GCE A LEVEL MARKING SCHEME

AUTUMN 2021

A LEVEL
BIOLOGY – COMPONENT 3
A400U30-1

INTRODUCTION

This marking scheme was used by WJEC for the 2021 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

REQUIREMENT FOR LIFE

AUTUMN 2021 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)			Amylase (1) A and D (1)	2			2		
	(b)	(i)		$C_{18}H_{32}O_{16}$		1		1		
		(ii)		Enzymes specific to single substrate/ owtte		1		1		
	(c)	(i)		**Any two (x1) from:** Insoluble (1) Too large to diffuse out (1) Doesn't cause osmosis (1) Compact so can fit a large amount in a small space (1)	2			2		
		(ii)		Iodine (solution has been added)		1		1		1
		(iii)		64mm x 1000 divided by 27 x2370 answer will depend on measuring anywhere in the range 2320 to 2420 gains 2 marks. 1 mark for evidence of image size divided by 27		2		2	2	
	(d)			**Any two (x1) from:** Starch only alpha glucose, cellulose only B glucose (1) Starch can be branched/coiled, cellulose straight (1) Starch all glucose same orientation, cellulose every other glucose is inverted (1) (not microfibrils)	2			2		
				Question 1 total	**6**	**5**	**0**	**11**	**2**	**1**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)			**Any three (x1) from:** Hydrogen bonds provide cohesion/ water molecules polar so form hydrogen bonds (1) Transpiration pulls water up/ continuous column of water up the xylem (1) Forms a transpiration stream (1) Also provides adhesion to walls of the xylem vessels (1)	3			3		
	(b)	(i)		They are all clones/ genetically identical (1) So results are due to cadmium chloride/ not genetically controlled (1)			2	2		2
		(ii)		Potometer	1			1		1
		(iii)		**Any two (x1) from:** Light intensity (1) CO_2 concentration (1) Humidity (1) Air currents (1) Temperature (1)			2	2		2
		(iv)		Those grown in cadmium chloride can be compared to it/ shows that the differences in transpiration rate are due to cadmium			1	1		1
		(v)		48 = 2 marks Award 1 mark for 48.2 2.30/4.77* 100		2		2	2	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(vi)	I	Cadmium stops K^+ from {entering/ being actively transported} into the guard cells (1) Water potential in guard cells will not fall/ water does not move in (1) (More) stomata (stay) closed (1)			3	3		
			II	(More) stomata (stay) closed (1) Less CO_2 available (for photosynthesis)/ Lower rate of water transport to the leaves (1) (or converse)		2		2		
	(c)			inhibit enzyme activity (1) That convert TP into next product/ named product (1) So TP increases as it cannot be converted (1)		3		3		
				Question 2 total	**4**	**7**	**8**	**19**	**2**	**6**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			The inner (pleural) membrane moves outward. (1) This pulls on the surface of the lungs and causes the alveoli to expand. (1)	2			2		
	(b)			It is small enough to diffuse across alveolar wall/ similar size to oxygen/ Not a problem in small amounts/ only a single breath/ not normally involved in respiration			1	1		
	(c)	(i)		Emphysema= lower surface area (1) Therefore less CO enters the blood/ more stays in expired air (1)		1	1	2		
		(ii)		Lower than 80%/ decreases (1) (Higher) concentration gradient maintained (1)		2		2		
	(d)	(i)		Cut through in different planes/ flexed/ contorted		1		1		1
		(ii)		Large surface area of capillary wall in contact with blood cells (1) So faster exchange/diffusion (1) OR More friction slows down blood flow (1) So more time for exchange to occur (1)		2		2		
		(iii)		**Any three (x1) from** Providing a barrier between the maternal and foetal blood (1) Protection from the immune system of the mother (1) Protection from the difference in maternal and foetal blood pressures (1) Secretion of hormones/ named hormones (1)	3			3		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(e)	(i)	I	70.8 x 70 = 4 956 (1)		1		1	1	
			II	2.08152/ 2.1 = 2 marks If incorrect award 1 mark for 2081.52 (not in dm^3) 2.0 (incorrect rounding) Ecf from (i)		2		2	2	
		(ii)		Can carry more oxygen to the developing {foetus/ placenta}	1			1		
				Question 3 total	**6**	**9**	**2**	**17**	**3**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		Makes it easy to compare values that cover a large range/ order of magnitude differences in values		1		1	1	
		(ii)		Increased diameter= increased surface area (1) Over which exchange of ions can occur (1) or Larger diameter offers less resistance (1) So, ions flow faster (through the axoplasm) (1) Accept ref to localised currents travelling further		1	1	2		
	(b)	(i)		Mammals have a higher body temp. (1) Therefore, faster rate of <u>diffusion</u> so action potential reached faster. (1)			2	2		
		(ii)		ATP is needed for Na^+/K^+ pump/ active transport (1) In myelinated axon= only at nodes **and** In unmyelinated = along whole length of axon (1)		2		2		
	(c)			Calcium ions do not diffuse into the synaptic knob (1) Prevents neurotransmitter release into the cleft/ exocytosis (1) Impulse is not transmitted (1)		1	2	3		
	(d)	(i)		**Any three (x1) from:** Do not shade (1) Do not cross label lines (1) Do not use sketch lines (1) Add magnification or scale bar (1) Show tissue layers not individual cells (1)	3			3		3

