GCE A LEVEL MARKING SCHEME

SUMMER 2023

A LEVEL
BIOLOGY – COMPONENT 3
A400U30-1

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.

GCE A LEVEL BIOLOGY

COMPONENT 3 – REQUIREMENTS 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.

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)		{Number/ group} of tissues + working together / {same/ similar/ specific} {role/ function} (1)	1			1		
		(ii)		maintenance of (constant) <u>internal</u> {state/ environment/ conditions} (1)	1			1		
	(b)			A = (Squamous) epithelial/ epithelium (1) B = Proximal convoluted tubule (1) Accept PCT/ DCT/ convoluted tubule C = Bowman's capsule (1)		3		3		3
	(c)	(i)		1epu = 3.7(037037) µm = 2 marks accept correct rounding (Accept range from 3.3-3.8 for 2 marks) If incorrect award one mark for 0.0037(mm) 0.00375 (mm) 0.0038 (mm) 0.003 (mm) 1 epu = 10/27 or 15/40 or 5/13 or 1/3 0.37 x 0.01		2		2	2	2
		(ii)	I	19		1		1		2
			II	70.3 µm (1) ecf from (i) – answer from (i) multiplied by answer from (ii)I If measurement includes Bowman's capsule = 24epu 24x3.7 = 88.8/89um Or 24 x answer from (i)		1		1		
				Question 1 total	**2**	**7**	**0**	**9**	**2**	**7**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		Independent variable: Sun and Shade ignore light intensity Dependent variable: number stomata (in field of view). **Both correct for 1 mark**	1			1		1
		(ii)		**Any two (×1) from** (similar) {size/ (surface) area} of leaves (1) (Same) species (of ivy)/ used Hedera helix (1) ignore type (Same) magnification/ objective lens kept at x 40/ size of field of view (1) ignore same microscope	2			2		2
		(iii)		**Any two (×1) from** Increase number of leaves/ use more than 10 leaves (1) Increase number of plants/ use more than {one plant/ two trees} (1) Increase number of fields of view/ owtte (1)			2	2		2
	(b)	(i)		t = 8.238 (3) (same as statistical table) Accept 8.24 If incorrect award 2 marks for any of: $t = 40 – 27/\sqrt{(11.6/10 + 13.3/10)}$ $t = 13 / \sqrt{(11.6/10 + 13.3/10)}$ $t = 13 /\sqrt{(1.16 + 1.33)}$ $t = 13 /\sqrt{(2.489)}$ t = 13 / 1.578 8.2 (not to 2 or 3dp) If incorrect award 1 mark for: $\sqrt{(11.6/10 + 13.3/10)}$ $\sqrt{(1.16 + 1.33)}$ $t = 40 – 27/\sqrt{((11.6)^2/10 + (13.3)^2/10)}$ 8.3 (incorrect rounding of correct figure + not to 2 or 3 dp)		3		3	3	3

