GCE A LEVEL MARKING SCHEME

AUTUMN 2020

A LEVEL
BIOLOGY - COMPONENT 3
A400U30-1

INTRODUCTION

This marking scheme was used by WJEC for the 2020 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 2020 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)*			Any **three** (x1) from: Haemoglobin has a higher affinity for oxygen (1) Acts as an oxygen store (1) Only releases oxygen when the pp oxygen is lower/ use of data (1) Delays anaerobic respiration / allows them to dive for longer (1)		3		3		
	(b)	(i)		A group of (similar) cells working together to perform a function	1			1		
		(ii)		Penguin: elliptical/oval cells (1) Contain a nucleus (1) Larger (1) Accept reverse argument	2			2		
	(c)	(i)		Heat from blood warms the air.		1		1		
		(ii)		Any **three** (x1) from: One way air flow (1) Fresh and stale air don't mix (1) Gas exchange takes place on inhaling and exhaling/ air constantly moving through lungs (1) Whole of the lung is filled with fresh air or empties with each / no residual volume (1)		2	1	3		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		The blood flows in the opposite direction to the air flow (countercurrent) (1) Maintains the concentration gradient (across whole length of parabronchi) / equilibrium never reached (1) Oxygen diffuses into blood across whole length of parabronchi. (1)		3		3		
				Question 1 total	**3**	**9**	**1**	**13**	**0**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	*(a)*	(i)		More Na^+ outside than inside (1) Actively transported out of axon (by pump) (1) Relatively impermeable to Na^+ / Na^+ {channels/ gates} shut (1)	3			3		
		(ii)		(ions are hydrophilic and) membrane has hydrophobic {tails/ centre} NOT lipid soluble	1			1		
	(b)			Takes longer to return to resting potential / would not hyperpolarise (1) Any **two** (x1) from: K+ ions stay inside axon (as channels blocked) (1) (as they don't diffuse out) the inside of the axon stays more positive for longer/ the outside stays more negative for longer (1) Resting potential only restored by action of sodium/ potassium pump (1)			3	3		
				Question 2 total	**4**	**0**	**3**	**7**		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	*(a)*	(i)		(Chain B (no mark) as it is saturated	1			1		
		(ii)		Not made of monomers/repeating units/ made of fatty acids and glycerol.	1			1		
	(b)	(i)		Extracellular	1			1		
		(ii)		Different triglycerides have different structures/ different lengths of fatty acids/ some are unsaturated and some saturated. (1) Needs {different shaped/ complementary/ specific} active sites. (1)		2		2		
	(c)	(i)		5.5 $x10^{-2}$ = 3 marks Allow answers in range 5.3 to 5.7$x10^{-2}$ 0.055 = 2 marks 1.1/ 20 (1)		3		3	3	
		(ii)		Line drops to zero faster (1) Bile emulsifies the lipids (1) Gives a larger surface area for lipase to work on (so faster rate of reaction). (1)	 1 1	1		3		
		(iii)		Carnivores have more fat in diet/ herbivores have little fat in the diet.			1	1		
	(d)			Induced fit	1			1		

<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></td><td>(e)</td><td>(i)</td><td></td><td>Both solutions reach the same temperature</td><td></td><td>1</td><td></td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>Any two (x1) from:

