GCE A LEVEL MARKING SCHEME

SUMMER 2019

A LEVEL
BIOLOGY - COMPONENT 3
A400U30-1

INTRODUCTION

This marking scheme was used by WJEC for the 2019 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.

EDUQAS A LEVEL COMPONENT 3
REQUIREMENTS FOR LIFE

MARK SCHEME SUMMER 2019

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.

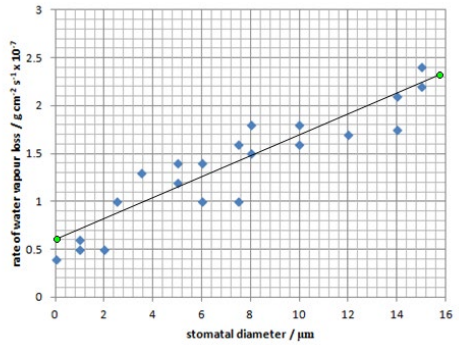
Marking abbreviations

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)	A B	palisade mesophyll labelled clearly as **A** (1) xylem vessel(s) labelled clearly as **B** (1) Label lines must end in / Letters must be in / on the correct tissue layer / xylem vessel Accept correct names if given.		2		2		
		(ii)		**Type of plant** hydrophyte (1) Mark type and adaptations independently **– no ecf** **Any two (×1) from:** {stomata / guard cells} in upper {epidermis/ surface of leaf} (1) {large / numerous} air spaces (in spongy mesophyll) (1) {Thin / no} cuticle on upper {surface / epidermis} (1)		1 1 1	1	3		
		(iii)		**Any 1 from:** to {increase/ maximise} absorption of light / so that greater surface area of leaves face the sun / long axis of chloroplasts is in same direction as light (1)		1		1		
	(b)	(i)		× 60 (2) **1 mark for conversion of length of scale bar to µm:** 1.5 cm × 10 000 15 mm × 1 000		2		2	2	2
		(ii)		**vacuolar**: water crosses more membranes than symplast/ water moves in and out of vacuole/ water has to pass through the {tonoplast/ vacuolar membrane}/ water has to pass through vacuole and cytoplasm (1) NOT vacuole to vacuole **symplast**: (moves through cytoplasm and) {cell membrane/ plasmodesmata} / only crosses one membrane (1)		2		2		
	(c)	(i)		arranged around the {periphery / edge} (of the stem) (1) No reverse argument for arrangement in root	1			1		1
		(ii)		**Both needed for 1 mark:** **xylem** lignin (cellulose – neutral) **phloem** cellulose	1			1		
				Question 1 total	**2**	**9**	**1**	**12**	**2**	**3**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	*(a)*	(i)		**All three needed for 1 mark:** **D** cortex **E** medulla / renal pyramid **F** ureter	1			1		1
		(ii)		**Both needed for 1 mark:** Ultrafiltration D Selective reabsorption D		1		1		
	(b)	(i)		**X** = microvilli (1) Reject villi / cilia Increase surface area (1)		1 1		2		
		(ii)		Maintain concentration gradient/ Thin walls to reduce diffusion distance (1)		1		1		
	(c)			• (child would suffer from) Type 2 AS/ autosomal recessive form (1) • **Type 2** : **both** parents must {have the recessive allele /be carriers / be heterozygous} (1) • **Type 1: both** parents are normal {so cannot have dominant allele for Type 1 / {one of the parents /mother or father} would have Type 1 AS as it is caused by a dominant allele/ Males cannot be carriers (1)		1	2	3		
				Question 2 total	**1**	**5**	**2**	**8**	**0**	**1**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	*(a)*	(i)		**All three ✓ = 2; 2 ✓ = 1 1 ✓ = 0** • distance (travelled by bubble)/ position of bubble at start and end/ movement of air bubble in {mm/cm}; • {surface/ leaf} area (of leaves); • Time/ how long it took the air bubble to move;		2		2		2
		(ii)		to move the air bubble back to the start / reset the position of the air bubble (1)	1			1		1
	(b)	(i)		y = (0.11 × 10) + 0.6 = 1.7 (1)		1		1	1	
		(ii)		straight line drawn with a ruler (through **both** (0, 0.6) and (10, 1.7) ecf (2) straight line drawn with a ruler through (0, 0.6) **or** (10, 1.7) (1) Ignore extrapolations  		2		2	2	
		(iii)		water {evaporates / loss} from {leaf surface / epidermis/ cuticle} (1) Reject ref to transpiration / respiration/ photosynthesis		1		1		
	(c)	(i)		{decrease / plateau / reach a constant} (1) NOT stop		1		1		
		(ii)		less water loss (1) NOT stop/ prevent		1		1		
				Question 3 total	**1**	**8**	**0**	**9**	**3**	**3**