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)	I II	Dorsal horn (1) Ventral horn/ grey matter (1)	1	1		2		
		(iii)		Nerve net	1			1		
				Question 4 total	**5**	**6**	**5**	**16**	**1**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			650 = 1 mark Accept 600 cm- 700 cm Picture 130 cm Scale: 2cm = 10cm 1cm = 5cm So 130x 5 = 650cm		1		1	1	1
	(b)	(i)		Food is already digested by the host's enzymes (1) Does not have to waste its own {resources / energy} / does not have to synthesise its own digestive enzymes (1)		1	1	2		
		(ii)		**Any three (x1) from:** Denatures enzymes (1) So less product to be absorbed (1) Denatures the shape of carrier proteins (1) So food molecules don't fit (1)		3		3		
		(iii)		The increased H^+ decreases the affinity of haemoglobin for oxygen (1) H^+ binds to the oxyhaemoglobin and releases the oxygen (1)		2		2		
				Question 5 total	**0**	**7**	**1**	**8**	**1**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6				***Indicative content*** **Role of ADH** • Water potential of blood detected by osmoreceptors in hypothalamus • Pituitary release more/less ADH • Travels in blood to collecting ducts • Makes collecting duct more/less permeable to water • Reference to aquaporins **Graph** • Water enters the blood and water potential of the blood increases. • less ADH/ ADH release Inhibited • less permeable to water • Less water reabsorbed into the blood. • Therefore larger volumes (of dilute) urine are produced • NEGATIVE FEEDBACK. **EXERCISE:** • Student has lost water by sweating/exhaling more • To cool the body. • Water potential of the blood already very low' • So less water is lost in order to keep water potential of blood correct. • Less urine formed.	**3**	**2**	**4**	**9**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				7-9 marks Detailed content from all three areas *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** Detailed content from two areas or less detail from three 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** Content from one area *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	**3**	**2**	**4**	**9**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		An epidemic occurring {worldwide /crossing international boundaries/owtte} and usually affecting a large number of people. (1)	1			1		
		(ii)		UK has water treatment/sewage treatment to provide uncontaminated drinking water/water supply (1)		1		1		
	(b)	(i)		There would be too many colonies to count/colonies would merge/complete lawn or cover of bacteria. (1)	1			1		1
		(ii)		175000/1.75 X 10^5/17.5 X 10^4= 2 marks Award 1 mark for 21 X 10^4/21 X 10000 = 2.1 X10^5/210000 2.1 X 10^5 - 3.5 X 10^4 210000 – 35000 =		2		2	2	
	(c)	(i)		Stomach acids/low pH (kill bacteria) Reject Answers referring to immune system Accept references to saliva containing antibacterial chemical. Accept lysozyme Reject lysosome	1			1		
		(ii)		**Any three (×1) from:** Tetracycline inhibits translation (by binding to (small/30s subunit of) ribosome) (1) tRNA anticodon cannot bind to mRNA codon (1) amino acid does not bond/ form a peptide bond with adjacent amino acid (eq). (1) (One of the) {CT/cholera toxin polypeptides/subunits/primary protein structures/amino acid chains} cannot form (1)	2	1		3		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		Bacteriostatic	1			1		
		(iv)		**Any three (×1) from:** Nanoparticles <u>agglutinate</u> the {Toxin protein/CT} (1) Reject 'bind/bound to'. (stated in question) Less toxin/toxin molecules bind to receptors (1) Fewer chloride ions leave cell/enter gut lumen. (1) Less water leaves cell/enters gut lumen/less watery diarrhoea (1)			3	3		
