



**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

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

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**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.

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## 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	

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## Section B

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

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





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

Question	Answer	Marks	Guidance
18	<p><b><i>In summary:</i></b>  <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, <b>Level 1</b>, <b>Level 2</b> or <b>Level 3</b>, best describes the overall quality of the answer.</i>  <i>Then, award the higher or lower mark within the level, according to the <b>Communication Statement</b> (shown in italics):</i></p> <ul style="list-style-type: none"> <li>○ <i>award the higher mark where the Communication Statement has been met.</i></li> <li>○ <i>award the lower mark where aspects of the Communication Statement have been missed.</i></li> </ul> <ul style="list-style-type: none"> <li>● <b><i>The science content determines the level.</i></b></li> <li>● <b><i>The Communication Statement determines the mark within a level.</i></b></li> </ul>		
(a)*	<p><b>Level 3 (5–6 marks)</b>  Full and detailed plan of how to carry out a valid investigation into the rate of transpiration.</p> <p><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></p> <p><b>Level 2 (3–4 marks)</b>  Detailed plan of how to carry out a valid investigation into the rate of transpiration.</p> <p><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></p> <p><b>Level 1 (1–2 marks)</b>  Response is aware of how to plan a valid investigation.</p> <p><i>The information is basic and communicated in an unstructured way. The information is supported by limited method which may be unclear.</i></p>	6	<p><b>Indicative scientific points may include...</b>  <b>IGNORE</b> potometer set up detail  These are <b>not</b> mark points  <b>See appendix</b>  <b>Method and planning to obtain valid data</b></p> <ul style="list-style-type: none"> <li>● method described</li> <li>● movement of bubble in potometer / mass measured</li> <li>● timing distance travelled by bubble</li> <li>● repeating investigation with two different plant species</li> <li>● repetition to gain replicates</li> <li>● calculation (rate / mean)</li> <li>● statistical test</li> </ul> <p><b>Variables</b></p> <ul style="list-style-type: none"> <li>● named variables controlled  e.g. temperature  humidity  light  wind movement  surface area of leaves</li> </ul>

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Question		Answer	Marks	Guidance
		<b>0 marks</b> No response worthy of credit <b>NR</b> No response		<ul style="list-style-type: none"> <li>how variables are controlled</li> </ul>
	(b)	insoluble ✓ unreactive / inert ✓ high <u>tensile</u> strength ✓ flexible ✓ can form hydrogen bonds with neighbouring chains ✓	<b>3</b> <b>max</b>	<b>List Rule</b> If all <b>three</b> prompt lines used and more than one property is on prompt line mark the <b>first</b> one on each line. If only <b>one</b> or <b>two</b> lines used but there is more than one property listed mark the first three properties given. <b>IGNORE</b> detail about structure or cell walls  <b>IGNORE</b> permeable <b>IGNORE</b> rigid <b>IGNORE</b> strong
	(c)	<u>extracellular</u> <b>AND</b> (it) takes place outside of cells / cellulose cannot enter (bacterial) cells ✓	<b>1</b> <b>max</b>	<b>ALLOW</b> enzymes must , leave / be secreted from , (bacterial) cells <b>IGNORE</b> 'excrete'
		<b>Total</b>	<b>10</b>	

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Question		Answer			Marks	Guidance												
19	(a)	<table border="1"> <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 <b>OR</b> lipid <b>and</b> 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> <p>✓✓✓</p>			Genus	Diet	Justification	<i>Camponotus</i>	mainly carbohydrate	(RQ is) 1.0	<i>Melophorus</i>	protein <b>OR</b> lipid <b>and</b> carbohydrate	(RQ is) 0.9	<i>Cataglyphis</i>	lipid	(RQ is) 0.7	3	<p><b>DO NOT ALLOW</b> all three substrates for <i>Melophorus</i>  <b>ALLOW</b> amino acids for protein for <i>Melophorus</i>  <b>ALLOW</b> fat / oil / triglyceride / fatty acid for lipid for <i>Cataglyphis</i></p> <p><b>ALLOW THREE</b> marks for correctly completed table  <b>ALLOW RQs</b> to greater number of sig.figs. e.g. 1.01 / 0.89 / 0.687  If <b>Rf or RV</b> is stated instead of RQ allow <b>max 1</b> for <b>justification</b> column</p> <p><b>ALLOW TWO</b> marks for all correctly calculated RQ values in <b>justification</b> column / on Fig.19.1  <b>OR</b>  <b>ALLOW TWO</b> marks for:  correct two responses in <b>diet column</b>  <b>AND</b>  for correct three <b>justifications</b> written in words i.e.  <i>Camponotus</i> – CO<sub>2</sub> produced is , similar / equal to O<sub>2</sub> consumed  <i>Melophorus</i> - CO<sub>2</sub> produced is 0.07 less than O<sub>2</sub> consumed  <i>Cataglyphis</i> - CO<sub>2</sub> produced is 0.46 less than O<sub>2</sub> consumed</p> <p><b>If RQ values have not been calculated or are incorrect</b></p> <p><b>ALLOW ONE</b> mark for correct <b>diet</b> column  <b>OR</b>  correct <b>justification</b> column written in words  <b>OR</b>  two correct RQ values</p>
Genus	Diet	Justification																
<i>Camponotus</i>	mainly carbohydrate	(RQ is) 1.0																
<i>Melophorus</i>	protein <b>OR</b> lipid <b>and</b> carbohydrate	(RQ is) 0.9																
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Question		Answer	Marks	Guidance
19	(b)	<p><i>Similarities</i>  <b>Any two from:</b>            polymers / polysaccharides ✓            have , 6 carbon / C6 , sugars ✓            have 1-4 glycosidic bonds ✓            have CH<sub>2</sub>OH side group (in monomers) ✓</p> <p><i>Differences</i>  <b>Any two from:</b>            chitin has β-glycosidic bonds ✓            chitin contains , nitrogen / N / amide / NH-CO-CH<sub>3</sub> ✓            no 1-6 glycosidic bonds in chitin ✓            no branching in chitin ✓</p>	4 max	<p><b>ALLOW</b> have hexose(s)</p> <p><b>ALLOW</b> glycogen has α-glycosidic bonds  <b>ALLOW</b> ORA for glycogen  <b>ALLOW</b> ORA for glycogen  <b>ALLOW</b> ORA for glycogen</p>
		<p><b><i>In summary:</i></b>  <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, <b>Level 1</b>, <b>Level 2</b> or <b>Level 3</b>, best describes the overall quality of the answer.</i>  <i>Then, award the higher or lower mark within the level, according to the <b>Communication Statement</b> (shown in italics):</i></p> <ul style="list-style-type: none"> <li>○ <i>award the higher mark where the Communication Statement has been met.</i></li> <li>○ <i>award the lower mark where aspects of the Communication Statement have been missed.</i></li> </ul> <ul style="list-style-type: none"> <li>• <b><i>The science content determines the level.</i></b></li> <li>• <b><i>The Communication Statement determines the mark within a level.</i></b></li> </ul>		
	*(c)	<p><b>Level 3 (5–6 marks)</b>            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.</p> <p><i>There is a well-developed line of reasoning with accurate descriptions of the processes. The information presented is relevant and clearly outlined.</i></p>	6	<p><b>Indicative scientific points may include...</b>            These are <b>not</b> mark points  <b>See appendix</b></p> <ul style="list-style-type: none"> <li>• occurs in mitochondria / on membrane</li> <li>• involves inner membrane and matrix</li> <li>• involves movement of hydrogen across membrane</li> <li>• use of enzyme / channel protein / ATP synthase</li> <li>• Hydrogen ions / H<sup>+</sup> ions pumped out of matrix</li> </ul>

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Question	Answer	Marks	Guidance
	<p><b>Level 2 (3–4 marks)</b> 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.</p> <p><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></p> <p><b>Level 1 (1–2 marks)</b> A description of the processes involved in chemiosmosis is attempted, with some understanding of the different stages, reactants and products.</p> <p><i>The information is basic and communicated in an unstructured way. The information is supported by limited detail which may be unclear.</i></p> <p><b>0 marks</b> No response or no response worthy of credit. <b>NR</b> No response</p>		<p>across membrane into intermembrane space</p> <ul style="list-style-type: none"> <li>• Proton / H<sup>+</sup> gradient created</li> <li>• proton-motive force</li> <li>• H<sup>+</sup> ions pass through hydrophilic transmembrane protein</li> <li>• cristae / stalked particles involved</li> <li>• ATP synthase produces ATP from ADP + P<sub>i</sub></li> <li>• H<sup>+</sup> ions move from area of high concentration to low concentration</li> <li>• Some H<sup>+</sup> ions leak back into matrix / process is not completely efficient</li> </ul>
	<b>Total</b>	<b>13</b>	

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

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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	<b>IGNORE</b> average <b>DO NOT ALLOW</b> prevents anomalies <b>IGNORE</b> remove anomalies  <b>ALLOW</b> reproducibility <b>IGNORE</b> reliability / validity / accuracy  <b>ALLOW</b> can complete , standard deviation / t-test
			<b>Total</b>	<b>10</b>	



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

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

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

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Question		Answer	Marks	Guidance
		removing CO <sub>2</sub> would prevent photosynthesis ✓ CO <sub>2</sub> would be a limiting factor for photosynthesis ✓		<b>ALLOW</b> e.g. so they could still photosynthesise e.g. CO <sub>2</sub> 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 ✓	<b>2 max</b>	'at 1510 (lux)' only needs to be mentioned <b>once</b> throughout  <b>ALLOW</b> at 1510 (lux) compensation point has been reached
		<b>Total</b>	<b>8</b>	

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

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