GCE

Biology B

H422/01: Fundamentals of biology

A Level

Mark Scheme for June 2022

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.

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

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 50% 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, email or via the RM Assessor messaging system.

5. Work crossed out:

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. There is a NR (No Response) option. Award NR (No Response)

   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

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 email.

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 **31b** and **34b**.

11. **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

1. Subject Specific Marking Instructions

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.

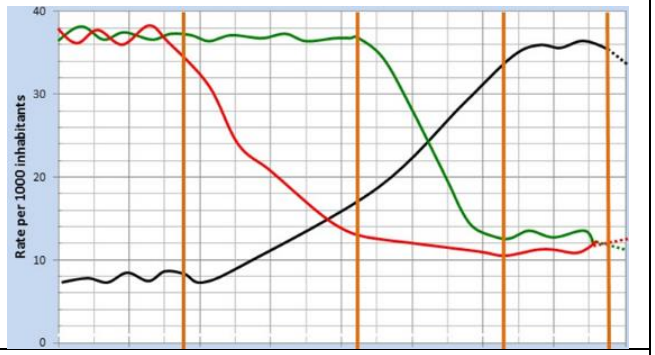
You should ensure that you have copies of these materials.

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	AO element	Guidance
1	C	**1**	AO1.2	
2	C	**1**	AO2.3	
3	D	**1**	AO1.2	
4	D	**1**	AO1.1	
5	C	**1**	AO1.2	
6	B	**1**	AO2.1	
7	C	**1**	AO1.2	
8	B	**1**	AO2.7	
9	C	**1**	AO2.5	
10	B	**1**	AO1.2	
11	C	**1**	AO2.6	(3500 ÷ 1500) x 15 000
12	D	**1**	AO2.8	
13	C	**1**	AO2.8	(2 x15) – 2 = 28
14	B	**1**	AO2.5	
15	A	**1**	AO1.1	
16	B	**1**	AO2.1	
17	B	**1**	AO1.1	
18	D	**1**	AO1.2	
19	B	**1**	AO1.2	
20	A	**1**	AO1.2	
21	B	**1**	AO1.1	
22	C	**1**	AO2.1	
23	A	**1**	AO1.2	
24	B	**1**	AO2.5	
25	B	**1**	AO1.2	

26	C	**1**	AO2.6	$= 2^7 = 128$
27	C	**1**	AO2.1	
28	A	**1**	AO2.5	
29	D	**1**	AO2.1	
30	C	**1**	AO2.3	
	Total	**30**		

Question			Answer	Mark	AO element	Guidance
31	(a)	(i)	curve starts low in stage 1 **and** ends higher in stage 4 (above 20) ✓ curve starts rising during stage 2 **and** begins to level out by the end of stage 3 ✓	**2**	AO3.2	**DO NOT ALLOW** rate starting at zero 
31	(a)	(ii)	(birth rate) high(er) in stage 2 **and** falls in stage 3 ✓ **In stage 2** (birth rate) high due to , religious / cultural , beliefs✓ (birth rate) high due to , lack of / no , contraception ✓ (birth rate) high due to improving , health care / nutrition , for (pregnant) women ✓ **In stage 3** (birth rate) falls due to increased , wealth / economics ✓ (birth rate) falls due to better education (for women) ✓ (birth rate) falls due to (access to) contraception ✓ (birth rate) falls due to decreased , fertility / having children later in life ✓	**3 max**	AO2.5	**IGNORE** high due to lower infant death **ALLOW** need children to provide an income **ALLOW** choosing to work **ALLOW** could decide not to have children
31	(a)	(iii)	low / decline in , fertility ✓ financial independence for women ✓ more women have , jobs / professions / careers ✓ choose not to have children / more contraception used ✓ more people dying qualified ✓	**1 max**	AO1.2	**ALLOW** have children later in life

<table>
<tr><td>31</td><td>(b)*</td><td></td><td colspan="4">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.</td></tr>
<tr><td></td><td></td><td></td><td>Level 3 (5–6 marks)
There is a statement that includes reference to the challenges and the impact on the environment and how success can be measured.

