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# **GCE AS MARKING SCHEME**

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**SUMMER 2016**

**BIOLOGY - NEW AS UNIT 1  
2400U10-1**

## **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 NEW AS BIOLOGY  
UNIT 1 – BASIC BIOCHEMISTRY AND CELL ORGANISATION**

**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)	Telophase (1) Accept cytokinesis Metaphase (1) Any reference to meiosis – penalise 1 mark	2			2		
		(ii)	Chromosomes Accept chromatids Reject chromatin/ spindle fibres		1		1		
		(iii)	DNA is found( in other parts of the cell)(1) in mitochondria (1) Reject chloroplast		2		2		
	(b)		(4 days = 96 hours) 96/19 = 5 cycles (accept 5.05 cycles) Evidence of 5 cycles e.g. 96/19 or 5 cycles/ 5.05 cycles/ 5.1 cycles = 1 mark  30 000 x 2 <sup>5</sup> (accept 30 000 x 2 <sup>5.05/5.1</sup> ) = 960 000/ 996 000/ 1 028 902 = 2 marks  = 9.6 x 10 <sup>5</sup> cm <sup>-3</sup> (accept 9.96 x 10 <sup>5</sup> cm <sup>-3</sup> / 1.0 x 10 <sup>6</sup> ) = 3 marks		3		3	3	
			<b>Question 1 total</b>	<b>2</b>	<b>6</b>	<b>0</b>	<b>8</b>	<b>3</b>	<b>0</b>

Question			Marking details	Marks Available																	
				AO1	AO2	AO3	Total	Maths	Prac												
2	(a)		<p>genetic material in the epithelial cell is DNA (1)</p> <p><b>Any 3 ( x1) from:</b></p> <table border="1"> <thead> <tr> <th>DNA/ epithelial cell</th> <th>RNA/ virus</th> </tr> </thead> <tbody> <tr> <td>double stranded/double helix</td> <td>single stranded (1)</td> </tr> <tr> <td>deoxyribose</td> <td>ribose (1)</td> </tr> <tr> <td>contains thymine</td> <td>contains uracil (1)</td> </tr> <tr> <td>Larger/ longer molecule</td> <td>Smaller/ shorter molecule (1)</td> </tr> <tr> <td>(Genetic material contained in nucleus)</td> <td>Genetic material not {contained in nucleus/ membrane bound} (1)</td> </tr> </tbody> </table> <p>Answers must be comparative (apart from fifth MP)</p> <p>Reference to prokaryotic cells is neutral</p>	DNA/ epithelial cell	RNA/ virus	double stranded/double helix	single stranded (1)	deoxyribose	ribose (1)	contains thymine	contains uracil (1)	Larger/ longer molecule	Smaller/ shorter molecule (1)	(Genetic material contained in nucleus)	Genetic material not {contained in nucleus/ membrane bound} (1)	4			4		
	DNA/ epithelial cell	RNA/ virus																			
double stranded/double helix	single stranded (1)																				
deoxyribose	ribose (1)																				
contains thymine	contains uracil (1)																				
Larger/ longer molecule	Smaller/ shorter molecule (1)																				
(Genetic material contained in nucleus)	Genetic material not {contained in nucleus/ membrane bound} (1)																				
(b)	(i)	{Endocytosis/phagocytosis} Accept micropinocytosis	1			1															
		(ii)	<p><b>Any four (x1) from:</b></p> <ol style="list-style-type: none"> <li>(Viral) RNA acts as a template (1)</li> <li>(Free RNA nucleotides attach to their) complementary base pairs (1) Reject DNA</li> <li>Adenine with uracil <u>and</u> cytosine with guanine (1) Accept A:U, C:G</li> <li>RNA polymerase catalyses the formation of the new RNA molecule (1)</li> <li>Forming the {sugar phosphate backbone/phosphodiester bond} (1)</li> </ol>		4		4														

