GCE A LEVEL MARKING SCHEME

SUMMER 2024

A LEVEL
BIOLOGY – COMPONENT 1
A400U10-1

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

EDUQAS GCE A LEVEL BIOLOGY

COMPONENT 1: ENERGY FOR LIFE

SUMMER 2024 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.

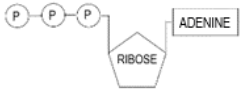
Extended response question

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)		 Diagram correct (1) Must have a pentose+3 phosphates+ base (in correct positions) Labels (ribose + phosphate + adenine) (1) Accept adenosine	2			2		
		(ii)		• Source of energy for (nearly) all reactions in all {cells / organisms} (1) • energy stored in (high energy) phosphate-phosphate bonds / energy released through {hydrolysis/ breaking} of P-P bond / OWTTE(1)	2			2		
		(iii)		**Any one (×1) from:** ATP contains ribose but DNA contains deoxyribose (1) ATP - 3P DNA 1 P (1) ATP - adenine DNA - any one of four different bases (1)		1		1		
	(b)	(i)		**Any two (×1) from:** • 70S / smaller ribosomes (1) **K** • DNA circular / loop of DNA (1) • Ignore plasmids DNA free in stroma / matrix (1)	2			2		
		(ii)		eubacteria / bacteria **and** archaebacteria / archaea **Both for 1 mark**	1			1		

