COMPONENT 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 (apart from the questions where a level of response mark scheme is applied).

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 and 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)*	(i)		Phylogenic/ phylogenetic tree (1)	1			1		
		(ii)		Protoctista, Plantae, Prokaryotae, Fungi All correct 2 marks 2/3 correct 1 mark	2			2		
	(b)			{*Neofelis nebulosa* / Clouded Leopard} and {*Uncia uncia* / Snow Leopard}(1) different genus names to the tiger (1)		2		2		
	(c)			Model B **+** Tiger and snow leopard have the most bases in common (1)			1	1		
	(d)			ribosomal RNA (1) transfer RNA (1)	2			2		
				Question 1 total	**5**	**2**	**1**	**8**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)			Transpiration (1)	1			1		
	(b)	(i)		Volume of water = (151 x 3.14 x 0.5^2) (1) divided by 5 (1) = 23.7 (1)		3		3	3	3
		(ii)		Wind removed water vapour from leaf surface / removes diffusion shells /removes water molecules from the leaves microclimate (1) Increased {diffusion gradient/ water potential} between inside and outside of leaf (not: blows water away) (1) Therefore more water lost and more water taken up to replace it(1)		3		3		
	(c)	(i)		[K+] (actively) pumped into cells {which lowers the cell water potential /draw water in by osmosis} (not: move in/diffuse) (1)	1			1		
		(ii)		[water potential] decreased to draw water in (from adjacent cells) (1)	1			1		
		(iii)		[uneven thickness] inner wall is thicker causing cells to {bend/curve} (not: open) (1)	1			1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			Cover top surface of leaf with Vaseline / grease on one plant and bottom surface of leaf on another (1) Calculate the rate of water uptake for both (1) Rate of water uptake would be lower when lower surface is covered as this is where most stomata are (1)			3	3		3
	(e)	(i)		Xerophytes (1)	1			1		
		(ii)		Thick (waxy) cuticle (1) **Reduce** evaporation (1) NOT stop Sunken stomata(1) Increase humidity outside stomata / reduce {diffusion gradient/ water potential gradient} (1) Hairs surrounding stomata / on lower leaf surface (1) Trap moisture / increase humidity in stomatal pit/ reduces water potential gradient (1)		6		6		
				Question 2 total	**5**	**12**	**3**	**20**	**3**	**6**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		Alkaline {mucus / secretions}/ bile from gall bladder/ Brunners Gland (1)	1			1		
		(ii)		Nutrients digested (1) Into amino acids /fatty acids/ acid products (1)		2		2		
	(b)	(i)		C and D (1)	1			1		
		(ii)		Thick cuticle / secretes mucus to withstand acid / alkaline pH/ host immune system (1) Scolex / hooks and suckers to attach to gut wall / prevent being removed by peristalsis (1)	2			2		
	(c)	(i)		Increase the chance of infecting a secondary host/ many will die (1)	1			1		
		(ii)		50 000 x 6 x 365 x 25 (1) = 2 737 500 000 (1) = 2.7×10^9 (1) Max 2 if answer not given in standard form Max 2 if answer not rounded to 2 sig figures eg 2.737×10^9		3		3	3	
	(d)			(Heterotrophic) both obtain their energy and raw materials from other organisms (1) Holozoic nutrition involves ingesting and then digesting food internally (1) *Taenia* only absorbs pre-digested nutrients (1)		3		3		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(e)			more likely omnivore because it has incisors and sharp pre-molars for biting and cutting food indicates animal material in diet and grinding surfaces of rear premolars and molars indicate plant material in diet (1) {gut length / ratio of body length : gut length} intermediate between omnivore and carnivore (but closer to that of a carnivore (1)			2	2		
				Question 3 total	**5**	**8**	**2**	**15**	**3**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		Insects – (ends of)tracheoles and Mammals – alveoli (1)	1			1		
		(ii)		Protection of gas exchange surface (1) Reduce heat / water loss (1)	2			2		
	(b)			Mammals can absorb more O_2 from air than insects (1) Mammals need a smaller surface area:volume ratio to absorb sufficient oxygen(1) Circulatory system can transport oxygen to all tissues but in insects relies on diffusion alone (1) The haemoglobin in mammals increases volume of O_2 that can be absorbed / transported (1)		1	3	4		
	(c)			Single (1)	1			1		
	(d)			Large surface area provided by gill filaments and lamellae (1) Extensive network of blood capillaries (1) Maintain (oxygen/concentration) gradient along whole length of capillaries/filament (1) blood flow in opposite direction to water/ description of countercurrent(1)	4			4		
				Question 4 total	**8**	**1**	**3**	**12**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			**Biodiversity:** The number of species and number of organisms within each species found within a specified geographic region (1) **Extinction:** All individuals of a species are dead / species which has no living members (1)	2			2		
	(b)	(i)		**Calculation of N(N-1)** = 167 x 166 = 27722 (1) **Calculation of Σn(n-1)** = 1332 + 420 + 1260 + 132 + 3660 = 6804 (1) **Calculation of Diversity Index** 1 – (6804/27722) = 0.75 (1) Max 2 for correct process but incorrect answer		3		3	3	3
		(ii)		Biodiversity has decreased (1) Elder has increased in number/ ivy covers more plants/ less hazel – open structure/ more hawthorn – dense structure (1) Caused increased shade so other plants can't get enough light (1)		2	1	3		
	(c)			Take random distances along hedge (1) Use same technique with net at each position (1) Classify and count organisms found (1)			3	3		
				Question 5 total	**2**	**5**	**4**	**11**	**3**	**3**

