



GCE A LEVEL MARKING SCHEME

SUMMER 2023

**A LEVEL
BIOLOGY - UNIT 3
1400U30-1**

INTRODUCTION

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.

WJEC GCE A LEVEL BIOLOGY
UNIT 3 – ENERGY HOMEOSTASIS AND THE ENVIRONMENT
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.

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)		<table border="1"> <thead> <tr> <th>Name</th> <th>Location</th> </tr> </thead> <tbody> <tr> <td>glycolysis</td> <td>Cytoplasm/cytosol (1)</td> </tr> <tr> <td>Link (reaction)</td> <td>Matrix (of mitochondrion) (1)</td> </tr> <tr> <td>Krebs (cycle)</td> <td>Matrix (of mitochondrion) (1)</td> </tr> </tbody> </table> <p>1 mark for each row</p>		Name	Location	glycolysis	Cytoplasm/cytosol (1)	Link (reaction)	Matrix (of mitochondrion) (1)	Krebs (cycle)	Matrix (of mitochondrion) (1)	3			3		
			Name	Location														
			glycolysis	Cytoplasm/cytosol (1)														
			Link (reaction)	Matrix (of mitochondrion) (1)														
Krebs (cycle)	Matrix (of mitochondrion) (1)																	
(b)	Decarboxylase (1) (Released as) CO_2 (1)	2	2															
(c) (i)	Reduction/ hydrogen gain (1)	1	1															
(ii)	I black one is NAD grey one is FAD (1) Reject NADP	1	1															
		II Any three (×1) from: A. {Transport/ donate} {H atoms/electrons/ H^+ / protons} to {ETC / inner mitochondrial membrane/ electron carriers} (1) B. NAD delivers to first proton pump and FAD to second /NAD uses 3 (types of) proton pumps and FAD uses 2 (1) C. (Reduced) NAD results in more protons being pumped (across membrane) than reduced FAD /Reduced NAD leads to a steeper proton gradient. (1) D. NAD gives 3ATP FAD gives 2ATP (1) E. NAD involved in glycolysis + link + Krebs but FAD only Krebs (1)	3	3														
	(iii)	<u>Final</u> {Hydrogen/electron} acceptor (1)	1	1														
Question 1 total			4	7	0	11	0	0										

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)		<ul style="list-style-type: none"> {Peaks/maximum values} on absorption spectrum are at similar <u>wavelengths</u> to peaks on action spectrum/ At <u>wavelengths</u> (of light) where absorption {is higher/ increases} the rate of photosynthesis {is higher/ increases}/ora/ <u>owtte</u> (1) Wavelengths (most) absorbed are the wavelengths used in photosynthesis. (1) Allow correct reference to values		1	1	2		2
	(b)	(i)	Any one (x1) from <ul style="list-style-type: none"> Chlorophyll b has a peak {at approx. 640/ in the red (wavelengths)} but chlorophyll c does not (1) Chlorophyll b absorbs longer wavelengths of light (1) Chlorophyll b absorption increases around approx. 600 but chlorophyll c does not (1) Chlorophyll c has one peak whereas Chlorophyll b has two (1) Chlorophyll c absorbs less {at 640nm/ in the red (wavelengths)}/ ORA (1) 		1		1		1
		(ii)	Any one (x1) from <ul style="list-style-type: none"> {No peak/ lower rate of photosynthesis} at 640nm (1) Narrower peak {at 670nm/ in red region} (1) 			1	1		1
	(c)		Any one (x1) from <ul style="list-style-type: none"> {Orange light/light of wavelength approx. 640} {does not penetrate water column/ does not reach 200m (use of figures)} (1) (Advantage to have chlorophyll c) as blue light penetrates {further / to 300m / 200m} (use of figures) (1) 			1	1		
	(d)		Domain-Eukaryota/e (1) Reason: has {nucleus/chloroplast/membranous/ membrane bound organelles} (1)		2		2		

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(e)	(i)	44 gm ⁻³ day ⁻¹ (1)		1		1	2	
		(ii)	3.2x10 ⁵ = 3 marks Award 2 marks for any of 320000 8000000/25 8000/0.025 3.2 x 10 ² (not converted) Award 1 mark for any of 8000kg converted to g = 8000000 25g converted to kg = 0.025 320 (not converted and not standard form)		3		3	3	
			Question 2 total	0	8	3	11	5	4

