

GCSE (9–1)

Biology A (Gateway)

J247/04: Paper 4 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for Autumn 2021

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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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1. 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

2. 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

3. 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:

	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	B ✓	1	1.2	
2	A ✓	1	1.1	
3	A ✓	1	1.1	
4	B ✓	1	1.1	
5	D ✓	1	1.1	
6	D ✓	1	2.2	
7	C ✓	1	1.1	
8	B ✓	1	1.2	
9	C ✓	1	1.2	
10	A ✓	1	1.2	
11	B ✓	1	2.1	
12	A ✓	1	2.2	
13	C ✓	1	1.2	
14	B ✓	1	2.2	
15	C ✓	1	1.1	

BLANK PAGES MUST BE ANNOTATED TO SHOW THEY HAVE BEEN SEEN

Question		Answer	Marks	AO element	Guidance	
16	(a)	<p><i>Quadrat:</i></p> <p>Sample the plants (in the hedge) ✓</p> <p>Count the number (of different species) in the quadrat ✓</p> <p><i>Key:</i></p> <p>Identify the species of plants ✓</p>	3	3 x 1.2	<p>ALLOW random placement</p> <p>ALLOW idea that the small area is representative of the rest of the hedge</p> <p>ALLOW key to identify species so they can be counted = 2 marks if counted not credited for quadrat</p>	
	(b)	(i)	All correct points correctly plotted ✓✓	2	2 x 2.2	<p>ALLOW +/- half a square</p> <p>0 to 2 correct points plotted = 0 mark</p> <p>3 or 4 correct points plotted = 1 mark</p> <p>All 5 correct points plotted = 2 marks</p>
		(ii)	Correctly drawn line of best fit ✓	1	2.2	<p>ALLOW best straight line or smooth curve</p> <p>DO NOT ALLOW dot to dot line</p> <p>ALLOW line of best fit for their plotting</p> <p>IGNORE any extrapolation of line</p> <p>DO NOT ALLOW double lines</p>
		(iii)	<p>FIRST CHECK ANSWER ON THE ANSWER LINE</p> <p>If answer = 261 (years) award 2 marks</p> <p>$2.1 \times 110 + 30$ ✓</p> <p>= 261 (years) ✓</p>	2	2 x 2.2	

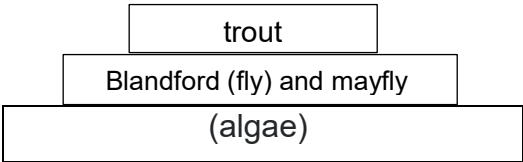
Question		Answer	Marks	AO element	Guidance
	(iv)	<p>Yes (no mark)</p> <p>As the age of field increases the area of the field decreases ✓</p> <p>D/oldest field has small area and E/newest field has large area / 261yr old/oldest field has 1500m² area and 162yr old/newest field has 10 000m² area ✓</p>	2	2 x 3.2b	<p>IF ANSWER IS NO THEN ZERO MARKS</p> <p>ORA</p>
	(c)	<p>Blackbirds eat/kill greenfly and/or caterpillars ✓</p> <p>Less wheat will be eaten ✓</p>	2	2 x 3.1a	<p>ALLOW blackbirds are predators to the greenfly and/or caterpillars</p> <p>ALLOW blackbirds hunt greenfly and/or caterpillars</p> <p>ALLOW greenfly and/or caterpillars are blackbirds prey</p> <p>ALLOW decrease consumers of the wheat</p>

