

Higher

GCSE

Biology A Gateway

J247/04: Paper 4 (Higher 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. 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.

Level of response question on this paper is **18(c)(ii)**.

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	D✓	1	2.2	
2	C✓	1	1.1	
3	B✓	1	1.1	
4	A✓	1	1.1	
5	C✓	1	1.1	
6	A✓	1	2.2	
7	A✓	1	1.2	
8	A✓	1	1.1	
9	D✓	1	1.1	
10	C✓	1	1.1	
11	C✓	1	1.1	
12	C✓	1	2.2	
13	C✓	1	2.2	
14	B✓	1	1.1	
15	D✓	1	1.2	

Question			Answer	Marks	AO element	Guidance
16	(a)		Any two from: Use a quadrat ✓ Positioned at random / use of several (quadrats) ✓ Count the number (of thistle in a quadrat) ✓ AND Any one from: Idea of scaling up a smaller area of quadrat to the number in 1m² ✓ Work out the mean (of the 1m² quadrat) ✓	3	3 x 1.2	DO NOT ALLOW transect line. Maximum 1 mark from this section. IGNORE quadrant ALLOW random number generator/use co-ordinates to generate positions IGNORE count the organisms/percentage cover ALLOW work out the average/divide number of thistle plants by number of quadrats
	(b)		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 1.8 award 2 marks 36/20 ✓ OR $\frac{36}{(1/2 \times 10 \times 4)} \quad \checkmark$ 1.8 ✓	2	2 x 2.2	ALLOW rounding to 2 for 2 marks
	(c)			3		Assume answer refers to thistles after mowing

Question			Answer	Marks	AO element	Guidance
			Will receive more light ✓		2.1	ALLOW ORA for before mowing ALLOW less competition for light IGNORE less competition for space/water/minerals IGNORE sun
			Will be able to photosynthesise more/faster ✓		1.1	ALLOW more sunlight for photosynthesis = 2 marks IGNORE respire faster
			Produce more sugars/glucose/raw material (for growth) ✓		2.1	IGNORE produce more food At least one marking point must be comparative to score any marks

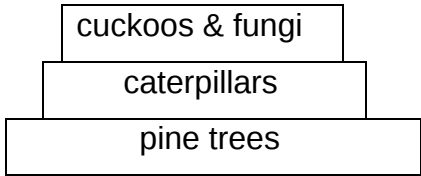
Question			Answer	Marks	AO element	Guidance
Question			Answer	Marks	AO element	Guidance
17	(a)		To allow oxygen gas into the bottle ✓	1	1.2	
	(b)	(i)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 16.3 award 3 marks 300-235 / 4 ✓ or 65/4 ✓ 16.25 ✓ = 16.3 ✓	3	2 x 2.2 1.2	ALLOW 16.2 without working for 1 mark ALLOW Clear evidence of correct conversion of incorrect answer to 3 significant figures
		(ii)	Greater the number of (air) holes, the faster the rate (of decomposition) ✓ Idea that the relationship is not linear E.g. The rate of decomposition is not increasing at the same rate that the number of air holes are ✓	2	2 x 2.2	ALLOW ORA for less number of (air) holes IGNORE air flow IGNORE more air holes more mass lost ALLOW the relationship is not directly proportional
		(iii)	(Easier) to compare (the amount of mass that had been lost) ✓	1	2.2	ALLOW no need to calculate the percentage change IGNORE to make it a fair test/is more accurate/is more reliable/is a control variable/fewer calculations
		(iv)	Number of (air) holes ✓	1	2.2	IGNORE air holes unqualified
		(v)	Idea that it/water would not have been weighed / the mass would have been lower ✓	2	2.2 3.3b	ALLOW not all mass lost would have been due to decomposition IGNORE references to loss of plant waste reducing the mass IGNORE mass affected by loss of water DO NOT ALLOW block up the drain holes

Question			Answer	Marks	AO element	Guidance												
			(Collect the water) and measure its mass / pour it back into the bottle ✓			ALLOW at the end of the experiment measure the plant wastes dry mass												
Question			Answer	Marks	AO element	Guidance												
18	(a)		Any two from: All the offspring will be identical/clones ✓ Bulbs will grow/flower faster (than seeds) ✓ Idea that they know exactly what the flowers will look like / will be able to replicate desirable plants ✓	2	2 x 1.2	DO NOT ALLOW grow faster if linked to reproduce/finding a mate/having one parent IGNORE there will be more tulips made IGNORE ideas about cost/profit/efficiency												
	(b)		<table><tr><td></td><td>Theory 1</td><td>Theory 2</td><td></td></tr><tr><td>Changes the phenotype of the tulip plant</td><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>Changes the genotype of the tulip plant.</td><td>✓</td><td>x</td><td>✓</td></tr></table>		Theory 1	Theory 2		Changes the phenotype of the tulip plant	✓	✓	✓	Changes the genotype of the tulip plant.	✓	x	✓	2	2 x 2.1	1 mark for each correct row
	Theory 1	Theory 2																
Changes the phenotype of the tulip plant	✓	✓	✓															
Changes the genotype of the tulip plant.	✓	x	✓															
	(c)	(i)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 2112.68 award 2 marks $\frac{2 \times 10^9}{14200} \times \frac{1.5}{100}$ ✓ 2112.68 ✓	2	1.2 2.2	ALLOW any correct rounding of 2112.676056 ALLOW 2112/2113 for total number of infected tulips for 2 marks ALLOW correct answer in standard form												

Question			Answer	Marks	AO element	Guidance
	(ii)*		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) Discusses the advantage of early detection and appreciates its consequences AND Discusses the usefulness of the machine including judgements based on the data <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) States an advantage of early detection AND Discusses the usefulness of the machine <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) State an advantage of early detection OR Discusses the usefulness of the machine	6	2 x 2.1 2 x 1.1 2 x 3.2a	AO1.1 Demonstrates knowledge and understanding to state the advantages of early detection - less insecticide/spray is needed - less chance that the virus is spread to other tulips (by the insects) AO2.1 Apply knowledge and understanding to appreciate the consequences of early detection. - less insecticide sprayed means less chance of pollution/less damage to the environment - less insecticide sprayed means less cost to grower - less insecticide sprayed means less risk to other insects AO3.2a Analyse information to make judgements on the usefulness of the machine. - machine can reduce the time needed to inspect tulips/the machine is faster - fairly accurate diagnosis/all/15 infected tulips are identified - only 14 diagnosed incorrectly

Question			Answer	Marks	AO element	Guidance															
			<i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit</i>			14 diagnosed incorrectly can lead to more area being sprayed/loss of biodiversity - idea that although some non-infected are diagnosed, no infected tulips are missed															
Question			Answer	Marks	AO element	Guidance															
19	(a)	(i)	<table><tr><td></td><td>Number in the family</td></tr><tr><td>males</td><td>6</td></tr><tr><td>People who are homozygous recessive for the gene</td><td>6 ✓</td></tr><tr><td>People who are homozygous dominant for the gene</td><td>0 ✓</td></tr></table>		Number in the family	males	6	People who are homozygous recessive for the gene	6 ✓	People who are homozygous dominant for the gene	0 ✓	2	2 x 2.1								
	Number in the family																				
males	6																				
People who are homozygous recessive for the gene	6 ✓																				
People who are homozygous dominant for the gene	0 ✓																				
		(ii)	<table><tr><td></td><td colspan="2">Person 1</td></tr><tr><td></td><td>a</td><td>a</td></tr><tr><td>Person 2</td><td>Aa</td><td>Aa</td></tr><tr><td>A</td><td></td><td></td></tr><tr><td>a</td><td>aa</td><td>aa</td></tr></table> Gametes ✓ Correct cross ✓ Probability = 0.5 / 50% ✓		Person 1			a	a	Person 2	Aa	Aa	A			a	aa	aa	3	2 x 2.1 3.2b	ALLOW ECF correct cross for incorrect gametes for 1 mark ALLOW ½, 1:1, 1 in 2
	Person 1																				
	a	a																			
Person 2	Aa	Aa																			
A																					
a	aa	aa																			
	(b)		Sugar/glucose (level)✓ Insulin <u>and</u> glucagon ✓ Metabolic ✓	4	4 x 1.1	ALLOW either order DO NOT ALLOW glycagon/glycogen															

Question			Answer	Marks	AO element	Guidance
			Thyroxine ✓			IGNORE TSH
	(c)		Killing the plasma cells stops production of amyloid/ Protein/killing the plasma cells stops blood vessels being blocked (from the pancreas and thyroid gland)✓ Stem cells can differentiate into new plasma cells/stem cells can be used to replace the plasma cells ✓	2	2 x 2.1	IGNORE stops amyloidosis IGNORE the new plasma cells cannot make the amyloid/protein
	(d)		The (amyloid) protein is not made ✓ The allele/gene is not having an effect/ the allele/gene is not expressed✓	2	2 x 2.1	ALLOW the gene/allele/mRNA is not translated DO NOT ALLOW the DNA/mRNA is not transcribed DO NOT ALLOW the allele/gene is destroyed DO NOT ALLOW prevents the gene coding for the amyloid protein

Question			Answer	Marks	AO element	Guidance
20	(a)		 Three trophic levels correctly drawn ✓ Correctly labelled ✓	2	2 x 2.1	ALLOW birds for cuckoos ALLOW triangle
	(b)		A mutation occurs (so some cuckoos have a sticky membrane) ✓ (These cuckoos) can eat caterpillars ✓ (These cuckoos) will pass on the allele (for sticky membranes) ✓ Over many years/eventually all the cuckoos have sticky membranes/the allele ✓	4	4 x 2.1	IGNORE cuckoos get more food IGNORE gene IGNORE pass on the characteristic ALLOW over time, all cuckoos without sticky membranes die out ALLOW over time, allele frequency increases so all cuckoos have it
	(c)	(i)	Biological ✓	1	1.1	
		(ii)	2 ✓	1	1.2	

