GCE

Biology A

H420/01: Biological processes

A Level

Mark Scheme for June 2024

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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.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING
RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM Assessor messaging system, or by email.

5. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

   Rubric Error Responses – Optional Questions
   Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).

When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add a tick to confirm that the work has been seen.

7. Award No Response (NR) if:
    - there is nothing written in the answer space

    Award Zero '0' if:
    - anything is written in the answer space and is not worthy of credit (this includes text and symbols).

Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM Assessor **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
If you have any questions or comments for your team leader, use the phone, the RM Assessor messaging system, or e-mail.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response: Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.
Once the level is located, award the higher or lower mark:

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

In summary:

The skills and science content determines the level.

The communication statement determines the mark within a level.

Level of response questions on this paper are **18(d)** and **19(b)(ii).**

11. **Annotations**

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

12. **Subject Specific Marking Instructions**

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
I	alternative and acceptable answers for the same marking point
✓	Separates marking points
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

13. **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	Marks	Guidance
1	B	1	
2	B	1	
3	A	1	
4	A	1	
5	D	1	
6	A	1	
7	D	1	
8	B	1	
9	B	1	
10	D	1	
11	B	1	
12	C	1	
13	B	1	
14	A	1	
15	C	1	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>16</td><td>(a)</td><td></td><td>
<table>
<tr><th>Biological molecule</th><th>Is a monomer</th><th>Is a polymer</th><th>Contains glycosidic bonds</th></tr>
<tr><td>Amino acid</td><td>✓</td><td></td><td></td></tr>
<tr><td>Amylopectin</td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>Glucose</td><td>✓</td><td></td><td></td></tr>
<tr><td>Sucrose</td><td></td><td></td><td>✓</td></tr>
</table>
1 mark per correct row ✓ ✓ ✓</td><td>3</td><td>IGNORE crosses and hybrid ticks</td></tr>
<tr><td>16</td><td>(b)</td><td></td><td>(α-) glycosidic ✓

carbon 1 to carbon 4 (bond) ✓</td><td>2</td><td>ALLOW marks clearly shown on annotated diagram
IGNORE ref to any named carbohydrate

ALLOW (α-)1,4 glycosidic bond for 2 marks
DO NOT ALLOW beta / β

ALLOW 1,4 (bond)
DO NOT ALLOW 1,6 (bond)
ECF e.g β-1,4 glycosidic bond gets MP2
beta / β 1, 6 (bond) = 0 marks</td></tr>
<tr><td>16</td><td>(c)</td><td>(i)</td><td>H_2O / water ✓

2 / two ✓</td><td>2</td><td>ALLOW 1 mark for just H_2O / water
IGNORE incorrect number e.g. 3 for MP1</td></tr>
</table>

16	**(c)**	**(ii)**	(maltotriose is) complementary to the <u>active site</u> (of maltase / the enzyme) **OR** (maltotriose also) contains (α-1,4) glycosidic bonds **OR** (maltase / the enzyme) hydrolyses (α-1,4) glycosidic bonds ✓	**1**	**ALLOW** (maltotriose) can bind to or fit into <u>active site</u> (of maltase / the enzyme) **DO NOT ALLOW** beta / β **ALLOW** breaks down for hydrolyses
			Total	**8**	

