H

GCSE (9–1)

Biology A (Gateway)

J247/04: Paper 4 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for November 2020

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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.

Annotations

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

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

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**.

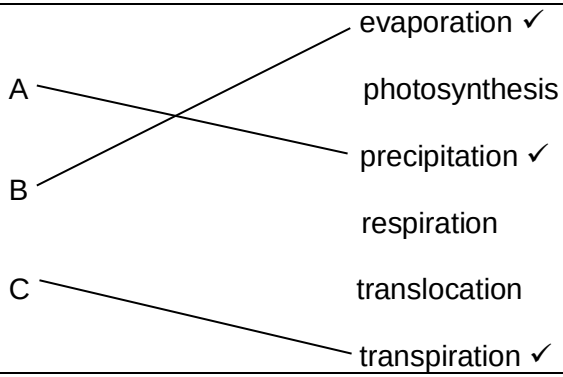
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

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

Question			Answer	Marks	AO element	Guidance
16	(a)			3	3x1.1	**Each correct line = 1 mark** **DO NOT ALLOW** more than 1 line from each letter
	(b)		prevents lake drying out / replenishes lake water / washes minerals into the lake ✓	1	1.1	**ALLOW** idea of lack of water in lake causing harm to organisms that live in the water / will provide organisms with sufficient/enough water to live in **ALLOW** idea of providing organisms with dissolved oxygen **IGNORE** will provide organisms with more water **IGNORE** nutrients
	(c)		idea that water is added from (each) lake to a (separate) Petri dish using (sterile) pipette ✓ filter paper/antibiotic disc is placed in (the centre of) each dish with the (sterile) forceps ✓ Petri dishes are incubated ✓ idea that the inhibition zone/clear area/area with no bacteria growth around the discs is measured ✓	4	4 x 1.2	**ALLOW** idea of repeats **ALLOW** idea of setting up a control

Question			Answer	Marks	AO element	Guidance
	(d)		Lake Bellandur– no mark **Any two from:** more (antibiotic) resistant bacteria / more species of bacteria are resistant to antibiotics / ORA ✓ Lower number of bacteria killed by antibiotics / less species of bacteria killed by antibiotics / ORA ✓ this lake contains a higher ratio of resistant bacteria compared to bacteria killed by antibiotics✓ (antibiotic) resistant bacteria more likely to survive/reproduce with more (antibiotic) pollution ORA✓	**2**	**2 x 3.2a**	Incorrect or no lake given then no marks **ALLOW** bacteria are more resistant (antibiotic) **DO NOT ALLOW** more resistant to bacteria **IGNORE** immune **ALLOW** only 28 species are killed **ALLOW** idea of natural selection causing increased resistant bacteria with more (antibiotic) pollution

Question			Answer	Marks	AO element	Guidance
17	(a)	(i)	Yes (no marks) cooler than black/grey skin **OR** Yes (no marks) lighter skin is cooler **OR** No (no marks) zebra skin was similar temperature to the other barrels **OR** No (no marks) idea it is warmer than the barrel covered by the white skin / ORA ✓	**1**	**3.2a**	argument must support decision
		(ii)	paint the barrels different colours rather than using the skins / use the same type of skin painted different colours **OR** idea to make sure that thicknesses/SA/V /volume/temperature of water in barrel need to be controlled ✓	**1**	**3.3a**	**ALLOW** use painted towels to cover barrels **ALLOW** for same type of skin e.g. hair-free skin
	(b)	**(i)**	**Any two from:** zebras with stripes attracts less/fewer insects / ORA✓ narrower stripes attract less insects / ORA ✓ stripe width for least number of insects/optimum protection is about 8cm / stripe width for most number of insects is about 25cm ✓	**2**	**2 x 3.1a**	**ALLOW** insect bites for insects **IGNORE** length of stripe **ALLOW** width range between 5-10cm for least number of insects / most number of insects is 22-27cm

Question			Answer	Marks	AO element	Guidance
		(ii)	stripe width of 8cm because it is the lowest point on the graph/fewest number of insects ✓	1	3.2a	**ALLOW** width tolerance between 7-9cm and least number of insects (on tape)
		(iii)	**Any three from:** stripes developed as a mutation / variation for skin stripes ✓ (animals with stripes) less likely to be bitten by insects / more healthy / spread less pathogens / ORA ✓ (striped animals) more likely to survive ✓ (striped animals) more likely to reproduce ✓ pass on allele/gene for stripes / ORA ✓ process occurs over many generations ✓	3	3 x 2.1	**ALLOW** some more striped than others **ALLOW** offspring produced / breed together **IGNORE** selective breeding **ALLOW** pass on advantageous gene **IGNORE** trait is passed on / genes are passed on **IGNORE** over time

