

GCE

Biology A

Unit **H420/01**: Biological purposes

Advanced GCE

Mark Scheme for June 2018

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations

Annotation	Meaning
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

Subject-specific Marking Instructions**INTRODUCTION**

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Section A

Question			Answer	Marks	Guidance
1			A ✓	1	
2			B ✓	1	
3			A ✓	1	
4			D ✓	1	ALLOW A
5			B ✓	1	
6			D ✓	1	
7			B ✓	1	
8			C ✓	1	
9			C ✓	1	
10			C ✓	1	
11			D ✓	1	
12			C ✓	1	
13			D ✓	1	
14			C ✓	1	
15			C ✓	1	
			Total	15	

Section B

Question			Answer	Marks	Guidance
16	(a)	(i)	(Type) 2 / II / two ✓ <i>explanation:</i> insulin is (still) produced ✓ beta / β , cells still working ✓ <i>idea that</i> (liver) cells no longer respond to insulin ✓ fewer / damaged , (insulin) receptors ✓ if it was Type I then the woman would not produce (normal levels of) insulin ✓	2 max	ALLOW it is diabetes mellitus not diabetes insipidus ALLOW late onset 1 mark max for explanation DO NOT ALLOW B / b , cells ALLOW (develop) insulin resistance ALLOW (insulin) receptors not working
		(ii)	low , carbohydrate / sugar , diet ✓ exercise ✓ manage weight (gain) ✓ drugs to control glucose levels ✓	2 max	List Rule If both prompt lines used and more than one suggestion is on the line mark the first one on each line. If only one line used but there is more than one suggestion listed mark first two written. ALLOW regulate / control / reduce , for “low” ALLOW named sugar / starch IGNORE low fat / healthy / balanced / low “carb” , diet ALLOW example of exercise e.g. walking ALLOW named drug e.g. metformin ALLOW ref to injecting insulin
	(b)	(i)	liver (tissue) ✓	1	ALLOW hepatic (tissue) IGNORE hepatocytes / cells IGNORE muscle

Question			Answer	Marks	Guidance
		(ii)	(glucose) for respiration / as respiratory substrate / to release energy ✓ to produce ATP ✓ ATP needed (in muscle contraction) for breaking cross-bridges between myosin and actin / AW ✓ ATP , hydrolysed / to ADP and Pi , to reset myosin heads ✓ ATP for active transport of calcium ions (back) into sarcoplasmic reticulum ✓	3 max	DO NOT ALLOW produce energy ALLOW ATP needed for myosin to detach from actin ALLOW ATP hydrolysed for myosin to resume normal position IGNORE power-stroke
		(c)	<i>use of data from Fig.16.1:</i> calculated rate of oxygen uptake between 0.010 and 0.018 (dm³ s⁻¹) ✓ calculated reduction in rate of oxygen uptake between 10 and 50% ✓ <i>supporting statements:</i> (claim is) correct / incorrect AND a comparison of calculated rate with , 20% statement / mean uptake / 0.020 (dm³ s⁻¹) ✓ <i>validity statements:</i> one , woman / reading , is not enough (for a valid conclusion) ✓ (being) 36 weeks pregnant / late pregnancy , is not representative of whole pregnancy / AW ✓	3 max	ALLOW MP 1 as a percentage i.e calculated value between 50 and 90% (of mean uptake) Supporting statements MUST match evidence from calculation e.g. statement is incorrect because my calculation showed reduction of 40% which is higher than 20% If calculation in MP1 or MP2 is incorrect MP3 can still be awarded using calculation in response. ALLOW only one woman tested
			Total	11	