17	**(a)**	**(i)**	**X** = water / H_2O **Y** = carbon dioxide / CO_2 **Z** = oxygen / O_2 ✓ ✓	**2**	All **three** correct for **TWO** marks **One** or **two** correct for **ONE** mark
17	**(a)**	**(ii)**	**1** *idea that* light (energy) is the only requirement from outside the terrarium / AW ✓ **2** respiration provides carbon dioxide **and** water for photosynthesis **OR** photosynthesis provides glucose **and** oxygen for respiration ✓ **3** water used for photolysis **OR** oxygen used as final electron acceptor (in respiration) ✓ **4** carbon dioxide used for , light independent stage / Calvin cycle ✓ **5** ATP (still) produced / energy provided , for (named) cell activities ✓ **6** decomposing plant material provides (named) mineral ions ✓	**max 3**	**ALLOW** O_2 for oxygen, H_2O for water, CO_2 for carbon dioxide and $C_6H_{12}O_6$ for glucose throughout **MP1 ALLOW** e.g. as light (energy) can pass through glass for photosynthesis **MP1 ALLOW** e.g. plants in glass containers will have access to light **MP2 IGNORE** equations unqualified **MP5 ALLOW** e.g. active transport / protein synthesis / active uptake of mineral ions **IGNORE** produces energy **MP6 IGNORE** nutrients
17	**(b)**	**(i)**	21 or 22 or 23 or 24 (%) ✓	**1**	**ALLOW** e.g. 22.0 but **DO NOT ALLOW** other decimal places e.g. 22.3

17	**(b)**	**(ii)**	**1** **2** **3** **4** **5**	(alga has) <u>accessory</u> pigments ✓ (other pigments) absorb , different / other , wavelengths (of light) ✓ little / not all , light (wavelengths) is absorbed by , chlorophyll a / primary pigment ✓ (light) energy is transferred to reaction centre ✓ for use in , light-dependent reaction / LDR ✓	**max 3**	**MP1 IGNORE** named pigments **MP2 ALLOW** longer / shorter / AW for different **MP2 ALLOW** λ for wavelength **MP2 IGNORE** more / wider range , wavelengths **MP4 ALLOW** chlorophyll a / primary pigment for reaction centre / photosystem **MP4 ALLOW** AW e.g. accessory pigments harvest (light) energy for reaction centre
17	**(b)**	**(iii)**		(red) algae have pigments that absorb short(er) (light) wavelengths / AW ✓ (these wavelengths) can penetrate water to great(er) depths / AW ✓	**2**	**ALLOW** values in range 500 – 630nm / blue / green / yellow for short(er) wavelengths **ALLOW** e.g. can pass through water to reach the (red) algae (at depth)
17	**(c)**	**(i)**		GP was the only compound seen after 1 , sec(ond) / s ✓ TP appears after 5 , sec(onds) / s ✓	**2**	**ALLOW** glycerate 3 -phosphate for GP and triose phosphate for TP **ALLOW** AW for compound e.g. molecule / product **ALLOW** e.g. GP and no other products were seen after 1 second **IGNORE** any other products after 5 seconds
17	**(c)**	**(ii)**		(TP is) converted into / source of, sugar phosphates / (named) amino acid(s) / citrate / sucrose / RuBP ✓	**1**	**must be idea of synthesis into / AW not breaking down into** **ALLOW** glutamic acid / serine / glycine / aspartic acid for named amino acids **DO NOT ALLOW** GP
				Total	**14**	

Question			Answer	Mark	Guidance
18	(a)	(i)	Any **one** (named) banned substance from: e.g. rhEPO **OR** (named) anabolic / androgenic , steroid e.g. nandrolone **OR** (named) narcotic drug e.g. cannabis / methadone **OR** (named) stimulant e.g. amphetamine **OR** e.g. (named) peptide / steroid , hormone e.g. testosterone ✓	1	**ALLOW** either banned substance or a named substance – check with IOC list **IGNORE** (named) diuretics / alcohol
18	(a)	(ii)	*idea that* collecting duct becomes less permeable to water ✓ (rapid) water loss ✓ larger volume of urine produced ✓	max 2	**ALLOW** e.g. fewer aquaporins inserted into collecting duct wall **ALLOW** reduction in 'water weight' **ALLOW** more water lost in urine **ALLOW** more / greater amount of urine produced
18	(a)	(iii)	it could increase removal of , (performance enhancing) drugs / other banned substances **OR** (performance enhancing) drugs / other banned substances , are undetectable in larger volume of urine produced ✓	1	**ALLOW** e.g. it could increase removal of ***them*** as drugs is mentioned in question stem **ALLOW** AW e.g. the concentration of drug would be too small to be noticed **ALLOW** more dilute for larger volume of urine

