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# **GCE AS MARKING SCHEME**

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**SUMMER 2016**

**BIOLOGY - NEW AS UNIT 2  
2400U20-1**

## **INTRODUCTION**

This marking scheme was used by WJEC for the Summer 2016 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

**WJEC GCE AS BIOLOGY  
UNIT 2**

**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		60 000 : 1 Accept correct ratio not to 1 e.g. 120 000:2		1		1	1	
		ii		<i>Advantage:</i> Any one from: Reduces water loss/ allows them to live in arid conditions (1) No {blood / circulatory system/ pigment} required (1) Oxygen supplied directly to the cells/ muscles (1) Tracheoles go directly into cells/ tissues (1) <i>Disadvantage:</i> Size/ shape limitation (1)	2			2		
	(b)			<b>Any 3 (x1) from:</b> <ul style="list-style-type: none"> <li>• Diffusion of gases related to Surface Area (1)</li> <li>• Oxygen use related to volume (1)</li> <li>• Amoeba has large Surface Area : volume ratio (1)</li> <li>• Therefore diffusion of gases sufficient (to supply demand) (1)</li> <li>• Short diffusion distance (1)</li> </ul>	3			3		
	(c)			Ventilation (movements/system)/ description of replacing oxygen in alveoli/ ORA for carbon dioxide (1) {Blood/ transport system} (takes oxygen away from respiratory surface)/ ORA for carbon dioxide/ or description of (1)	2			2		

Question			Marking Details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)		<b>Any two (x1) from:</b> <ul style="list-style-type: none"> <li>Low body temperature (1)</li> <li>Metabolic rate low / example of (metabolic) reactions not required/ working at lower rate(1)</li> <li>Less energy required for support / fish are buoyant (1)</li> </ul> ORA for dog Reject dogs move more than fish/ dogs are more active than fish/ more oxygen needed for respiration		2		2		
	(e)		1. Mammalian (red blood cells) evolved when O <sub>2</sub> levels were lower/ ORA (1) 2. {Biconcave/shape} increases surface area (for increased O <sub>2</sub> absorption) (1) 3. No nucleus + can carry more haemoglobin (so increased O <sub>2</sub> transport) / ORA(1) 4. Thin centres/small/ biconcave so short diffusion distance (so faster diffusion) (1) 5. Small(er) in size so have a higher sa : vol ratio (1) 6. Small(er), {so more of them/ total surface area larger} (1) Accept ref. to smaller capillaries qualified/ biconcave shape gives flexibility to fit through capillaries		4		4		
			<b>Question 1 total</b>	<b>7</b>	<b>7</b>	<b>0</b>	<b>14</b>	<b>1</b>	<b>0</b>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	i		Hypothesis 2, Because all three mutations only occur once. (In hypothesis 1 would need to occur twice)/ mutations occur just before the branch of mammals and dolphins/ OWTTE		1		1		
		ii		Compare amino acid {sequence/ order} in a (specific) protein (1) Greater similarity more closely related/ more recent common ancestor (1) OR Antibody antigen precipitation test(1) More precipitate the more related they are (1)	2			2		2
	(b)	i		Any three (x1)from: <ul style="list-style-type: none"><li>• HIV 1 has evolved from chimp (SIV) (1)</li><li>• HIV2 has evolved from monkey (SIV) (1)</li><li>• HIV1 and HIV 2 have evolved several times/ 5 strains of HIV (1)</li><li>• 3 different origins for HIV1/ 2 different origins for HIV2 (1)</li><li>• All forms of HIV from one common ancestor (1) must be correct context</li></ul>			3	3		
		ii		Predict when next mutation may occur	1			1		
		iii		SIV must have been evolving for a longer period/ ORA			1	1		
				Question 2 total	3	1	4	8	0	2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	i		Dependent Variable = numbers of each species (1) Independent Variable = (presence of) pollution (1)	2			2		2
		ii		Some easier to catch than others / misidentification/ recounting/ they move around/ camouflaged	1			1		1
		iii		Calculation of $N(N-1) = 22350$ (1) Calculation $\sum n(n-1) = 6926$ (1) calculation diversity index = 0.69 (1)		3		3	3	
		iv		biodiversity was low(er)/ the {number/types} of species were low(er).		1		1		
		v		There had been a mathematical error (1) highest possible diversity index is 1 (1)		2		2	2	
	(b)	i		<b>Any two (x1) from:</b> The existence of a number of distinct (inherited) varieties (coexisting in the same population in a single species)/ snails {are different colours/ have different bands}/ different morphology/ different phenotypes(1) at frequencies too great to be explained by recurrent mutation (1) multiple alleles for the same gene(1)	2			2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	b	ii		<ul style="list-style-type: none"> <li>Different {colours / banding/ features} give (a selective) advantage in different habitats/ different colours are camouflaged in different habitats (1)</li> <li>Habitats vary depending on times of the {year / seasons} and so different colours will have an advantage (1)</li> <li>{Main predator / thrush} will predate different forms of the snail in {different areas / different seasons} (1)</li> </ul>		3		3		
				<b>Question 3 total</b>	<b>5</b>	<b>9</b>	<b>0</b>	<b>14</b>	<b>5</b>	<b>3</b>



Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	i		Some water used by {photosynthesis/metabolic reactions}/ water produced in respiration/ measures the rate of absorption not the rate of transpiration		1		1		
		ii		<b>Any 3 (x1) from:</b> humidity/ or description (1) wind/ air currents (1) surface area of leaves (1) age of leaves (1) Accept air pressure NOT same number/ mass of leaves/ length of stem/ plant	2	1		3		3
	(b)			Lower surface of oak leaf shaded/ or description of/ ORA (1) so higher density of stomata to reduce water loss (1) OR neither surface of wheat shaded/ or description of (1) equal distribution of stomata water loss equal both sides (1)		2		2		

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)		1. (Potassium ions/ malate) reduce water potential in (guard) cell (1) Accept osmotic pressure increases/ osmotic potential decreases/ solute potential decreases/ hypertonic to outside 2. water moves in by osmosis (down water potential gradient) (1) 3. (Turgor) pressure inside (guard) cell increases/ cells become turgid (1) NOT cells expand 4. ends of guard cell have a thinner wall than centre/ ORA (1) 5. ends of guard cell expand and stomata opens (1)	3		2	5		
	(d)	i	$2 \times \pi \times 2 \times 423 = 5312.9$ (1) $= 5310$ ( to 3 sig figs) (1) Allow 5320 if they use value of $\pi$ from calculator. 5310/ 5320 = 2 marks 5312.9/ 5313/ 5315.6/ 5316 = 1 mark Evidence of $2 \pi r \times 423 = 1$ mark		2		2	2	
		ii	(water molecules) escape more readily from) species B because it has larger (total) circumference. Ecf if calculation incorrect in (i)		1		1		
			<b>Question 4 total</b>	<b>5</b>	<b>7</b>	<b>2</b>	<b>14</b>	<b>2</b>	<b>3</b>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	i		% O <sub>2</sub> saturation stays above 95% at altitudes/ O <sub>2</sub> affinity stays high up to 1500m/ Enables humans to {live/ survive} at altitude		1		1		
		ii		Increased red blood cell count/ more haemoglobin/ haemoglobin has an increased affinity for oxygen		1		1		
		iii		(gut lumen) highly anaerobic/ low concentration of oxygen (in gut) (1) higher affinity (for O <sub>2</sub> than humans)/ can absorb any available O <sub>2</sub> / higher saturation at lower partial pressures (1)		2				
	(b)	i		{Structures / molecules} with no close phylogenetic links / have evolved from different origins/ different structures/ ref to analogous structures(1) adapted to carry out {same/ similar} function (1)	2			2		
		ii		As temp rises {higher ppO <sub>2</sub> / higher concentration of oxygen} (needed {to fully saturate/ reach saturation/ reach 96%}).		1		2		
		iii		As temperature rises more O <sub>2</sub> released (to tissues).		1		1		
				<b>Question 5 total</b>	<b>2</b>	<b>6</b>	<b>0</b>	<b>8</b>	<b>0</b>	<b>0</b>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	i		<p>K<sup>+</sup> (mainly) transported (upwards) in xylem (1)</p> <p>K<sup>+</sup> only moves {laterally / sideways} into phloem from xylem/</p> <p>K<sup>+</sup> does not move up or down in the phloem (1)</p>			2	2		
		ii		<p>To show that the waxed paper stops the movement/ owtte (1)</p> <p>Shows that separating the xylem and phloem (and then putting back into contact) does not affect movement (1)</p> <p><i>If when separated they return back together</i></p> <p>Values would be the same at all points (1)</p> <p><i>If stay separated</i></p> <p>Expect values to be the same in xylem and phloem as in previous experiment (1)</p>			2	2		2
	(b)	i		<p>No / little transport in xylem (1)</p> <p>transport in phloem in <b>both</b> directions (1)</p>			2	2		
