GCE A LEVEL MARKING SCHEME

SUMMER 2022

A LEVEL
BIOLOGY – COMPONENT 3
A400U30-1

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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 3 – REQUIREMENTS 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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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			3x26= 78, but may include start and or stop so allow 81 and 84		1		1		
	(b)			**Any four (×1) from** A. Sodium ions {enter/ continue to enter} the {axon/ neurone/ cell} (1) Ignore ions entering membrane B. Threshold is reached (1) C. an action potential formed/ causing depolarisation (1) D. in a sensory neurone (1) E. carrying impulses to the {central nervous system/ brain} (1)	2	2		4		
	(c)	(i)		X vesicle/ {synaptic/ neurotransmitter} vesicle (1) Z Exocytosis (1)	2			2		
		(ii)		**Any three (×1) from** A. {Synthesis of/ reuptake of} neurotransmitter/ owtte (1) B. {Movement of/ or description of movement} vesicles/exocytosis (1) C. Active transport of Calcium ions <u>out</u> (of knob) (1) D. Synthesis of neurotransmitter receptors (1) E. (Energy to) package neurotransmitters into synaptic vesicles (1)		3		3		
				Question 1 total	**4**	**6**	**0**	**10**	**0**	**0**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		0.07 / 0.067675376 or correct rounding (: 1) = 2 marks Award 1 mark for $\frac{20096}{296947}$ 0.067675376 rounded incorrectly		2		2	2	
		(ii)		Larger (SA:vol ratio) + diameter is smaller	1			1		
		(iii)		**Any two (x1) from** They can rely on diffusion over their (external) surface {for gas exchange/ or description of} (1) Large {surface area to volume/ SA:V} ratio (allows diffusion to occur at a sufficient rate) (1) Short diffusion distance (1) Single celled organisms have a comparatively low {metabolism / oxygen demand} (1)	2			2		
	(b)	(i)		{Keeps a high/ maintains} {diffusion/ concentration} gradient (1) Maintaining {oxygen diffusion rate/ oxygen absorption}/ to get enough oxygen (1)		2		2		
		(ii)		Oxygen diffuses directly into {cells/ tissue} (1) From tracheoles (1)		2		2		
		(iii)		Blood not in vessels/ no blood vessels	1			1		
				Question 2 total	**4**	**6**	**0**	**10**	**2**	**0**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		Internal digestion of food substances/ ingested and digested	1			1		
		(ii)		Could digest the cell/ prevent autolysis (1) Only converted when {<u>hydrochloric acid/ HCl</u>} is present (1)	1	1		2		
	(b)	(i)		**Any four (x1) from:** {Use of data/ description of graph} for sugar and protein (1) Solid needs (more) {mechanical digestion/ or description of} (1) Proteins are large molecules, take {longer/ long time} to digest (1) Carbohydrates not digested in stomach/ carbohydrates digested in small intestine (1) Protein remains in the stomach longer so it can be broken down (1)			4	4		
		(ii)		(Rate) decreases / it takes longer (1) Enzymes in stomach {have a low (optimum) pH/ require acid condition/ no longer at optimal pH}/ ORA/ acid needed to activate pepsinogen (1)			2	2		
	(c)	(i)		Endopeptidase {breaks bonds in the middle of the chain / produces shorter polypeptides} (1) Exopeptidase only removes terminal amino acids **+** so (more) free amino acids produced (1) Combination gives more ends for exopeptidase to work on so most free amino acids released (1)		3		3		
		(ii)		Add biuret, stays blue (1) Enzyme is a protein (1)		2		2		2

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		59.5 or 60 = 2 marks Award 1 mark for substitution Y= 0.85 x 70 +0		2		2	2	
		(iv)		Only used 2 results so {they cannot assume a straight line/ Line may plateau/level off/ change gradient/ line cannot be extrapolated/ owtte}			1	1		1
				Question 3 total	**2**	**8**	**7**	**17**	**2**	**3**