<table><tr><td>Inaccuracy</td><td>Improvement</td></tr><tr><td>Difficulty deciding the end-point / subjective decision/ owtte (1)</td><td>Use a colorimeter/ use colour standard (1)</td></tr><tr><td>Difficulty in mixing the solutions (1)</td><td>Agitate at regular intervals / or reasonable suggestion (1)</td></tr><tr><td>Difficulty deciding when to start the stop clock (1)</td><td>Start as soon as solutions are completely mixed / or reasonable suggestion (1)</td></tr></table>
Reject buffer</td><td></td><td></td><td>4</td><td>4</td><td></td><td>4</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 3 total</td><td>6</td><td>7</td><td>5</td><td>18</td><td>3</td><td>5</td></tr>
</table>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
4	*(a)*	(i)		No glomeruli/ Bowman's capsules	1			1		
		(ii)		Any **two** (x1) from: Sodium ions/ chloride ions lost in urine/ not absorbed into tissue fluid (1) Less water reabsorbed from collecting duct/ descending limb into the blood (1) Lower water potential gradient (1) Any **one** (x1) from: Increased urination (1) Dehydration (1)			3	3		
	(b)			3 and 4 do not have condition Child 6/7 does have condition and so alleles must come from both parents		2		2		
	(c)			X (no mark) has longest loop of Henle (1) Longer loop increases concentration difference between filtrate and tissue fluid (1) More water reabsorbed (1)	1	2		3		
				Question 4 total	**2**	**4**	**3**	**9**		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	*(a)*	(i)		Aphid can be sedated/stunned/ anaesthetised			1	1		1
		(ii)		Benedict's test is negative (1) then add acid, heat then add alkali then Benedict's (1) turns from blue to orange/ brick red (1)	3			3		3
	(b)	(i)		0.0617/ 0.062 mms^{-1}= 2 marks 400/(108 x 60) or 6480 1 mark		2		2	2	
		(ii)		± 0.5 % = 2 marks (error at both ends of distance) Accept= ±0.25 % = 2 marks (error at one end of distance) If answer incorrect allow 1 or 2 / 400 x 100 = 1 mark		2		2	2	2

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		Any **three** (x1) from: • As light intensity /temperature are at their highest. (1) • The rate of photosynthesis is highest around midday (1) • Photosynthesis produces sugars that are transported into the phloem for transport (1) • this increases the pressure, so rate is greater. (1) Accept reverse answers		3		3		
		(ii)		Any **two** (x1) from: Provide energy for fruit/ seed growth (1) Make fruit attractive to animals (1) For seed dispersal (1)		2		2		
	(d)			Companion cell: (large number of) mitochondria produce ATP (1) To (actively) transport sugars into/out of sieve tubes (1) Sieve tube: very few cell contents give more space (1) For unrestricted flow/mass flow/ transport of sugars (1)	4			4		
				Question 5 total	**7**	**9**	**1**	**17**	**4**	**6**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
6	*(a)*			A + Sino Atrial Node	1			1		
	(b)	(i)		Difference is 75 – 67 = 8 (8.3) = 2 marks Rate = 60/0.9 = 66.7 (67 bpm) = 1 mark		2		2	2	
		(ii)		A. Sample size too small (1) B. Age range varies (1) C. No information on which medication were being taken/ when (1) D. No information on health of patients (1) E. No information on whether patients are genetically predisposed to TdP (1) F. Symptoms may occur at a later time (than the 20 minute exposure) (1) G. Gender imbalance between groups (1)			4	4		4
				Question 6 total	**1**	**2**	**4**	**7**	**2**	**4**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7				**Indicative content** **Mass and Surface area** • Larger mass means more cells/tissues to supply with oxygen • Large surface area of gills to absorb more oxygen/ greater rate of oxygen absorption • Increased surface area to volume ratio • More oxygen in the blood/ more aerobic respiration • Cichla does not fit this trend • Use of data **Behaviour and habitat** • Larger surface area of gills = faster swimmers • To gain enough oxygen for their needs. • Fast swimming fish require a higher rate of respiration/ metabolic rate (or converse) • *Electrophorus* lies on river bed so low level of activity. Only low levels of respiration needed. • *Cichla* larger SA as it needs to move to catch fish. • *Cichla* water not moving fast so does not maintain concentration gradient. • Use of data **Pollution:** • Lamellae thickens / shortens lamellae/ lamellae fused • Smaller surface area for gas exchange • Larger diffusion distance • This means the fish will not gain as much oxygen in their blood • So will move more slowly/ have a higher ventilation rate	1	5	3	9		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
				7-9 marks Indicative content of this level is IDENTIFY AND EXPLAIN All 3 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** Indicative content of this level is 2 of the 3 areas covered *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 1 of the areas covered *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 7 total	**1**	**5**	**3**	**9**		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8	*(a)*			Endemic: (A disease) which is always present at low levels in an area /that occurs frequently at a predictable rate in a specific location/area or population (1)	1			1		
	(b)	(i)		Any **two** (x1) from: Antibodies/T cells can only {target/detect} antigens while they are outside human cells (1) Target early stage of infection while parasite numbers are low/ before {reproduction/numbers of parasite increase} (1) Accept prevent the parasite producing the sexual stages of the life cycle Destroy parasite before it enters/damages (the liver) cells (1)		1	1	2		
		(ii)		Mutations within the parasite/plasmodium (DNA) change antigen (shape)/ high antigenic variation Too many different types of antigen (for each stage in the life cycle) (1) (Mark is either for changes in the antigen OR number of different types of antigens)		1		1		
		(iii)		Injection of a {placebo/inert/inactive} substance instead of the antigen		1		1		1

