GCE A LEVEL MARKING SCHEME

SUMMER 2023

A LEVEL
BIOLOGY – COMPONENT 1
A400U10-1

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This marking scheme was used by WJEC for the 2023 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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EDUQAS GCE A LEVEL BIOLOGY

COMPONENT 1: ENERGY FOR LIFE

SUMMER 2023 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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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)	I	Proton pump / carrier protein (1) Reject channel protein	1			1		
			II	ATP synthetase / synthase (1) Reject ATPase	1			1		
		(ii)		(At C) (protons /H^+) are transported against concentration gradient (1) (At D) moving down {concentration/ electrochemical} gradient / moving from a higher to a lower concentration (1)	1	1		2		
		(iii)		{hydrogen / protons / H^+} {removed / lost} (1) Ignore ref to electrons		1		1		
	(b)	(i)		Mitochondria + inner <u>membrane</u> (1) Ignore cristae Chloroplasts + thylakoid <u>membrane</u> (1) Ignore chlorophyll	2			2		
		(ii)		ADP + {Pi / iP} ➔ ATP All correct for 1 mark Ignore water Accept phosphate / PO_4/(P)	1			1		
		(iii)		Endergonic + energy {being stored / taken in / gained}/ **high energy bonds {created / formed}**	1			1		
				Question 1 total	**7**	**2**	**0**	**9**	**0**	**0**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Palisade (mesophyll) (1)		1		1		1
		(ii)		Presence of (large) <u>air</u> spaces (1) Enable {gas exchange/ diffusion of gases / storage of gases/ owtte} (1) OR Chloroplasts (1) To absorb light that has passed through upper cells (1)		2		2		1
		(iii)		Chloroplasts (1)		1		1		1
	(b)			Zeaxanthin **and** chlorophyll b (1) Most light reaching forest floor is {between 500 and approx. 650nm / green/ yellow} (1) (named pigments) absorb most light in these wavelengths (1)			3	3		
	(c)	(i)		**All three for 1 mark** Water + Oxygen + Suitable temperature (1)	1			1		
		(ii)		leaves grow large enough to measure / give time for leaves to {develop / grow} OWTTE (1)			1	1		1
		(iii)		**Any two (x1) from:** Leaves are {irregular/ not flat} so difficult to {draw around/ estimate area} (1) Ignore reference to human error Leaves may not be flat so drawing around not representative of actual area (1) Counting squares (needs judgement so) open to human error (1) (Weighing a leaf gives) {quantitative data/ owtte} (1) Reject numerical unqualified in place of quantitative		2		2		2

