

GCSE (9–1)

Biology A (Gateway Biology)

J247/03: Paper 3 (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 for GCSE (9-1) in Biology A:

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

Question			Answer	Marks	AO element	Guidance
16	(a)	(i)	Progesterone ✓	1	1.1	
		(ii)	Maintains lining of uterus / stops the lining of the uterus breaking down ✓	1	2.1	ALLOW higher level responses e.g. inhibits the release of FSH hormone / inhibits the development of follicle in ovary ALLOW slows down the rate of egg production IGNORE thickens the lining of the uterus
	(b)	(i)	Menstrual blood cells are adult stem cells / Menstrual blood cells/adult stem cells can only form certain types of cells ✓ (Embryo stem cells) can produce a wide range of cell types ✓	2	2 x 2.1	ALLOW Menstrual blood cells can only specialise into blood cells / menstrual blood cells are multipotent/partially differentiated ALLOW Embryo stem cells can produce any type of cell / embryo stem cells are pluripotent
		(ii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 77.6 (hours) award 2 marks 4 (generations) ✓ $4 \times 19.4 = 77.6$ (hours) ✓	2	2 x 2.2	
		(iii)	$\frac{48}{19.4} = 2.5$ ✓	1	2.2	ALLOW 2.4742 etc ALLOW any correct rounding

Question		Answer	Marks	AO element	Guidance
	(iv)	<p>Any two from: Quick to culture / divide rapidly / fast growth ✓ Easily obtainable source of stem cells ✓ Frequently accessible source of stem cells ✓ Less ethical issues in obtaining them (compared to stem cells from embryo tissue) ✓</p>	2	2 x 3.1b	<p>ALLOW reverse argument for embryo stem cells if stated assume menstrual blood stem cells if not stated</p> <p>IGNORE just quicker</p> <p>ALLOW idea of less invasive technique</p> <p>IGNORE just supply more</p>

Question			Answer	Marks	AO element	Guidance
17	(a)	(i)	Photosynthesis ✓	1	2.1	
		(ii)	Oxygen stops being produced ✓	1	3.1a	ALLOW because photosynthesis produces oxygen
	(b)	(i)	Light enables the moss ball plant to float/rise ✓ Idea of slight time lag between exposure to light and floating or sinking ✓	2	2 x 3.2a	ALLOW converse arguments in the dark
		(ii)	Any two from: Idea that exposure to light produces oxygen/allows photosynthesis, so ball floats ✓ Idea that (in experiment 1) dark conditions stop photosynthesis/oxygen production causing sinking ✓ Idea that the light is shone for a longer time in experiment 2, so the ball floats for longer ✓	2	2 x 2.1	DO NOT ALLOW in the dark respiration starts Answer needs to compare the length of time the light is shone and the length of time the ball floats to score this marking point

Question		Answer	Marks	AO element	Guidance
	(c)	<p>Any three from:</p> <p>(Increased temperature) will increase photosynthesis/respiration /transpiration/water uptake ORA ✓</p> <p>Molecules move faster / increased kinetic energy ✓</p> <p>Increased rate of collisions between enzymes and substrates/ increased rate of formation of ES complexes ✓</p> <p>High temperature levels/above 37°C will stop/reduce the rate of photosynthesis/respiration ✓</p>	3	3 x 1.1	<p>ALLOW increase evaporation</p> <p>ALLOW higher level responses to high temperature effects on enzymes e.g. enzymes/structural proteins in plants may start to denature</p>