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)
There is a statement that includes reference to the challenges and the impact on the environment or how success can be measured.

OR

There is a statement that includes reference to the challenges or the impact on the environment and how success can be measured.

There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.</td><td>6</td><td>AO2.1</td><td>Indicative scientific points may include

Challenges
• sufficient amounts of food for increased demand
• safe / nutritious food
• sustainable practices
e.g. fish farms / agricultural farms
• hygiene standards e.g. FSA in UK
• food crime
e.g. contamination of beef products
• transport / living costs
• conflict / war

Impact on environment
• overfishing
• reference to quotas / bans e.g. fishing
• intensive farming / fertilizers
• eutrophication
• land clearance / deforestation to build farms
• farm / transport pollution of environment
• farming loss of biodiversity / habitats
• global warming
• monocultures</td></tr>
</table>

			Level 1 (1–2 marks) There is a statement that includes reference to the challenges **or** the impact on the environment **or** how success can be measured. *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.*			***How success can be measured*** • national data • international data • information from charities / organisations • scientists monitoring environment • community surveys • food banks data • causes of death e.g. malnutrition • measure the increase in biodiversity (index)

Question			Answer	Mark	AO element	Guidance
31	(c)	(i)	amino acid(s) / peptide chain ✓	1	AO2.1	**IGNORE** protein / polypeptide
31	(c)	(ii)	fatty, acid / tail , is <u>hydrophobic</u> ✓ fatty, acid / tail , could fit between phospholipids in the cell membrane ✓ disrupts / forms a hole in , the cell membrane / phospholipid bilayer ✓	2 max	AO2.1	**IGNORE** reference to cell wall **IGNORE** pores
31	(c)	(iii)	(daptomycin) cannot penetrate (outer) membrane ✓	1	AO1.1	**ALLOW** gram negative bacteria have outer membrane **ALLOW** membrane has different phospholipids **IGNORE** reference to cell wall
31	(d)		*no because* ratio / C_{max} : MIC / peak antibiotic concentration : MIC, is 45 to 8 ✓ (dose is insufficient as) , should be 80 µg cm^{-3} / below optimum by 35 µg cm^{-3} ✓	2	AO3.1	**ALLOW** plasma concentration for antibiotic concentration throughout **ALLOW** ratio 44-46 to 7.5-8.5 **ALLOW** ratio is <u>5.6</u> : 1 **ALLOW** C_{max} is only <u>5.6</u> times greater than MIC

Question			Answer	Mark	AO element	Guidance
32	(a)	(i)	*increases* follicle-stimulating (hormone) / luteinsing (hormone) ✓ *decreases* oestrogen ✓	2	AO1.1	**ALLOW** FSH / LH
32	(a)	(ii)	chemotherapy / radiotherapy ✓ hysterectomy / removal of ovaries ✓	1 max	AO1.1	**ALLOW** PCOS (polycystic ovary syndrome) / cancer or tumour qualified / pituitary gland tumour / Turner syndrome / oophorectomy
32	(b)		*conclusions:* **1** non-users estimate the risk of having uterine cancer is greater with HRT ✓ **2** non-users estimate the risk of having breast cancer is greater with HRT ✓ *reasons for differences:* **3** bias e.g. questionnaires ✓ **4** women may not be informed about HRT / may have researched HRT ✓ **5** women may have experience of cancer whilst taking HRT / family history of cancer ✓	4 max	AO3.2	**ALLOW** ora users estimate same risk of uterine cancer is the same with or without HRT users estimate the risk of having breast cancer is greater with HRT non-users not aware of risks **OR** users more aware of risks
32	(c)	(i)	formation of (large) nodules within prostate ✓ (nodules / prostate) presses on <u>urethra</u> ✓ restrict flow of urine from bladder ✓	2 max	AO1.2	**ALLOW** increase in number /size of cells in prostate **ALLOW** enlargement of the prostate gland **ALLOW** scar tissue narrows urethra **IGNORE** blockage

