GCE

Biology B

H422/02: Scientific literacy in 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.

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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, concentrating on features that make it a stronger or weaker answer using the indicative scientific content as guidance. The indicative scientific content 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 science content of the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, **best** describes the overall quality of the answer using the guidelines described in the level descriptors in the mark scheme.

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 science content determines the level.**
- **The communication statement determines the mark within a level.**

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

12. **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.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>
<table>
<tr><th>Conversion</th><th>H</th><th>C</th><th>O</th><th>R</th></tr>
<tr><td>ATP → ADP + P_i</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>glucose → glycogen</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>maltose → glucose</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>pyruvate → lactate</td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>transfer of hydrogen atoms to NAD^+</td><td></td><td></td><td></td><td>✓</td></tr>
</table>
All 4 rows correct = ✓ ✓ ✓
3 rows correct = ✓ ✓
2 rows correct = ✓
</td><td>3</td><td>1.2</td><td></td></tr>
<tr><td>1</td><td>(b)</td><td></td><td>(because it involves) formation / release / production / removal of <u>carbon dioxide / CO_2</u> ✓

(and) dehydrogenation (of pyruvate) ✓</td><td>2</td><td>1.2

1.2</td><td>

ALLOW production of reduced NAD / NADH or transfer of hydrogen (atoms) to NAD / NAD^+
IGNORE hydrogen ions / H^+, oxidation</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
1	(c)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 2 from glucose and 1 from glycogen award 2 marks** H^+ consumed (in both) = 2 ✓ H^+ produced from glucose = 4 **AND** H^+ produced from glycogen = 3 ✓	**2**	 2.2 2.2	**ALLOW** 'proton' for H^+ throughout **ALLOW** 1 mark for one correct answer
1	(c)	(ii)	(acidosis) accumulation of H^+ / reduces pH / increases <u>concentration</u> of H^+ ✓ changes <u>tertiary structure</u> of , enzymes / (named) muscle protein(s) ✓	**2**	2.1 2.1	**DO NOT ALLOW** standard answer based on lactic acidosis **ALLOW** denatured

Question			Answer	Marks	AO element	Guidance
1	(d)	(i)	**Any three from:**	3		
			(ATP) binds to myosin (head group) ✓		1.2	
			causes myosin to detach from actin / breaks cross-bridges ✓		1.2	**ACCEPT** AW e.g. dissociation from actin
			hydrolysis of ATP provides energy ✓		1.2	
			to return myosin head to its original configuration ✓		1.2	**ALLOW** any appropriate description of 'original configuration' / energises myosin head group
1	(d)	(ii)	**Any two from:**	2		
			calcium ions will not bind to troponin ✓		2.5	**ALLOW** for 1 mark P_i will not be available to form ATP
			(so) tropomyosin blocks myosin binding sites on actin ✓		2.5	**ALLOW** myosin binding sites not exposed **DO NOT ALLOW** calcium phosphate cannot bind to troponin
			(so) cross-bridges cannot form / myosin head cannot bind to actin ✓		2.5	

Question			Answer	Marks	AO element	Guidance
1	(e)*		***Please refer to the marking instructions on page 5 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) A description that includes detail on the Electron Transport Chain **and** Chemiosmosis **and** the Role of Oxygen. *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)** A description that includes detail on the Electron Transport Chain **or** Chemiosmosis **and** the Role of Oxygen. **OR** A description that includes detail on the Electron Transport Chain **and** Chemiosmosis **or** the Role of Oxygen. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.*	**6**	2.5	**Indicative points include** **Electron Transport Chain (ETC)** • ETC components located in the inner mitochondrial membrane • reduced NAD as a source of H^+ and electrons • ETC as a series of redox reactions / electron transfers **Chemiosmosis** • energy released linked to pumping H^+ across inner mitochondrial membrane • establishment of electrochemical gradient / proton motive force • chemiosmosis as diffusion of H^+ via ATP synthase • energy released by movement of electrons used to drive synthesis of ATP from ADP + P_i **Role of Oxygen** • electrons and H^+ combine with O_2 to form water • oxygen is the final electron acceptor **ALLOW** NADH, $NADH_2$ but not rNAD

