GCE

Biology B

H422/03: Practical skills in biology

Advanced GCE

Mark Scheme for November 2020

Oxford Cambridge and RSA Examinations

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

Marking Annotations

Annotation	Use
BOD	Benefit of Doubt
CON	Contradiction
✗	Cross
ECF	Error Carried Forward
GM	Given Mark
〰	Extendable horizontal wavy line (to indicate errors / incorrect science terminology)
I	Ignore
●	Large dot (various uses as defined in mark scheme)
🟥	Highlight (various uses as defined in mark scheme)
NBOD	Benefit of the doubt not given
✓	Tick
^	Omission Mark
BP	Blank Page
L1	Level 1 answer in Level of Response question
L2	Level 2 answer in Level of Response question
L3	Level 3 answer in Level of Response question

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.

Question			Answer	Mark	AO element	Guidance
1	(a)	i	*Explanation must be qualified and correspond to the variable* *Credit any two pairs* speed / gradient (of treadmill) ✓ *because (*higher speed/gradient) creates higher energy demands for body and higher heart rates ✓ health of participant / smoking ✓ *because* heath conditions / smoking, (may) increases heart rate ✓ BMI / obesity ✓ *because* high(er) BMI / obesity, increases heart rate ✓ sex ✓ *because* males (tend to) have higher heart rate ✓ age of participants ✓ *because* older people have lower heart rates ✓ initial fitness of the subject ✓ *because* fitter people have lower (resting) heart rates ✓	max 4	AO 2.7	**ALLOW** 'pulse rate' as alternative wording for 'heart rate' **IGNORE** 'speed person ran' as unrelated to the treadmill

1	**(a)**	**ii**	*Any two from* from a larger sample so, more (likely to be) reliable ✓ peer reviewed so, conclusions more valid ✓ different methods (may have been used) so, achieved reproducibility ✓ *idea that* procedure used to collect secondary data (may have) used a more, accurate / precise, methodology, so improved accuracy of data (obtained) ✓	max 2	AO 2.5	Must explain point for mark
	(b)	**i**	*Description* (slight) increase in heart rate ✓ *Explanation* anticipatory response/ increases delivery of oxygen to muscles in anticipation of exercise OR caused by release of, neurotransmitters / noradrenaline / adrenaline ✓	2	AO 2.3	**ALLOW** use of data to show increase of heart rate **IGNORE** 'HR <u>changes</u>' as this could be an increase or a decrease in the HR
1	**(b)**	**ii**	23925 **AND** <u>$cm^3 min^{-1}$</u> ✓	1	AO 2.4	Correct answer only: 165 x 145 = 23925 Must include units for mark. **ALLOW** correct answer in other form, e.g. 23.925dm^3 min^{-1}, 23925 ml min^{-1}
1	**(b)**	**iii**	less time for ventricles to fill so, stroke volume is lower ✓	1	AO 2.3	**ALLOW** ref to incomplete filling of ventricles <u>and</u> reduced SV

<table>
<tr><td><b>1</b></td><td><b>(c)</b></td><td><b>i</b></td><td><table><tr><td>Elevation of the ST section</td><td>✓</td></tr><tr><td>Abnormally shaped P-wave</td><td></td></tr><tr><td>Deep S wave</td><td></td></tr></table></td><td>1</td><td>AO 1.2</td><td></td></tr>
<tr><td><b>1</b></td><td><b>(c)</b></td><td><b>ii</b></td><td>(cardiac) muscle in atrial wall contracts, arrhythmically / in an uncoordinated way
<b>AND</b>
inefficient filling of ventricles ✓</td><td>1</td><td>AO 2.5</td><td></td></tr>
</table>