18	**(b)**	**(i)**	it does not require surgery / no recovery time required ✓ less painful / less chance of infection (after surgery) ✓ it is more rapid / gives results more quickly ✓ it is , less expensive / cheaper ✓	**max 1**	**IGNORE** disadvantages of biopsy **ALLOW** is , not / less , invasive **ALLOW** less damage to (named) tissues
18	**(b)**	**(ii)**	any **one** from (needs substance and application): glucose **AND** diabetes **OR** protein **AND** kidney disease / albuminuria **OR** creatinine **AND** kidney disease / muscle damage ✓	**max 1**	**ALLOW** other correct substance and condition e.g. hCG **AND** pregnancy **ALLOW** kidney failure / kidney damage for kidney disease
18	**(c)**	**(i)**	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = –1.5 (kPa) award 2 marks** ✓✓ net hydrostatic pressure = 1.7 – 1.1 = 0.6 net oncotic pressure = –3.3 – (–1.2) = –2.1 net pressure = 0.6 + (–2.1) = –1.5 (kPa)	**2**	**Minus sign needed for two marks** **For one mark** 1.5 (without the minus) **OR** anywhere within calculation (net hydrostatic pressure) = 0.6 **OR** anywhere within calculation (net oncotic pressure) = –2.1

18	**(c)**	**(ii)**	hydrostatic (pressure) at arteriole end is higher than oncotic (pressure) so fluid moves out (of blood / capillaries) **OR** net positive pressure at arteriole end so fluid moves out (of blood / capillaries) ✓ hydrostatic (pressure) at venule end is lower than oncotic (pressure) so fluid moves in (to blood / capillaries) **OR** net negative pressure at venule end so fluid moves in (to blood / capillaries) ✓	**2**	Must be comparative **ALLOW** arterial for arteriole and venous for venule **ALLOW** e.g. plasma / water for fluid **DO NOT ALLOW** blood **ALLOW** ora e.g. oncotic is lower at arteriole end than hydrostatic so fluid moves out

18	**(d)***		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Describes in detail the regulation of the water content of blood with reference to action of ADH **AND** role of receptors **AND** (posterior) pituitary *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)** Describes the regulation of the water content of blood with reference to action of ADH **AND** receptors **OR** Describes the regulation of the water content of blood with reference to receptors **AND** (posterior) pituitary **OR** Describes the regulation of the water content of blood with reference to action of ADH **AND** (posterior) pituitary *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Describes the regulation of water content of blood with reference to the action of ADH **OR** receptors **OR** (posterior) pituitary *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*	**6**	**Loss of mark for communication statement if incorrect science / terminology used** **e.g anterior pituitary rather than (posterior) pituitary / ADH secreted by adrenal gland** **OR give details of setting up a water potential gradient** **OR** **if no ref to homeostatic mechanism e.g. returning water potential of blood to normal value / ref to negative feedback** **Indicative scientific points may include:** ***Mechanism of ADH action*** • ADH targets / binds to cells of collecting duct • release of second messenger • vesicles with aquaporins fuse with plasma membrane • increase in permeability of collecting duct wall • more water moves down water potential gradient into cells ***Role of Receptors*** *Sensory receptors* • sensory receptors located in the hypothalamus • osmoreceptors • detect changes in osmotic pressure / water potential of blood • respond to effects of osmosis by shrinking or swelling *Receptors in collecting duct* • receptors located on cells of collecting duct ***(Posterior) pituitary*** • ADH made in hypothalamus • moves down axon to posterior pituitary

					• stored in vesicles • action potentials in neurosecretory cells • ADH released by posterior pituitary • by exocytosis • from neurosecretory cells
			Total	**16**	