Question		Answer	Marks	AO element	Guidance												
17	(a)	<table border="1"> <tr> <td>Acid will decrease the pH and cause the enzyme to change shape.</td> <td>✓</td> </tr> <tr> <td>Acid will increase the pH and cause the enzyme to change shape.</td> <td></td> </tr> <tr> <td>Acid will increase the pH and cause the substrate to change shape.</td> <td></td> </tr> <tr> <td>The enzyme will not fit into the active site of the substrate.</td> <td></td> </tr> <tr> <td>The substrate will denature</td> <td></td> </tr> <tr> <td>The substrate will not fit into the active site of the enzyme.</td> <td>✓</td> </tr> </table>	Acid will decrease the pH and cause the enzyme to change shape.	✓	Acid will increase the pH and cause the enzyme to change shape.		Acid will increase the pH and cause the substrate to change shape.		The enzyme will not fit into the active site of the substrate.		The substrate will denature		The substrate will not fit into the active site of the enzyme.	✓	2	2 x 2.1	More than 2 boxes ticked then each additional incorrect box negates a mark
Acid will decrease the pH and cause the enzyme to change shape.	✓																
Acid will increase the pH and cause the enzyme to change shape.																	
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The substrate will not fit into the active site of the enzyme.	✓																
	(b)	(i)	(Distilled) water ✓	1	2.2												
		(ii)	<p>Yes:</p> <p>Increasing concentrations (of sulfur dioxide) are linked to lower rates of photosynthesis ✓</p> <p>No:</p> <p>Because there is no evidence that it is due to sulfur dioxide being an acid ✓</p>	2	2 x 3.2a	<p>ALLOW sulfur dioxide reduces the rate of photosynthesis</p> <p>IGNORE pH/acid references</p> <p>ALLOW reference to a correlation and not a cause/no causal mechanism</p>											
		(iii)	Use different acids ✓	1	3.3b	<p>IGNORE measure the pH to show it is an acid</p> <p>IGNORE repeat experiment with different concentrations of sulphuric acid</p>											

Question		Answer	Marks	AO element	Guidance								
18	(a)	<table border="1"> <thead> <tr> <th>Name of disease</th> <th>Cause</th> </tr> </thead> <tbody> <tr> <td>Barley mildew</td> <td>fungus ✓</td> </tr> <tr> <td>Crown gall disease</td> <td>bacterium ✓</td> </tr> <tr> <td>Tobacco mosaic disease</td> <td>virus ✓</td> </tr> </tbody> </table>	Name of disease	Cause	Barley mildew	fungus ✓	Crown gall disease	bacterium ✓	Tobacco mosaic disease	virus ✓	3	3 x 1.1	
		Name of disease	Cause										
		Barley mildew	fungus ✓										
		Crown gall disease	bacterium ✓										
Tobacco mosaic disease	virus ✓												
	(b)	<p>Any two from: Choose the type/correct treatment to use ✓</p> <p>Stop/limit the (pathogen) spread ✓</p> <p>Limit the loss of the crop ✓</p>	2	2 x 2.2	<p>ALLOW different pathogens require different treatments DO NOT ALLOW treat with pesticides IGNORE destroy/isolate the crop</p> <p>ALLOW stop other/more tomatoes from getting infected</p>								
	(c) (i)	<p>Faster /</p> <p>Reduces (human) error /</p> <p>No/reduced damage to plant/leaf ✓</p>	1	2.2	<p>Assume new method if not stated. ALLOW reverse argument for current method if stated. IGNORE efficient</p> <p>ALLOW provides quantitative data IGNORE accurate/detailed/technological advancements</p>								
	(ii)	<p>Any wavelength in the range 725 – 900 (nm) ✓</p> <p>(At this wavelength) there is a big difference between the fraction of light reflected (from each type of leaf) ✓</p>	2	2 x 3.1b	<p>Incorrect wavelength chosen = 0 marks</p> <p>ALLOW can distinguish (each type of leaf) with correct fractions of light reflected with correct data quoted.</p>								

Question		Answer	Marks	AO element	Guidance
19	(a)	Idea that they grow/divide in an uncontrolled way ✓ Form tumours ✓	2	2 x 1.1	ALLOW change in rate of growth/division IGNORE grow unqualified IGNORE cancer reproduces ALLOW invade healthy tissue/cells
	(b)	(i)	3	1.2 2.2 2.2	ALLOW 45 000 = 2 marks Clear evidence of correct conversion to standard form of incorrect answer = 1 mark
		(ii)	2	2 x 2.2	ALLOW chemotherapy/radiotherapy/gene therapy ALLOW correct named treatment ALLOW removal of the tumour from the breast / removal of breast (tissue) IGNORE remove organ that makes oestrogen DO NOT ALLOW use FSH / LH which inhibit oestrogen