Question		Answer	Marks	AO element	Guidance	
18	(a)	<p>Any four from:</p> <p>Guard cells photosynthesise producing sugar ✓</p> <p>Water enters guard cells ✓</p> <p>By osmosis ✓</p> <p>Guard cells swells/becomes turgid ✓</p> <p>Thickened inner part of wall bends less than outer part ✓</p> <p>Guard cells curve forming opening ✓</p>	4	4 x 1.1		
	(b)	(i)	0.0314 ✓	1	2.2	
		(ii)	10 ✓	1	1.2	
		(iii)	<p>FIRST CHECK THE ANSWER ON ANSWER LINE</p> <p>If answer = 318 (stomata/mm²) award 2 marks</p> <p>318.47133 ✓</p> <p>= 318 (stomata/mm²) ✓</p>	2	2 x 2.2	<p>ALLOW ECF from (i) and (ii)</p> <p>Clear evidence of correct rounding to 3 sig figs of an incorrect answer = 1 mark</p>
		(iv)	By calculating the mean/average ✓	1	3.1b	<p>ALLOW by repeating readings / taking three counts / using (three) different areas/zones</p> <p>IGNORE reference to significant figures</p>
	(c)	(i)	Stomatal density decreases as leaf area increases ✓	1	2.1	<p>ALLOW converse</p> <p>ALLOW negative correlation</p> <p>IGNORE inversely proportional</p>

Question			Answer	Marks	AO element	Guidance
		(ii)	<p>Any two from:</p> <p>Plant A has lower range of leaf areas ✓</p> <p>Plant A has stronger correlation / more points closer to line of best fit / range of stomatal densities is less ✓</p> <p>Plant A has a higher overall stomatal density than Plant B ✓</p> <p>Reference to the gradient for plant A being steeper ✓</p>	2	2 x 3.2b	<p>ALLOW converse answers for B in each case.</p> <p>ALLOW reference to size of leaves rather than leaf area</p> <p>ALLOW data being less spread out for A, if neither of the first two marking points are scored ✓</p>
	(d)	(i)	Identifies uncertainty/variability in results / shows any overlap of data / shows how consistent the data is ✓	1	1.2	<p>ALLOW idea of how precise a measurement is / how far from the reported value the true (error free) value might be</p> <p>IGNORE gives more reliable results</p> <p>IGNORE shows the range of values</p>
		(ii)	Stomatal density and cuticle thickness do not have a relationship ✓	1	3.1b	ALLOW correct indication of answer e.g. circled or underlined

Question		Answer	Marks	AO element	Guidance
19	(a)	Idea that it allows (metabolic) reactions to proceed at appropriate rates ✓ By allowing optimum conditions for enzymes / by controlling temperature/pH ✓	2	1.1 2.1	Provides optimum conditions/temperature/pH for enzyme reactions = 2 marks
	(b) (i)	Any two from: Sweat glands close ✓ Hairs in skin become erect ✓	2	2 x 1.1	Mark the first two methods ALLOW reduced sweating / stops sweating ALLOW Shivering / a description of shivering
	(ii)	Contain elastic walls/tissues / contain muscle fibres ✓	1	2.1	
	(iii)	(hand A) Fingers/hand much cooler/lower temperature/cold ✓ As less heat brought into the hand (by the blood) ✓	2	2 x 2.1	no mark if hand B identified IGNORE reference to body temperature
	(c)	Any two from: Negative feedback process ✓ (Receptors) detect variable ✓ Compare to fixed point ✓ Idea that effectors respond to restore variable to fixed point ✓	2	2 x 2.1	ALLOW answers that specifically refer to the control of temperature or thyroxine

Question			Answer	Marks	AO element	Guidance
20	(a)	(i)	Endocrine/Adrenal ✓ Chemical ✓	2	2 x 1.1	
		(ii)	Any two from: Respiratory/air passages dilate/widen to provide the muscles with (more) oxygen ✓ Increased breathing rate/deeper breathing to provide the muscles with (more) oxygen ✓ Idea that it re-directs blood toward muscles/heart/lungs ✓ Increased heart rate/blood pressure to provide the muscles with (more) oxygen / glucose ✓ Increased breakdown of glycogen (to glucose) for the muscles to use ✓	2	2 x 2.1	
		(iii)	(Cellular) respiration ✓ Supplies ATP ✓	2	2 x 1.1	
	(b)	(i)	Left atrium ✓	1	1.1	
		(ii)	(Bicuspid) valve ✓	1	1.1	ALLOW mitral valve
		(iii)	Cardiac muscle ✓	1	1.1	

