

UNIT 2 – BIODIVERSITY AND PHYSIOLOGY OF BODY SYSTEMS**MARK SCHEME****GENERAL INSTRUCTIONS**Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark.

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statement. Award the middle mark in the level if most of the content statements are given and the communication statement is partially met. Award the lower mark if only the content statements are matched.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only

ecf = error carried forward

bod = benefit of doubt

Question		Marking details		Marks available														
				AO1	AO2	AO3	Total	Maths	Prac									
1	(a)			homologous - structures evolved from same structure but may have different function (1) analogous – structures evolved from different structures to carry out the same function (1)	2			2										
	(b)			<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="4">Kingdom</th> </tr> </thead> <tbody> <tr> <td>Animalia (Accept Animals)</td> <td>Fungi</td> <td>Plantae (Accept Plants)</td> <td>Protoctista</td> </tr> </tbody> </table> <p>All 4 correct = 2 marks; 3 or 2 correct = 1 mark; 1 or 0 correct = 0 marks</p>	Kingdom				Animalia (Accept Animals)	Fungi	Plantae (Accept Plants)	Protoctista	2			2		
Kingdom																		
Animalia (Accept Animals)	Fungi	Plantae (Accept Plants)	Protoctista															
	(c)	(i)		phylogenic tree (Accept phylogenetic) / cladogram (1)	1			1										
		(ii)		Three Domain Theory	1			1										
	(d)			Compare nucleotide / base <u>sequences</u> of DNA in the gene(1) Organisms within a domain have a greater similarity to each other than with other domains (ORA) (1)	2			2		2								
	(e)			Phospholipids would have ether bonds and branched fatty acid side chains (1) More resistant to chemical effects and high temperatures due to ether bonds (1) Cell membrane less permeable at high temperatures as molecules less able to move (1)			3	3										
				Question 1 total	8	0	3	11	0	2								

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)		Measure length and convert to μm (1) Divide by actual size (1) Record answer with 3 sig figs (1) Max 2 if not given as 3 sig figs. length = 43mm x 1000 = 43 000 / 65 = 661.54 = x 662		3		3	3	3
	(b)	(i)	Lower water potential in guard cells so water moves in by osmosis (1) Cells become turgid and open stomata (1)		2		2		
		(ii)	Stomata stay open for entry of fungal hyphae (1) Increases chance of fungus being able to infect the plant(1)		2		2		
	(c)	(i)	Any 2 from Some water absorbed is used for photosynthesis (1) Some water is used to maintain turgidity(1) Some water produced in respiration(1)		2		2		
		(ii)	<u>Adapting method:</u> Cover different surfaces of leaves with Vaseline(1) Measure reduction in mass over same period of time(1) Calculate % decrease in mass(1) <u>Reaching conclusions:</u> Compare (%) decrease in mass from shoots treated in different ways(1) Covered surface that has lowest (%) decrease in mass has lost least water therefore has most stomata(1) Allow ecf if % decrease in mass not calculated			5	5		5
			Question 2 total	0	9	5	14	3	8

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Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)	endopeptidases (1) that break peptide bonds within / not at the ends of the protein (1)	2			2		
		(ii)	to prevent autolysis of tissues (1) pepsin (activated by) hydrochloric acid (1) trypsin (activated by) enterokinase (1)	3			3		
	(b)		villus reduced in size so causing a reduced surface area (1) for final stage digestion of disaccharides and dipeptides (1) and reduced absorption of sugars needed for respiration / release of energy – fatigue (1) and amino acids required for growth (1)		4		4		
	(c)		200 cm ³ of milk contains 24 / 100 * 1050 = 252mg calcium(1) 1 mg = 200/252 * 1050 = 833.3 = 833cm ³ (1) OR 1% = 200/24 = 8.33 cm ³ 100% = 8.33x 100 = 833.3 = 833cm ³		2		2	2	
Question 3 total				5	6	0	11	2	0

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
4	(a)		Any 2 from water more dense than air so diffusion rates much slower (1) water is more dense/viscous than air so more difficult to ventilate gas exchange surface (1) water contains only 1% oxygen, air 24%(1)	2			2		
	(b)	(i)	<i>Parallel flow</i> , water and blood in gills flow in same direction (1) <i>Counter current</i> , water and blood flow in opposite directions (1) Concentration gradient maintained over entire distance travelled by water over gills (1)	3			3		
		(ii)	Uses forward movement to maintain flow of water over gills (1)		1		1		
	(c)		Any 5 from: mackerel lives in cold waters with a higher O ₂ concentration than the leopard shark (1) to respond to more active lifestyle, mackerel haemoglobin dissociates more easily at higher pO ₂ than the leopard shark (1) leopard shark haemoglobin has a higher O ₂ affinity than that of the mackerel (1) leopard shark can absorb O ₂ more efficiently from warm, low O ₂ waters than mackerel (1) but cannot release O ₂ as easily as mackerel at low pO ₂ (1) doesn't need to due to feeding on slow –moving animals (1) Accept reverse arguments		4	1	5		
Question 4 total				5	5	1	11	0	0