<table>
<tr><td><b>1</b></td><td><b>(d)</b></td><td></td><td colspan="4"><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, <b>Level 1</b>, <b>Level 2</b> or <b>Level 3</b>, best describes the overall quality of the answer. Then, award the higher or lower mark within the level, according to the <b>Communication Statement</b> (shown in italics): award the higher mark where the Communication Statement has been met.
Award the lower mark where aspects of the Communication Statement has been missed.
<b>• The science content determines the level.</b>
<b>•The Communication Statement determines the mark within a level.</b>
<b>A level annotation should be used where all marks for a level have been achieved e.g. for 6 marks</b></i> <b>L3, 5 marks L3^ etc.</b>
<i><b>No marks (0) should have a cross</b></i></td></tr>
<tr><td></td><td></td><td></td><td><b>Level 3 (5-6 marks)</b>
Describes <b>and</b> <u>explains</u> both benefits <b>and</b> drawbacks, with conclusion drawn. Detailed evidence of using information from both statements 1 and 2. <i>There is a well-developed line of reasoning, which is clear and logically-structured and uses scientific terminology at an appropriate level. The information presented is relevant and substantiated.</i>

<b>Level 2 (3-4 marks)</b>
Describes some benefits <b>and</b> drawbacks and explains at least one benefit <b>and</b> at least one drawback in detail. Evidence of using information from either statements 1or statements 2.
<i>There is a line of reasoning presented with some structure and use of appropriate scientific language. The information presented in the most part relevant and supported by some evidence.</i>

<b>Level 1 (1-2 marks)</b>
Describes some benefits <b>or</b> drawbacks.
Information from statement 1 and 2 may not be stated clearly.
<i>There is an attempt at a logical structure with a line of reasoning. The information is mostly relevant.</i>

0 marks</td><td>6</td><td>AO 3.2</td><td>Indicative marking points may include:

<i>Benefits/ advantages :</i>
• Unexplained symptoms may have an effect on quality of life and may lead to anxiety
• Patients are reassured and further investigations can be avoided
• Results are immediately available
• Less disruption to lifestyle than other cardiac monitors
• Less additional cost to NHS than cardiac monitors.
• The knowledge allows doctors to make more informed treatment decisions e.g. such as medication dosage
• Other indicators of (later onset) heart disease are painful and frightening – e.g. pressure in chest, breathlessness, discomfort
• Patient is involved in diagnosis of symptoms
• Less need for training in emergency treatment of heart attacks e.g. defibrillator, CPR
• Median time from symptoms to diagnosis relatively short
• Less need for GP/ consultant appointment time
• No need for specialist to fit device</td></tr>
</table>

			No response or no response worthy of credit.			*Drawbacks/disadvantages:* • (Older) people, who are at greater risk of heart disease, may not possess compatible smartphones • Patients may not use the smartphone app correctly • No evidence of correlation between use of smartphone app and decreased GP consultation • New device not fully tested on trialled over many years • May create fear /worry from user as they can access data / trace in real time • Battery life of smartphone may affect the long-term use of the app • Quality of trace not as good as the CEM /standard hospital ECG with 12 electrodes • Older people, who are at greater risk of heart disease, may not have confidence in technology • Less data is collected as a result of lack of continual recording (as compared to CEM being worn continuously) • Patients may not use the app if they fail to recognise their own symptoms