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iv)	I	Infants immune system is not fully developed/less developed than children (so lower antibody production) (1)	1			1		
			II	Passive immunity (1) Infants receive antibodies (to malaria antigens) from their {mother/breast milk /colostrum/transplacental} (1) Mothers exposed to higher incidence of {malaria/malaria antigens} may produce {more antibodies/different antibodies} to different plasmodium antigens (and pass them to infants) (1)			2	2		
	(c)	(i)		B lymphocytes/cells differentiate/develop into plasma cells (1) (ignore ref to memory cells) Plasma cells produce antibodies {<u>specific/ complementary</u>} to {puff adder toxin/ the antigen} (1)	1	1		2		
		(ii)		An immune response/production of victim's own antibodies would be too slow/insufficient quantity to prevent symptoms becoming fatal/prevent tissue damage/ latent period would be too long OR (converse) Need additional antibodies for the response to be fast enough to prevent fatality/tissue damage (1)			1	1		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		Either - Camel antibodies/proteins are more thermostable/can withstand higher temperatures (1) so antibodies require less refrigeration/freezing (in hot country) (1) OR - Camels are larger (than sheep) (1) so can extract larger volumes of blood/yield more antibody (1) (Reason must match the observation for two marks. Observation 1mark, reason 1 mark)		1	1	2		1
	(d)	(i)		Cell walls weaker/fewer cross links between peptidoglycan molecules/do not develop correctly (1) Water uptake (by osmosis) causes cells to burst (1) (direction of water flow needs to be clear)	2			2		
		(ii)		gram negative cell wall has extra layer of lipopolysaccharide /other components/description (1) (Lipopolysaccharide layer of gram negative bacteria) protects cell wall/peptidoglycan (from antibiotic) (1)	1	1		2		
	(e)	(i)		Antilog of 6.4 = 2,511,886 = 2 marks Reject decimal place/s 1 mark only (6.4) Reading from graph (1)		2		2	2	
		(ii)		So bacteria can produce proteins/enzymes/named protein/ nucleic acids (1)		1		1		1
				Total question 8	**6**	**9**	**5**	**20**	**2**	**3**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
9	*(a)*	(i)		Thoracic; Articulation of/joint with ribs (2)	1	1		2		
		(ii)		Haversian system/osteon (1)	1			1		
		(iii)		Organic – collagen; Inorganic – Hydroxyapatite/Calcium phosphate (2)	2			2		
	(b)	(i)		12.72 = 2 marks 59.74 - 52.14× 100 = 1 mark 59.74(2)		2		2	2	
		(ii)		Pelvis because it has the lowest SD/least variation in the data/least deviation from the mean (1)		1		1		1
		(iii)		Lumbar vertebrae - support the (entire) weight of the upper body/ position under the centre of gravity for support; Wrist - supports least body weight so proportionally less affected by loss of weight (when taken from earth's gravity) OWTTE (2)			2	2		2
		(iv)		Osteoblasts increase activity so more bone matrix produced than broken down (slows bone loss) (1) Any **two** (x1) from: Running increases (mechanical) stress on weight bearing bones (1) Osteoclasts resorb/ breakdown bone compounds in the compact bone/matrix (1) Osteoblasts deposit hydroxyapatite/calcium salts/named calcium salts (1)		2	1	3		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		Cartilage (white fibrous) (1) Any **one** from: {Reduction in/damage to} cartilage causes increased {friction/contact} between bones (1) Bone develops irregular spurs (causing further inflammation/friction) (1) Possible pressure on nerves of the spine (1)		1	1	2		
		(ii)		(Immune system/lymphocytes) recognise <u>proteins</u> in the joint tissue as antigens/ recognise antigens in the joint tissue (1)	1			1		
		(iii)		B AND sarcoplasmic reticulum (1)	1			1		
		(iv)		Any **three** (x1) from**:** Calcium ions (accept Ca^{2+} but not Ca) bind to troponin, changing its <u>shape</u> (1) Causes tropomyosin to change position/tropomyosin pulled to one side (1) Myosin binding site is exposed on actin molecule (1) Structure Y is the Myosin head which forms a crossbridge with actin/enables actinomyosin crossbridge to form (1)		2	1	3		
				Total question 9	**6**	**9**	**5**	**20**	**2**	**3**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
10	*(a)*	(i)		Behaviour that doesn't need to be learned/ a response that is inherited/ Accept instinctive Reject 'inborn'	1			1		
		(ii)		Temperature is likely to affect rate of movement/metabolic rate (so needs to be constant/same for all individuals)/ so that a change in temperature does not affect movement differently for each individual (1)			1	1		1
		(iii)		Kinesis (1) Rate/speed of movement higher in dry area/lower in humid area/ Non directional movement/ Frequency of turning/change of direction higher in humid/lower in dry area (1)	1	1		2		
		(iv)		Maintains its position in a higher humidity/ less likely to move out of humid conditions/ more likely to move out of low humidity/dry conditions (1) Inside a dead animal will be damp/high humidity (1) (inside a dead animal will be damp/humid SO more likely to stay there = 2 marks)		1	1	2		
		(v)		Maggot may have deviated from a straight line and moved a greater distance during each 10 second interval. (1)			1	1		1