Question				Marking details		Marks Available					
						AO1	AO2	AO3	Total	Maths	Prac
4	*(a)*	(i)		Peripheral (nervous system) (1)		1			1		
		(ii)		Any **three** (×1) from: **More coordinated: (Max 2)** A. {Nerve ring/ co-ordinator} in starfish, but not in hydra (1) B. Impulses are carried in one direction only (1) C. Have sensory receptors in specific places/ different neurones {have different functions/ have specialised functions/ carry sensory and motor information} (1) **Slow:** D. Nerve net slows down transmission (1) E. Impulses in both directions slows down transmission (1)				3	3		
	(b)	(i)		**Diagram clearly labelled as follows:** **P** a synaptic knob / end of an axon **Q** dendrite/ cell body **R** a synaptic knob / end of an axon  **3 ✓ = 2; 2 ✓ = 1**			2		2		
		(ii)		Any **three** (×1) from: • Myelin (1) • Acts as an <u>electrical</u> insulator/ prevents ion movement (1) • Depolarisation can only take place {at nodes of Ranvier / between Schwann cells / where there is no insulation} (1) • Saltatory conduction / suitable description of saltatory conduction e.g. node to node (1)		3			3		
				Question 4 total	**0**	**4**	**2**	**3**	**9**	**0**	**0**

Question				Marking details		Marks Available					
					S	AO1	AO2	AO3	Total	Maths	Prac
5	*(a)*	(i)	I II III	Lowers pressure so that water enters (1) Increase pressure {so water forced over gills/ water moved into opercular / gill cavity} (1) So water leaves (1)		3			3		
		(ii)		Ribcage {moves up/ moves out/ expands} (1) Diaphragm {flattens/ contracts/ moves down} (1) Pull pleural membranes out which expands the volume of the lungs (and reduces pressure) (1) NOT reference to pleural membrane expands		3			3		
	(b)	(i)		**IV** temperature (of water) (1) **DV** number of times operculum opens per minute (1)			2		2		2
		(ii)	I	So that there is no change to the {ion / solute / salt} concentration of the water/ same water potential/ same pH (1) Reject ref to maintaining O_2 concentration				1	1		1
			II	To allow them to {acclimatise/ adjust} to the water / equilibrate to changed conditions / return to resting conditions/ OWTTE (1) NOT adapt				1	1		1
	(c)	(i)		**First mark: Any one (×1) of:** • Readings follows the same {pattern/ trend} (1) • Range of results at each temperature is similar/ Within the acceptable range of results at 14ºc (1) • Only 4 fish have been used, unsure of normal range (1) • Fish 1 consistently higher than other fish tested (1) **Second mark:** Use of data (1) e.g. decrease from 26 to 23 for Fish 1 is the same as from 22 to 19 for Fish 3/ comparison of values obtained for different fish at 14ºc				2	2	1	2