Question	Marking details	Marks Available					
		AO1	AO2	AO3	Total	Maths	Prac
6	Indicative content • Tadpole haemoglobin has a higher oxygen affinity than adult frog haemoglobin at a given partial pressure of oxygen which enables it reach a higher % saturation with oxygen than the adult frog • This can be seen from the graph at any pH, as the dissociation curve for tadpole haemoglobin lies to the left of that for adult frog haemoglobin and reaches a higher % saturation • Tadpoles live in water with a low pO_2 and this enables the tadpole to absorb oxygen more efficiently than adult frogs • Adult frogs that are able to breathe air with a higher pO_2 do not need as high an O_2 affinity because of the higher O_2 content of air • Due to its higher O_2 affinity, tadpole haemoglobin does not dissociate and release O_2 as easily as adult frog haemoglobin • This can be seen from the graph as % saturation does not fall, showing dissociation, until pO_2 is very low while the % saturation of adult frog haemoglobin decreases at higher pO_2 showing that it dissociates more easily than tadpole haemoglobin –this is due to its lower O_2 affinity • To meet changing oxygen needs, adult frog haemoglobin dissociates more easily as pH decreases – this fall in pH would be caused by an increase in pCO_2 release during respiration.	2	5	2	9		

				• This is called the Bohr Shift / Effect and enables the adult frog to increase O_2 availability to muscles and tissues if the O_2 demand increases • Tadpole haemoglobin shows the opposite effect – as pH decreases O_2 affinity increases; • This enables the tadpole to absorb more O_2 if pO_2 falls, i.e. the water where it lives becomes more anaerobic. As a result, if O_2 levels become lower the tadpole is still able to absorb enough O_2 for respiration.						
				7-9 marks Clear and detailed explanations are given of why tadpoles need haemoglobin with a high O_2 affinity while adult frog haemoglobin does not need to be as high. The effect of pH on oxygen affinity and the dissociation of oxyhaemoglobin are also explained in detail. Explanations must include clear references to the information provided and the advantages that these adaptations give to the larval and adult frogs. *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, 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.*						

				4-6 marks A partial explanation of the links between low O_2 content of water and high O_2 content of air and the oxygen affinity of tadpole and frog haemoglobin. Some explanation of the effect of pH on oxygen affinity and dissociation of haemoglobin is made together and an understanding of the advantage to the larval and adult frog is communicated. References to the information provided are made to support explanations given. *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.* **1-3 marks** A limited understanding of the need for different oxygen affinities and dissociation of haemoglobin in larval and adult frogs is communicated. Some reference is made to the information provided but the understanding of the effect of pH is limited or incorrect. An attempt is made to link between the changes described and the advantages to the tadpole and adult frog. *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.* **0 marks** *The candidate does not make any attempt or give a relevant answer worthy of credit.*						
				Question 6 total	**2**	**5**	**2**	**9**	**0**	**0**

COMPONENT 2: BIODIVERSITY AND PHYSIOLOGY OF BODY SYSTEMS

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	5	2	1	8	0	0
2	5	12	3	20	3	6
3	5	8	2	15	3	0
4	8	1	3	12	0	0
5	2	5	4	11	3	3
6	2	5	2	9	0	0
TOTAL	**27**	**33**	**15**	**75**	**9**	**9**