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		• (18 d.f. so the correct) critical value 2.101 (1) Accept circled in table • Calculated value greater than Critical Value/ {8.238/ their value}>2.101 (1) • Reject Null hypothesis (1) • There is a significant difference between the {two groups/ sun and shade} / any difference between the {two groups/ sun and shade} is not due to chance (1) Ecf from (i)		4		4	4	4
	(c)	(i)		CO_2 used for photosynthesis/ increased carbon dioxide causes increased rate of photosynthesis (1) (Higher concentration CO_2) {faster/ more} <u>diffusion</u> / higher concentration <u>gradient</u> (1) Fewer stomata needed for same carbon dioxide intake (1)	1		2	3		
		(ii)		A. Reference to presence of {K^+ / malate} in {guard cells/ cytoplasm/ vacuole}(1) B. reduces their {water/ solute} potential / owtte (1) C. H_2O enters (guard cells) by osmosis. (1) D. Turgor pressure increases/cell become turgid (1) E. Ends of guard cell walls are thinner/ central wall is thicker (1) F. Ends expand opens stomata/ cells are forced apart/ owtte (1)	1 1 1		1 1	5		
				Question 2 total	**7**	**7**	**6**	**20**	**7**	**12**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		**Any three (x1) from** • RA pumps blood into RV to lungs (in adult). (1) • Lungs not functional in foetus/ {no need for pulmonary circulation/ owtte} in foetus (1) • as O_2 from {mother/placenta} (1) • Hole allows blood to pass {RA→ LA(→ LV)/ missing out the lungs} (1)		1	1 1	3		
		(ii)		**Any two (x1) from** {Deoxygenated blood/ blood containing less oxygen} around body/ ref to oxygenated and deoxygenated being mixed (1) (less oxygen) to the {tissues / muscles/ cells} (1) less (aerobic) respiration (1)		1	1	2		
	(b)	(i)		A = Aorta B = Pulmonary artery. **Both for 1 mark**	1			1		
		(ii)		**Any two (x1) from** Increased {hydrostatic/ blood} pressure (1) Damage to capillaries (increases permeability) (1) {Water / fluid} not reabsorbed/ less {water / fluid} reabsorbed (1)			2	2		
	(c)			Fish = Gills/ gill plate/ lamellae/ gill filaments Mammals = alveoli (ignore lungs) Earthworm = skin/ epidermis/ (body) surface Insects = Tracheoles Reject spiracles/ tracheae **4 correct for 2 marks** **2/3 correct for 1 mark** **0/1 correct = 0 marks**	2			2		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		Quaternary/ 4^o (1)	1			1		
		(ii)		4 (one gene for each pp chain)		1		1		
	(e)	(i)		**Any two (x1) from** (Haemoglobin has) greater affinity for oxygen. (1) more saturated than adult haemoglobin {at values of less than approx. 11 ppO_2 / at lower pp} (1) so oxygen is able to pass from mother to foetus/ owtte (1)	2			2		
		(ii)		Yak haemoglobin has a (very) high affinity for oxygen (1) highly saturated at {low pp of O_2 / environmental oxygen levels/ approx. 1.5–2.5kPa} (1)		1	1	2		
		(iii)		difficult for oxygen to dissociate/ only dissociates at very low ppO_2/ dissociates over a narrow change in pp/ owtte			1	1		
		(iv)		Lower pp of oxygen/ lower level of oxygen in the environment (1) (High breathing rate) to maintain conc gradient/ to get sufficient oxygen/ owtte (1)		2		2		
				Question 3 total	**6**	**6**	**7**	**19**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		**Any two (x1) from** (Ratio) goes {down/ to zero} (1) (they are) (re)absorbed / move back (from filtrate into blood) (1) By cotransport/ facilitated diffusion/ secondary active transport (1)		1	1	2		
		(ii)		**Any two (x1) from** Urea ratio (in the filtrate) increases (1) (because) water reabsorbed/ volume decreases (1) but urea {not (all) reabsorbed/ stays in the filtrate} (1)		1	1	2		
	(b)			higher concentration gradient (for DDT as more water has been absorbed)			1	1		
	(c)			(Glucose reabsorbed using) co-transport/ facilitated diffusion/ secondary active transport (1) **Any one (x1) of** {Proteins/ protein carriers} are saturated (at high glucose concentrations)/ limited number of carrier proteins/ owtte (1) OR Low sodium ion concentration limits (cotransport) (1)		2		2		
				Question 4 total	**0**	**4**	**3**	**7**	**0**	**0**

<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>arrow correctly placed in node at +40 or clearly indicated (1)
Depolarised / inside (the axon) +ve (1)</td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td>Ref to hyperpolarisation/ Ref to -90 / owtte (1)
Synaptic vesicles only on {presynaptic side/ synaptic knob / synaptic bulb}/ owtte/ ORA (1)</td><td></td><td>2</td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td></td><td>P = Schwann cell
Q = Axon/ cytoplasm/ axoplasm
R = Myelin (sheath)