Question			Answer	Mark	Guidance
19	(a)	(i)	directional growth in response to a stimulus ✓	1	**ALLOW** grows towards / away from a stimulus **DO NOT ALLOW** 'growth' unqualified – it must have the sense of being directional
19	(a)	(ii)	phototropism / geotropism / hydrotropism / thigmotropism / chemotropism ✓	1	**ALLOW** any correct plant tropism **ALLOW** gravitropism **DO NOT ALLOW** 'trop***h***ism'
19	(a)	(iii)	*abiotic stress:* drought / lack of water ✓ *response:* closing stomata / leaf drop / wilting ✓ **OR** *abiotic stress:* freezing / cold or low temperatures ✓ *response:* closing stomata / leaf drop / wilting / production of anti-freeze chemicals ✓ **OR** *abiotic stress:* high temperature ✓ *response:* closing stomata / opening stomata / wilting ✓ **OR** *abiotic stress:* low light levels / short day length ✓ *response*: closing stomata / abscission / leaf fall / etiolation ✓ **OR** *abiotic stress:* high wind (speeds) ✓ *response:* closing stomata / wilting ✓	2	**For two marks** correct response linked to abiotic stress **ALLOW one mark** for a correct abiotic stress factor with incorrect response **DO NOT ALLOW** grazing / herbivory or other examples of biotic stress. **IGNORE** ref to hormones

19	**(b)**	**(i)**	by enclosing the (donor / recipient) plant in (airtight plastic) bag ✓	**1**	**ALLOW** container / AW for bag **ALLOW** e.g. glass jar to cover the aerial parts e.g. cover that prevents interaction between aerial parts **IGNORE** separate the plants in containers alone as the answer must imply separating aerial parts

19	**(b)**	**(ii) ***	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** An evaluation that includes statement**s** for supporting evidence **AND** statement**s** for non-supporting evidence **AND** includes general statement about quality of data *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)** An evaluation that includes statement**s** for supporting evidence **OR** statement**s** for non-supporting evidence **AND** includes general statement about quality of data **OR** An evaluation that includes **a** statement for supporting evidence **AND a** statement for non-supporting **AND** includes general statement about quality of data *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** An evaluation that includes a statement for supporting evidence **OR** a statement for non-supporting evidence **OR** includes a general statement about quality of data *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*	**6**	**Loss of mark for communication statement if incorrect science e.g. muddled group comparisons** **Group 1 = leaves / small mesh bag / no hyphae** **Group 2 = no leaves / small mesh bag / no hyphae** **Group 3 = leaves / large mesh bag / hyphae** **Group 4 = no leaves / large mesh bag / hyphae** **Assume points relate to PPO activity** **Indicative scientific points may include:** ***Supporting evidence*** • defoliation increased (PPO) activity • non defoliation did not increase (PPO) activity as much • group 2 bigger increase than 1 / group 4 bigger increase than 3 • bigger increase with large-mesh bag / hyphae involved • groups 2 and 4 had large increase / groups 1 and 3 had small increase • group 1 had smallest increase • group 1 SDs overlap • group 4 had largest increase • calculation of comparative difference in increase • group 1 activity only increased by 11% and group 2 increased by 213% • group 3 increased by 83% and group 4 increased by 544% ***Non-supporting evidence*** • increase in all groups • plants not defoliated also showed increase

					• groups 1 and 3 still increased even though they didn't have leaves removed • increase in activity even when leaves are not removed from donor plant • some transmission by mycorrhizae regardless of whether donor leaves removed or not • increase even with small-mesh bag / no hyphae involved • increase in even when hyphae cannot grow between plants • some transmission by means other than mycorrhizae / hyphae ***Quality of data -general statements*** *Good quality because* • SD calculated • low spread of results about the mean • small standard deviations compared to size of mean • increases (in activity) could be significant *Poor quality because* • no control for effect of mesh bag • sample size relatively small • may not be representative of mature trees / trees growing in the wild • no statistical test • only two species used / different species for donor and recipient • raw data not shown – possible anomalies were included
			Total	**11**	

