GCE A LEVEL MARKING SCHEME

SUMMER 2022

A LEVEL
BIOLOGY – COMPONENT 1
A400U10-1

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INTRODUCTION

This marking scheme was used by WJEC for the 2022 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.

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GCE A LEVEL BIOLOGY

COMPONENT 1 – ENERGY FOR LIFE

SUMMER 2022 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.

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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

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<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>1</td><td>(a)</td><td>(i)</td><td></td><td>
<table>
<tr><th>Stage</th><th></th><th></th></tr>
<tr><td>A</td><td>Lag</td><td>Synthesis of {enzymes / proteins /RNA/ amino acids/ DNA} /absorption of nutrients / cell growth (1) Ignore acclimatise/ adapt</td></tr>
<tr><td>B</td><td>Log phase/ exponential</td><td>{Rapid/ owtte} cell division/ doubling in a unit time/ exponential growth (1)</td></tr>
<tr><td>C</td><td>Stationary phase</td><td>Cell death = cell production / {nutrients/ specified nutrients} reduced / accumulation {waste products/ named}/ carrying capacity reached/ increased environmental resistance/ there are limiting factors (1)</td></tr>
</table>
Reject ref to birth rate once in either B or C</td><td>3</td><td></td><td></td><td>3</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Total count (higher because) dead and living (cells) / Viable count (lower because) only living (cells)/ Total count will include dead cells</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>Colonies only grow from living / viable bacteria / ORA</td><td></td><td>1</td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>Any two for 1 mark:
Temperature
{Conc/ type/ availability/ volume} of {nutrients/ named nutrient}
pH
oxygen {availability/ concentration}
accumulation of {waste/ toxins}

Ignore space/ food/ water</td><td></td><td>1</td><td></td><td>1</td><td></td><td>1</td></tr>
</table>

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		2^{24} = 2 marks For 1 mark: sight of calculation of 24 generations/ 16777216		2		2	2	
	(c)	(i)		1.9 = 3 marks For 2 marks: 1.8984337 (or any correct rounding) For 1 mark: (10 – 8) or 2 / 0.301 x 3.5 Incorrect rounding of 1.8984337		3		3	3	
		(ii)		Calculated value shows {approx. 2 generations per hour / 0.95 generations per 30 minutes} (1) Therefore conditions are (almost) optimum/ conditions are not optimum as it is less (1) Ecf (i) applies to both marks			2	2		2
				Question 1 total	**4**	**7**	**2**	**13**	**5**	**4**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		(Both contain) Ribose Adenine Phosphate (groups) **All 3 ✓ = 2 marks** **2✓ = 1 mark** Award 1 mark adenosine + phosphate	2			2		
		(ii)		(sugar in DNA nucleotide) is deoxyribose/ DNA nucleotide has one phosphate/ ORA NAD and ATP both contain adenine/ ORA	1			1		
		(iii)		**Any four (x1) from:** A. (NAD) becomes reduced/ owtte (during glycolysis, link and Krebs) (1) B. Deliver H (atoms) to electron transport chain (1) C. Electrons released provide energy for H+ to be pumped / fuel proton pumps (1) D. (Protons pumped) into inter-membrane space (1) E. Creates {H+ / electrochemical / chemiosmotic} gradient (1) F. needed for ATP synthesis/ or description of (1)	4			4		
	(b)	(i)		**Any three (x1) from:** A. no proton gradient produced (1) B. {Less/no} Protons flow through {stalked particles/ ATP synthetase} (1) C. {Less/No ATP} produced (via ATP synthase) therefore any energy released is lost as heat. (1) D. So increased respiration rate (1)		3		3		

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		Attracts (more) insects (1) Increases chance of cross-pollination / Increases chance of fertilisation by gametes from another flower/ less self-pollination (1)			2	2		
				Question 2 total	**7**	**3**	**2**	**12**	**0**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		GPP = gross primary {productivity / production} NPP = net primary {productivity/ production} Both needed for 1 mark	1			1		
		(ii)	I	(950 + 1050 + 2500 =) 4500		1		1	1	
			II	(1050 + 2500=) 3550		1		1	1	
	(b)	(i)	I II	Egestion (1) Excretion / urination (1)		2		2		
		(ii)		(Secondary productivity = 450 + 1250 =) 1 700 (1) **(R** = 2500-1700) = 800 (1)		2		2	2	
		(iii)		Bacteria **+** fungi (1)	1			1		
		(iv)		**Any four (x1) from:** **In winter** A. {Decomposers/ saprophytes} + {convert {nitrogenous compounds/ named example} to ammonium ions/ carry out ammonification (1) B. Nitrifying bacteria / *Nitrosomonas* / *Nitrobacter* (1) C. Convert ammonium ions to {nitrites / nitrates} / convert nitrites to nitrates (1) Accept correct formulae **In spring / summer** D. (As more leaves grow) {ammonium ions / nitrates} absorbed {from soil/ by plants} (1) E. To make {proteins / amino acids / nucleic acids}(in new plant tissue) (1)		4		4		