Question			Answer	Marks	Guidance
17	(a)	(i)	(pigments) absorb , light / photons ✓ electrons , excited / raised to higher energy level ✓ accessory pigments pass energy to , reaction centres / primary pigments ✓ primary pigments , become oxidised / lose electrons / pass electrons to ETC ✓ for light dependent reaction / photophosphorylation ✓	4 max	ALLOW named accessory pigments e.g. chlorophyll b / xanthophyll / carotenoids ALLOW chlorophyll a for primary pigment ALLOW for making , ATP / reduced NADP
		(ii)	<i>idea that they have to absorb light of short (er) wavelengths ✓</i> <i>idea that some wavelengths (of light) don't reach , depths / them ✓</i>	1 max	ALLOW blue / blue-violet light ALLOW wavelengths between 400 and 500nm ALLOW high(er) frequency e.g. some wavelengths of light may not reach <i>Chromista</i> if they are in deep water
	(b)		<i>Chromista</i> (chloroplast) has <u>fewer</u> thylakoids ✓ <i>Chromista</i> (chloroplast) has no , inter-granal lamellae / lamellae between thylakoids ✓ plants (chloroplasts) have thylakoids in groups of more than three ✓ plants (chloroplasts) have starch grains / <i>Chromista</i> (chloroplast) does not have starch grains ✓	2 max	IGNORE reference to external membrane ALLOW plants (chloroplasts) have <u>more</u> thylakoids ALLOW plant (chloroplasts) have lamellae between thylakoids ALLOW thylakoids in plant (chloroplasts) form grana IGNORE <i>Chromista</i> (chloroplast) has thylakoids in groups of three

Question			Answer	Marks	Guidance
	(c)	(i)	property hydrophobic (region / fatty acid tails) ✓ explanation (helps to) form bilayer / separates two aqueous regions ✓ property (region) contains cholesterol ✓ explanation regulates (membrane) fluidity / AW✓	2 max	IGNORE stability for explanations property MUST be linked to its explanation
	(c)	(ii)	compartmentalisation OR form / surround , (named) organelles ✓ purpose of / need for , compartments / separation ✓ sites of , chemical reactions / electron carriers / photophosphorylation / chemiosmosis / oxidative phosphorylation ✓ provide attachment sites for , enzymes / pigments ✓ allow formation of concentration gradients ✓	2 max	e.g. separating organelles from cytoplasm e.g. form vesicles for transport is MP1 and MP2 ALLOW ETC for electron carriers ALLOW correctly named enzyme e.g. ATP synthase
			Total	11	

Question	Answer	Marks	Guidance
18			In summary: <i>Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.) Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer. Then, award the higher or lower mark within the level, according to the Communication Statement (shown in italics):</i> <i>award the higher mark where the Communication Statement has been met.</i> <i>award the lower mark where aspects of the Communication Statement have been missed.</i> The science content determines the level. The Communication Statement determines the mark within a level.
	(a)*	Level 3 (5–6 marks) Full and detailed plan of how to carry out a valid investigation into the rate of transpiration. <i>There is a well-developed plan and sequence as well as an appreciation of the need to obtain valid data. The information presented is relevant and clearly explained.</i> Level 2 (3–4 marks) Detailed plan of how to carry out a valid investigation into the rate of transpiration. <i>There is a reasonable explanation and sequence as well as an appreciation of the need to obtain valid data. The information presented is in the most-part relevant and well-explained.</i> Level 1 (1–2 marks) Response is aware of how to plan a valid investigation. <i>The information is basic and communicated in an unstructured way. The information is supported by limited method which may be unclear.</i>	6 Indicative scientific points may include... IGNORE potometer set up detail These are not mark points See appendix <i>Method and planning to obtain valid data</i> - method described - movement of bubble in potometer / mass measured - timing distance travelled by bubble - repeating investigation with two different plant species - repetition to gain replicates - calculation (rate / mean) - statistical test <i>Variables</i> - named variables controlled e.g. temperature humidity light wind movement surface area of leaves