		(v)		**Any one (x1) from** Bacteria cannot develop resistance to the nanoparticles/ Nanoparticles target the toxin directly/ less likely to have an adverse immune reaction to nanoparticles. (1) Accept converse for antibiotics			1	1		
	(d)	(i)		**Any three (x1) from** {different/ multiple} antigens (1) antibodies are produced that destroy bacteria <u>and</u> neutralise/destroy toxin (1) Killed bacterial cells (in vaccine) cannot replicate/produce toxin/cause cholera (1) Use of (only) one sub unit will not produce toxic effect/description of. (1)		2	1	3		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		**Any one (x1) from** (Duty of care) to protect others from infection/could carry infection back to UK (1) government has a duty to protect whole population (not just individuals) (1) (if health workers contract cholera) reduce resources/number of medical staff available to treat cholera sufferers in affected country (1) Health workers more likely to come into contact with disease/vulnerable people/people at risk of disease (1)		1		1		
		(iii)		(Increase reliability) Random assignment of vaccine or placebo so <u>reduced bias</u> or (Double blind/neither volunteers nor researchers knew who had vaccine) reduces placebo effect/description of. (1) (Reduce reliability) <u>*Not representative*</u> *because:* + Larger number of subjects needed/too few individuals/ Volunteers in America may be genetically different from population in other countries/ No information about age/gender/state of health for volunteers (1)		2		2		2
				Question 7 total	**6**	**9**	**5**	**20**	**2**	**3**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)			X Radius. Y Ulna Z Carpals 3 correct = 2 marks 2 correct = 1 mark 1 or 0 correct = 0 marks	2			2		
	(b)	(i)		More fast twitch fibres contract SO **Any one (x1) from** Faster contraction time (1) Greater force generated (1) Greater tolerance to lactic acid/ anaerobic respiration/ lactate removed quickly. (1) **AND** **Any one (x1) from** Maximum number of slow twitch fibres contracting at slower swim speed (1) no more slow twitch fibres contract at faster swim speed. (1)		2		2		
		(ii)		Myoglobin – More O_2 released/dissociated (when PO_2 of muscle is very low)/store of O_2 allows aerobic respiration {to continue/be maintained} when PO_2 in Hb is low (1) Large number of mitochondria produces <u>more</u> ATP / more <u>Aerobic</u> respiration (1)		2		2		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		ATP (binds to myosin head) causes actin to be released from myosin. (1) ATP releases energy to change the angle/position of the myosin head. (1) Actin binding site could change shape – Prevent actin from binding to myosin/crossbridge formation OR Change of shape of ATP binding site/active site on ATPase – ATP cannot bind so energy is not released for contraction. (1)	2		1	3		
		(iv)		To prevent denaturing of ATPase/change in protein structure which may affect actin binding site OR To prevent activity of enzymes that could hydrolyse/break down muscle proteins. (1) Buffer solution maintains constant pH (1)			2	2		2
		(v)		The two heavy chains are a similar/same distance / same number of heavy chains **AND** light chains appear at different/variable distances in the two samples/ differing number of light chains (1)			1	1		1
	(c)	(i)		392 = 2 marks Award 1 mark 56 + 4 = 60Kg X 9.8 = 588 N 588 X 0.12 = F2 X 0.18 365.86 or 365.57		2		2	2	