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>32</td><td>(c)</td><td>(ii)</td><td>decrease in mass of , testes / testicular tissue ✓
erectile dysfunction ✓
reduction in elasticity of (named) tissue ✓
sclerosis of epididymis ✓</td><td>1 max</td><td>AO1.1</td><td>IGNORE prostate cancer
ALLOW decreased testosterone / sperm count</td></tr>
<tr><td>32</td><td>(c)</td><td>(iii)</td><td>cost of testing / expensive ✓

not proven that benefits would outweigh risk ✓
tests unreliable / high level of false-positives ✓</td><td>2</td><td>AO2.5</td><td>IGNORE time-consuming / ref to late-onset
ALLOW money invested into research / other cancers</td></tr>
<tr><td>32</td><td>(d)</td><td></td><td>
<table>
<tr><th rowspan="2">Method</th><th colspan="4">Statement</th></tr>
<tr><th>Specifically targets cancer cells</th><th>Does not destroy healthy cells</th><th>Monoclonal antibodies linked to anti-cancer drugs</th><th>DNA is damaged by ionising radiation</th></tr>
<tr><td>Complementary therapy</td><td>×</td><td>✓</td><td>×</td><td>×</td></tr>
<tr><td>Chemotherapy</td><td>×</td><td>×</td><td>×</td><td>×</td></tr>
<tr><td>Immunotherapy</td><td>✓</td><td>✓</td><td>✓</td><td>×</td></tr>
<tr><td>Radiotherapy</td><td>✓</td><td>✓/×</td><td>×</td><td>✓</td></tr>
</table>
✓✓✓</td><td>3</td><td>AO1.2</td><td>One mark per row</td></tr>
</table>

Question			Answer	Mark	AO element	Guidance
33	(a)	(i)	Any **two** from: most seeds germinate in , normal / white , light / AW ✓ green light , has fewest seeds / slowest , germination / AW ✓ seeds germinate , quicker / in 24 hours / in 48 hours , in blue light / AW ✓ germination success is similar in red and white / normal light ✓	**2 max**	AO3.1	**ALLOW** 19 out of 20 seeds germinate in normal / white light **ALLOW** only 1 out of 20 seeds germinate in green light
33	(a)	(ii)	take more measurements ✓ calculate a mean ✓	**2**	AO3.3	**IGNORE** repeat investigation unqulaified **ALLOW** more seeds per dish / have more petri-dishes
33	(a)	(iii)	**FIRST CHECK ANSWER ON ANSWER LINE** **if answer = 21 (%) award 2 marks** (13÷14) - (10÷14) ✓ 21(.4285714%) ✓	**2**	AO2.8	**ALLOW** any correctly rounded number

Question			Answer	Mark	AO element	Guidance
33	(a)	(iv)	*x-axis* (light) <u>wavelength</u> **and** nm / x 10^{-9}m ✓ *y-axis* cumulative / total , <u>percentage germination</u> (after 120 hours) **and** % ✓	**2**	AO3.4	**ALLOW ECF** 1 mark max if a both labels are given without units
33	(a)	(v)	*supporting statements* (following germination) seeds gain mass due to <u>photosynthesis</u> ✓ easier than looking for signs of germination / reduced human error / more objective / less subjective ✓ *non-supporting statements* evaporation of water can decrease the mass (of the dish) ✓ seeds use up food reserves so they decrease in mass / AW ✓ cannot be sure the change in mass is due to germination ✓ *either argument-* reference to time over which investigation took place ✓	**3 max**	AO3.4	**IGNORE** accuracy throughout **IGNORE** not sure change is due to germination (unqualified) **ALLOW** nutrient solution for water e.g. seeds may not start photosynthesising / seedling leaves may not appear within 5 days e.g. would need to measure over a longer time period