Question			Marking details	Marks available													
				AO1	AO2	AO3	Total	Maths	Prac								
3	(a)	(i)	<ul style="list-style-type: none"> Can be used in {all organisms/cells/species}/ Can be used in both prokaryotes and eukaryotes (1) For {most/ all} {reactions/ biological processes/ metabolic processes} (1) 	2			2										
		(ii)	Glucose and water / accept correct chemical formulae (1) ADP and {P _i / phosphate} (1) <u>Contracted/ contracting</u> muscle (1)		3		3										
	(b)	(i)	A-chloroplast, B-mitochondria (1) Both correct for 1 mark		1		1										
		(ii)	<table border="1"> <thead> <tr> <th>Organelle A</th> <th>Organelle B</th> </tr> </thead> <tbody> <tr> <td>thylakoid</td> <td>Inner membrane (1)</td> </tr> <tr> <td>Thylakoid space/lumen</td> <td>Matrix (1)</td> </tr> <tr> <td>stroma</td> <td>Intermembrane space (1)</td> </tr> </tbody> </table> <p>1 mark for each correct row Ecf from (i)</p>	Organelle A	Organelle B	thylakoid	Inner membrane (1)	Thylakoid space/lumen	Matrix (1)	stroma	Intermembrane space (1)		3		3		
Organelle A	Organelle B																
thylakoid	Inner membrane (1)																
Thylakoid space/lumen	Matrix (1)																
stroma	Intermembrane space (1)																
		(iii)	<p>Any five (×1) from:</p> <p>A. Proton pump pumps protons {into intermembrane space/ across membrane/ from Y to Z} (1)</p> <p>B. To create {proton / H⁺/electrochemical} gradient (1)</p> <p>C. {ATP synth(et)ase/ stalked particle} allows {protons / H⁺s} {through membrane/ down gradient} (1)</p> <p>D. {convert/combine} ADP (+ P_i) to ATP (1)</p> <p>E. correct reference to {electron carriers/ electron transport chain} (1)</p> <p>F. Ref to: Proton pump and ATP synth(et)ase (1)</p>	3	2		5										

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)		<p>A. In pH 4 (no ATP produced as) no proton gradient (1)</p> <p>B. When pH {raised/8} a proton gradient is produced / The buffer solution at pH 8 has a lower proton concentration than the vesicle / ORA (1)</p> <p>C. (When the proton gradient is in place) protons move {out/ across the membrane/ through stalked particle/ through ATP synth(et)ase} (1)</p> <p>D. (When protons move across the membrane) ATP is made / no ATP is made when protons do not move across (1)</p>			4	4		4
			Question 3 total	5	9	4	18	0	4

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)	(Birth rate + immigration) = (death rate + emigration) (1)		1		1		
	(b)	(i)	159/ 160 (2) Award 1 mark for (19 ×143)/17 159.8		2		2	2	2
		(ii)	Removing {part of digit/ toe} might affect {ability to survive/ increase chance of recapture/ owtte} (1)			1	1		1
	(c)		Shape – rods (1) reject cylinders Colour – pink/red (1)		2		2		
	(d)	(i)	190 or 180 or 170 = 3 marks Award 2 marks for 186.9565217 / any number that gives a 2 sf of 170 180 or 190 Award 1 mark for Sight of correct calculation for gradient = 4300/23/ or any gradient correctly indicated on the graph		3		3	3	3
		(ii)	<ul style="list-style-type: none"> Because Pond 1 has more tadpoles (than Pond 2) (1) the {rate of decline/ population decrease} was faster in high density pools /use of data (1) Because of {<u>competition</u> for food/ predation/ disease/ accumulation of (toxic) waste} (1) 			3	3		

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(e)	(i)	<p>Selection increases {rate of development/ body length/ rate of growth} (1)</p> <p>Any one (x1) from {Rate of development/ growth} is faster if density is low/OR A (1) The less tadpoles in an area the longer they get (1) Less time needed for development if density is low/ OR A (1) The lower the density the higher the rate of development (1) Longer body length in the low density tank/ owtte (1)</p>			2	2		2
		(ii)	<ul style="list-style-type: none"> Removing tadpoles would {reduce/ change} the {density/ population}/ owtte (1) Remove same number of tadpoles of random size from {the high density tank/ tank 2}/ Replace the two removed with two of {mean/ random} size (1) 			2	2		2
			Question 4 total	0	8	8	16	5	10

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)	I II	Ultrafiltration – glomerulus / Bowman’s capsule (1) Reabsorption – proximal convoluted tubule (1)	2			2		
		(ii)		X-ascending limb/ loop of Henle} and Y-collecting duct (1) Osmoregulation (1)	2			2		
	(b)	(i)		(Conc of urea increases because) {little/no} urea is reabsorbed but water is reabsorbed (1) (Conc of chloride decreases because) Chloride is {reabsorbed /diffuses out /actively transported out}{faster than water) (1)			2	2		2
		(ii)		A. (Concentration of glucose decreases because) glucose is reabsorbed (faster than water) (1) Any three (x1) from B. With inhibitor no respiration and therefore {no/less} ATP (1) C. No active transport of Na ⁺ (out of PCT) (1) D. Therefore no concentration gradient of Na ⁺ / owtte E. For the co-transport of glucose (1)			4	4		
	(c)	(i)		{To compare concentration/ show the loss} (of Na ⁺) {in loop of Henle/ in descending and ascending limbs/ between PCT and DCT/ before and after absorption}			1	1		1