Question		Answer	Marks	AO element	Guidance
	(c) (i)	<p>Any two from: Muscles generate heat when exercising ✓ Increased heart rate to supply the muscles ✓ Dehydration produces a greater increase in heart rate and body temperature compared to normal hydration ✓</p> <p>Any two from: Higher body temperature when dehydrated is caused by a lack of water, so less sweating ✓ Dehydration/increased sweating reduces blood volume ✓ Drop in blood volume leads to increase in heart rate ✓</p>	4	2 x 2.1 2 x 3.2b	ALLOW Dehydration produces a higher heart rate and body temperature compared to normal hydration ✓
	(ii)	<p>Any two from: Correctly hydrate / take in fluid /drink (before desert marathon) ✓ Idea of (before marathon) conditioning body by increasing daily heat exposure ✓ Gradually increase the exercise intensity/duration each day ✓</p>	2	2 x 3.2a	<p>IGNORE reference to drinking during the race</p> <p>ALLOW condition body by heat acclimatization</p> <p>ALLOW avoid substances that can cause dehydration / avoid alcohol / avoid caffeine</p>

Question		Answer	Marks	AO element	Guidance
21	(a)	Plant / Photosynthetic organism ✓	1	1.1	ALLOW producers / autotrophs / green algae
	(b)	(i) Any three from: Idea that glucose might not be the only sugar in the food ✓ The colour of the food might affect the colour of the solution ✓ Different people might see colours differently ✓ Idea that (intermediate) colours are hard to judge ✓ Concentration is only given as low / intermediate and high / idea that there are only three levels given for five colours ✓	3	3 x 3.3a	ALLOW reference to colour blindness ALLOW colours may be mistaken ALLOW does not give numerical/exact/accurate concentrations
		(ii) Use a range of known concentrations of glucose solution ✓ Compare colour with a colour chart / measure how much light passes through precipitate / use a colorimeter ✓	2	2 x 3.3b	
	(c)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.75(%) award 2 marks $15 \times \frac{20}{100} = 3$ ✓ (from graph) 0.75 (%) ✓	2	2 x 2.2	ALLOW answers in range 0.7 – 0.8

Question			Answer	Marks	AO element	Guidance
22	(a)	(i)	S = DNA synthesis / replication ✓ M = movement of chromosomes / mitosis ✓	2	2 x 1.1	ALLOW chromosome replication ALLOW cytokinesis / cell division / chromosomes divided or split into two cells
		(ii)	Allows organisms to become more efficient ✓	1	1.1	
	*	(b)	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 detailed knowledge and understanding to describe protein synthesis. AND Applies knowledge and understanding of protein synthesis to explain the action of Actinomycin D. <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) Demonstrates detailed knowledge and understanding to describe protein synthesis. OR Applies knowledge and understanding of protein synthesis to explain the action of Actinomycin D. OR Demonstrates knowledge and understanding to describe protein synthesis. AND Attempts to apply knowledge and understanding of protein synthesis to explain the action of Actinomycin D.	6	2 x 1.1 4 x 2.1	AO1.1 Demonstrate knowledge and understanding to describe protein synthesis <ul style="list-style-type: none"> the unzipping of the DNA molecule around the gene copying to mRNA in nucleus (transcription) (translation) of the nucleotide sequence in the cytoplasm AO2.1 Apply knowledge and understanding of protein synthesis to explain the action of Actinomycin D/drug <ul style="list-style-type: none"> only unzipped DNA blocked so this means copying to mRNA does not happen no new mRNA made/transcription is prevented mRNA already made / DNA unwound is unaffected the mRNA already in cytoplasm can continue to translate the nucleotide sequence to form proteins on ribosomes

Question		Answer	Marks	AO element	Guidance
		<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) Demonstrates limited knowledge and understanding to describe protein synthesis.</p> <p>OR Attempts to apply knowledge and understanding of protein synthesis to explain the action of Actinomycin D.</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>DNA determines the sequence of amino acids in a protein ✓</p> <p>Order of bases (in DNA) determines the type of protein ✓</p>	2	2 x 1.1	<p>IGNORE order of bases determine which amino acids are made</p> <p>Order of bases in DNA determines the amino acid sequence = 2 marks</p>

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