Question			Answer	Mark	Guidance
20	(a)	(i)	(inhaled) oxygen is , being used / removed ✓	1	**ALLOW** (exhaled) carbon dioxide , absorbed / removed **ALLOW** less oxygen in exhaled air
20	(a)	(ii)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 12 / 13 / 14 / 15** ($cm^3\ kg^{-1}$) **award 2 marks** ✓✓ oxygen consumption in 120 s = 1.0 dm^3 = 1000 cm^3 so consumption $\frac{1000}{75} = 13$ ($cm^3\ kg^{-1}$)	2	**If answer is incorrect** **MAX** 1 mark for answer not to 2 sig. figs. Range of 0.9 to 1.1dm^3 from **Fig.20.1** **ALLOW** 1 mark for failure to convert to cm^3 e.g.1.3 x 10^{-2} / 0.013 / 0.014 ($dm^3\ kg^{-1}$) **OR** volume ÷ 75 (Kg)
20	(a)	(iii)	*At 120-240s* deeper / AW , breaths ✓ amplitude / tidal volume , becomes more variable ✓ same / similar , (calculated) breathing rate ✓	**max 2**	**ALLOW ora MPs 1 and 2** for 0-120s **ALLOW** greater tidal volume **ALLOW** breaths per minute for breathing rate

20	**(a)**	**(iv)**	**1**	breathing rate **AND** heart rate both increase ✓	**max 4**	
			2	(blood) oxygen , saturation / concentration , decreases / increased concentration of CO_2 (in the blood) ✓		
			3	reduction in pH ✓		**MP3 ALLOW** increase in H^+ / H ions for reduction in pH
			4	(detected by) chemoreceptors in medulla (oblongata) ✓		**MP4 ALLOW** chemoreceptors , in carotid arteries / aorta for 'in medulla'
			5	cardiovascular centre controls heart rate ✓		
			6	impulses along , sympathetic / accelerator , nerve (to heart / SAN) ✓		**MP6 IGNORE** signals / messages
			7	sino-atrial node / SAN , responds by increasing rate at which it generates wave of excitation ✓		
20	**(b)**			enrich / AW , the air in the spirometer with oxygen ✓ so that high (blood) oxygen saturation is maintained / AW ✓	**2**	**IGNORE** bigger spirometer **IGNORE** take resting intervals **ALLOW** so oxygen saturation , does not drop too low / is kept above 90%
20	**(c)**	**(i)**		(volume of) oxygen , consumed / inhaled / AW **AND** (volume of) carbon dioxide , produced / exhaled / AW ✓	**1**	**Both needed for the mark**

20	**(c)**	**(ii)**	RQ of carbohydrate is 1 / RQ of fat is (approx) 0.7 ✓ at rest fat is used ✓ as intensity increases (more) carbohydrate is used ✓ (even) at highest intensity some fat is used **OR** (even) at highest intensity not just carbohydrate is used ✓	**max 3**	**ALLOW** named carbohydrates e.g. sugars **ALLOW** fatty acids / named fats e.g. lipids **IGNORE** ref to protein at 0.8 (approx.) **ALLOW** 0% / low / 0-10% intensity for at rest **ALLOW** at 100% intensity **ALLOW** at high intensities mixed respiratory substrates / mainly carbohydrate being used **IGNORE** protein and fat / carbohydrate and fat
			Total	**15**	