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td>i</td><td>15.50 ✓✓
Ascending rank
<table>
<tr><th>Sample</th><th>Petiole length (mm)</th><th>Rank</th><th>Leaf width (mm)</th><th>Rank</th><th>d</th><th>d^2</th></tr>
<tr><td>1</td><td>28</td><td>2</td><td>52</td><td>3.5</td><td>-1.5</td><td>2.25</td></tr>
<tr><td>2</td><td>30</td><td>3</td><td>55</td><td>5</td><td>-2</td><td>4</td></tr>
<tr><td>3</td><td>17</td><td>1</td><td>31</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>4</td><td>31</td><td>4</td><td>52</td><td>3.5</td><td>0.5</td><td>0.25</td></tr>
<tr><td>5</td><td>35</td><td>6</td><td>56</td><td>6</td><td>0</td><td>0</td></tr>
<tr><td>6</td><td>45</td><td>7</td><td>61</td><td>7</td><td>0</td><td>0</td></tr>
<tr><td>7</td><td>46</td><td>8</td><td>62</td><td>8</td><td>0</td><td>0</td></tr>
<tr><td>8</td><td>77</td><td>10</td><td>98</td><td>10</td><td>0</td><td>0</td></tr>
<tr><td>9</td><td>33</td><td>5</td><td>40</td><td>2</td><td>3</td><td>9</td></tr>
<tr><td>10</td><td>57</td><td>9</td><td>69</td><td>9</td><td>0</td><td>0</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Total</td><td>15.50</td></tr>
</table>
Descending rank
<table>
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<tr><td>2</td><td>30</td><td>8</td><td>55</td><td>6</td><td>2</td><td>4</td></tr>
<tr><td>3</td><td>17</td><td>10</td><td>31</td><td>10</td><td>0</td><td>0</td></tr>
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<tr><td>6</td><td>45</td><td>4</td><td>61</td><td>4</td><td>0</td><td>0</td></tr>
<tr><td>7</td><td>46</td><td>3</td><td>62</td><td>3</td><td>0</td><td>0</td></tr>
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<tr><td>9</td><td>33</td><td>6</td><td>40</td><td>9</td><td>-3</td><td>9</td></tr>
<tr><td>10</td><td>57</td><td>2</td><td>69</td><td>2</td><td>0</td><td>0</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Total</td><td>15.50</td></tr>
</table></td><td>2</td><td>AO 2.8</td><td><b>ALLOW</b> 15.5
1 mark for
both rank columns correct
OR
any correct column for d OR d^2 (also allowing ECF for incorrect rankings)</td></tr>
<tr><td>2</td><td>(a)</td><td>ii</td><td>$r_s = 0.9061$ ✓✓</td><td>2</td><td>AO2</td><td><b>ALLOW</b> ECF from Q2ai
<i>Answer must be given to 4dp (refer to table in Q2aiii)</i>
<i><b>ALLOW</b> one mark if calculated correctly but not given to 4dp</i></td></tr>
</table>

<table>
<tr><td>2</td><td>(a)</td><td>iii</td><td><i><u>reject</u> the null hypothesis because</i>:
(degrees of freedom is 10 so) critical value (at p=0.05) = 0.6485 ✓
calculated value is greater than the critical value, so correlation significant (at 0.05 level) ✓
correlation is, a weak positive ✓
results are not due to chance ✓</td><td>max 2</td><td>AO 2.8</td><td><i>Candidates should use n = 10 and critical value at p=0.05 / 95% confidence level</i>
ALLOW ECF for correct interpretation of incorrect calculation of r_s from Q2aii
No mark for stating ‘reject null hypothesis’ without explanation
<b>ALLOW</b> ‘(relatively) strong’</td></tr>
<tr><td>2</td><td>(b)</td><td></td><td><table>
<tr><th>Adaptation</th><th>Behavioural</th><th>Physiological</th><th>Anatomical</th></tr>
<tr><td>Stomata open only at night</td><td>✓</td><td></td><td></td></tr>
<tr><td>Stem becomes more rounded with fewer folds when water is available</td><td></td><td>✓</td><td></td></tr>
<tr><td>Stomata are located in sunken pits</td><td></td><td></td><td>✓</td></tr>
</table></td><td>3</td><td></td><td></td></tr>
<tr><td>2</td><td>(c)</td><td>i</td><td>Control (group), for /to allow, comparison ✓</td><td>1</td><td>AO 3.1</td><td></td></tr>
</table>