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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>4</td><td>(a)</td><td></td><td></td><td>
<table>
<tr><th>Hazard</th><th>Risk</th><th>Control measure</th></tr>
<tr><td>{Instruments/ scalpel} are sharp</td><td>Cut hand when dissecting</td><td>Care when cutting/ Cut away/ down onto tile/hard surface</td></tr>
<tr><td>Bacteria are a biohazard</td><td>Risk of infection from handling</td><td>Disinfect bench/ any equipment used Cover cuts/ Wear gloves/ wash hands</td></tr>
</table>
1 mark for hazard
1 mark for risk and associated control measure</td><td>2</td><td></td><td></td><td>2</td><td></td><td>2</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>(High blood pressure) increases (ultra)filtration rate/ more filtration/ or description of (1)
{Higher rates/ more filtered} in {unaffected/ other} tubules {are needed to maintain normal rate/ to compensate/owtte}/ higher rates needed to compensate for blocked tubules (1)</td><td></td><td></td><td>2</td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>High blood pressure {increases pressure/ causes high pressure} (at arterial end) capillary/ hydrostatic pressure is greater than osmotic pressure (1)
So more (tissue) fluid formed than can be reabsorbed/ so excess fluid cannot be reabsorbed/ owtte (1)
Fluid accumulates in tissues/ tissues retain more fluid (1)</td><td></td><td>3</td><td></td><td>3</td><td></td><td></td></tr>
</table>

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			**Any four (x1) from** **For:** {Most/ 11} of the {pain scores /average pain} decreased after the procedure (1) **Against:** Some of the scores did not decrease/ some stayed the same/ 1 increased (1) The sample size is too small (1) No statistical test has been carried out (1) Pain scale is subjective (1) Only carried out on men (1) No information on other medicines taken (1)			4	4		4
	(d)	(i)		a chromosome that is not a sex chromosome/ not sex linked (1) Only 1 copy of the allele needed to inherit disease/ always expressed {when present/ in the phenotype} (1) (not just “dominant”)	2			2		
		(ii)		**Any two (x1) from** • There are no mutations/ no new alleles are created. (1) • There is no immigration /emigration/ no new alleles are introduced/ lost. (1) • There is no selection/ no alleles are favoured or eliminated. (1) • Mating is random/ alleles are mixed randomly. (1) • The population is {large/ over 100} /no genetic bottlenecks. (1) • No genetic drift (1)	2			2		
				Question 4 total	**6**	**3**	**6**	**15**	**0**	**6**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		351/353/354= 3 marks Accept 360 (if rounded area to 0.025) **Award 2 marks** 9/0.025434 9/0.025 353.8…… 88/ 89 (used diameter instead of radius) 300 (rounded area to 0.03) **Award 1 mark for** Area = 3.14x 0.09^2 = 0.025(434) mm^2 88.46 (used diameter instead of radius and not rounded) 9/0.03		3		3	3	3
		(ii)		**Any two (x1) from** Use several {counts/fields of view/ areas of leaf}/ repeat and calculate a mean (1) Some method of discounting half a stoma in a field of view/ owtte (1) Make sure each is only counted once (1)			2	2		2
	(b)	(i)		Area covered by water (1) {No/ reduced} {gas exchange could take place/ {carbon dioxide/ air} can enter} (1)			2	2		
		(ii)		**Any three (x1) from** Plates {trap a layer of {still air/water} / prevent blowing water away} (1) Layer becomes saturated with water vapour/ (area of) increased humidity (1) Reduce {concentration/ water potential} gradient (1) So water loss decreases/ conserves water/ less transpiration/ ORA (1)		3		3		

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		Symplast (1) Casparian strip / layer of suberin (1)	2			2		
	(c)			**Any three (x1) from** • Stomata open to allow CO_2 (to diffuse) in for photosynthesis (1) • (At higher CO_2 concentrations) there is an increased (rate of) CO_2 {uptake/diffusion} (1) • Sufficient CO_2 can be absorbed with {fewer stomata open/ stomata open less} (1) • More photosynthesis means more water used (1)		1	2	3		
	(d)	(i)		Difference = 1.2341 x10^{13} or 1.2 x 10^{13}= 3 marks 2 marks if Not standard form Incorrect rounding 1 mark (7500- 3400) x 70000 x 43000		3		3	3	
		(ii)		{decrease in transpiration/ less water absorbed/ less water lost by leaves} (so more water will remain on ground)			1	1		
				Question 5 total	**2**	**10**	**7**	**19**	**6**	**5**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6				**X** Artery: Thicker {wall/ muscle layer} To {withstand/ maintain} high pressure (due to ventricular contraction) Thicker elastic tissue Evens out flow/ recoils when lower pressure Muscle layer contracts to give smaller lumen diameter Alters blood supply to different organs **Y** Vein: Thinner {wall/ muscle layer} Allows skeletal muscle to increase pressure in lumen {large/ wide} lumen to reduce resistance to flow Backflow of blood prevented By the presence of valves Aneurysm: Wall stretched/ bulging/ or description of Outer layer not broken {Smooth muscle/ wall} “torn”/ damaged/ inflammation of tunica media May break (and bleed out)/ owtte Less {blood/ oxygen} to destination. Blood pools	6	3	0	9	0	0