Question			Answer	Mark	Guidance
21	(a)		rough endoplasmic reticulum / RER ✓ Golgi (body / apparatus) ✓ (secretory / transport) vesicle(s) ✓	3	 **ALLOW** lysosome
21	(b)	(i)	(because) hydrogen peroxide / H_2O_2 , is toxic / damages cells **OR** breakdown of hydrogen peroxide / H_2O_2 , minimises / prevents, damage (to cells) ✓ products of breakdown are, harmless / water and oxygen ✓	2	**ALLOW** damage to organelles / triggers apoptosis / damage to enzyme **ALLOW** prevents damage to organelles / prevents apoptosis / prevents damage to enzyme **ALLOW** H_2O and O_2
21	(b)	(ii)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 3.7 ± 0.6 award 2 marks** ✓✓ drawn tangent at t = 30 s figures from tangent e.g. 170 (µg) ÷ 46 (s) **Unit =** µg s^{-1} ✓	3	*Max 2 if answer given to more than 3 significant figures* If answer incorrect **One mark for** tangent drawn with **straight** line that meets the curve at 30s and can be any length **OR** calculation showing difference in volume ÷ difference in time (from tangent / triangle) **ALLOW** µg / s

21	**(c)**	**(i)**	because they have many mitochondria ✓ catalase activity may be (too) low ✓ mutation in / less transcription of , catalase gene✓ (or) SOD activity may be (too) high ✓	**max 2**	 **ALLOW** catalase may be inactive **ALLOW** low concentration of catalase **ALLOW** high concentration of SOD

21	**(c)**	**(ii)**		*Evidence to support* **1** as (H_2O_2) concentration increases motility (of treated sperm) decreases ✓ **2** as (H_2O_2) concentration increases cells with changes to (composition of) plasma membrane increase ✓ *Evidence that does not support -**max 2*** **3** correlation does not prove causation ✓ **4** sample size was (relatively) small / only 10 men ✓ **5** no statistical test has been performed ✓ **6** (sperm cell) samples , not representative / show bias ✓ **7** (some motility) error bars overlap ✓	**max 3**	**MP1 ALLOW** e.g. negative correlation between hydrogen peroxide concentration and motility **MP1 DO NOT ALLOW** normal sperm cells **MP2 ALLOW** e.g. positive correlation between concentration of hydrogen peroxide and cells with changes to plasma membrane **MP3 ALLOW** there may have been another cause of low motility **MP5 ALLOW** no correlation coefficient calculated / no Spearman's rank **MP6 ALLOW** samples from fertility clinic more likely to have abnormal sperm **MP6 ALLOW** *idea of* skewed results
21	**(c)**	**(iii)**		oxidises / reacts with / AW , fatty acids / phospholipids / cholesterol ✓ damages / denatures (named) , membrane proteins ✓ disrupts phospholipid bilayer ✓ causes membrane to be more permeable ✓	**max 2**	**ALLOW** changes the fluidity of the membrane **ALLOW** causes breaks / pores in membrane
				Total	**15**	

Question			Answer	Mark	Guidance
22	(a)		any **two** from: size / shape / surface area / dimensions , of (beetroot) pieces ✓ type / varieties , of beetroot ✓ same part of beetroot / no skin on beetroot ✓ age of beetroot ✓ time (beetroot) pieces are kept in ethanol (before measuring absorbance) ✓ volume of ethanol (solution) ✓	**max 2**	**IGNORE** mass of beetroot / temperature / 25°C (these are given in the stem) **IGNORE** pH **ALLOW** same beetroot / same species
22	(b)	(i)	(increased) ethanol (concentration) increases permeability of membranes / AW ✓ (curve) levels off as , no more / all , pigment is released ✓	**2**	**ALLOW** e.g. ethanol disrupts phospholipid bilayer so more pigment leaks out **IGNORE** positive correlation **ALLOW** until concentration of pigment inside and outside cell is the same
22	(b)	(ii)	curve to the left of the student's curve ✓ reaches same max value ✓	**2**	**IGNORE** start point (increased temperature may cause release of pigment at 0% ethanol) **Max 1** if curve drops below student curve at any point (allow if touches points) or if goes above maximum shown by last two points
			Total	**6**	

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