Question			Answer	Marks	AO element	Guidance
18	(a)		<table><tr><td>bacteria in the compost kill disease causing fungi</td><td></td></tr><tr><td>the compost is sterile and so is aseptic</td><td></td></tr><tr><td>the compost provides carbon dioxide for photosynthesis</td><td></td></tr><tr><td>the compost provides minerals for the plants</td><td>✓</td></tr></table>	1	1.1	more than one box ticked = 0 marks
	(b)		normal bin has holes to allow in air / oxygen ✓ (making normal compost) so aerobic respiration occurs ✓	2	2.1 1.1	**ALLOW** converse arguments for bokashi bin **ALLOW** aerobic bacteria carry out respiration **IGNORE** bacteria work aerobically
	(c)		used the same pile of dead plant material for both composters / used same plant type / used equal mass in both composters ✓	1	2.2	**ALLOW** used the same time interval for both composters **ALLOW** used the same water/moisture content for both composters **ALLOW** idea of same external conditions e.g. put both in same place / external temperature kept the same / kept in the same environment **IGNORE** references to fair testing
	(d)	(i)	Axes – both correctly labelled, including units✓ Axes - even scales occupying more than half of the grid ✓ Plotting - all points correctly plotted ✓ Line - lines labelled or a key ✓ Line - points with curve of best-fit lines ✓	5	5 x 2.2	Must have time on x-axis and temperature on y-axis **ALLOW** +/- half a square at least 8 points correctly plotted **IGNORE** extrapolated lines

Question			Answer	Marks	AO element	Guidance
		(ii)	temperature increased as compost decomposed / bacteria released heat by respiration ✓ temperature starts to drop as decomposition slows down/complete / bacterial respiration slows ✓	2	2 x 2.1	**ALLOW** rise in temperature due to energy released by respiration ✓ **ALLOW** bacterial activity slows (if respiration already mentioned) **ALLOW** temperature starts to drop as enzymes in respiration denature at high temperatures
		(iii)	idea that decomposition in bokashi (method) bin much slower ✓ anaerobic respiration releases less heat/energy than aerobic respiration ✓	2	2 x 2.1	
	(e)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 27 (%) award 3 marks** 400 / 1500 x 100 ✓ 26.6 (%) ✓ = 27 (%) ✓	3	 **2.2** **2.2** **1.2**	**If answer = 26.6 (%) award 2 marks** **ALLOW** ECF for correct rounding
		(ii)	idea that the gas given off is carbon dioxide ✓ less greenhouse gas produced / less likely to result in global warming / less contribution to greenhouse effect ✓	2	2.2 **3.1b**	**ALLOW for 2 marks** less carbon dioxide produced which is a greenhouse gas **ALLOW** correct formula **ALLOW** explanations of the greenhouse effect **IGNORE** references to environmental damage/not environmentally friendly/pollution/not good for the environment

Question			Answer	Marks	AO element	Guidance
19	(a)		**Any two from:** anaemia / tiredness / lack of energy due to lack of red blood cells ✓ inability to fight off infections / prone to infections due to lack of white blood cells/WBC ✓ slow blood clotting due to lack of platelets ✓	2	2 x 1.1	**DO NOT ALLOW** incorrectly matched symptom to blood cell type **ALLOW** less immunity / reduced immune response / weakened immune system due to lack of white blood cells/WBC **ALLOW** (recurring) nosebleeds / bruise easily due to lack of platelets
	(b)	(i)	people may be ill with infection / have a pathogen / just recovering from infection ✓ therefore have produced more white blood cells to destroy the pathogen/produce antibodies ✓ **OR** weakened immune system/cancer/cancer treatment reducing white blood cell number so less white blood cells to defend against pathogens/produce antibodies	2	2 x 2.1	**IGNORE** fighting(off) pathogens
		(ii)	Area = 10 × 10 = 100(mm^2) Volume = 100 × 0.001 = 0.1 (mm^3) ✓	1	2.2	

Question			Answer	Marks	AO element	Guidance
		(iii)	No (no mark) 1000 ÷ 0.1 OR 1000 x 10 ✓ number of white blood cells/mm^3 is 10 x 10^3 / 1.0 x 10^4 / 10000 ✓ within the range of 6.0 – 16.0 x 10^3 ✓	**3**	**2 x 2.2** **3.2b**	**ALLOW** ECF from (ii) **ALLOW** number of white blood cells /mm^3 = 10 000 **ALLOW** within the normal white blood cell range/ 6000 – 16000
	(c)		(Fanconi anaemia) (no mark) (3 x 10^6 is a) low red blood cell count ✓ must be Fanconi anaemia because: caused by recessive allele ✓ obtained from heterozygous/carrier parents who don't have a blood disorder ✓ **OR** cannot be D-B anaemia because: neither parents have a blood disorder ✓ it is caused by a dominant allele ✓	**3**	**3 x 3.2b**	**if incorrect disorder then no marks** **IGNORE** low numbers of all cells