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		tree 1 = 520-524 + tree 2 = 500-504 (1)		1		1	1	
		(ii)		mode and mean in the same range (1) {even distribution of values from/ symmetrical around} the mean/ bell shaped curve (1)		2		2	2	2
		(iii)		Tree1 + larger (total leaf) surface area (1) **Any 2 (x1) from:** More {chloroplasts/ chlorophyll/ photosynthetic pigment} (1) More palisade mesophyll cells (1) More stomata (1)		3		3		
				Question 2 total	**1**	**12**	**4**	**17**	**3**	**8**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		OH group 'below' **C1** on alpha glucose and above on beta glucose (1)	1			1		
		(ii)		Active site changes shape (when substrate binds / when ES complex forms) (1) Accept structure in place of shape Alpha and beta glucose similar shape (1)	1	1		2		
		(iii)		Chlorophyll / ATPase / other correct function (1)	1			1		
	(b)	(i)		Substrate-level phosphorylation (1) Reject photophosphorylation	1			1		
		(ii)		2 ATP used to phosphorylate glucose to {fructose 6 phosphate / triose phosphate} / correct description of use of ATP in pathway shown (1) 4 ATP produced (1)		2		2		
		(iii)		dehydrogenase (1) removal of hydrogen / oxidation of triose phosphate (1) reject reference to hydrogen molecules	2			2		
		(iv)		(Pyruvate) {converted/ reduced} to lactate / lactic acid	1			1		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			A. Acts as a competitive inhibitor (1) **Any 2 (x1) from:** B. G6P has similar {shape / structure} to glucose (1) Reject same C. G6P can {bind to / block} active site / prevents ES complex forming / forms EI complex} (1) D. G6P {reduces rate of formation of ES complex / slows conversion of glucose to G6P} (1) OR if state non-competitive inhibitor E. {there is a phosphate group / structure or shape not the same} so cannot bind to active site (1) F. {binds to allosteric site / site other than active site} / changes shape of active site / prevents formation of ES complexes (1) G. G6P {reduces rate of formation of ES complex / slows conversion of glucose to G6P} (1)	1	1	1	3		
	(d)	(i)		123 (3) If incorrect: **Award 2 marks for**: 122.66… / 122.7/ 122.67 (2) **Award 1 mark for**: 122.6 (1) 0.123 (1) (has not converted g to mg) (4600 / 18) x (4.8/10) (4.6 or 46 or 460 / 18) x (4.8 / 10) (1)		3		3	3	
		(ii)		<u>very high</u> risk of becoming diabetic (1) OWTTE 199 at top end of range/ 1 mg below diabetic range (1)		1	1	2		
				Question 3 total	**8**	**8**	**2**	**18**	**3**	**0**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		**Any two (x1) from** {Protein/amino acids} (1) {nucleic acids / nucleotides / ATP} (1) Chlorophyll (1)	2			2		
		(ii)		**Any four (x1) from** A. {ammonia / ammonium} produced by {decomposers/ bacteria}/ ref to ammonification (1) B. {NH_4^+ / NH_3} converted to {nitrite (ions) / NO_2^-} (1) C. By *Nitrosomonas* (1) D. {nitrite/ NO_2^-} to {nitrate / NO_3^-} (1) E. By *Nitrobacter* (1) F. Ref to Nitrification / by nitrifying bacteria (1)	2	2		4		
		(iii)		**Any two (x1) from:** • (Aeration) provides a source of O_2 / maintains aerobic conditions (1) • (nitrifying) Bacteria are aerobic / nitrification only takes place in aerobic conditions (1) • Prevent denitrification / make sure that {denitrifying bacteria/ *Pseudomonas}* are not present (1)		2		2		
		(iv)		Some of water {changed /added}/ tank cleaned / owtte (1)		1		1		
	(b)	(i)		(Concentration) decreases as plants absorb nitrate ions (1) To synthesise {proteins / nucleic acids / other N containing compounds} (1)		1	1	2		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		{urine / faeces / food / dead fish/ egesta / excreta}/ ref to {excretion/ egestion} (1) contain N-containing compounds/named N-containing compounds (1) (N-containing compounds) released during decay of {dead fish / food / faeces / egesta} (1)			3	3		
	(c)			**Any three (x1) from** Algal bloom/ growth of algae (1) Bacteria / saprotrophs / decomposers decay {dead algae / dead plants / food / faeces} (1) Ignore fungi use oxygen from water/ respire aerobically (1) (fish die) as they cannot respire (due to lack of oxygen) (1)		2	1	3		
				Question 4 total	**4**	**8**	**5**	**17**	**0**	**0**

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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>5</td><td>(a)</td><td></td><td></td><td>Accept 3.6 or 3.7 or 3.8 (2)
If incorrect award 1 mark for:
A value between 3.675 and 3.750 (1)
(48,49 or 50 / 20) x 1.5 (1)</td><td></td><td>2</td><td></td><td>2</td><td>2</td><td>2</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>bacillus / bacilli</td><td>1</td><td></td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Can respire aerobically and anaerobically / can survive in aerobic and anaerobic conditions(1)</td><td>1</td><td></td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>Cell wall has an {extra / outer} layer of {lipopolysaccharide/ lipoprotein} (1)</td><td>1</td><td></td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(c)</td><td></td><td></td><td>endocytosis / phagocytosis (1) Reject pinocytosis
(ATP needed) as a source of energy to {change shape of cell membrane / form the vesicle/ form the vacuole} (1)</td><td>1</td><td>1</td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>(d)</td><td></td><td></td><td>Any 2 (x1) from: 1 mark per row
<table>
<tr><td>Bunsen burner flame</td><td>convection current/ removes risk of aerosol</td></tr>
<tr><td>Keep lid of Petri dish {at an angle/ closed as much as possible}</td><td>reduce risk of contamination (from airborne spores / bacteria)</td></tr>
<tr><td>Flame inoculating loop {before/ after} taking sample</td><td>to sterilise/ or description of</td></tr>
<tr><td>Flame neck of sample container</td><td>to reduce risk of contamination/ removes risk of aerosol</td></tr>
<tr><td>Do not place lid of container on bench/ owtte</td><td>to reduce risk of contamination</td></tr>
</table></td><td>2</td><td></td><td></td><td>2</td><td></td><td>2</td></tr>
</table>