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		Climax (community)	1			1		
		(ii)		CO_2 is absorbed during photosynthesis is (the equivalent of) GPP (1) CO_2 is released during respiration means GPP-R is NPP/ OWTTE (1)		2		2		
		(iii)		**Any three (x1) from:** A. {Biodiversity / biomass} increases during (primary) succession (1) B. (R) heterotroph respiration increases (1) C. More energy lost from {ecosystem/ trophic levels} (1) D. Until NPP = $R_{heterotrophs}$ / owtte(1)			3	3		
				Question 3 total	**3**	**12**	**3**	**18**	**4**	**0**

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Question 4				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		40.5/ 40.52% = 2 marks For 1 mark: 40.515679% 41% (38 X 30.6 / 2870) x 100 1162.8/2870 x 100		2		2	2	
		(ii)		{Lost as/ released as} heat	1			1		
		(iii)	I	Lipid higher energy value/ accept use of data (1) Seed much lighter to store same energy value/ less stored releases the same amount of energy (1)		2		2		
			II	Releases more metabolic water/ use of data		1		1		
	(b)	(i)		(glycerol) 2 (1) Accept 3 (fatty acids) 4 (1)	2			2		
		(ii)		Any **three** (x1) from Water added to {split / break/ hydrolysed} <u>peptide</u> bond (1) protein hydrolysed into amino acids. (1) **(**amino acids) enter as {organic acids/ acetic acid/ keto acid/ malate/ numbered carbon organic acid} (1) in {Krebs/ point 5 / pyruvate/ point 3} (1)	2	1		3		
				Question 4 total	**5**	**6**	**0**	**11**	**2**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		×65 = 2 marks For 1 mark 13000/ 200		2		2	2	
		(ii)	I	Mass flow (hypothesis)		1		1		1
			II	Apoplast: {along/ through} cell walls (1) Reject osmosis Symplast: through the cytoplasm **and** plasmodesmata (1) Ignore ref to osmosis / membrane	2			2		
	(b)			**Any three (x1) from:** A. Yellow rattle absorbs {nutrients/ named nutrient} from grass (roots) (1) B. (Fast) grass plants grow {less well/ slower}/ inhibiting growth (1) C. Less competition for the flowering plants/ Less interspecific competition. (1) D. more {light / water / nutrients} available for flowering plants (1)			3	3		
	(c)	(i)		**Any two (x1) from:** Identify co-ordinates/ or description of (1) {samples could be selected/ quadrats placed/ or description of} at random (1) to reduce bias (1)		2		2		2
		(ii)		To act as a <u>control</u> (habitat) (1) Make sure that it is yellow-rattle that having an effect (and not just time) / comparison (1)		2		2		2
		(iii)		{Increase/ test} repeatability/ reliability (1) reject accuracy/ ensure it is reliable Allows a {mean/ average} to be calculated (1)			2	2		2

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<tr><td></td><td>(d)</td><td></td><td></td><td>
<table>
<tr><td>Changes:</td><td></td></tr>
<tr><td>Calculate the biodiversity index again five years after seeding</td><td>Yellow rattle may not have an effect in 1 growing season/
to ensure it is still there/
it may take time to grow /
to see if it is still having an effect (1)</td></tr>
<tr><td>Calculate the biodiversity index a number of different times in the same year</td><td>Plants {grow / flower} at different times of the year (so may not be present in a single sampling period) (1)
ignore season/ weather</td></tr>
<tr><td>Carry out the investigation in different areas with different grass species</td><td>To determine if yellow rattle has the same effects on different grass species (1)</td></tr>
</table>
</td><td></td><td></td><td>3</td><td>3</td><td></td><td>3</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 5 total</td><td>2</td><td>7</td><td>8</td><td>17</td><td>2</td><td>10</td></tr>
</table>