		ii		<p>Analyse samples from (above and) below the lower leaf (1)</p> <p>If both positive then movement in both directions (1)</p>			2	2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			Any 5 from: 1. In summer, leaves {photosynthesise / make sugars} {loaded/ moved into} {phloem / sieve tubes} (1) 2. Water potential falls water absorbed by osmosis (1) Must be in phloem or sieve tubes 3. Reference to hydrostatic pressure (1) 4. Flow (in sieve tubes) from high to low pressure regions (1) 5. tubers (sucrose) converted into starch (1) 6. water potential rises + water lost (1) 7. (Sugars in tubers)allows (rapid) growth (in spring) / sugars used to form cellulose for growth/ sugars for respiration (1)	3	2		5		
				<b>Question 6 total</b>	<b>3</b>	<b>2</b>	<b>8</b>	<b>13</b>	<b>0</b>	<b>2</b>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7				<ul style="list-style-type: none"> <li>Pepsin in stomach, hydrolyses peptide bonds breaking down polypeptides into shorter chains of amino acids.</li> <li>The pancreas produces proteases such as trypsin which breaks down polypeptide chains into shorter chains.</li> <li>Cells in small intestine secrete peptidases which complete the breakdown of polypeptides into amino acids.</li> <li>Ref to exopeptidases and endopeptidases.</li> <li>Amino acids absorbed into the blood from small intestine transported to the muscles.</li> </ul> <ul style="list-style-type: none"> <li>Cows large numbers of bacteria are produced in the first three chambers of the 'stomach'</li> <li>make protein using urea</li> <li>when the bacteria pass into the true stomach they are killed by the acid.</li> <li>Proteins {in/ from} the bacteria are then digested and absorbed</li> </ul> <ul style="list-style-type: none"> <li>Horses do not have saliva containing urea</li> <li>This explains why horses need more protein in food than cows</li> <li>In horses the bacteria are found in the caecum/ large intestine</li> <li>Protein in these bacteria are lost in the faeces because no digestion or absorption takes place in the large intestine.</li> <li>This explains why horse manure has a higher levels of organic nitrogen.</li> </ul>	3	4	2	9		
				<p><b>7-9 marks</b></p> <p>Detailed explanation of protein digestion</p> <p>Explanation of use of urea by bacteria in cow/ digestion of bacteria</p> <p>Explanation of increased protein in diet of horse/ nitrogen content in manure of horse</p> <p><i>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.</i></p>						

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				<b>4-6 marks</b> Any two from: Explanation of protein digestion Brief explanation of use of urea by bacteria in cow/ digestion of bacteria Brief explanation of increased protein in diet/ nitrogen content in manure  <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>						
				<b>1-3 marks.</b> Any one from: Brief explanation of protein digestion Brief explanation of ruminant digestion Brief explanation of increased protein in diet/ nitrogen content in manure  <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>						
				<b>0 marks</b> <i>The candidate does not make any attempt or give a relevant answer worthy of credit.</i>						
				<b>Question 7 total</b>	<b>3</b>	<b>4</b>	<b>2</b>	<b>9</b>	<b>0</b>	<b>0</b>

## SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	7	7	0	14	1	0
2	3	1	4	8	0	2
3	5	9	0	14	5	3
4	5	7	2	14	2	3
5	2	6	0	8	0	0
6	3	2	8	13	0	2
7	3	4	2	9	0	0
<b>TOTAL</b>	<b>28</b>	<b>36</b>	<b>16</b>	<b>80</b>	<b>8</b>	<b>12</b>