Question				Marking details		Marks Available					
					S	AO1	AO2	AO3	Total	Maths	Prac
		(ii)		Any **four** (×1) from: A. (Graph shows) that O_2 content of water decreases as temperature increases (1) B. Increased ventilation rate/ operculum open more frequently (1) C. So {more/ enough} O_2 could be absorbed from the water / could absorb the same amount of oxygen (1) D. Gulp air when {ventilation rate reaches maximum/ cannot breathe any faster / cannot absorb enough O_2 from water} (1) E. Air has a higher O_2 content (1) F. Can absorb O_2 from air (when the oxygen content of water is low)/ gulp for (more) oxygen (1)				4	4		
		(iii)		Temperature range within that of the normal habitat of the fish (1) At higher temperatures fish may not have been able to get enough O_2 and could suffocate (if prevented from getting the surface) / stop normal behaviour / cause distress(1)				2	2		2
				Question 5 total	**0**	**6**	**2**	**10**	**18**	**1**	**8**

Question				Marking details		Marks Available					
					S	AO1	AO2	AO3	Total	Maths	Prac
6	*(a)*	(i)	core	**Any two needed for 1 mark** • membrane-bound organelles (or named) • large / 80S ribosomes • chromosomes containing histones/ chromatin • linear DNA		1			1		
	(b)	(i)		0.1 (: 1) 2 marks **Award 1 mark for** 40 200 / 377 000 0.11 / 0.1066....			2		2	2	
		(ii)		SA:vol ratio would be too small (1) [SA:vol ratio = 0.07:1] to absorb enough O_2 (for respiration needs) (1) OR diffusion distance (to centre of cell would be) too high (1) [diffusion distance = 45 µm compared to 20 µm] So too long for O_2 to diffuse to centre of cell (1)			2		2		
	(c)	(i)	C1	**aerobic** = 38 (accept between 32-38) **anaerobic** = 2	2	2			2		
		(ii)		Any **two** (×1) from Blood at higher pressure (1) {circulates/ travels} faster / transported over longer distances (1) ora Maintains a higher concentration gradient between blood and tissues (1) ora		2			2		
	(d)			**Advantage** Can reach {maximum / high} o_2 saturation at low ppo_2 (1) **Disadvantage** O_2 not released readily / oxyhaemoglobin does not dissociate easily (1)		2			2		

Question				Marking details		Marks Available					
					S	AO1	AO2	AO3	Total	Maths	Prac
	(e)			A. Bohr {effect / shift} (1) Any **three** (×1) from: B. Nacl concentration increases as water evaporates (1) C. Higher NaCl concentration decreases O_2 affinity of haemoglobin/ reference to correct data (1) D. So O_2 released more readily (1) E. This is an advantage because O_2 content of water decreases as water temperature increases (1)		1		3	4		
				Question 6 total	**2**	**8**	**4**	**3**	**15**	**2**	**0**

Question	Marking details	Marks Available					
		AO1	AO2	AO3	Total	Maths	Prac
7		2	6	1	9	0	0

Organism	A: Mode of nutrition	B: Description of Nutrition Type	C: Adaptations to mode of nutrition
Chroococcus	• autotrophic	**autotrophic** • uses energy from the Sun / light • to combine inorganic compounds • to produce its own organic compounds/ photosynthesis	• has chloroplasts / chlorophyll (for photosynthesis)
		heterotrophic • uses organic compounds from other organisms • as a source of raw materials / energy • to produce its own organic compounds	
Botrytis	• Heterotrophic • saprotrophic	**saprotrophic** • extracellular digestion of food substances • absorption of the products of digestion	• {hyphae / mycelium} which grow {over / through} the food it lives on • secretes enzymes • digest the food outside the body
Amoeba	• Heterotrophic • holozoic	**holozoic** • digests it internally /intracellularly • involves ingestion, digestion and egestion	• {Ingests/ engulfs} prey / endocytosis • Exocytosis of waste • Contains digestive enzymes
Echinococcus	• heterotrophic • parasitic	**parasitic** • obtaining nutrients from a host organism	• no digestive system • does not secrete digestive enzymes/ food has already been digested by its host; • {thin/flattened} (proglottids) increasing surface area / reducing diffusion distance