3 for 2 marks
2 for 1 mark.</td><td></td><td>2</td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Slow down (1)
No saltatory conduction/ more local circuits/ ref to function of myelin/ owtte (1)</td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td><table><tr><td>Temperature</td><td>Affects {rate of diffusion/ kinetic energy} (of ions) or example</td></tr><tr><td>Diameter of axon</td><td>affects resistance/ or example</td></tr></table>Accept two factors for 1 mark if explanation incorrect.</td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
</table>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			**Any four (x1) from** A. Post synaptic neurone more -ve/ hyperpolarised (1) B. (because) Cl^- in **and** K^+out. (1) C. {Neurotransmitter/ Ach} released from {excitatory neurone / neurone X} / {Neurotransmitter/ Ach} binds to receptors. (1) D. Na^+ in/ ref to depolarisation (1) E. Threshold not reached (therefore no action potential) (1)		2	2	4		
	(e)			(Acetylcholinesterase) cannot break down Ach (1) Ach (remains in cleft and) continually {binds to / stimulates} {receptors/ post synaptic membrane} owtte (1)			2	2		
				Question 5 total	**6**	**6**	**4**	**16**	**0**	**0**

Question	Marking details	Marks available					
		AO1	AO2	AO3	Total	Maths	Prac
6	**Amoeba.** A1 Phagocytosis/ endocytosis/ description of formation food vacuole. A2 Golgi body producing lysosomes A3 lysosomes fuse with food vacuole/ lysosomes contain enzymes A4 ref to: intracellular digestion/ digestion inside vacuole A5 Products of digestion absorbed/ owtte A6 Exocytosis/ or description of **Hydra** B1 Can ingest {large organisms/ prey/ food}/ or description of B2 Enzymes produced by gland cells/ extracellular digestion B3 {Food/ waste} {mixed/ moved} by flagella B4 intracellular digestion in the food vacuole B5 Microvilli to increase SA. for absorption B6 large numbers of mitochondria for {ATP/energy} for {absorption/ active transport/ AVP} **Further adaptations mammals.** C1 Mechanical digestion/ teeth/ churning C2 Peristalsis/ or description of C3 Long gut allows time for {digestion/ absorption} C4 Different regions modified to digest specific nutrients /given examples of at least two regions/ owtte C5 Reference to region with adaptation for {absorption/ owtte} e.g. microvilli/ folding/ C6 Mammals gut ingestion mouth + egestion from anus/ owtte	3	6		9		

Question	Marking details	Marks available					
		AO1	AO2	AO3	Total	Maths	Prac
	7-9 marks Indicative content of this level is detailed explanation 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 detailed explanation of two sections or less detail 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 comment 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.* **0 marks** *The candidate does not make any attempt or give a relevant answer worthy of credit.*	3	6		9		
	Question 6 total	**3**	**6**	**0**	**9**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		A disease which is present {at low levels (in an area)/ frequently at a predictable rate (in a specific location/population)} (1)	1			1		
		(ii)		Population size may vary / Proportional to population size (1) In order to make a comparison / show a trend (1)		2		2		2
		(iii)		5% = 2 marks 0.5/ 10 x 100 = 1 mark		2		2	2	
		(iv)		Not all cases diagnosed as TB / More of the population may have died from TB but not diagnosed / misdiagnosed/ owtte			1	1		
	(b)	(i)		Rifampicin {is not soluble / has low solubility} in water / Rifampicin is highly soluble in {organic / non-polar} solvents (1) Rif. Can pass through hydrophobic outer envelope to enter cell (1)			2	2		1
		(ii)	I II	Affects { {many / most} {species/ types} of bacteria/ Gram +ve and –ve} kills bacteria (1)	2			2		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		Inhibits the formation of mRNA (1) Prevents translation from taking place / stops protein synthesis/Cell cannot synthesise {proteins / enzymes} (1) Metabolism stops and cell dies / {essential processes/ named process} cannot occur without enzymes/ owtte (1)		3		3		
	(c)	(i)		Epidermis acts as physical barrier to infection/ needs to reach {blood/ antigen presenting cells/ macrophages} (1) To initiate a (primary) immune response (1)		2		2		
		(ii)		**Any three (×1) from** • Macrophages engulf the bacterial cells by phagocytosis/ Antigen presentation by macrophages (1) • Activation of T helper cells/ ref to cytokines (1) • B cells are activated/ clonal selection (1) • clonal expansion/ or description of (1) • some then differentiate into plasma cells (1)	3			3		
		(iii)		Could cause {pathogenic response/ disease}/ owtte (1) Not: side effects unqualified Antigen / RNA/ {dead/ inactive/ related} pathogen (1)			2	2		
				Question 7 total	**6**	**9**	**5**	**20**	**2**	**3**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		**Any two (×1) from** Restriction of movement of the rib cage/ rib cage cannot expand (1) diaphragm pushed against Abdominal contents / diaphragm cannot flatten / harder to push down owtte (1) lungs cannot increase in volume / shallow breathing / less air drawn in (1)		1	1	2		
		(ii)		Highly active individuals have mineral density above the fracture threshold at 80 yoa (1) High activity reduces chances of developing osteoporosis ORA (1)			2	2		
		(iii)		**Any 2 from:** Same sex/ gender (1) Similar nutrition (1) Similar bodyweight / BMI (1) Ethnicity (1) Other underlying health issues (1)			2	2		
	(b)			Simple / Displaced (fracture) (1) Radius / ulna (1) Manipulation / re-alignment (to set the fracture)/ Immobilisation to allow fracture to heal/ owtte Painkillers/ anti-inflammatory (1)	2	1		3		1