Question			Answer	Mark	AO element	Guidance
33	(b)	(i)	aerobic respiration ✓ produce ATP / release of energy ✓ (ATP is used for) synthesis of , enzyme / amylase ✓ (ATP is used for) active transport / mineral uptake ✓ growth ✓	2	AO1.2	**DO NOT ALLOW** produce energy **ALLOW** synthesis of other correctly named enzymes (located in seeds)
33	(b)	(ii)	(simple / passive) diffusion ✓	1	AO1.2	**DO NOT ALLOW** facilitated diffusion
33	(b)	(iii)	oxygen produced in photosynthesis ✓	1	AO1.2	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>34</td><td>(a)</td><td>(i)</td><td>
<table>
<tr><th>Structure</th><th>Letter</th><th>Function</th></tr>
<tr><td>Coronary artery</td><td>X</td><td>Supplies heart muscle with oxygen</td></tr>
<tr><td>Carotid artery</td><td>V</td><td>Has receptors in its walls that detect changes in pH</td></tr>
<tr><td>Pulmonary artery</td><td>W</td><td>carries deoxygenated blood to the lungs</td></tr>
</table>
</td><td>3</td><td>AO1.1</td><td>One mark per row</td></tr>
<tr><td>34</td><td>(a)</td><td>(ii)</td><td>Medulla (oblongata) ✓</td><td>1</td><td>AO1.1</td><td></td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>34</td><td>(b)*</td><td></td><td colspan="4">Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.
In summary:
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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.
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<tr><td></td><td></td><td></td><td>Level 3 (5–6 marks)
Balanced comparison that includes actions of the sympathetic nerve and vagus nerve and adrenaline.
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)
Comparison that includes the action of sympathetic nerve or vagus nerve and adrenaline.
OR
Comparision of both nerves (unqualified) and adrenaline
OR
Comparison of sympathetic nerve and vagus nerve

There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.</td><td>6</td><td>AO1.2</td><td>Indicative scientific points may include
Applies to either nerve
• nerve impulses are triggered by information from e.g. chemoreceptors
• chemoreceptors detect pH / CO_2 levels
• baroreceptors detect blood pressure
• medulla oblongata generates impulse down nerves
Sympathetic nerve
• sympathetic nerve increases heart rate
• sympathetic nerve is part of the sympathetic nervous system
• act on SAN / pacemaker
• part of autonomic nervous system
• increase frequency of impulses to SAN
Vagus nerve
• vagus nerve decreases heart rate
• vagus nerve part of the parasympathetic nervous system
• act on SAN / pacemaker
• part of autonomic nervous system
• decrease frequency of impulses to SAN</td></tr>
</table>

			Level 1 (1–2 marks) Basic statement that includes the action of one of the nerves **OR** adrenaline. *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.*			**Adrenaline** • adrenaline is a hormone secreted by (adrenal) gland • adrenaline is secreted in response to stress / fight and flight • adrenaline travels in blood stream • adrenaline binds to receptors on cells of SAN • adrenaline involves secondary messenger system • adrenaline enables SAN cells to depolarise more quickly • adrenaline increases heart rate • adrenaline is part of endocrine system

Question			Answer	Mark	AO element	Guidance
35	(a)	(i)	neutrophil ✓	1	AO1.1	
		(ii)	annotated / labelled , to show two (or more) correctly labelled structures ✓ sharp pencil **and** clear continuous lines ✓	2	AO2.3	**Any two from** cell surface membrane, (lobed) nucleus, cytoplasm **IGNORE** lysosomes, mitochondria, granules
		(iii)	stage micrometer ✓	1	AO1.2	
		(iv)	**FIRST CHECK ANSWER ON ANSWER LINE** **if answer = 66 award 2 marks** $\frac{100\mu m}{65}$ = 1.5384615385 µm **OR** 43 EPU x ANS / 44 EPU x ANS / 42 EPU x ANS ✓ 66µm / 68 µm / 65 µm ✓	2	AO2.8	**ALLOW 1 mark for incorrect sig figs** 66.153846 / 67.692308 / 64.615385
	(b)		thrombokinase / thromboplastin / prothrombinase ✓ fibrinogen ✓ fibrin ✓ calcium / Ca^{2+} ✓	4	AO2.5	**ALLOW** phonetic spelling **DO NOT ALLOW** Ca / Ca^{+}