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
		(iii)	<p><b>Any five (x1) from:</b></p> <ol style="list-style-type: none"> <li>1. Translation (1)</li> <li>2. mRNA attaches to a ribosome (1)</li> <li>3. tRNA brings a (specific) amino acid (1)</li> <li>4. Complementary base pairing between mRNA codon and tRNA anticodon/ codon anticodon interaction (or description of) (1)</li> <li>5. Ribosome has room for two tRNA molecules/Brings two amino acids into close proximity/ or description of (1)</li> <li>6. Condensation reaction occurs/peptide bond formed (between amino acids)(1)</li> <li>7. Ribosome moves to the next codon (or description of)/ reference to stop codon (1)</li> <li>8. Post translation processing/ or description of e.g. folding of polypeptide chain role of Golgi(1)</li> </ol>	5			5		
		(iv)	<p>It does not possess {any ribosomes/tRNA / the organelles for protein synthesis} (1) Reject: organelles unqualified</p> <p>All other organelles = neutral</p> <p>It does not possess mitochondria / cannot produce its own ATP for the process (1)</p>		2		2		
			<b>Question 2 total</b>	<b>10</b>	<b>6</b>	<b>0</b>	<b>16</b>	<b>0</b>	<b>0</b>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			A: nucleus (1) Accept nucleolus B: chloroplast (1)	1	1		2		
	(b)			<p>apparent length = <math>13\text{mm} / 13 \times 1000 = 13000\mu\text{m}</math>  magnification = <math>13000 / 32.3 \mu\text{m}</math> or <math>13/0.0323</math> (1)  magnification = <math>402.48/ 402.5/ 403/ 402</math>  (correct answer = 2 marks)  OR  apparent length = <math>13.5\text{mm} / 13.5 \times 1000 = 13500\mu\text{m}</math>  magnification = <math>13500 / 32.3 \mu\text{m}</math> or <math>13.5/ 0.0323</math> (1)  magnification = <math>417.96/ 418</math> (correct answer = 2 marks)</p> <p>Award 1 mark for evidence of figures showing image size/ actual size</p>		2		2	2	
	(c)			<ol style="list-style-type: none"> <li>straight chains of <math>\beta</math>-glucose/ alternative molecules of <math>\beta</math>-glucose rotate through <math>180^\circ</math> / chains cross-linked / form microfibrils (1)</li> <li>which provide {strength/rigidity/inelasticity} to the cell wall (1) support = neutral</li> <li>When the {solute concentration/ solute potential} changes (water potential will change) causing water to {move into /out of} the cell (1)</li> <li>cell wall prevents {osmotic lysis/ cell bursting}/ cell wall prevents cell shrinking (1) turgid/ plasmolysed = neutral Reject if direction of water movement is incorrect</li> </ol>	1  1		1  1	4		

Question			Marking details	Marks Available																						
				AO1	AO2	AO3	Total	Maths	Prac																	
3	(d)		<p><i>Spirogyra</i> – eukaryotic cells &amp; <i>Nostoc</i> - prokaryotic cells (1) Similarity: Both contain ribosomes / cell membranes / DNA/ genetic material (1)</p> <p><b>Difference: any 2 from: (1 mark)</b></p> <table border="1"> <thead> <tr> <th><i>Spirogyra</i></th> <th><i>Nostoc</i></th> </tr> </thead> <tbody> <tr> <td>{Membrane bound organelles/ named organelle} present</td> <td>{Membrane bound organelles/ named organelle} absent</td> </tr> <tr> <td>DNA enclosed within nuclear membrane</td> <td>DNA free in cytoplasm</td> </tr> <tr> <td>Linear DNA</td> <td>Loop of DNA Accept plasmid</td> </tr> <tr> <td>Larger/80s ribosomes Accept ribosomes are different sizes</td> <td>Smaller/70s ribosomes</td> </tr> <tr> <td colspan="2">Accept following</td> </tr> <tr> <td>DNA associated with histones</td> <td>DNA not associated with histones</td> </tr> <tr> <td>Mesosome absent</td> <td>Mesosome present</td> </tr> </tbody> </table>	<i>Spirogyra</i>	<i>Nostoc</i>	{Membrane bound organelles/ named organelle} present	{Membrane bound organelles/ named organelle} absent	DNA enclosed within nuclear membrane	DNA free in cytoplasm	Linear DNA	Loop of DNA Accept plasmid	Larger/80s ribosomes Accept ribosomes are different sizes	Smaller/70s ribosomes	Accept following		DNA associated with histones	DNA not associated with histones	Mesosome absent	Mesosome present		1 1					
<i>Spirogyra</i>	<i>Nostoc</i>																									
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DNA associated with histones	DNA not associated with histones																									
Mesosome absent	Mesosome present																									
					1		3																			
			<b>Question 3 total</b>	<b>3</b>	<b>6</b>	<b>2</b>	<b>11</b>	<b>2</b>	<b>0</b>																	



Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)	Diagram shows the addition of water (1) Glucose and fructose drawn with –OH groups on C1 and C2 in down positions (1)	2			2		
		(ii)	Glycosidic	1			1		
		(iii)	They have the same {chemical formula/ molecular formula/ number of atoms of each element} but different {structural formulae/ structures}/ both $C_6H_{12}O_6$ but different {structural formulae/ structures}	1			1		
	(iv)	Add Biuret solution to a sample of both solutions (1) Reject reference to heat The sucrase will cause a colour change from blue to lilac (and the sucrose will remain blue) (1) OR Heat both solutions with acid, <u>then</u> neutralise with alkali, <u>then</u> (heat) with Benedicts (1) The sucrose will cause a colour change from blue to brick red (and the sucrase will remain blue)(1)	1	1		2		2	

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)	Any two (x 1) from: concentration of {sucrose / sucrose / DNS} (1) temperature (1) filter/ wavelength of light in the colorimeter (1) method of mixing (1)		2		2		2
		(ii)	Linear axes with values at origin (1) X-axis labelled pH and Y-axis labelled <u>mean</u> absorbance + au (1) Correct plots (1) tolerance $\pm \frac{1}{2}$ small square Plots joined (1) no extrapolation		4		4	4	4
		(iii)	Hypothesis is incorrect (1) The {fastest rate of reaction/ most product produced} is {pH 4/ acidic/ between pH3-5}/ the optimum pH is pH 4 (1) Use of data e.g. mean light absorption was 0.87 au at pH 4 and only 0.30 au at pH 7/ rate is approx three times faster at pH4 than at pH 7 (1)		3		3		3

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
4		(iv)	3.8 ( $\mu\text{g cm}^{-3}$ ) (1) Accept any figure between 3.7-3.8 3.8/2 = 1.9 ( $\mu\text{g cm}^{-3}$ ) (1) OR 3.7 ( $\mu\text{g cm}^{-3}$ ) (1) 3.7/2 = 1.85( $\mu\text{g cm}^{-3}$ ) (1) OR 4.2 ( $\mu\text{g cm}^{-3}$ ) (1) Accept any figure between 4.2-4.3 4.2/2 = 2.1 ( $\mu\text{g cm}^{-3}$ ) (1) OR 4.3 ( $\mu\text{g cm}^{-3}$ ) (1) 4.3/2 = 2.15 ( $\mu\text{g cm}^{-3}$ ) (1)			2	2	2	2
	(c)		There is {overlap / high variability} in the repeat readings at {pH 3/4/5/ low pH} (1)  Repeat experiment with a range of intermediate values between pH 3-5/ Repeat data {to obtain a more reliable mean/ to improve reliability} (1) Reject references to accuracy			2	2		2
			<b>Question 4 total</b>	<b>5</b>	<b>10</b>	<b>4</b>	<b>19</b>	<b>6</b>	<b>15</b>

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)		<p>1. Oxygen crosses the membrane by (simple) diffusion (1) NOT facilitated</p> <p>2. oxygen passes through the phospholipid (bilayer) (1) Membrane = neutral</p> <p>3. Sodium ions pass through {channel/carrier} proteins (1) intrinsic proteins = neutral</p> <p>4. by {facilitated diffusion/active transport/ cotransport} (1) Reject active transport in relation to channel proteins</p> <p>If oxygen and sodium are not treated separately, allow one mark max for correct linkage of diffusion with phospholipid bilayer or {facilitated diffusion/ active transport/ cotransport} with {channel/ carrier} proteins</p>	4			4		
	(b)		<p>1. The percentage ion composition of {fresh water/ habitat} is <u>lower</u> than that in the carp's blood plasma/ fresh water is hypotonic to the blood/ ORA (1)</p> <p>2. The water potential of fresh water is {higher/less negative} than the water potential of the carp's blood/ ORA (1)</p> <p>3. The carp takes in water (through the gills) by osmosis (1)</p> <p>4. (Producing large volumes of dilute urine) prevents {osmotic lysis/ bursting} of cells (1)</p> <p>5. Maintaining ion composition (1) Accept reduces the loss of ions</p>		1 1	1 1	4		