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		Third (order lever) (1)	1			1		
		(ii)		105.8(4) or 106 Newtons 2 marks If incorrect award one mark for: Substitution into equation = 1 mark Sight of 11.76 = 1 mark		2		2	**2**	
		(iii)		**Any 4 (x1) from:** Muscles can only exert a pulling force / can only contract and relax (1) Can only move bones when they contract / can only pull on bones (1) biceps and triceps (are antagonistic) / when biceps contracts, triceps relaxes (1) biceps contracts to pull the lower arm up / flex arm (1) triceps contracts to pull lower arm down / extend arm (1)		4		4		
	(d)	(i)		Striated/ skeletal	1			1		
		(ii)		**A:** myosin (1) **B:** actin (1)	2			2		2
		(iii)		Line C		1		1		
				Question 8 total	**6**	**9**	**5**	**20**	**2**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)	(i)		**A:** frontal lobe/ cerebral cortex/ cerebrum/ cerebral hemisphere **B:** cerebellum **C:** corpus callosum All 3 for 2 marks, 1 or 2 for 1 mark	2			2		1
		(ii)		Left hemisphere; (1) Movement of the right side of the body is controlled by the left side of the brain; (1)	1	1		2		
	(b)	(i)		The sooner therapy is started after the injury the faster the rate of recovery (1) Range bars do not overlap suggesting high confidence (1)			2	2	1	
		(ii)		Neuroplasticity; (1) Neurones can grow and make new connections to bypass the damaged area (1)	2			2		
		(iii)		**Any 2 (x1) from:** Similar age Same sex Similar level of injury/ paralysis Same type of therapy Same ethnicity			2	2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iv)		**Any 4 (x1) from:** Synapse formation increases rapidly from birth to 4 months / valid use of data (1) Rate of synapse formation in sensory pathways is highest during this time (1) If {Speech/Language} areas of the brain are not stimulated synapses do not form (1) There is more pruning of unused synapses (1) After critical period – brain is 'hard wired' and more difficult/impossible to form new synapses (for language) / harder to learn language after four years / after synaptic pruning (1)		4		4		
	(c)	(i)		Kinesis (1)	1			1		
		(ii)		4.4 mms^{-1} (1)		1		1	1	1
		(iii)		as light intensity decreases, speed decreases / ORA (1)		1		1		1
		(iv)		In bright areas, the woodlice move faster, increasing chances of finding darker areas as these are more favourable/ escape from predators/ owtte (1)			1	1		
		(v)		Add a (known volume of) water to the filter paper in each petri dish (to give a range of humidities) (1) Light = Controlled variable / keep light level the same owtte (1)			2	2		
				Question 9 total	**6**	**9**	**5**	**20**	**2**	**3**

COMPONENT 3: REQUIREMENTS FOR LIFE

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	2	7	0	**9**	2	7
2	7	7	6	**20**	7	12
3	6	6	7	**19**	0	0
4	0	4	3	**7**	0	0
5	6	6	4	**16**	0	0
6	3	6	0	**9**	0	0
Option A Question 7	6	9	5	**20**	2	3
Option B Question 8	6	9	5	**20**	2	3
Option C Question 9	6	9	5	**20**	2	3
TOTAL	**30**	**45**	**25**	**100**	**11**	**22**