Question			Answer	Marks	Guidance
			0 marks No response worthy of credit NR No response		how variables are controlled
	(b)		insoluble ✓ unreactive / inert ✓ high <u>tensile</u> strength ✓ flexible ✓ can form hydrogen bonds with neighbouring chains ✓	3 max	<u>List Rule</u> If all three prompt lines used and more than one property is on prompt line mark the first one on each line. If only one or two lines used but there is more than one property listed mark the first three properties given. IGNORE detail about structure or cell walls IGNORE permeable IGNORE rigid IGNORE strong
	(c)		<u>extracellular</u> AND (it) takes place outside of cells / cellulose cannot enter (bacterial) cells ✓	1 max	ALLOW enzymes must , leave / be secreted from , (bacterial) cells IGNORE ‘excrete’
			Total	10	

Question			Answer	Marks	Guidance												
19	(a)		<table><thead><tr><th>Genus</th><th>Diet</th><th>Justification</th></tr></thead><tbody><tr><td><i>Camponotus</i></td><td>mainly carbohydrate</td><td>(RQ is) 1.0</td></tr><tr><td><i>Melophorus</i></td><td>protein OR lipid <u>and</u> carbohydrate</td><td>(RQ is) 0.9</td></tr><tr><td><i>Cataglyphis</i></td><td>lipid</td><td>(RQ is) 0.7</td></tr></tbody></table> ✓✓✓	Genus	Diet	Justification	<i>Camponotus</i>	mainly carbohydrate	(RQ is) 1.0	<i>Melophorus</i>	protein OR lipid <u>and</u> carbohydrate	(RQ is) 0.9	<i>Cataglyphis</i>	lipid	(RQ is) 0.7	3	DO NOT ALLOW all three substrates for <i>Melophorus</i> ALLOW amino acids for protein for <i>Melophorus</i> ALLOW fat / oil / triglyceride / fatty acid for lipid for <i>Cataglyphis</i> ALLOW THREE marks for correctly completed table ALLOW RQs to greater number of sig.figs. e.g. 1.01 / 0.89 / 0.687 If Rf or RV is stated instead of RQ allow max 1 for justification column ALLOW TWO marks for all correctly calculated RQ values in justification column / on Fig.19.1 OR ALLOW TWO marks for: correct two responses in diet column AND for correct three justifications written in words i.e. <i>Camponotus</i> – CO₂ produced is , similar / equal to O₂ consumed <i>Melophorus</i> - CO₂ produced is 0.07 less than O₂ consumed <i>Cataglyphis</i> - CO₂ produced is 0.46 less than O₂ consumed If RQ values have not been calculated or are incorrect ALLOW ONE mark for correct diet column OR correct justification column written in words OR two correct RQ values
Genus	Diet	Justification															
<i>Camponotus</i>	mainly carbohydrate	(RQ is) 1.0															
<i>Melophorus</i>	protein OR lipid <u>and</u> carbohydrate	(RQ is) 0.9															
<i>Cataglyphis</i>	lipid	(RQ is) 0.7															

Question		Answer	Marks	Guidance
19	(b)	<i>Similarities</i> Any two from: polymers / polysaccharides ✓ have , 6 carbon / C6 , sugars ✓ have 1-4 glycosidic bonds ✓ have CH₂OH side group (in monomers) ✓ <i>Differences</i> Any two from: chitin has β-glycosidic bonds ✓ chitin contains , nitrogen / N / amide / NH-CO-CH₃ ✓ no 1-6 glycosidic bonds in chitin ✓ no branching in chitin ✓	4 max	ALLOW have hexose(s) ALLOW glycogen has α-glycosidic bonds ALLOW ORA for glycogen ALLOW ORA for glycogen ALLOW ORA for glycogen
		<i>In summary:</i> <i>Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.)</i> <i>Using a ‘best-fit’ approach based on the science content of the answer, first decide which of the level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.</i> <i>Then, award the higher or lower mark within the level, according to the Communication Statement (shown in italics):</i> ○ <i>award the higher mark where the Communication Statement has been met.</i> ○ <i>award the lower mark where aspects of the Communication Statement have been missed.</i> • <i>The science content determines the level.</i> • <i>The Communication Statement determines the mark within a level.</i>		
	*(c)	Level 3 (5–6 marks) Full and detailed description of the processes involved in chemiosmosis. Learner demonstrates a detailed understanding of where it occurs, the stages, reactants and products, describing a range of the processes involved. <i>There is a well-developed line of reasoning with accurate descriptions of the processes. The information presented is relevant and clearly outlined.</i>	6	Indicative scientific points may include... These are not mark points See appendix • occurs in mitochondria / on membrane • involves inner membrane and matrix • involves movement of hydrogen across membrane • use of enzyme / channel protein / ATP synthase • Hydrogen ions / H⁺ ions pumped out of matrix

