H

GCSE (9–1)

Biology A (Gateway)

J247/04: Paper 4 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for Autumn 2021

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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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.

1. 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

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

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

<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><table>
<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></td><td>2</td><td>2 x 2.1</td><td>More than 2 boxes ticked then each additional incorrect box negates a mark</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>(Distilled) water ✓</td><td>1</td><td>2.2</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Yes:

Increasing concentrations (of sulfur dioxide) are linked to lower rates of photosynthesis ✓

No:

Because there is no evidence that it is due to sulfur dioxide being an acid ✓</td><td>2</td><td>2 x 3.2a</td><td>

ALLOW sulfur dioxide reduces the rate of photosynthesis
IGNORE pH/acid references

ALLOW reference to a correlation and not a cause/no causal mechanism</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Use different acids ✓</td><td>1</td><td>3.3b</td><td>**IGNORE** measure the pH to show it is an acid
IGNORE repeat experiment with different concentrations of sulphuric acid</td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>18</td><td>(a)</td><td></td><td><table><tr><th>Name of disease</th><th>Cause</th></tr><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></table></td><td>3</td><td>3 x 1.1</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>Any two from:
Choose the type/correct treatment to use ✓

Stop/limit the (pathogen) spread ✓

Limit the loss of the crop✓</td><td>2</td><td>2 x 2.2</td><td>ALLOW different pathogens require different treatments
DO NOT ALLOW treat with pesticides
IGNORE destroy/isolate the crop

ALLOW stop other/more tomatoes from getting infected</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>Faster /

Reduces (human) error /

No/reduced damage to plant/leaf ✓</td><td>1</td><td>2.2</td><td>Assume new method if not stated.
ALLOW reverse argument for current method if stated.
IGNORE efficient

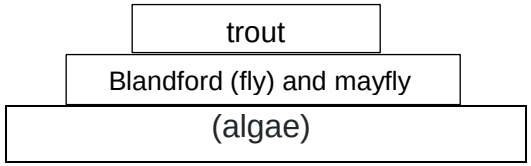
ALLOW provides quantitative data
IGNORE accurate/detailed/technological advancements</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Any wavelength in the range 725 – 900 (nm) ✓

(At this wavelength) there is a big difference between the fraction of light reflected (from each type of leaf) ✓</td><td>2</td><td>2 x 3.1b</td><td>Incorrect wavelength chosen = 0 marks

ALLOW can distinguish (each type of leaf) with correct fractions of light reflected with correct data quoted.</td></tr>
</table>

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)	**First check answer on the answer line** **If answer = 4.5 x 10^4 award 3 marks** $\frac{3 \times 10^7}{400}$ OR $\frac{30\,000\,000}{400}$ ✓ $\frac{75\,000}{100} \times 60$ OR 75 000 x 0.6 OR 75 000 x 60%✓ = 4.5 x 10^4 ✓	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)	**Any two from:** Treatment that stop cells dividing/destroy cancerous cells ✓ Removal of ovaries (because they produce oestrogen) ✓ Use drugs that block the action of oestrogen / stop oestrogen production ✓	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)		 Shape ✓ Labels ✓	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	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>21</td><td>(a)</td><td>(i)</td><td>
<table>
<tr><td>Number of people who will develop CJD.</td><td>3</td></tr>
<tr><td>Number of people that are homozygous recessive for this gene.</td><td>8✓</td></tr>
<tr><td>Number of people who are heterozygous for this gene.</td><td>3✓</td></tr>
</table>
</td><td>2</td><td>2 x 2.1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>
person B
<table>
<tr><td></td><td>d</td><td>d</td></tr>
<tr><td>person A D</td><td>Dd</td><td>Dd</td></tr>
<tr><td>d</td><td>dd</td><td>dd</td></tr>
</table>
✓

probability = 0.5 / ½ / 50% /1 in 2 / 1:1 ✓
</td><td>2</td><td>2.1

3.2b</td><td>ALLOW use of a different letter but must be same letter with clearly different upper and lower case e.g. Aa