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
7					2	6	1	9	0	0
				7-9 marks Detailed explanation of all three areas in the indicative content. *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** Detailed explanation of 2 areas of the indicative content, or partial description of 3 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** Some explanation of one area of the indicative content or partial description of 2/3 areas. *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 7 total	**2**	**6**	**1**	**9**		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
8	*(a)*			**Cells:** There are {more than 1 000 times/ many more} microbial cells {on /in} our bodies than human cells. (1) **Genomes:** There are {many different/ variety} bacterial {genomes/ species} within the human body. (1) **Protection:** They prevent {harmful microbes/ pathogens} colonising the human body and causing disease/ outcompete pathogenic bacteria. (1)	2	1		3		
	(b)	(i)		Any **three** (×1) from: {engulfs the foreign microbe/ ref to phagocytosis} (1) antigenic presentation. (1) The T-cell recognises the foreign antigen (1) T cells are then activated / undergo clonal expansion (1)		3		3		
		(ii)		Killer T cells – {cause lysis of/ destroy} {target cells/ named cells}. NOT kill (1) Helper T cells – co-operate with B cells to initiate antibody response/ secretes cytokines/ B cell activation (1) Memory T cells – remain {dormant/ in circulation} until host is exposed to antigen again/ initiate secondary immune response/owtte (1) Reject reference to antibodies except in relation to B cell activation.	3			3		
	(c)	(i)		Any **two** (×1) from It allows the antibody to {bend/flex/distort/change shape} in order (for both arms) to bind to different antigens (1) because antigens are different distances apart on the target cell (1) antigens on different cells / cause clumping/ agglutination of bacterial cells(1)			2	2		
		(ii)		IgM can bind to more antigen than IgG / so it can agglutinate more antigen/ bind to more antigen/ form larger clumps of antigen (1)			1	1		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		1.25×10^8 or 125 000 000 = 2 marks If incorrect award 1 mark for $\frac{25 \times 100\,000}{0.02}$		2		2	2	
		(ii)		Any **two** (×1) from flame mouth of test tube/ flask work near updraft of Bunsen burner use sterile {pipette/ equipment}/ flame {loop/ spreader} tilt lid of Petri dish/ owtte		2				2
		(iii)		Human body temperature to culture human pathogens			1			1
		(iv)		Any **two** (×1) from • Antibiotics are not specific/ Bacteriophage only infect specific bacteria (1) • antibiotics cause {side effects/ phages} / have no side effects/ no allergic reactions(1) • More chance of bacterial resistance with antibiotics/ Low chance of bacterial resistance to phage therapy (because bacteriophage can mutate as fast as bacteria). (1)	1	1		2		
		(v)		Any **one** (×1) from The bacteriophage mutates to make infection worse/ infect human cells. Cost vs effectiveness of treatment/ religious objections Unknown side effects (1)			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 Humerus B Radius C Ulna **All three** correct = 1 mark	1			1		
		(ii)		It reduces friction in the joint/ stops rubbing. (1) The joint moves in one plane only / (it is a hinge joint) so the forearm can **only** {move up / flex} **and** {down / extend} in relation to the humerus. (1) NOT one direction	2			2		
		(iii)		Hyaline cartilage has collagen fibres **and** yellow elastic cartilage has elastin fibres. (1) Yellow elastic cartilage {more flexible than hyaline cartilage / maintains shape} (1) Hyaline cartilage is firmer/ tougher and can withstand forces in the joint. (1)	1	2		3		
		(iv)		It has no blood vessels + so nutrients are acquired by diffusion.		1		1		
	(b)	(i)	I	167.9 or 167.86 or 168 = 2 marks $\frac{750-280}{280} \times 100 =$ 1 mark		2		2	2	
			II	Vitamin D deficiency in the diet/ increased use of sunblock/ children spend less time outside. (1)	1			1		
		(ii)		Not all rickets sufferers will seek medical attention/ misdiagnosis/ data for under 5s only/ cases unreported			1	1		1