2	(c)	(ii)*	***Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.*** ***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.***			
			Level 3 (5–6 marks) Balanced, detailed evaluation with both supporting and undermining statements using information from **Fig. 2.2a and Fig. 2.2b/c** *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Evaluation with both supporting and undermining statements using information from **Fig. 2.2a and Fig. 2.2b/c** *There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.* **Level 1 (1–2 marks)** Limited evaluation with basic descriptive statements that may not include reference to **Fig. 2.2a and Fig. 2.2b/c** *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** *No response or no response worthy of credit.*	6	AO3.2 AO3.3	**Indicative scientific points may include (not exhaustive):** **ALLOW** ORA to shade species throughout *Supporting statements:* • chloroplast from *M.o* (2.2a) shows more similar ultrastructure to *M. g* chloroplast in sun conditions (2.2b) • chloroplast from *M.o (2.2a)* and chloroplast from *M.g* in sun conditions have similar sized grana / thylakoid stacks (2.2b) • chloroplast from *M.o (2.2a*) and chloroplast from *M.g* in sun conditions (2.2b) have similar numbers of grana • chloroplast from *M.o (2.2a*) and chloroplast from *M.g* in sun conditions (2.2b) have similar numbers of thylakoids per granum • chloroplast from *M.o (2.2a*) don't need as many thylakoids / grana for light capture as they are in high light intensity • fewer thylakoids in both chloroplasts from *M.o (2.2a*) and chloroplasts from *M.g* in sun conditions (2.2b) than chloroplast from *M.g* in shade conditions (2.2c)

						Undermining statements: • only have **one** drawing of a chloroplast from each micrograph • student's drawings may be inaccurate • chloroplasts / leaves from extinct species may have been damaged • images / electron micrographs may have been poor quality • methods of obtaining the leaf samples may have been different • more data required to draw this conclusion • there (maybe) different numbers of chloroplasts in different species • there (maybe) different numbers of leaves in different species

Question			Answer	Mark	AO	Guidance
3	**(a)**	**(i)**	*Line measured as 112mm = 28.0* (μm) *and 114mm = 28.5* (μm) 28.0 to 28.5 (μm) ✓✓	2	AO 2.8	*Only allow values within the range (using image size 112 to 114)* **ALLOW** one mark as ECF for incorrect measurement provided there is evidence of rearranging formula **AND** showing working **AND** answer given to 3 sf i.e. $= \frac{\text{incorrect measured value}}{4000}$ = ECF value to 3sf
3	**(a)**	**(ii)**	iodopsin ✓	1	AO1.1	
3	**(a)**	**(iii)**	*MARK FIRST TWO REPONSES* procedure is more technical / requires more advanced practical skills / AW ✓ further detail of skill required e.g. complex staining process needed to prepare specimens ✓ artefacts may occur ✓	2 max	AO 2.7	**IGNORE** Specimens must be placed in a vacuum and so must be dehydrated / dead as image 3.1 is a <u>section</u> of tissue **IGNORE** reference to black and white images as this is not related to the preparation of the image **IGNORE** references to cost

<table>
<tr>
<td><b>3</b></td>
<td><b>(b)</b></td>
<td></td>
<td>✓✓✓
<table>
<tr><th>Label</th><th>Name</th><th>Function</th></tr>
<tr><td><b>A</b></td><td><i>ciliary muscle</i></td><td>alter shape of lens</td></tr>
<tr><td><b>B</b></td><td>iris</td><td><i>Control amount of light entering the eye</i></td></tr>
<tr><td><b>C</b></td><td>lens</td><td><i>Focusses light rays</i></td></tr>
<tr><td><b>D</b></td><td><i>cornea</i></td><td>Refracts light (to retina)</td></tr>
<tr><td><b>E</b></td><td><i>retina</i></td><td>Contains photoreceptors / converts light energy to action potentials</td></tr>
<tr><td><b>F</b></td><td>choroid</td><td><i>Pigmented layer to prevent internal reflection</i></td></tr>
</table>
</td>
<td>3</td>
<td>AO 1.1</td>
<td><b>ALL six rows</b> correct <b>3 marks</b>
<b>Four or five rows</b> correct <b>2 marks</b>
<b>Two or three rows</b> correct <b>1 mark</b>

<b>One</b> row correct <b>0 marks</b></td>
</tr>
<tr>
<td><b>3</b></td>
<td><b>(c)</b></td>
<td></td>
<td><i>Only allow 2 marks maximum from any one area to ensure candidates address both parts of the question</i>