ALLOW 50:50, $^{2}/_{4}$
ALLOW correct interpretation of probability from diagram drawn
DO NOT ALLOW correct probability from incorrect diagram</td></tr>
<tr><td></td><td>(b)</td><td></td><td>Not caused by a pathogen / not spread / not passed from person to another person ✓</td><td>1</td><td>2.1</td><td>ALLOW they are not infectious/contagious/transmissible</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>CJD Protein/antigens are not foreign/are made by the body✓

Body/antibodies will not attack its own protein/(self)antigens ✓</td><td>2</td><td>1.1

2.1</td><td>ALLOW antibodies are only made against foreign cells/antigens/proteins</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Cruel / unethical ✓

Animals may not react in the same way as humans ✓</td><td>2</td><td>2 x 3.2a</td><td>IGNORE references to religion/playing god etc.

IGNORE different immune systems unqualified
ALLOW may not be reproducible in humans
ALLOW medicine may not work in the same way</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
22	(a)		**FIRST CHECK ANSWER ON THE ANSWER LINE** **If answer = 32 (%) award 2 marks** 4700 – 3200 x 100 4700 OR 1500 x100 ✓ 4700 OR 31.9 etc ✓ 32 (%) ✓	**2**	**2 x 2.2**	**DO NOT ALLOW** 32.0 (%) Clear evidence of correct rounding to 2 sig figs of an incorrect answer = 1 mark
	(b)		(Climate change/global warning) could cause less rain ✓ (Low rainfall produces) higher yields / show less decrease in yield ✓	**2**	**1.1** **2.1**	Assume they refer to hybrid rice if not stated **ORA** for inbred **ALLOW** hybrid only decreases by 32%/1500kg/ha **ALLOW** more food/rice If no marks awarded allow rainfall/drought will have less of an effect on rice yield/food supply
	(c)		(Seedbanks) contain a large store of seeds ✓ Act as a store of biodiversity✓ (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 ✓	**3**	**1.2** **1.2** **2.2**	**ALLOW** preserve/conservation of seeds **ALLOW** contain seeds of endangered plants/prevent plants from extinction **ALLOW** maintain biodiversity **ALLOW** grow new hybrids (in the future) **IGNORE** grow hybrid rice **ALLOW** gene bank (for the future)

Question			Answer	Marks	AO element	Guidance
23	(a)		**Any two from:** Change in the (inherited) characteristics of a population over time ✓ By natural selection ✓ (May) result in a new species✓	**2**	**2 x 1.1**	**AW** genotype/phenotype/features for characteristics
	(b)		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 ✓	**4**	**4 x 1.2**	**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

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)** 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 and explanation how secondary consumers could exist. *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)** 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. *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)** Identifies the production of oxygen in photosynthesis or its use in aerobic respiration. **OR**	**6**	**2 x 1.1** **2 x 2.1** **2 x 3.2b**	**AO1.1: Demonstrate scientific knowledge and understanding of photosynthesis and respiration.** • photosynthesis will produce oxygen (rather than sulfur) • aerobic respiration needs oxygen **AO2.1 Apply knowledge and understanding of respiration.** • 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 **AO3.2b Analyse information and ideas to draw conclusions about the evolution of consumers.** • 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
			Provides an explanation why larger primary consumers were able to live **OR** Provides an explanation how secondary consumers could exist. *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.*			
	(d)		**Any two from:** (Presence of secondary consumers) the primary consumers were more likely to be eaten ✓ (Primary consumer) best adapted more likely to survive ✓ (Those best adapted) reproduce and pass on advantageous allele/gene ✓	**2**	**2 x 3.1b**	**ALLOW** higher level answer referring to selection pressure **ALLOW** only those with best adaptations e.g., run faster/camouflage to survive

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk