OCR
Oxford Cambridge and RSA

GCE

Biology A

Unit **H420/01:** Biological purposes

Advanced GCE

Mark Scheme for June 2018

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

© OCR 2018

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 ✓ *explanation:* insulin is (still) produced ✓ beta / β , cells still working ✓ *idea that* (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)		*use of data from Fig.16.1:* calculated rate of oxygen uptake between 0.010 and 0.018 (dm^3 s^{-1}) ✓ calculated reduction in rate of oxygen uptake between 10 and 50% ✓ *supporting statements:* (claim is) correct / incorrect **AND** a comparison of calculated rate with , 20% statement / mean uptake / 0.020 (dm^3 s^{-1}) ✓ *validity statements:* 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)	*idea that* they have to absorb light of short (er) wavelengths ✓ *idea that* some wavelengths (of light) don't reach , depths / them ✓	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 *Chromista* if they are in deep water
	(b)		*Chromista* (chloroplast) has fewer thylakoids ✓ *Chromista* (chloroplast) has no , inter-granal lamellae / lamellae between thylakoids ✓ plants (chloroplasts) have thylakoids in groups of more than three ✓ plants (chloroplasts) have starch grains / *Chromista* (chloroplast) does not have starch grains ✓	2 max	**IGNORE** reference to external membrane **ALLOW** plants (chloroplasts) have more thylakoids **ALLOW** plant (chloroplasts) have lamellae between thylakoids **ALLOW** thylakoids in plant (chloroplasts) form grana **IGNORE** *Chromista* (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**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>18</td><td></td><td></td><td colspan="3">In summary:
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):
○ award the higher mark where the Communication Statement has been met.
○ award the lower mark where aspects of the Communication Statement have been missed.

• The science content determines the level.
• The Communication Statement determines the mark within a level.</td></tr>
<tr><td></td><td>(a)*</td><td></td><td>Level 3 (5–6 marks)
Full and detailed plan of how to carry out a valid investigation into the rate of transpiration.

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.

Level 2 (3–4 marks)
Detailed plan of how to carry out a valid investigation into the rate of transpiration.

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.

Level 1 (1–2 marks)
Response is aware of how to plan a valid investigation.

The information is basic and communicated in an unstructured way. The information is supported by limited method which may be unclear.</td><td>6</td><td>Indicative scientific points may include…
IGNORE potometer set up detail
These are not mark points
See appendix
Method and planning to obtain valid data
• 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

Variables
• named variables controlled
e.g. temperature
humidity
light
wind movement
surface area of leaves</td></tr>
</table>

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**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>19</td><td>(a)</td><td></td><td>
<table>
<tr><th>Genus</th><th>Diet</th><th>Justification</th></tr>
<tr><td>Camponotus</td><td>mainly carbohydrate</td><td>(RQ is) 1.0</td></tr>
<tr><td>Melophorus</td><td>protein
OR
lipid <u>and</u>
carbohydrate</td><td>(RQ is) 0.9</td></tr>
<tr><td>Cataglyphis</td><td>lipid</td><td>(RQ is) 0.7</td></tr>
</table>
✓✓✓
</td><td>3</td><td>DO NOT ALLOW all three substrates for Melophorus
ALLOW amino acids for protein for Melophorus
ALLOW fat / oil / triglyceride / fatty acid for lipid for Cataglyphis

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 <u>column</u>
AND
for correct three justifications written in words i.e.
Camponotus – CO_2 produced is , similar / equal to O_2 consumed
Melophorus - CO_2 produced is 0.07 less than O_2 consumed
Cataglyphis - CO_2 produced is 0.46 less than O_2 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</td></tr>
</table>

Question			Answer	Marks	Guidance
19	(b)		*Similarities* ***Any two from:*** polymers / polysaccharides ✓ have , 6 carbon / C6 , sugars ✓ have 1-4 glycosidic bonds ✓ have CH_2OH side group (in monomers) ✓ *Differences* ***Any two from:*** chitin has β-glycosidic bonds ✓ chitin contains , nitrogen / N / amide / NH-CO-CH_3 ✓ 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
			In summary: *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):* ○ *award the higher mark where the Communication Statement has been met.* ○ *award the lower mark where aspects of the Communication Statement have been missed.* • ***The science content determines the level.*** • ***The Communication Statement determines the mark within a level.***		
	*(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. *There is a well-developed line of reasoning with accurate descriptions of the processes. The information presented is relevant and clearly outlined.*	**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. *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.* **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. *The information is basic and communicated in an unstructured way. The information is supported by limited detail which may be unclear.* **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)	*diaphragm is paralysed so:* 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)	*suggestion:* slows / decreases , heart rate ✓ *explanation:* ***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$\dot{}$ ✓✓	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 $\frac{2.9-1.2}{1.2} \times 100$ **OR** $\frac{1.7}{1.2}$ x 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 , muscle ✓	3	**IGNORE** cells **ALLOW** Islet of Langerhans / acini
	(b)		*carboxylic acid* should be carbonic acid / H_2CO_3 ✓ *vagus* (nerve) should be , accelerator / sympathetic / accelerans , (nerve) ✓ *AVN* should be , SAN / sinoatrial node ✓ *baroreceptors* should be chemoreceptors **OR** *pH* should be pressure ✓ *smooth muscle* should be cardiac muscle ✓	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)	*description:* (rapid) blinking / shutting / closing (of eyes) ✓ *explanation:* 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	

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553

© OCR 2018