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		{6 x 2/ 12} oxygen atoms in CO_2 (1) 12 atoms / 6 molecules oxygen produced (1) Ignore reference to oxygen formulae		2		2		
		(ii)		O_2 from {water/ photolysis} (1) as $^{18}O_2$ only produced {when $H_2{}^{18}O$ is used/ in suspension B} (and not $C^{18}O_2$) (1)		2		2		2
	(b)	(i)		A Light (energy)/ photons B Electron Transport Chain / photophosphorylation/ ATP {synthesis/ synthase} C Photosystem II /PS II / antenna complex/ P680 D Photolysis (of water) E F Electron {acceptors/ carriers} All 5 ✓ = 3 4 ✓ = 2 2 / 3 ✓ = 1 0 /1 = 0	3			3		
		(ii)		Reduction (1) Gain of {electrons/ H^+/ hydrogen (atom)} (1)		2		2		
		(iii)		Transfer energy in (the photons of) light into {chemical energy/ named example}		1		1		

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<tr><td></td><td></td><td>(iv)</td><td></td><td>Any four (x1) from:
A. Reduced NADP / $NADPH_2$ not produced. [1]
B. ATP not made by non cyclic photophosphorylation/ less ATP [1]
C. So G(3)P is not reduced to TP (1)
D. {Ribulose 5 phosphate/ RuBP} is not regenerated (1)
E. Carbon fixation stops / Calvin cycle / light independent stage of photosynthesis cannot take place [1]
F. No glucose produced for respiration (so plant dies) (1)
reject reference to energy for respiration</td><td></td><td></td><td>4</td><td>4</td><td></td><td></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td></td><td>Maintain pH</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>same concentration of solutes/ same water potential</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>Any four (x1) from:
<table><tr><td>A</td><td>Tube 1</td><td>in the light chloroplasts {release electrons/ causing colour change} (1)</td></tr><tr><td>B</td><td>Tube 2</td><td>{cell contents/ named cell contents} must cause {release electrons/ causing colour change}/ sucrose buffer does not {release electrons/ causing colour change} (1)</td></tr><tr><td>C</td><td>Tube 3</td><td>with no light {chloroplasts/ light dependent reactions} do not release electrons (so no colour change)</td></tr><tr><td>D</td><td>Tube 4</td><td>supernatant does not contain chloroplasts/ it must be the chloroplasts causing change colour (1)</td></tr><tr><td>E</td><td colspan="2">(Chlorophyll only found in chloroplasts so must be) chlorophyll that releases electrons (1)</td></tr></table></td><td></td><td></td><td>4</td><td>4</td><td></td><td>4</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 6 Total</td><td>5</td><td>7</td><td>8</td><td>20</td><td>0</td><td>8</td></tr>
</table>

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7				**Eutrophication** • {(Nitrate) fertiliser use / Animal waste / manure} {washed/ leached} into water • (Increased nutrient level in the water) increases algal {growth/ bloom}. • {Algae/ plants} die (due to lack of light) • Bacteria decompose {algae/ plants} • Respiration by decomposers cause oxygen levels fall/ ref to BOD. • {Fish/ invertebrates} die (due to lack of oxygen for respiration) **Deforestation** • Habitat destruction/ or description of • Reduction {biodiversity/ genetic diversity} • Extinction of species • CO_2 increase, {global warming/ climate change/ greenhouse} • Soil unstable / landslides / ref effect on soil **Resolved**. ▪ Sustainable farming techniques / or description/ less (nitrate) fertiliser (close to water courses)/ owtte ▪ Regeneration of forests / planting endemic species. ▪ Change to lifestyle e.g. encourage eating less meat/ Alternatives to palm oil ▪ National parks / SSSIs / encourage ecotourism as alternative source of income/ seed banks ▪ Change in government policy / public awareness/ education	4	3	2	9		

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				7-9 marks Indicative content of this level is… Detailed description of all three sections. *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** Indicative content of this level is… Detail from two sections or less detailed account of three sections *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** Indicative content of this level is… Any correct indicative from any one area *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 7 total	**4**	**3**	**2**	**9**	**0**	**0**

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COMPONENT 1: ENERGY FOR LIFE

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	4	7	2	**13**	5	4
2	7	3	2	**12**	0	0
3	3	12	3	**18**	4	0
4	5	6	0	**11**	2	0
5	2	7	8	**17**	2	10
6	5	7	8	**20**	0	8
7	4	3	2	**9**	0	0
TOTAL	**30**	**45**	**25**	**100**	**13**	**22**

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