<table>
<tr><th colspan="4">Question</th><th>Marking details</th><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>
<table>
<tr><th>Process in ATP synthesis</th><th>Chloroplasts</th><th>Mitochondria</th></tr>
<tr><td>Protons are pumped…</td><td>thylakoid (membrane)</td><td>inner (mitochondrial) (membrane) / cristae</td></tr>
<tr><td>A high concentration</td><td>thylakoid space / lumen
Ignore inter</td><td><u>inter</u>-membrane space
Reject inner / intra</td></tr>
</table>
All 4 correct = 2 marks; 3 or 2 correct = 1 mark;
</td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td></td><td>Correct rate
1.53…(2) Accept values in the range 1.45 – 1.6
if rate calculated incorrectly award 1 mark for calculation using their values e.g. 510 – 395 / 135 – 60 (1)
Must be clearly change in y / change in x
Correct unit
μM s^{-1} or μM /s (1)
Reject μM /s^{-1}
Lines drawn on graph to show where values were taken (1)
Must have enough lines to give 2 values of x and y</td><td></td><td>4</td><td></td><td>4</td><td>4</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Any one (x1) from
{ADP / substrate} concentration at its {maximum / most / more substrate at start / owtte} (1)
higher ADP concentration at start of reaction (1)
{at 100s / over time} the substrate starts to be used up (1)
{at 100s / over time} {ADP / substrate concentration} becomes a limiting factor / ORA (1)</td><td></td><td>1</td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 1 total</td><td>9</td><td>6</td><td>0</td><td>15</td><td>4</td><td>0</td></tr>
</table>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Producers = (photo)autotrophic Consumers = heterotrophic Accept holozoic **both needed for 1 mark** (1)	1			1		
		(ii)		• (NPP is the) energy {stored in new growth / in biomass } (1) • Energy lost from GPP through respiration is not available / NPP = GPP – R so some energy lost / owtte (1)	1	1		2		
		(iii)		{Growth rate / population density} keeps on increasing **over time** / owtte		1		1		
		(iv)		Carrying capacity	1			1		
	(b)	(i)		Water availability / lack of water / little rainfall (both) / little rain in deserts + water frozen in arctic regions (1) Reduces rate of photosynthesis / or description of (1) OR Nitrate availability (1) Low rate of decomposition / owtte (1) OR Extreme temperatures / OWTTE (1) Reduces rate of photosynthesis (1)		2		2		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		• {Wavelengths between 650 and 750nm / red light} {provide energy / are absorbed /for photosynthesis} ((1) Ignore blue light • (In water) less light energy available / red wavelengths absorbed / Less red light available / Only blue light available / Blue light not absorbed / (on land) {all / more} all wavelengths of light are available (1) • So {rate of photosynthesis decreases / less photosynthesis} (in marine plants) (1) Accept higher rate of photosynthesis in land plants		3		3		
	(c)	(i)		**Award 3 marks for** 0.91 **If incorrect award 2 marks for** 0.9125 (2) 0.913 (2) 0.9 (2) 912 500 000 000 000 (2) 9.125×10^{14} (2) 9.13×10^{14} (2) **If incorrect award 1 mark for** $5 \times 10^{9} \times 500 \times 365$ (1) 500 000 000 000 x 365 (1) $5 \times 10^{11} \times 365$ (1)		3		3	3	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		**Award 2 marks for** 33.91…/ 34 / 33.9 **If incorrect award 1 marks for** (1.15 – 0.76 / 1.15) x 100 0.39 / 1.15 (incorrect rounding)		2		2	2	
		(iii)		**Any three (×1) from:** A. consumption of {NPP / plants} by livestock greater than by humans (1) B. Lower level of wastage if eat plants than if eat livestock (1) C. As fewer trophic levels (1) D. So less energy lost between trophic levels (1) E. More land available for growing crops for humans / less land needed for growing crops for livestock (1) F. Use of data e.g. human plant consumption 0.76 + livestock consumption 2.2 / (2.2-0.15 =) 2.05 Pg NPP used to raise animals / calculation of efficiency of transfer (1)			3	3		
				Question 2 total	**3**	**12**	**3**	**18**	**5**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		Digestion (of substrate / food) {outside the organism / externally} (followed by absorption of nutrients)	1			1		
		(ii)		Anaerobic		1		1		
		(iii)	I	C1 = carbon dioxide / CO_2 C2 = ethanol Reject ethanal C3 = pyruvate 3 correct = 2 marks 2 correct = 1 mark 0/1 correct = 0 marks		2		2		
			II	{Carbon dioxide / C1} {makes bread rise / acts as a leavening agent} (1) {Carbon dioxide / C1} provides the bubbles **and** {ethanol / C2} is alcohol (1)		1	1	2		
		(iv)		• Ethanol {is toxic / cannot be converted to non-toxic substances/ cannot be broken down} (1) • Anaerobic respiration in animals produced {lactate / lactic acid} (1) ignore CO_2 produced Reject if refer to mitochondria • Lactate can be {removed in presence of (excess) oxygen / Broken down (in liver)} / Production of lactate is reversible (1)		3		3		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		**Any one (x1) from** Allow {enzymes / yeast} and substrate to {reach the same temperature / equilibrate} (1) Allow {both / the} tubes to {reach the same temperature / equilibrate} (1) Reject acclimatise / adjust / reach equilibrium			1	1		1
		(ii)		Prevent oxygen entering the mixture / create anaerobic conditions (1) So yeast respires {anaerobically / by fermentation} (1) ORA			2	2		2
	(c)	(i)		Same {chemical / molecular} formula but different {arrangement of atoms/ structural formula / structure}	1			1		
		(ii)		X = water Y = (alpha) glucose Reject Beta glucose Z = fructose 3 ✓ = 2 marks; 2 ✓ = 1 mark; 1 or 0 ✓ = 0 marks		2		2		
		(iii)		Sucrose must be broken down (before being available for respiration) / or description of			1	1		
		(iv)		• No lactase (produced by yeast) / lactose cannot be {hydrolysed / metabolised} (by yeast) (1) • So {glucose / respiratory substrates} cannot be produced (1)		1	1	2		
				Question 3 total	**2**	**10**	**6**	**18**	**0**	**3**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		Magnesium / Mg^{2+}	1			1		
		(ii)		Chlorophyll *a* also contains {oxygen / nitrogen} (atoms)		1		1		
		(iii)		(Carotene hydrophobic is embedded in centre of membrane because) • {fatty acids in membranes / centre of membrane / centre of phospholipid bilayer} are {hydrophobic / non-polar} (1) • whereas the stroma is {hydrophilic / polar} (1)	1	1		2		
		(iv)		Stabilise membranes / maintain {fluidity / rigidity / flexibility}	1			1		
	(b)	(i)		(Propanone / ethanol / solvents) (highly) {flammable / could catch fire easily} (if exposed to a naked flame)			1	1		1
		(ii)		Pencil {does not dissolve / is insoluble} (in the solvents used) / ink would {dissolve / is soluble}		1		1		1
	(c)	(i)	I	Rf = Accept any value in range 0.70 - 0.75 = 2 marks Accept 0.7 **Award 1 mark for** Sight of Measurements 51-53mm + 71-73mm / 5.1 – 5.3cm + 7.1-7.3cm (1)		1 1		2	1	1
			II	Phaeophytin (1) ecf from I			1	1		1

