cell division/multiply quickly **IGNORE** tumour cells **IGNORE** cancer growing **IGNORE** tumours spread slowly

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

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

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

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

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