Question			Answer	Marks	AO element	Guidance
20	(a)		antigens are different shapes ✓ idea that antigen binding site/antibody needs to fit the antigen✓	2	2 x 1.1	**ALLOW** idea of each antigen being specific **ALLOW** idea of antigen binding site/antibody complementary to antigen **IGNORE** 'lock and key' **IGNORE** antibody bind/bonds to antigen (in stem of question)
	(b)	(i)	**Any two from:** pregnancy testing ✓ detecting diseases/cancer ✓ treating disease/cancer ✓	2	2 x 1.1	 **ALLOW** specific diseases e.g. malaria **ALLOW** pathogen identification **ALLOW** vaccine development **ALLOW** drug testing
		(ii)	they divide rapidly / rapid mitosis / divide indefinitely / can produce many cells ✓	1	2.1	

Question			Answer	Marks	AO element	Guidance
	(c)	(i)	**Any four from:** plasmid used to insert the gene ✓ restriction enzyme to cut open the plasmid / for removing the gene ✓ ligase enzyme to insert the gene / join ends of gene and plasmid ✓ correct reference to sticky ends ✓ correct reference to selection using antibiotic markers ✓	**4**	**4 x 1.1**	enzyme and role must be correct link
		(ii)	idea (this method) does not use mice / ORA ✓ people may think original method is cruel / unethical / killing mice ✓	**2**	**2.1**	**ALLOW** does not use animals **IGNORE** references to religion/playing god etc.
		(iii)	to repeat the work / make sure it is reproducible ✓ to make sure it worked / was safe ✓	**2**	**2 x 1.1**	**ALLOW** make sure work was valid **ALLOW** check for errors/mistakes **ALLOW** was correct **ALLOW** was reliable **ALLOW** was ethical **ALLOW** make sure work was original / authentic **ALLOW** recognise significance of work **ALLOW** to improve quality of report/published work

<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></td><td>smallest → largest:
nucleotide
allele
chromosome
genome</td><td>1</td><td>1.1</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>66000000 ÷ 500 = 132 000✓</td><td>1</td><td>2.2</td><td>ALLOW 0.132 million or 132 thousand</td></tr>
<tr><td></td><td>(c)</td><td></td><td>man
woman
<table><tr><th></th><th>D</th><th>d</th></tr><tr><td>d</td><td>Dd</td><td>dd</td></tr><tr><td>d</td><td>Dd</td><td>dd</td></tr></table>✓
0.5 / 50(%) ✓</td><td>2</td><td>2.2
3.1a</td><td>ALLOW appropriate use of other lower/upper case letters
ALLOW ECF
ALLOW 1 in 2 / ½ / 1:1 ✓
DO NOT ALLOW 1:2</td></tr>
<tr><td></td><td>(d)</td><td></td><td>FIRST CHECK THE ANSWER ON ANSWER LINE
If answer = 839 award 2 marks
2517/3 ✓
= 839 ✓</td><td>2</td><td>2 x 1.2</td><td>ALLOW 840 or 2521/3 ✓</td></tr>
</table>

Question	Answer	Marks	AO element	Guidance
(e)*	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)** Demonstrates a knowledge of the importance of the blood supply to the heart. **AND** Applies knowledge to explain why a failure of this blood supply can lead to heart disease. **AND** Analyses the information to explain the link between a lack of LDL protein and heart disease. *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)** Demonstrates a knowledge of the importance of the blood supply to the heart. **AND** Applies knowledge to explain why a failure of this blood supply can lead to heart disease. **OR** Demonstrates a knowledge of the importance of the blood supply to the heart. **AND** Analyses the information to explain the link between a lack of LDL protein and heart disease. **OR** Applies knowledge to explain why a failure of this blood	**6**	**2 x 1.1** **2 x 2.1** **2 x 3.1a**	**AO1.1 Demonstrate knowledge and understanding of the importance of the blood supply to the heart muscle.** • blood in the coronary artery supplies heart muscle • oxygen / glucose is supplied to the muscle • this is needed for the muscle to contract/for respiration **AO2.1 Apply knowledge and understanding of the requirements of the heart muscle** • without oxygen / glucose the heart muscle cannot respire • energy from respiration is needed for the muscle to contract **AO3.1a Analyse information and ideas to interpret the effects of lack of LDL receptor protein.** • without LDL receptor protein there will be more cholesterol in the blood / cholesterol levels will be too high to be removed/broken down • increased build up of cholesterol in the coronary artery will increase the risk of heart disease / decrease blood flow to the heart muscle

Question			Answer	Marks	AO element	Guidance
			supply can lead to heart disease. **AND** Analyses the information to explain the link between a lack of LDL protein and heart disease. *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)** Demonstrates a knowledge of the importance of the blood supply to the heart. **OR** Applies knowledge to explain why a failure of this blood supply can lead to heart disease. **OR** Analyses the information to explain the link between a lack of LDL protein and heart disease. *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*			
	(f)		low dose of the drug does not seem to have any effect✓ because the effect is very similar to the placebo ✓ high dose of the drug lowers blood cholesterol level most and would be the best way to administer the drug ✓	**3**	**3 x 3.1b**	

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