Question			Answer	Marks	AO element	Guidance
	(d)	(i)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 69.23 award 2 marks $9/13 \times 100 \checkmark$ 69.23 (%) $\checkmark$	2	 1.2 2.2	 ALLOW 69.2307692308 or any correct rounding e.g. 69/69.2
		(ii)	Any one from: Predators $\checkmark$ Parasites/other pathogens/diseases $\checkmark$ Weather conditions/change in temperature $\checkmark$ Lack of food $\checkmark$ More competition $\checkmark$	1	2.1	IGNORE the oil from the pine trees
		(iii)	Any two from: Ginger is more effective than rosemary (at killing larvae) / ORA $\checkmark$ Ginger/rosemary is more effective on the pine trees than in the lab / ORA $\checkmark$ Both are more effective than the control treatment $\checkmark$ AND Data used to back up argument $\checkmark$	3	3 x 3.1b	ALLOW AW throughout for more effective e.g. better Data mark can only be given if at least one correct evaluation mark awarded Data must involve some manipulation e.g. ginger kills 1586 and rosemary kills 1061 in total/ginger kills 525 more overall than rosemary

Question			Answer	Marks	AO element	Guidance
						e.g. ginger kills 412/41.2% more in the lab than rosemary e.g. ginger kills 113/11.3% more on the pine trees than rosemary e.g. ginger kills 16.2% more on the pine trees than in the lab

Question			Answer	Marks	AO element	Guidance
21	(a)		Vaccine contains weakened/dead/inactive pathogen ✓ (formation of) memory cells ✓ Idea of infected with the real pathogen then antibodies are produced faster/in larger numbers ✓	3	3 x 1.1	ALLOW any type of pathogen ALLOW vaccine contains a pathogen's antigens ALLOW vaccine contains mRNA/genetic material IGNORE dead version of the disease/measles DO NOT ALLOW antibodies become memory cells/antibodies make memory cells IGNORE kills the pathogen quicker
	(b)	(i)	1985 ✓ Because the number of cases has a steeper/the steepest decline/more people had the (MMR) vaccine ✓	2	2 x 3.1a	ALLOW 1984/1986 If year is incorrect 0 marks
		(ii)	2001 ✓ Idea of the number of cases increased as people were concerned about the risk (of autism)/the report/did not trust the vaccine AND	2	3.1a 3.2a	ALLOW 2000/2002 If year is incorrect 0 marks

Question			Answer	Marks	AO element	Guidance
			Less people were vaccinated ✓			
	(c)		People who have had measles have fewer different antibodies ✓ Idea that they are more likely to develop other diseases/more prone to other pathogens making them ill ✓	2	2 x 3.2b	IGNORE they have lots of antibodies for measles ALLOW less protection against other diseases

Question			Answer	Marks	AO element	Guidance
22	(a)	(i)	Haploid is half the number of chromosomes/one chromosome from each pair/one set of chromosomes ✓ Diploid is the full number of chromosomes/the chromosomes are all in pairs/two sets of chromosomes ✓	2	2 x 1.1	ALLOW haploid cells have 23 chromosomes and diploid cells have 46 chromosomes IGNORE incorrect chromosome numbers ALLOW haploid cells have half the genetic information
		(ii)	(Meiosis makes gametes/cells) that are haploid/have half the number of chromosomes ✓ or (meiosis makes gametes/cells) with 23 chromosomes/that do not have an extra chromosome/that do not have 24 chromosomes ✓ Idea that after fertilisation, the diploid/full number of chromosomes is restored/the zygote has 46 chromosomes ✓	2	2 x 1.1	

Question			Answer	Marks	AO element	Guidance
	(b)		Has Down's syndrome/does not have Edward's syndrome ✓ Female/a girl ✓	2	2 x 3.2b	DO NOT ALLOW more likely to/may have Down's syndrome/less likely to have Edward's syndrome IGNORE they have an extra chromosome/47 chromosomes
	(c)	(i)	Any two from: Down's syndrome increases as the age of the mother increases ✓ Edward's syndrome increases as the age of the mother increases ✓ Down's syndrome is more common than Edward's syndrome (at any age) ✓ Down's syndrome increases more rapidly after the age of 25-29/30-34/35-39/40/40 or older ✓ Edward's syndrome increases more rapidly after the age of 30-34/35-39/40 or older ✓	2	2 x 3.2b	ORA for all marking points
		(ii)	In older women meiosis takes longer which increases the chance of an egg being made with an extra chromosome/ a mutation occurring ✓	1	3.2b	IGNORE eggs have been in a woman longer with no reference to duration of meiosis

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