Question		Answer	Marks	AO element	Guidance
	(c)	Damage cerebellum ✓ Disturb balance/posture/co-ordination of movement/muscular activity ✓	2	2 x 3.1b	ALLOW tumour located in the cerebellum

Question		Answer	Marks	AO element	Guidance	
20	(a)	 <p>Shape ✓ Labels ✓</p>	2	2 x 2.2	If more than 3 trophic levels are drawn max 1 mark for shape	
	(b)	(i)	(Blood) contains protein ✓	1	2.1	ALLOW males do not need more protein
		(ii)	(Sensory receptors) can't detect, stimulus/pain/touch, to generate nerve impulse ✓ Idea that stops the person feeling the fly so fly can feed more/for longer OR Idea that this stops the person feeling the fly and so stops the swatting/killing/removing ✓	2	1.1 2.1	ALLOW sensory receptors normally detect, pain/touch/stimulus and generate nerve impulse AW electrical signal for nerve impulse IGNORE reflex action IGNORE reference to blood clotting
	(c)	(Antibodies) attach/bind to the antigen/protein ✓ (Protein gets) broken down/engulfed by phagocytes/white blood cells ✓	2	2 x 1.1	ALLOW antibodies clump/agglutinate the protein together ALLOW phagocytosis DO NOT ALLOW antibodies/lymphocytes engulf protein	
	(d)	(i)	Mutualism ✓	1	1.1	IGNORE symbiosis ALLOW mutual relationship

Question		Answer	Marks	AO element	Guidance
	(ii)	(Poison) activated by the low pH/high acidity in the gut of the Blandford flies ✓ (Poison) not activated/will not work in other flies because their guts are not so acidic/higher pH ✓	2	2 x 2.2	

Question			Answer	Marks	AO element	Guidance												
21	(a)	(i)	Number of people who will develop CJD.	3	2	2 x 2.1												
			Number of people that are homozygous recessive for this gene.	8✓														
			Number of people who are heterozygous for this gene.	3✓														
		(ii)	<p style="text-align: center;">person B</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>d</td> <td>d</td> <td></td> </tr> <tr> <td>person A</td> <td>D</td> <td>Dd</td> <td>Dd</td> </tr> <tr> <td></td> <td>d</td> <td>dd</td> <td>dd</td> </tr> </table> <p style="text-align: right;">✓</p> <p>probability = 0.5 / ½ / 50% / 1 in 2 / 1:1 ✓</p>		d	d		person A	D	Dd	Dd		d	dd	dd	2	2.1 3.2b	<p>ALLOW use of a different letter but must be same letter with clearly different upper and lower case e.g. Aa</p> <p>ALLOW 50:50, 2/4 ALLOW correct interpretation of probability from diagram drawn DO NOT ALLOW correct probability from incorrect diagram</p>
	d	d																
person A	D	Dd	Dd															
	d	dd	dd															
(b)		Not caused by a pathogen / not spread / not passed from person to another person ✓	1	2.1	ALLOW they are not infectious/contagious/transmissible													
(c)	(i)	CJD Protein/antigens are not foreign/are made by the body✓ Body/antibodies will not attack its own protein/(self)antigens ✓	2	1.1 2.1	ALLOW antibodies are only made against foreign cells/antigens/proteins													
		(ii)	Cruel / unethical ✓ Animals may not react in the same way as humans ✓	2	2 x 3.2a	<p>IGNORE references to religion/playing god etc.</p> <p>IGNORE different immune systems unqualified ALLOW may not be reproducible in humans ALLOW medicine may not work in the same way</p>												