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(e)			2.4% or 2.43% (2) **If incorrect award 1 mark for:** 2.43197/ 2.432 (1) (101 / 4153) x 100 (1)		2		2	2	
	(f)	(i)		(method only counts) bacteria that are alive (and can divide and grow) / does not count dead bacteria which cannot grow (1) Accept answers in context of colonies growing from live bacteria		1		1		1
		(ii)		1.19 / 1.2 / 1(.0) / 1.195(3) **If incorrect award 2 marks for any of**: 260 / √ 47343.75 260 / √ 187.5 x 252.5 260 / √ (0.25 x 750) x (0.25 x 1010) **Award 1 mark for any of**: calculation of N = 0.25 x 750 = 187.5 calculation of T = 0.25 x 1010 = 252.5 (1)		3		3	3	3
		(iii)		Risk is low/ there is no risk/ not at high risk (1) Would need to eat {large amount / about 1000 kg} of nuts to have high enough dose of *Salmonella* (1) ecf from (f) (ii)			2	2		
				Question 5 total	**6**	**9**	**2**	**17**	**7**	**9**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		Soil already present (1) Seeds / roots already present (1)	2			2		
		(ii)	I	{shrubs / tree seedlings / tall plants} (cut down so) cannot grow (to full size)/ Reject vegetation no (seral) progression (1)		1		1		
			II	Prevents vegetation being decayed on the verges (1) decay products don't enter soil / don't increase soil fertility/ORA (1) wildflowers {are adapted to live in/ need} low fertility soil/ORA (1)			3	3		
	(b)	(i)		Random placement of traps/ random number generator used/ random coordinates used (1)		1		1		1
		(ii)		(Different species of bee / wasp) attracted to different coloured flowers/ (traps) mimic flower colours/ owtte (1)			1	1		1
		(iii)		Ethical: Insects are <u>killed</u> (1) Ecological: (removing insects from a site) reduces {biodiversity/ number}/ some insects killed could be of rare species/ removing pollinators/ trampling when sampling/ disrupt balance of ecosystem (1)			2	2		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iv)		**Any 3 (x1) from:** A. No data on {how biodiversity has changed over time/ what the biodiversity was previously}/ Different biodiversity at different times of the year (1) B. Verges were close to agricultural land so {insects could have come from the fields / could have increased biodiversity} (1) C. Only 4 different colours of trap used/ many other colours in wild flowers (1) D. <u>Different</u> crops in fields could have affected biodiversity at different sites (1) E. did not assess sites with no arable land/ ora (1) F. Valid comment on {sample size/ random sampling} (1)			3	3		3
				Question 6 total	**2**	**2**	**9**	**13**	**0**	**5**

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Question	Marking details	Marks Available					
		AO1	AO2	AO3	Total	Maths	Prac
7	**Indicative content** **Density dependent and independent factors** A1 Density dependent: increased effect as population increases/ (affect and) are affected by the size of the population A2 Density independent: the effect is the same whatever the population size /(affect but) not affected by the size of the population <u>Examples</u>: A3 {better/ more} food A4 lower levels of disease/ parasites A5 better shelter / housing A6 improved health care / sanitation/ better water supply **Graph explained** B1 X – population still in log phase/ exponential growth/ population doubling in unit time B2 birth (rate) greater than death (rate) / people {living/ surviving} longer B3 Y – reached {stationary (phase) / carrying capacity/ plateaus/ no further change} B4 birth /survival = death rate B5 Z – {decline/ death} <u>phase</u> B6 birth rate less than death rate/ people not living as long **Effect on climate change boundary** C1 decreased population C2 reduces need for fossil fuel combustion so less CO_2 emitted C3 {less deforestation/ more afforestation/ or description of} {so more CO_2 absorbed / can act as carbon sinks} C4 fewer {animals farmed / paddy fields} so less methane C5 get closer to safe operating level for climate change boundary/ effects of crossing the boundary are reduced	2	4	3	9		

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Question	Marking details	Marks Available					
		AO1	AO2	AO3	Total	Maths	Prac
	7-9 marks To gain 9 marks: Identifies and explains all THREE of with no irrelevancies or errors *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*. **4-6 marks** To gain 6 marks: Identifies and explains TWO of *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** To gain 3 marks: Identifies and explains ONE of *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.*						
	Question 7 total	**2**	**4**	**3**	**9**	**0**	**0**

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SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Q	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	7	2	0	**9**	0	0
2	1	12	4	**17**	3	8
3	8	8	2	**18**	3	0
4	4	8	5	**17**	0	0
5	6	9	2	**17**	7	9
6	2	2	9	**13**	0	5
7	2	4	3	**9**	0	0
TOTAL	**30**	**45**	**25**	**100**	**13**	**23**

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