Question			Answer	Marks	Guidance
			Level 2 (3–4 marks) Detailed description of the processes involved in chemiosmosis. Learner demonstrates understanding of the where it occurs, stages, reactants and products, describing some of the processes involved. <i>There is a line of reasoning with accurate descriptions of the processes. The information presented is in the most-part relevant and supported by some detail.</i> Level 1 (1–2 marks) A description of the processes involved in chemiosmosis is attempted, with some understanding of the different stages, reactants and products. <i>The information is basic and communicated in an unstructured way. The information is supported by limited detail which may be unclear.</i> 0 marks No response or no response worthy of credit. NR No response		across membrane into intermembrane space • Proton / H⁺ gradient created • proton-motive force • H⁺ ions pass through hydrophilic transmembrane protein • cristae / stalked particles involved • ATP synthase produces ATP from ADP + P_i • H⁺ ions move from area of high concentration to low concentration • Some H⁺ ions leak back into matrix / process is not completely efficient
			Total	13	

Question			Answer	Marks	Guidance
20	(a)	(i)	3 OR 2 ✓ 5 ✓ 2 ✓	3	
		(ii)	variety / type / age / colour, of beetroot ✓ length / surface area / volume , of beetroot pieces ✓ pieces taken from same part of beetroot / skin removed from beetroot ✓ time taken to wash slices ✓ volume (of samples) removed from solution ✓ pH ✓ use same colorimeter filter / same blank ✓	2 max	List Rule If both prompt lines used and more than one variable is on the line mark the first one on each line. If only one line used but there is more than one variable listed mark first two written. IGNORE temperature / time / concentration of ethanol ALLOW same beetroot / same species ALLOW same SA :V / mass IGNORE size of beetroot
	(b)	(i)	x axis / concentration of ethanol , has no units ✓ should be a line graph (as continuous data) ✓ x axis / concentration (of ethanol) , has incorrect scale / 0.6 not included ✓ no title ✓	3 max	List Rule If all three prompt lines used and more than one criticism is on the line mark the first one on each line. If only one or two lines used but there is more than one criticism listed mark as continuous prose. ALLOW bar graph not appropriate for continuous data

Question			Answer	Marks	Guidance
20	(b)	(ii)	(so) can calculate a mean ✓ allows anomalies to be identified ✓ improves repeatability ✓ allows statistical test to be completed ✓	2 max	IGNORE average DO NOT ALLOW prevents anomalies IGNORE remove anomalies ALLOW reproducibility IGNORE reliability / validity / accuracy ALLOW can complete , standard deviation / t-test
			Total	10	

Question			Answer	Marks	Guidance
21	(a)	(i)	sodium ions / Na ions / Na⁺ , cannot enter ✓ no / prevents , depolarisation of membrane ✓ (membrane) remains at resting potential ✓ prevents action potential being generated ✓ impulse not conducted (along axon) ✓ (so) no release of neurotransmitter ✓	4 max	Award 3 max if explanation refers to what would normally happen in neurone instead of in presence of TTX DO NOT ALLOW cannot enter membrane ALLOW sodium ions / Na ions / Na⁺ , stay outside ALLOW action potential for impulse
		(ii)	<i>diaphragm is paralysed so:</i> no / little , change / increase , in volume of thorax ✓ no / little , change / decrease , in pressure in thorax ✓ no / little / less , air drawn into lungs ✓	2 max	Award 1 max if explanation refers to what would normally happen rather than if diaphragm is paralysed ALLOW chest cavity / lungs for thorax throughout IGNORE oxygen
		(iii)	<i>suggestion:</i> slows / decreases , heart rate ✓ <i>explanation:</i> Any two from slows transmission of impulse from AVN to ventricles ✓ slows ventricular , systole / contraction ✓ longer delay before ventricular , systole / contraction , begins ✓ increases time (the heart is) in diastole / relaxation ✓	3 max	ALLOW bradycardia ALLOW prevents / stops for 'slows' for MP2 and MP3 'ventricular' must be mentioned once