Question			Marking details	Marks available						
				AO1	AO2	AO3	Total	Maths	Prac	
5	(c)	(i)	<p>1. Percentage ion composition of sea water is <u>greater</u> than that of the blood plasma/ sea water is hypertonic/ water potential in the fish is <u>higher</u> than the sea water/ ORA (1)</p> <p>2. ions will move into the blood plasma, {by (facilitated) diffusion/ down a concentration gradient/ or description of}(1)</p> <p>3. therefore ions must be actively transported out (of the blood plasma into the surrounding sea water) (1)</p>		1					
	(c)	(ii)	<p>Cell 1 is from the salmon in sea water (1)</p> <p><b>Any one from:</b></p> <p>as it is {highly folded to give a larger surface} / contains {many/more} mitochondria to {provide ATP/ for respiration/ for active transport } (1)</p>			1				
						1	2			

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(d)			1. As the percentage ion composition of the blood plasma is higher than the surrounding water (1) 2. Ions will move out of the {fish/gills/blood plasma} by {(facilitated) diffusion/down a concentration gradient} (1) 3. Acidification will {denature/ inactivate/ change the shape of} the (carrier/ channel) proteins in the specialised cells/ denature/ inactivate enzymes (involved in ATP production) (1) 4. Therefore {no/fewer} ions are (actively) transported <u>into</u> the {fish/gills/blood (plasma)}/ fewer ions can diffuse out (1) (in context of damaged proteins)		1	1	4		
<b>Question 5 total</b>					<b>4</b>	<b>5</b>	<b>8</b>	<b>17</b>	<b>0</b>	<b>0</b>

Question	Marking details	Marks available					
		AO1	AO2	AO3	Total	Maths	Prac
6	<p>Indicative content</p> <ul style="list-style-type: none"> <li>• Pyrophosphatase has tertiary structure</li> <li>• The active site has a specific shape</li> <li>• Pyrophosphate has a complementary shape</li> <li>• fits into the active site/ forms Enzyme Substrate Complex</li> <li>• lock and key theory/ induced fit</li> </ul> <ul style="list-style-type: none"> <li>• Phenylalanine must be a non-competitive inhibitor;</li> <li>• As it has a shape different to pyrophosphate;</li> <li>• Phenylalanine bonds to the allosteric site/site away from the active site;</li> <li>• Causes a change in the shape of the active site;</li> <li>• Pyrophosphate's active site is no longer complementary/prevents pyrophosphate binding</li> <li>• fewer enzyme-substrate complexes are formed;</li> <li>• The maximum rate of reaction cannot be reached at any concentration of pyrophosphate;</li> </ul> <ul style="list-style-type: none"> <li>• Phosphate must be a competitive inhibitor;</li> <li>• As it has a similar shape to {pyrophosphate/ substrate} / phosphate has a complementary shape the active site;</li> <li>• Phosphate {binds to/ competes for} the active site;</li> <li>• Prevents pyrophosphate binding / fewer enzyme-substrate complexes are formed;</li> <li>• The maximum rate of reaction can be reached at higher concentrations of pyrophosphate;</li> </ul>						

			<p><b>7-9 marks</b></p> <p>Indicative content of this level is:  Detailed explanation of lock and key/ induced fit theory.  Detailed explanation of the action of inhibition of phenylalanine.  Detailed explanation of the action of inhibition of phosphate.</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>						
			<p><b>4-6 marks</b></p> <p>Indicative content of this level:  Any two from:</p> <p>Explanation of lock and key/ induced fit theory/ or description of.  explanation of the action of inhibition of phenylalanine  explanation of the action of inhibition of phosphate.</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>						



			<p><b>1-3 marks</b>  Indicative content of this level is:  Brief explanation of lock and key/ induced fit theory</p> <p>OR</p> <p>Brief explanation of the action of inhibition of phenylalanine</p> <p>OR</p> <p>Brief explanation of the action of inhibition of phosphate.</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><b>0 marks</b>  <i>The candidate does not make any attempt or give a relevant answer worthy of credit.</i></p>						
			<b>Question 6 total</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>9</b>		

**Unit 1: BASIC BIOCHEMISTRY AND CELL ORGANISATION**

**SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES**

<b>Question</b>	<b>AO1</b>	<b>AO2</b>	<b>AO3</b>	<b>TOTAL MARK</b>	<b>MATHS</b>	<b>PRAC</b>
<b>1</b>	2	6	0	8	3	0
<b>2</b>	10	6	0	16	0	0
<b>3</b>	3	6	2	11	2	0
<b>4</b>	5	10	4	19	6	15
<b>5</b>	4	5	8	17	0	0
<b>6</b>	4	3	2	9	0	0
<b>Total</b>	<b>31</b>	<b>36</b>	<b>16</b>	<b>80</b>	<b>11</b>	<b>15</b>