<i>Equipment</i>
use scissors, to cut away fatty tissue ✓
use scalpel, to remove, (rectus) muscles / fine sections of fat / make an incision in sclera ✓
use blunt seeker, to separate lens ✓

<i>Safe working</i>
(prevent) contamination from tissue or fluid, by wearing gloves / using mat / disinfecting instruments / washing hands / use of biological waste bin ✓
(prevent) injury from scalpel / scissors, by cutting away from body ✓
(prevent) allergic reaction, by assessing before starting dissection ✓</td>
<td>3 max</td>
<td>AO 1.1</td>
<td>Marks for equipment must give name of equipment <b>AND</b> use for each mark

Marks for safe working points must be linked to preventative action</td>
</tr>
</table>

3	**(d)**	**i**	histogram drawn (with bars touching), with appropriate bar widths for each age category ✓ X axis labelled as "age / years " **AND** Y axis labelled as 'Frequency Density' **AND** plot area covers 50% of the available space ✓ all data plotted correctly ✓	3	AO 2.8	Do not award mp1 if there is a line of best fit also plotted through histogram **ALLOW** +/- 0.5 small square
3	**(d)**	**ii**	(total = 198 + 540 =) 738 ✓✓	2		69-63 = 6 x 33 = 198 81-69 = 12 x 45 = 540 View of 198 or 540 gains **1 mark**
3	**(d)**	**iii**	*large sample size:* is more representative of the (actual) population **OR** gives a more accurate mean / is more likely to lie close to the true mean **OR** reduces the impact of anomalous results (on the mean) ✓	1		
3	**(d)**	**iv**	regional differences in incidence may relate to regional differences, in the organisation / delivery, of screening programmes ✓ uptake of screening and (as a result) opportunities for diagnosis, may be lower in rural versus urban areas (due to decreased accessibility of screening services) ✓ challenges in identifying diabetic retinopathy, including communication with screening services / communication with patients ✓	2 max	AO 3.4	

Question			Answer	Mark	AO	Guidance
4	(a)		*Plan should only show tissue regions and no cellular detail* Entire specimen drawn **AND** 4 distinct regions shown **AND** drawn to appropriate scale **AND** covering a minimum of 50% of the box ✓ Sharp, clear and continuous lines drawn for each region **AND** label lines are drawn with a ruler and do not have arrow heads ✓ the 4 specified tissues labelled correctly ✓ any 4 tissues annotated correctly ✓	4	AO 2.3	*There should not be any shading or other detail within the plan* **DO NOT ALLOW** (mp1) if cells drawn **DO NOT ALLOW** (mp1) if the diagram has clearly just been traced **DO NOT ALLOW** (mp2) if label lines are not ruled or if the label lines have arrowheads Examples of suitable labels and annotations • grey matter = dark(er) pink/purple • white matter = light(er) pink/purple • central canal = white/central, void/area • meninges = red/purple exterior band /AW Additional tissues that could be identified by the candidate • dura matter = peripheral / outer, band / layer • posterior/dorsal, horn(s) = narrow(er) area • anterior/ventral, horn(s) = wide(r) area • lateral horn(s) = bulbous / pointed / AW • dorsal/ventral rootlets = pink/purple 'lobed' areas under dura / AW • ventral median fissure = thin, dark red/purple line • grey commissure = above central canal • white commissure = below central canal
4	(b)		(Fig 4.3 is an electron micrograph and has) high**er /** great**er,** resolution ✓	1	AO 1.2	**IGNORE** 'better' resolution

<table>
<tr>
<td><b>4</b></td>
<td><b>(c)</b></td>
<td></td>
<td>
<table>
<tr><th>Parasympathetic nervous system</th><th>Sympathetic nervous system</th></tr>
<tr><td>acetylcholine ✓</td><td></td></tr>
<tr><td></td><td>ganglion is close to spinal cord ✓</td></tr>
</table>
</td>
<td>2</td>
<td>AO 1.1</td>
<td></td>
</tr>
</table>

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