Question			Answer	Marks	AO element	Guidance
			Level 1 (1–2 marks) A description that includes detail on the Electron Transport Chain **or** Chemiosmosis **or** the Role of Oxygen. *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.*			

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td></td><td>
<table>
<tr><th>Feature</th><th>DNA</th><th>tRNA</th></tr>
<tr><td>contains phosphodiester bonds</td><td>✓</td><td>✓</td></tr>
<tr><td>contains deoxyribose</td><td>✓</td><td></td></tr>
<tr><td>contains purines</td><td>✓</td><td>✓</td></tr>
<tr><td>contains paired and unpaired bases</td><td></td><td>✓</td></tr>
</table>
3 correct ✓✓, 2 correct ✓</td><td>2</td><td>1.1
1.1
1.1</td><td></td></tr>
<tr><td>2</td><td>(b)</td><td></td><td>transcription ✓
ATP ✓
covalent / phosphodiester ✓
anticodon ✓</td><td>4</td><td>1.2
1.2
1.2
1.2</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
3	(a)	(i)	**any three from:** use restriction endonucleases to produce DNA fragments ✓ separate fragments by (gel) electrophoresis ✓ use, dye / stain / fluorescent label / radioactive isotope , to visualise bands ✓ run side-by-side / use of standards ✓	**3**	2.3 2.3 2.3 2.3	**ALLOW** capillary (gel) electrophoresis
3	(a)	(ii)	(so that the) loci / VNTRs , are not linked / ORA ✓ linkage would reduce , variability / number of possible combinations ✓	**2**	2.3 2.3	**ALLOW** to ensure the VNTRs are independently assorted
3	(a)	(iii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1 in 2.3 × 10^5 award 2 marks** 0.135 × 0.078 × 0.123 × 0.066 × 0.051 = 0.000004359 / 4.4 x 10^{-6} ✓ 1 / 0.000004359 = 229 410 = 1 in 2.3 × 10^5 ✓	**2**	2.2	**ALLOW** 1 mark for use of percentages rather than decimal fractions / probabilities giving 43596 **ALLOW** 1 mark for correct answer to incorrect sig figs or not in standard form

Question			Answer	Marks	AO element	Guidance
3	(b)	(i)	a set of genes / alleles inherited together from one parent ✓	1	1.1	**ALLOW** 'group' for 'set' **ALLOW** on one chromosome
3	(b)	(ii)	**any four from:** **evidence for causes of hyperthyroidism:** other (*Tg*) mutations cause hypothyroidism / 25 other patients have different (*Tg*) mutations ✓ hyperthyroidism could be caused by, other / environmental, factors ✓ there is no information about numbers with hypothyroidism but no *Tg* mutations ✓ **evidence for founder effect (R/T):** mutations , localised / found in single village ✓ all cases had same haplotype ✓ patients from different families had same haplotype ✓ **evidence for S being old mutation:** occurs throughout Japan / not localised ✓ not all patients had same haplotype ✓	4	3.1 3.2 3.2 3.1 3.2 3.2 3.1 3.2	**ALLOW** other genes may cause hypothyroidism' e.g. 25 other patients have different mutations so hyperthyroidism could be cause by other factors = **MP1 + MP2**

Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	A = (ciliated) epithelia ✓ B = (hyaline) cartilage ✓	2	2.3 2.3	**ALLOW** epithelial tissue **DO NOT ALLOW** squamous epithelium, just 'cilia'
4	(a)	(ii)	structure = alveolus ✓ increases surface area / short diffusion pathway ✓	2	2.3 2.7	
4	(a)	(iii)	D = (smooth) muscle ✓ constriction of bronchiole **OR** narrowing / reduction in size, of lumen ✓	2	2.3 2.7	**DO NOT ALLOW** trachea / bronchus, contraction of airway **ALLOW** ECF from incorrect identification of D as bronchiole, e.g. distribute/deliver air to alveoli.
4	(b)		spaces / alveoli , would be larger ✓ because (alveoli) walls / elastin fibres have broken down ✓	2	2.1	**ALLOW** damage to (alveoli) walls due to elastase