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		• Pigments may have different solubilities in different solvents (1) • Move up stationary phase at different rates in different paper / different papers have different properties of {adhesion / cohesion / absorption} (1) • So may travel different distances (in different solvent / paper) / Rf values could be {different / not comparable / inaccurate} (1)		2	1	3		3
	(d)	(i)		Photons	1			1		
		(ii)		S = ATP (1) T = $NADPH_2$ / reduced NADP / NADPH (1) Ignore charges Reject NADH etc.		2		2		
		(iii)		A. (If no carotene synthesised) chlorophyll a damaged (at high light intensities) (1) **Any two (×1) from:** **Either**: B. Electrons cannot be passed to chlorophyll a from accessory pigments (1) C. Less photolysis (of water) (1) D. Electrons not available to be passed into electron transport chain (1) E. For {ATP / $NADPH_2$} synthesis/ photophosphorylation (1) **Or**: F. Less ATP available {as energy source to convert G3P to TP / for phosphorylation of ribulose-5 phosphate} (1) G. Less $NADPH_2$ available to reduce G3P to TP (1) H. Ribulose bisphosphate cannot be regenerated so carbon fixation stops (1) I. TP not produced for glucose synthesis so respiration stops (1)			3	3		
				Question 4 total	**4**	**9**	**6**	**19**	**1**	**7**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		Deforestation / description of e.g. old forest cut down (1) Loss of habitat / fewer (ecological) niches / monoculture (1)		2		2		
		(ii)		{Fewer / smaller} plants to carry out photosynthesis (1) So less CO_2 removed / more CO_2 remains in the atmosphere (1) OR {Burning / decomposition} of (felled) trees (1) Releases CO_2 (1) OR Less transpiration (1) Affects rainfall / humidity levels (1) OR Vehicles burning fossil fuels (1) Releasing CO_2 (1) first MP must awarded to gain second		2		2		
	(b)	(i)		Final stage in succession/ (Stage in which) {populations of organisms / communities} {remain stable / have no further change}	1			1		
		(ii)	I	(Less plant cover due to deforestation) so more evaporation from soil (1) Results in lower soil moisture content (1) OR Ref to irrigation required for growth of avocado trees / fewer trees removing water from soil (1) So moisture would increase (1) first MP must awarded to gain second			2	2		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
			II	**Any two from:** • Less dead plant material to decay so fewer minerals returned to the soil (1) • Avocados are harvested so nutrients removed from the ecosystem / avocados (are a monoculture so) remove (same) minerals from soil (1) • Soil more exposed to leaching / soil erosion (1) **and** Therefore lower soil fertility / less nitrates / minerals in the soil (1) OR • Avocado trees need fertilisers (1) • As they remove (same) nutrients from the soil (1) **and** • Therefore soil fertility would increase (1) • Trend mark can only be awarded if at least one explanation mark awarded			3	3		
		(iii)		A. Description of setting up a grid (1) reject reference to transect B. Quadrat {locations / co-ordinates} selected randomly (1) C. Count the numbers of (individuals of) each <u>species</u> present (1) must be in context of species not just plants D. Calculate (and compare) a (Simpson's) biodiversity index for each area studied (1)		2	2	4		4
	(c)	(i)		• Many alleles for the same genes (1) • So genetic crosses would be unpredictable / High variability in offspring / Low chance of getting suitable phenotypes / Cross-pollination increases genetic variation (1)		1	1	2		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		Xylem (1) Reject xylem and phloem (Wilt because) less water transported to {shoots / leaves} so {less support for tissues / cells have less water / cells are not turgid / cells plasmolyse} (1) (Die because) less {water / leaves} available for photosynthesis (so less glucose available for respiration) (1)		1	2	3		
		(iii)		To conserve {gene pools / valuable alleles} / Source of resistant alleles / Maintain genetic {diversity / variability} (1) **Any 2 (for 1 mark) from**: • (Habitat protection through) {nature reserves / SSSIs} • (Breeding / reintroduction programmes by) botanic gardens • Seed stores • Relevant legislation / compensation for farmers	2			2		
				Question 5 total	**3**	**8**	**10**	**21**	**0**	**4**

Question	Marking details	Marks Available					
		AO1	AO2	AO3	Total	Maths	Prac
6	**Indicative content** **Conditions for bacterial growth in a lab** A1 Water + {transport / metabolic reactions / hydrolysis} A2 {Carbon source / named organic molecule} + {synthesis of organic compounds / respiration} A3 {Nitrogen source / named molecule} + synthesis of {proteins / amino acids / nucleic acids} A4 Suitable / optimum {temperature / pH} Ignore value A5 Reference to {mineral / vitamin / growth factors} requirements A6 Correct ref to oxygen requirements **Identifying bacteria microscopically** B1 Size B2 Shape B3 Description of shapes: two examples from: coccus, bacillus, spirillum, vibrio B4 Staining characteristics / Gram staining B5 Description of results with Gram stain – Gram + purple, Gram -ve red/pink (details of cell wall structure revealed by Gram stain not relevant) **Viable count and serial dilution** C1 Method of determining the number of living cells (in a sample of drinking water) C2 Known volume of organisms is diluted / ref to serial dilution / Example of dilution e.g. in ten-fold steps C3 Known volume added to agar plates, C4 (Incubated and) the colonies counted C5 Justify choice of plate e.g. enough colonies to be confident in the estimate / or description of C6 Assume that one cell gives rise to one colony.	9			9		9

Question	Marking details	Marks Available					
		AO1	AO2	AO3	Total	Maths	Prac
	7-9 marks Indicative content of this level is detailed content from all three areas. *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** Indicative content of this level is detailed content from two areas. *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 statement from the indicative content. *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 6 total	**9**	**0**	**0**	**9**	**0**	**9**

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Q	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	9	6	0	15	4	0
2	3	12	3	18	5	0
3	2	10	6	18	0	3
4	4	9	6	19	1	7
5	3	8	10	21	0	4
6	9	0	0	9	0	9
TOTAL	30	45	25	100	10	24