Question			Marking details	Marks Available					
				AO1	AO2	AO3	Total	Maths	Prac
		(ii)	<p>Any four (x1) from:</p> <p>A. Descending limb water leaves by osmosis (1)</p> <p>B. Na⁺ concentration increases {as it moves down the descending limb/ as it get closer to the {hairpin/ apex}/ as it moves deeper into the medulla} (1)</p> <p>C. Ascending limb Na⁺ pumped out (1)</p> <p>D. Ascending limb is impermeable to water (1)</p> <p>E. Na⁺ concentration decreases as it moves up the ascending limb (1)</p>	4			4		
			Question 5 total	8	0	7	15	0	3

Question			Marking details		Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		RuBP/ribulose biphosphate + carbon dioxide (1) RUBISCO (1)	1	1		2		
		(ii)	I	X alongside arrow between organic compounds (dead plants and animals) and carbon dioxide (1)		1		1		
			II	(Microbes) {decay/ breakdown/ decompose} (dead plants and animals)/ (Microbes are) {decomposers/ saprotrophs} (1)		1		1		
		(iii)		Arrow labelled {C /combustion/ burning fossil fuels} from coal, gas, oil to Atmosphere (1)		1		1		
	(b)	(i)		Y – climate change and Z nitrogen/ biogeochemical flow (1) 1 mark for both	1			1		
		(ii)		(They have) exceeded the threshold (1)		1		1		
	(c)			<ul style="list-style-type: none"> (Safe operating space is) where {planetary/ global} systems are stable/ changes are reversible/ there is no detrimental impact on global systems(1) (Shown by the) {central circle / threshold/ dashed circle} (1) (Exceeding boundary) result in small changes having extreme effects / causes {irreversible/ unpredictable} {damage/ change} / given example e.g. extinction (1) 	3			3		
				Question 6 total	5	5	0	10	0	0

Question	Marking details	Marks available					
		A01	A02	A03	Total	Maths	Prac
7	<p>Indicative content</p> <p>Anaesthetic A</p> <p>A1 Anaesthetic A {blocks Na⁺ channels / Na⁺ channels don't open}</p> <p>A2 Threshold (potential) is not met/ ref to all or nothing</p> <p>A3 (membrane) not depolarised</p> <p>A4 Action potential is not generated</p> <p>A5 So impulse does not reach {pain centre/ brain}</p> <p>Anaesthetic B</p> <p>B1 Anaesthetic B Blocks Ca²⁺ channels/ Ca²⁺ channels do not open</p> <p>B2 (Ca²⁺ can't enter) so synaptic vesicles don't fuse with presynaptic membrane</p> <p>B3 Neurotransmitter not released into synaptic cleft/ no exocytosis</p> <p>B4 Postsynaptic membrane not depolarised</p> <p>B5 No action potential generated</p> <p>B6 So impulse does not reach {pain centre/ brain}</p> <p>Compare with reflex arc</p> <p>C1 Both have sensory neurones/ both have three neurones</p> <p>C2 (With cell bodies) in ganglia</p> <p>C3 Outside CNS</p> <p>C4 Pain pathway has no motor neurones/ shorter motor neurone/ motor neurone in brain Accept reverse answer for reflex</p> <p>C5 Pain pathway has no relay neurones/ relay neurone in brain/longer relay neurone Accept reverse answer for reflex</p> <p>C6 Pain pathway has no effector/ effector is located in the brain</p> <p>C7 Involves brain not spinal cord</p>	5	4		9		

Question				Marking details	Marks available						
					AO1	AO2	AO3	Total	Maths	Prac	
				<p>7-9 marks Indicative content of this level is detailed information from all three lists <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>4-6 marks Indicative content of this level is detailed information from two of the lists or less detail from three. <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>1-3 marks Indicative content of this level is some information from at least one of the lists or little information from more than one list. <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>0 marks <i>The candidate does not make any attempt or give a relevant answer worthy of credit.</i></p>							
				Question 7 total	5	4	0	9	0	0	

UNIT 3: ENERGY HOMEOSTASIS AND ENVIRONMENT

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	4	7	0	11	0	0
2	0	8	3	11	5	4
3	5	9	4	18	0	4
4	0	8	8	16	5	10
5	8	0	7	15	0	3
6	5	5	0	10	0	0
7	5	4	0	9	0	0
TOTAL	27	41	22	90	10	21