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		Neuroplasticity (1)	1			1		
		(ii)		Any **three** (x1) from: • Maximum rate of formation of synapses for hearing is <u>before</u> maximum rate of formation of synapses for speech/language development (1) • Hearing needed (to develop speech/language/)/hearing deficiency has caused no sensory input for sound (1) • So cannot develop motor functions/description of control of mouth/larynx in order to produce speech/language (1) • Use of data (1)		2	1	3		
		(iii)		(many) synapses lost/synaptic pruning before hearing is restored/ remaining synapses haven't been strengthened by appropriate sensory experience connections not reinforced by sensory stimulation weaken (1)		1		1		
		(iv)		Broca's area AND Wernicke's area (1) (1 mark for two correct names)	1			1		
	(c)	(i)		CT scan uses X-rays AND MRI scan uses magnetic field/and/or radio frequency pulses (1) CT scan, (computer) produces (multiple) 2d/cross-sectional images **and** MRI scan, (computer) can produce 3d image (1) MRI scan less risk to patient (does not involve X rays)/ MRI scan allows volumes to be measured/ MRI can show greater <u>detail</u> of soft tissue (of the brain) (1)	2	1		3		
		(ii)		Subjects need to be same age/age group/ gender		1		1		1

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)	I	411 : 1 = 2 marks 410.8:1 = 1 mark 1453000 3537		2		2	2	
			II	Faster decrease in the Volume of the hippocampus/faster rate of atrophy/shrinkage compared to the total volume/rest of the brain/ hippocampus is a smaller proportion of the brain after 12 months (than at the start) (1)			1	1		
				Total question 10	**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	3	9	1	13	0	0
2	4	0	3	7	0	0
3	6	7	5	18	3	5
4	2	4	3	9	0	0
5	7	9	1	17	4	6
6	1	2	4	7	2	4
7	1	5	3	9	0	0
TOTAL	**24**	**36**	**20**	**80**	**9**	**15**
8	6	9	5	20	2	3
9	6	9	5	20	2	3
10	6	9	5	20	2	3
TOTAL	**30**	**45**	**25**	**100**	**11**	**18**