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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 areas of indicative content *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…description of at least two areas of indicative content or less detail of three *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… description of at least one area of 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.*						
				Question 6 total	**6**	**3**	**0**	**9**	**0**	**0**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		A {molecule/ protein} that {causes an immune response/causes the production of antibodies/ binds to antibodies} (by the host's immune system)	1			1		
		(ii)		Do not contain {named organelles/ ribosomes} for protein synthesis/ enzymes for replication of nucleic acid (1) (sore throat) Cell {lysis/ burst} / inflammation/ {chemical factors/ histamines} involved in immune response (1)	1	1		2		
		(iii)		Neuraminidase unable to {hydrolyse/ break down} the glycoprotein (1) virus (particles) not released / virus (particles) remains attached to {host cell/glycoprotein}. (1) Could not infect other (host) cells/{antibodies/ phagocytes} better able to target virus (1)		1	2	3		
	(b)	(i)		(Does not have the nucleic acid/RNA and therefore) cannot replicate inside (human) cells/ ORA/ prevent production of viral RNA in cells		1		1		
		(ii)		**Any three (×1) from** A. antigen presentation or description of (1) B. T cell activation (1) C. clonal expansion (1) D. Release of cytokines (1) E. Cytokines stimulate {phagocytic cells/named phagocyte/monocyte/macrophages} (to engulf virus/antigens) (1) F. T memory cells are formed (1) (Reject antibody production or reference to B cells unless in the context of being stimulated by cytokines. Ignore reference to cytotoxic/killer T cells)	2	1		3		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)	I	Weaker immune system / owtte/ flu may adversely affect symptoms of other conditions/ more likely to contract flu so increase (reservoir of) viruses in community.			1	1		
			II	more likely to be infected as come into contact with greater numbers of infected people/ owtte could infect more vulnerable groups (eq) of people with flu/ reduce the number of staff available to care for vulnerable people.			1	1		
	(c)	(i)		Gram positive. (1) There is no lipopolysaccharide layer/there is a thick(er) layer of {murein/peptidoglycans} than gram negative bacteria)/ only peptidoglycan (1)	1	1		2		1
		(ii)		(Penicillin) because there is a {clear area/ zone of inhibition} / bacteria have not grown around disc P/bacteria have grown around disc S. (1) {Streptoccocus/the bacteria} {are not resistant to penicillin/are resistant to streptomycin/ are killed by penicillin} (1)		1	1	2		2
		(iii)		**Any two (×1) from** Bacteria can obtain plasmids that carry an antibiotic resistance allele from other (resistant) bacteria (1) Random mutation of DNA/during DNA replication (produce antibiotic resistance allele) (1) Resistant bacteria have a selective advantage (only when antibiotics are present) (1)	1	1		2		
	(d)			5 times larger (2) 0.75 (1) 0.15		2		2	2	
				Question 7 total	**6**	**9**	**5**	**20**	**2**	**3**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		Hyaline cartilage. (1) Reduce friction/allow smooth movement of bones over each other. (1)	2			2		
		(ii)		X Chondrocytes Y Matrix (Both required for 1 mark)	1			1		
		(iii)		no blood vessels/capillaries (in matrix). (1) diffusion (through matrix.) (1)	1	1		2		
	(b)	(i)		H zone becomes {smaller/disappears/ shortens} **+** A band remains the same (length/width) (1) **Any one (×1) from** {Thin filaments /actin filaments/Z line} move toward the centre of the sarcomere (reducing the distance between them) (1) The A band is the length of the {thick /myosin} filament (which does not change in length). (1)	1	1		2		
		(ii)		7000 = 2 marks Award 1 mark for $\frac{280000}{40}$ or $\frac{280}{0.04}$		2		2	2	
		(iii)		Antagonistic		1		1		
	(c)	(i)		Osteoblasts (1) Bones are {not hard enough/too soft /not strong enough} (1) (reject low bone density) So cannot support (increasing) body mass/weight (1)		3		3		