Question			Answer	Mark	AO element	Guidance
	(c)	(i)	*advantage* restores / maintain blood , volume / pressure ✓ *disadvantage* doesn't replace all the components of blood (that have been lost) **OR** may cause , electrolyte / salt / ion , imbalance **OR** may increase blood , volume / pressure (above normal) **OR** could be allergic ✓	**2**	AO2.1	**One** advantage and **one** disadvantage **ALLOW** can be , frozen / stored for a long time / readily available **IGNORE** reference to large quantities unqualified e.g. erythrocytes / leucocytes **DO NOT ALLOW** does not contain clotting factors
		(ii)	to reverse effects of anticoagulants ✓ during cardiac surgery ✓ replace blood clotting factors ✓ liver failure ✓ stem cell transfusion ✓	**1 max**	AO1.1	**IGNORE** references to serum **IGNORE** during dialysis

Question			Answer	Mark	AO element	Guidance
36	(a)	(i)	*(suitable because)* avoids bias ✓ *(not suitable because)* difficult to put grids on ocean floor / AW ✓ species may not be evenly distributed / some species could be missed ✓ may get unrepresentative data ✓ (only) 1 reef studied ✓ (only) 5 samples / only 100m^2 ✓	**3 max**	AO3.4	**IGNORE** random **ALLOW** Coral grows in, layers / strata **IGNORE** sampling size too small (unqualified)
36	(a)	(ii)	**FIRST CHECK ANSWER ON ANSWER LINE** **if answer = 0.2 (m^{-2}) award 2 marks** 4 ÷ 20 ✓ 0.2 (m^{-2}) ✓	**2**	AO2.8	**ALLOW** 0.26 (calculated by counting the total number in all the squares and divided by 100)

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>36</td><td>(b)</td><td>(i)</td><td>FIRST CHECK ANSWER ON ANSWER LINE
if answer = 0.8(18) award 2 marks

0.8(18) ✓✓</td><td>2</td><td>AO2.8</td><td>If answer incorrect allow one mark for

$(n/N)^2$ column correctly completed as below

<table>
<tr><th>Species</th><th>Percentage species cover (n)</th><th>$(n / N)^2$</th></tr>
<tr><td>Round starlet coral (Siderastrea siderea)</td><td>14</td><td>0.0196</td></tr>
<tr><td>Mountainous star coral (Orbicella faveolata)</td><td>30</td><td>0.0900</td></tr>
<tr><td>Great star coral (Montastraea cavernosa)</td><td>16</td><td>0.0256</td></tr>
<tr><td>Sea ginger (Millipora alcicornis)</td><td>15</td><td>0.0225</td></tr>
<tr><td>Brain coral (Diploria strigosa)</td><td>13</td><td>0.0169</td></tr>
<tr><td>Rough cactus coral (Mycetophyllia ferox)</td><td>5</td><td>0.0025</td></tr>
<tr><td>Maze coral (Meandrina meandrites)</td><td>7</td><td>0.0049</td></tr>
</table>

OR
0.182 (which = sum of $(n/N)^2$)</td></tr>
</table>

Question			Answer	Mark	AO element	Guidance
36	(b)	(ii)	less / low , impact of freshwater run off on coral reefs ✓ (because) high / increased , (bio)diversity index / 0.818 is high ✓ fresh water supplies nutrients (to the reef) ✓ species have been able to adapt / was less sensitive , to , freshwater run off / environmental changes ✓	**2 max**	AO3.2	**ALLOW ECF** throughout if calculation in (b)(i) shows low diversity index **DO NOT ALLOW** reference to the future of the reef **IGNORE** food

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