Question			Answer	Marks	Guidance
	(b)		no nodes of Ranvier ✓ shorter local , currents / circuits ✓ whole axon needs to be depolarised ✓	1 max	IGNORE ref to jumping between nodes ALLOW more local currents / circuits ALLOW e.g. action potentials need to be generated all the way along the axon
			Total	10	

Question			Answer	Marks	Guidance
22	(a)	(i)	9.7×10^{-3} OR 0.0097 ✓✓✓	3	IGNORE + or - ALLOW two marks if answer is correct but not to two S.F. ALLOW two marks if answer is incorrect for correct calculation e.g. $\frac{0.05^2 \times \pi \times 3.7}{3}$ OR $\frac{0.029}{3}$ ALLOW one mark for $0.05^2 \times \pi \times 3.7$ OR 0.029
		(ii)	140 (two s.f.) / 142 / 141.7 / 141.67 / 141.6* ✓✓	2	ALLOW one mark if answer is correct but 'decrease' has been calculated so response given as 'minus' number If answer is incorrect ALLOW one mark for $\frac{2.9-1.2}{1.2} \times 100 \quad \text{OR} \quad \frac{1.7}{1.2} \times 100$
	(a)	(iii)		1 max	ALLOW Calvin cycle / light independent stage for photosynthesis throughout

Question			Answer	Marks	Guidance
			removing CO ₂ would prevent photosynthesis ✓ CO ₂ would be a limiting factor for photosynthesis ✓		ALLOW e.g. so they could still photosynthesise e.g. CO ₂ needed for photosynthesis
	(b)		at 1510 (lux) the distance moved by the fluid (in respirometer) is , zero / 0 ✓ at 1510 (lux) rate of photosynthesis is equal to rate of respiration ✓ at 1510 (lux) there is no <u>net</u> change in volume in the respirometer ✓	2 max	'at 1510 (lux)' only needs to be mentioned once throughout ALLOW at 1510 (lux) compensation point has been reached
			Total	8	

Question			Answer	Marks	Guidance
23	(a)		W liver / hepatic ✓ X pancreas / pancreatic ✓ Y skeletal / striated , <u>muscle</u> ✓	3	IGNORE cells ALLOW Islet of Langerhans / acini
	(b)		<i>carboxylic acid</i> should be <u>carbonic acid</u> / H_2CO_3 ✓ <i>vagus</i> (nerve) should be , <u>accelerator</u> / <u>sympathetic</u> / <u>accelerans</u>, (nerve) ✓ AVN should be , <u>SAN</u> / <u>sinoatrial node</u> ✓ <i>baroreceptors</i> should be <u>chemoreceptors</u> OR <i>pH</i> should be <u>pressure</u> ✓ <i>smooth muscle</i> should be <u>cardiac muscle</u> ✓	max 4	Error and correct term must be clearly identified. ALLOW copied statements where correct terms replace errors. IGNORE carbon dioxide ALLOW specialised striated
	(c)	(i)	allows baby to , (try to) hold on / grasp ✓ (crying) draws attention (to the baby) ✓	2	ALLOW alerts parent / encourages someone to pick baby up
		(ii)	<i>description:</i> (rapid) blinking / shutting / closing (of eyes) ✓ <i>explanation:</i> involuntary ✓ prevents , damage to / objects entering , eyes ✓	3	ALLOW references to , ducking / raising hands / flinching ALLOW unconscious / automatic / innate / instinctive ALLOW protects the eyes
			Total	12	

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