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		Young – bones still growing/ ORA. (1) Albino – Rats with {skin/fur} colour/melanin would absorb different quantities of UV/so that rats absorb same quantity of UV/rats with no melanin absorb maximum UV (1)			2	2		2
		(iii)		**Any three (×1) from** • Both {UV/sunlight/1} and {Vitamin D supplements/2} increase {area of growing region/ bone growth}/ all three increase bone growth (1) • UV causes a greater increase than Vitamin D supplements/use of data (1) • For group 1 and group 2, SD at 0 and 10 days do not overlap so difference (at 0 and 10 days) is significant. (1) • No significant difference in the data for group 3/ SD causes sets of data to overlap (1)			3	3		1
	(d)	(i)		Scoliosis		1		1		
		(ii)		Genetic/inherited/gene mutation/{muscle problems/ or description of}	1			1		
				Question 8 total	**6**	**9**	**5**	**20**	**2**	**3**

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)	(i)		Specialised/different groups/castes perform different tasks (eq) (1) (worker termites) care for young/larvae OR collect food OR build the termite mound OR make the environment/specific example inside the termite mound suitable for colony (1)	1	1		2		
		(ii)	I	Phototaxis	1			1		
			II	**Any three (×1) from** Wingless termites (move away from light) remain within the termite colony (1) Where they carry out their roles/ named role within colony (1) Winged termites (move toward light) fly away from colony/can disperse before reproducing/produce a colony elsewhere. (1) Reducing competition (1)			3	3		
	(b)	(i)		**Any one (×1) from** Decreases the amount of aggression/fighting is less likely/is a last resort. (1) Dominant animals have greater access to resources so more likely to survive to reproduce/dominant animals more likely to mate and reproduce. (1)	1			1		
		(ii)		1.35 – 1.3 : 1 = 2 marks Award 1 mark for $\frac{26 \text{ or } 27}{20}$		2		2	2	
		(iii)		4.7- 4.9 (ecf)		1		1		1

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Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iv)		**Any one (x1) from** Difficult to place a numerical/quantitative value on a type of behaviour (1) OWTTE Interpretation of behaviour (by observer) is subjective/ qualitative (1) Behaviour influenced by other factors (may not be consistent) (1) Ref to graph showing a weak correlation (1)			1	1		1
	(c)	(i)		Imitation		1		1		
		(ii)		Hands {have many muscles to control/make complex movements}. (1) A larger number of neurones are needed to control {these muscles/movement} (1) (Needs some reference of comparison or proportion)		2		2		
	(d)	(i)		A (small quantity of) {radioactive isotope/radioactive fluorine/^{18}F} injected into the patient/subject. (1) More radioactivity taken up by cells that {are most active/have highest glucose uptake /have highest rate of respiration} (1) Quantity of radioactivity {converted/ transduced} to an image. (1)	1	2		3		1
		(ii)	I	(viewing written words) Visual cortex/occipital lobe	1			1		
			II	(speaking individual words) Broca's area/ temporal lobe	1			1		
		(iii)		Complex speech requires a {wider range of/conscious} thought processes/ uses (neural pathways from) other parts of the brain to think/uses stored memory.			1	1		
				Question 9 total	**6**	**9**	**5**	**20**	**2**	**3**

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COMPONENT 3

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	4	6	0	**10**	0	0
2	4	6	0	**10**	2	0
3	2	8	7	**17**	2	3
4	6	3	6	**15**	0	6
5	2	10	7	**19**	6	5
6	6	3	0	**9**	0	0
Option	6	9	5	**20**	2	3
TOTAL	**30**	**45**	**25**	**100**	**12**	**17**

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