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		Any **two** (×1) from Similar/ same ages (1) Similar/ same ethnic groups/skin tone (1) Similar/ same exposure to sunlight (1) Similar/same diets (1) Proportion of males/ females (1) **Ethics:** not giving vitamin D supplement to children makes them more likely to develop rickets.			2 1	3		2
		(iv)		Osteomalacia **and** Adult bones have stopped growing	1			1		
	(c)	(i)		Limited ATP in muscle, ATP used first/ quickly. (1) Creatine phosphate then used to phosphorylate ADP to provide ATP/ replenish the store of ATP. (1) Aerobic respiration takes over from anaerobic respiration because lactate builds up/ produces more ATP. (1)		3		3		
		(ii)		more suitable for sprinting/ short distances			1	1		
		(iii)		Flat {feet/foot} **and** treat using {special shoes/ exercise/surgery/ physiotherapy}. (1)		1		1		
				Question 9 total	**6**	**9**	**5**	**20**	**2**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10	*(a)*	(i)		A Frontal lobe B Temporal lobe C Parietal lobe D Occipital lobe 4 correct – 2 marks 2/3 correct – 1 mark 0/1 correct – 0 marks	2			2		
		(ii)		Mouse – 4000 times		1		1	1	
		(iii)		The long finned pilot whale has many more cortical neurones, (1) and so is likely to have a complex language / process sensory input. (1)		1	1	2		
		(iv)		Frontal lobe Occipital lobe Temporal lobe 3 correct – 2 marks 2 correct – 1 mark 0/1 correct – 0 marks		2		2		
	(b)	(i)		**Both for 1 mark** Acetylcholine Noradrenaline	1			1		
		(ii)		Increases heart rate/ ventilation/ blood pressure. (1) This ensures that muscles are supplied with blood to enable the response/ diversion of blood from {gut/skin} to muscles/ more oxygen delivered to muscles. (1)	1	1		2		
	(c)	(i)		Cortisol <u>binds</u> to glucocorticoid receptors in the hippocampus. (1) The hippocampus sends nerve impulses to the hypothalamus, inhibiting it/ owtte (1)	1	1		2		
		(ii)		Negative feedback doesn't work, (This increases vulnerability to mental illness.)	1			1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		They will be more <u>efficient</u> at finding food.			1	1		
		(ii)		Main risk: bee stings – minimise by wearing protective clothing/ any sensible suggestion. (1)		1				1
		(iii)	I	10.0 – 6.0 = 4.0 turns (1) Accept 3 - 4		1		1	1	
			II	Accuracy decreases with distance because there is less difference in turns as the distance is further away. (1)			1	1		
		(iv)		Many bees from different hives increases reliability/ repeatability of data (1) Other studies getting similar data./ peer review/ reproducibility (1) Penalise “accuracy” once only.			2	2		2
	(e)			allows them to {adapt to/ access available food} in different environments they are in/ owtte		1		1		
				Question 10 total	6	9	5	20	2	**3**

COMPONENT 3 – A2 BIOLOGY EDUQAS

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

QUESTION	Synoptic	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	**0**	**2**	**9**	**0**	**11**	**2**	**3**
2	**3**	**1**	**5**	**2**	**8**	**0**	**1**
3	**0**	**1**	**8**	**0**	**9**	**3**	**3**
4	**0**	**4**	**2**	**4**	**10**	**0**	**0**
5	**0**	**6**	**2**	**10**	**18**	**1**	**8**
6	**2**	**8**	**4**	**3**	**15**	**2**	**0**
7	0	**2**	**6**	**1**	**9**	**0**	**0**
TOTAL	**5**	**24**	**36**	**20**	**80**	**8**	**12**
8	**0**	**6**	**9**	**5**	**20**	**2**	**3**
9	**0**	**6**	**9**	**5**	**20**	**2**	**3**
10	**0**	**6**	**9**	**5**	**20**	**2**	**3**
TOTAL	**5**	**30**	**45**	**25**	**100**	**10**	**15**
TARGET		**30**	**45**	**25**	**100**	**10**	**15**