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Question			Marking details			Marks available									
						AO1	AO2	AO3	Total	Maths	Prac				
5	(a)	(i)	Any two for one mark (1) nitrates phosphates magnesium iron potassium Accept correct chemical formulae			1			1						
		(ii)	<table border="1"> <thead> <tr> <th>adaptation</th> <th>reason</th> </tr> </thead> <tbody> <tr> <td>thin walled</td> <td>shorter pathway to reach cell membrane (1)</td> </tr> <tr> <td>large number of mitochondria</td> <td>provide ATP for active transport (1)</td> </tr> <tr> <td>thin cuticle</td> <td>ions can come into contact more easily with transport proteins in cell membrane (1)</td> </tr> </tbody> </table>	adaptation	reason	thin walled	shorter pathway to reach cell membrane (1)	large number of mitochondria	provide ATP for active transport (1)	thin cuticle	ions can come into contact more easily with transport proteins in cell membrane (1)	3			3
adaptation	reason														
thin walled	shorter pathway to reach cell membrane (1)														
large number of mitochondria	provide ATP for active transport (1)														
thin cuticle	ions can come into contact more easily with transport proteins in cell membrane (1)														
	(b)	(i)	apoplast and symplast pathways correctly labelled (1)			1			1						
		(ii)	{Casparian strip or band / layer of suberin} in endodermal cells is water proof (1)			1			1						
	(c)		hyphae can absorb mineral ions from a larger volume of soil than root hairs (1) hyphae carry more ions to plant than it could otherwise take up (1) plant can absorb ions faster than possible without hyphae (1) hyphae within plant tissues have more protection than those in soil (1) hyphae can absorb sugars / nutrients from plant cells / vascular tissue / phloem (1)				5		5						

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			(parasitic) because hyphae penetrate cells / tissues of the host and derive nutrition from the host cells (1)			1	1		
	(e)			Alga: autotrophic - because it can carry out photosynthesis (1) heterotrophic - because it can grow in the dark so must be able to absorb and utilise glucose / nutrients from the culture medium (1) Fungus: saprotrophic - because it secretes cellulase / enzymes to digest the material on which it grows (1) heteterotrophic - because it is using complex / organic compounds that it cannot produce itself (1)		2	2	4		
				Question 5 total	6	7	3	16	0	0

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6	(a)		The number and variety of organisms found within a specified geographic region(1)	1			1		
	(b)		<p>mean = $137/5 = 27.4$ in $10\,000\text{m}^2$ (1) multiply by $1\,000\,000 / 10\,000 = 100$ (1) $27.4 \times 100 = 2740$ (1)</p> <p>or</p> <p>Total = 137 in $50\,000\text{m}^2$ (1) Multiply by $1\,000\,000 / 50\,000 = 20$ (1) $137 \times 20 = 2740$ (1)</p>		3		3	3	
	(c)		<p>Estimate is likely to be an underestimate, so decision may not be valid(1) Only surveyed a very small area of the reef and total reef area is very Large/ only surveyed 5 out of nearly 3000 reefs (1) Wide range in results (1) Only counted visible starfish (1)</p>			4	4		4
			Question 6 total	1	3	4	8	3	4

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
7			<p>Indicative content</p> <p>Cardiac muscle is myogenic and can contract without external stimulation.</p> <p>Structure A is the sino-atrial node, that acts as a natural pacemaker to control the rate of contraction. It does this by generating an electrical impulse that is transmitted across the atria. As the impulse travels across the atria it causes them to contract more or less simultaneously forcing the atrio-ventricular valves to open and to move blood into the ventricles. After 0.045s the impulse arrives at structure B which is the atrio ventricular node.</p> <p>There is a layer of connective tissue between the atria and the ventricles that prevents the impulse from travelling directly to the ventricles.</p> <p>There is a delay of 0.12s between the impulse arriving and leaving the AVN. This allows the atria to contract completely and the ventricles to fill with blood before they contract.</p> <p>It takes 0.04s for the impulse to be transmitted down the Bundle of His/ Purkinje fibres to structure C, the base of the ventricles and then another 0.04s to be transmitted to structure D the top of the ventricles. This causes the ventricles to contract from the base upwards to ensure that blood is forced upwards into the arteries. At the same time this closes the atrioventricular valves to ensure the blood flows in only one direction through the heart.</p>	3	6		9		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				<p>7-9 marks All structures involved in the transmission of electrical impulses through the heart are clearly and correctly identified including the connective tissue between the atria and ventricles. In addition, their role in generation and transmission of an electrical impulse is explained in detail. The candidate's account clearly relates the transmission of the impulse to the effect on blood flow in terms of atrial and ventricular contraction and the reasons for the delay in transmission at the AVN, simultaneous contraction of the atria and contraction of the ventricles from the base upwards. The answer includes correct use of the data provided.</p> <p><i>The candidate constructs an articulate, integrated account, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.</i></p> <p>4-6 marks The candidate identifies the structures involved in transmission of an electrical impulse through the heart and describes in detail the path taken by the impulse. The significance of simultaneous contraction of the atria and contraction of the ventricles from the base upwards is explained but may not be fully related to the times given in the question although some attempt is made to use the data.</p> <p><i>The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.</i></p>						

Question				Marking details	Marks available						
					AO1	AO2	AO3	Total	Maths	Prac	
				<p>1-3 marks Structures A to D are identified correctly and some attempt is made at describing their role in the transmission of an electrical impulse through the heart. Some indication is made as to how blood flows through the atria and ventricles but little or no use is made of the data to explain the significance of the delay at the AVN or the reasons for simultaneous contraction of the atria and / or contraction of the ventricles from the base upwards.</p> <p><i>The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.</i></p> <p>0 marks <i>The candidate does not make any attempt or give a relevant answer worthy of credit.</i></p>							
				Question 7 total	3	6	0	9	0	0	

COMPONENT 2: BIODIVERSITY AND PHYSIOLOGY OF BODY SYSTEMS - SUMMARY OF ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	8	0	3	11	0	2
2	0	9	5	14	3	8
3	5	6	0	11	2	0
4	5	5	1	11	0	0
5	6	7	3	16	0	0
6	1	3	4	8	3	4
7	3	6	0	9	0	0
TOTAL	28	36	16	80	8	14