Question		Answer	Marks	AO element	Guidance
22	(a)	<p>FIRST CHECK ANSWER ON THE ANSWER LINE If answer = 32 (%) award 2 marks</p> $\frac{4700 - 3200}{4700} \times 100$ <p>OR $\frac{1500}{4700} \times 100$ ✓</p> <p>OR 31.9 etc ✓</p> <p>32 (%) ✓</p>	2	2 x 2.2	<p>DO NOT ALLOW 32.0 (%) Clear evidence of correct rounding to 2 sig figs of an incorrect answer = 1 mark</p>
	(b)	<p>(Climate change/global warning) could cause less rain ✓</p> <p>(Low rainfall produces) higher yields / show less decrease in yield ✓</p>	2	1.1 2.1	<p>Assume they refer to hybrid rice if not stated</p> <p>ORA for inbred ALLOW hybrid only decreases by 32%/1500kg/ha ALLOW more food/rice</p> <p>If no marks awarded allow rainfall/drought will have less of an effect on rice yield/food supply</p>
	(c)	<p>(Seedbanks) contain a large store of seeds ✓</p> <p>Act as a store of biodiversity ✓</p> <p>(Could be used in the future) to breed/produce new varieties of crops / (Could be used in the future) as a supply of useful genes ✓</p>	3	1.2 1.2 2.2	<p>ALLOW preserve/conservation of seeds ALLOW contain seeds of endangered plants/prevent plants from extinction</p> <p>ALLOW maintain biodiversity</p> <p>ALLOW grow new hybrids (in the future) IGNORE grow hybrid rice ALLOW gene bank (for the future)</p>

Question		Answer	Marks	AO element	Guidance
23	(a)	<p>Any two from: Change in the (inherited) characteristics of a population over time ✓ By natural selection ✓ (May) result in a new species ✓</p>	2	2 x 1.1	AW genotype/phenotype/features for characteristics
	(b)	<p>Travelled on a voyage / studies were on islands ✓ Studied many species ✓ Animals in some areas had become better suited/adapted to their environment ✓ Documented his observations / described his theory in a book ✓</p>	4	4 x 1.2	<p>ALLOW Galapagos Islands//HMS Beagle/expeditions ALLOW named examples of plants and animals e.g. finches ALLOW struggle for existence within species/survival of the fittest ALLOW described adaptation e.g. finches beaks adapted to food source ALLOW Origin of the Species</p>

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) Identifies the production of oxygen in photosynthesis and its use in aerobic respiration. AND Provides an explanation why larger primary consumers were able to live AND Provides an explanation how secondary consumers could exist.</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) Identifies the production of oxygen in photosynthesis or its use in aerobic respiration. AND Provides an explanation why larger primary consumers were able to live OR Provides an explanation how secondary consumers could exist.</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) Identifies the production of oxygen in photosynthesis or its use in aerobic respiration. OR</p>	6	2 x 1.1 2 x 2.1 2 x 3.2b	<p>AO1.1: Demonstrate scientific knowledge and understanding of photosynthesis and respiration.</p> <ul style="list-style-type: none"> • photosynthesis will produce oxygen (rather than sulfur) • aerobic respiration needs oxygen <p>AO2.1 Apply knowledge and understanding of respiration.</p> <ul style="list-style-type: none"> • animals will be able to respire more / use more oxygen to respire (to increase their growth/biomass) • aerobic respiration makes more energy/ATP available to primary consumers • less production of lactic acid <p>AO3.2b Analyse information and ideas to draw conclusions about the evolution of consumers.</p> <ul style="list-style-type: none"> • therefore, there was more energy/ATP available for growth of primary consumers • so more energy is available to be transferred to secondary consumers, allowing them to survive

Question			Answer	Marks	AO element	Guidance
			<p>Provides an explanation why larger primary consumers were able to live</p> <p>OR</p> <p>Provides an explanation how secondary consumers could exist.</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>			
	(d)		<p>Any two from:</p> <p>(Presence of secondary consumers) the primary consumers were more likely to be eaten ✓</p> <p>(Primary consumer) best adapted more likely to survive ✓</p> <p>(Those best adapted) reproduce and pass on advantageous allele/gene ✓</p>	2	2 x 3.1b	<p>ALLOW higher level answer referring to selection pressure</p> <p>ALLOW only those with best adaptations e.g., run faster/camouflage to survive</p>

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