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		2nd order lever (1)	1			1		
	(d)	(i)		A hip (joint) socket is deeper (OWTTE) (ball of the hip joint fits further into/is surrounded by more bone of the socket) (1) Ligaments of the hip (joint) are larger/cover larger area of bone/surround a larger area of the joint/there are more ligaments. (Reject stronger) (1) Accept converse if clear.		1	1	2		
		(ii)		Closed or simple displaced fracture. (1)	1			1		
		(iii)		Immobilise the bone. (1) Using a sling/brace/(surgical insertion of) metal rivets (for severe breaks). (1) Reject splint unless described eg a figure of eight splint is sometimes used to describe a brace		2		2		
				Question 8 total	**6**	**9**	**5**	**20**	**2**	**3**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)	(i)		Hypothalamus	1			1		
		(ii)	I	SAN/SA node/Sino atrial node. (1)	1			1		
		(iii)	II	Sympathetic increases heart rate/SAN depolarisation (eq) increases in frequency AND parasympathetic decreases heart rate/ SAN depolarisation (eq) decreases in frequency. (1)	1			1		
		(i)		(Similar structure) {complementary to same receptors/fit into same receptors} (1)		1		1		
	(b)	(i)		{change in the control of gene expression/DNA} that does not change the nucleotide sequence (1)	1			1		
		(ii)		(If gene/NR3C1 is not transcribed/expressed) Glucocorticoid receptors not produced. (1) So cortisol cannot bind. (1) **Any one from:** Negative feedback prevented. (1) Hippocampus continues to stimulate pathway/description of pathway/hippocampus is not inhibited from stimulating hypothalamus/corticotrophin release not inhibited. (1) Continued/higher cortisol production (causes increased stress related illness). (1)		3		3		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		Yes BECAUSE there is a negative correlation between maternal age at exposure to trauma and mass of cortisol produced by their offspring/ owtte (1) No BECAUSE there is a large spread of data from the line of best fit/some of the values for group 2/group3 are higher than some of the values for group 1/Wide variation of values for higher cortisol production in all groups/ overlap in values (1)			2	2		
		(iv)		Volume of water in urine is variable/different volume of water would alter the concentration of urine. (1)		1		1		1
		(v)		Any two (x1) from Descendants may have their own/different sources of stress/specified examples that effect the mass of cortisol produced by the descendants. (1) The number of descendants in each group is too small <u>to be representative</u>. (1) Mass of cortisol in the urine could vary over different 24 hr periods/should have been recorded over several 24 hr periods and a mean calculated. (1)			2	2		2
	(c)	(i)		Stimulus produces an innate response in a different individual/ activates nerve pathways that do not involve decision making. (1) Stereotypical behaviour/fixed action pattern. (1)	2			2		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)		More likely to overcome other males in aggressive disputes/become dominant to other males so more likely to mate with females. (1) Females select males with larger tusks so females more likely to mate with males that have larger tusks/sexual selection of males with larger tusks. (1) MP 1 Needs to be clear male dominance leads to mating. MP 2 Needs to be clear female selection leads to mating.		2		2		
		(iii)		14.285% = 2 marks Award 1 mark for 70 - 60 10 70		2		2	2	
		(iv)		(male) elephants without tusks/who's tusks were removed are less likely to mate/ females less likely to mate with males who have no tusks (resulting in fewer calves produced/ fewer alleles for tusk growth in the population)/ less able to protect against predators (1)			1	1		
				Question 9 total	**6**	**9**	**5**	**20**	**2**	**3**

COMPONENT 3

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	6	5	0	11	2	1
2	4	7	8	19	2	6
3	6	9	2	17	3	1
4	5	6	5	16	1	3
5	0	7	1	8	1	1
6	3	2	4	9	0	0
TOTAL	**24**	**36**	**20**	**80**	**9**	**12**
Option	**6**	**9**	**5**	**20**	**2**	**3**
	30	**45**	**25**	**100**	**11**	**15**