Question			Answer	Marks	AO element	Guidance
4	(c)*		***Please refer to the marking instructions on page 5 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) A discussion that includes the Causes of Asthma **and** Long-term Treatments **and** Short-term Treatments. *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 outline that includes the Causes of Asthma **or** Long-term Treatments **and** Short-term Treatments. **OR** An outline that includes the Causes of Asthma **and** Long-term Treatments **or** Short-term Treatments. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.*	**6**	1.1 2.5	**Indicative points include** **Causes of Asthma** • inflammation and narrowing of bronchi / bronchioles • environmental factors ○ cigarette smoking ○ air pollution (e.g. ozone, sulfur dioxide, nitrogen oxides) ○ allergens • genetic factors • epigenetic factors **Long-term Treatments** • cannot be cured • steroids / corticosteroids reduce inflammation **Short-term Treatments** • treatment of acute symptoms • beta-agonists / bronchodilators cause bronchodilation / increase airflow / relaxation of muscles / opening of airways

Question			Answer	Marks	AO element	Guidance
			Level 1 (1–2 marks) A brief outline that includes the Causes of Asthma **or** Long-term Treatments **or** Short-term Treatments. *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.*			

Question			Answer	Marks	AO element	Guidance
5	(a)	(i)	**any two from:** name = chorionic villus sampling (CVS) ✓ **AND** source = placenta ✓ **OR** name = amniocentesis ✓ **AND** source = amniotic fluid ✓	**2**	1.1	**name and source must match** **ALLOW** amniotic fluid sampling
5	(a)	(ii)	karyotyping ✓	**1**	1.1	**ALLOW** producing / AW , a karyotype / karyograph / karyogram
5	(a)	(iii)	three copies of chromosome 21 ✓	**1**	1.1	**ALLOW** extra copy of chromosome 21

Question			Answer	Marks	AO element	Guidance
5	(b)	(i)	because it does not vary with head <u>shape</u> ✓	1	2.6	**ALLOW** head can be misshapen / different shape
5	(b)	(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 12 weeks 4 days award 2 marks** GA = $8.052 \times (61 \times 1.037)^{0.5} + 23.73 = 87.77$ ✓ conversion of answer in days to weeks and days (correctly rounded) ✓	2	 2.6 2.6	 **ALLOW** ECF from candidate's own answer
5	(b)	(iii)	(risk screening should be performed by) ultrasound ✓	1	3.1	**ALLOW** blood sample where candidate's answer is >14 weeks 2 days / 100 days
5	(c)		fetus B ✓ because HC was below the 5th percentile at each GA ✓	2	3.2 3.2	**DO NOT ALLOW** fetus A (only below 5th percentile at 14 weeks)

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>5</td><td>(d)</td><td>(i)</td><td>IGF-1 gene inserted into viral , DNA / genome ✓

adenovirus modified to prevent replication ✓</td><td>2</td><td>2.7

2.7</td><td></td></tr>
<tr><td>5</td><td>(d)</td><td>(ii)</td><td>group A is a (normal) control ✓

group C shows that effects are not due to the adenovirus / vector ✓</td><td>2</td><td>2.7

2.7</td><td>ALLOW for comparison with other groups</td></tr>
<tr><td>5</td><td>(d)</td><td>(iii)</td><td>any four from:

max 3 for MPs 1 to 4
supports conclusion
1 Ad-IGF-1 , restores normal growth / reverses FGR ✓

2 because fetal mass in group D not (significantly) different from group A ✓

3 fetal mass in group D was significantly greater than groups B or C ✓

4 should be low risk of germ line transfer ✓

does not support conclusion
5 sample size was , small / only 4 ✓

6 study carried out in rabbits not humans ✓

7 no evidence of safety (in humans) / could be harmful in humans / more research into humans needed / humans might not respond the same way ✓</td><td>4</td><td>

3.2
3.2

3.2

3.2

3.2

3.2

3.2</td><td>ACCEPT description of group as alternative to group letters (see table below)

ACCEPT fetal mass in D is very similar to A

<table>
<tr><th>Group</th><th>Fetus type</th><th>Placenta injected with</th></tr>
<tr><td>A</td><td>normal</td><td>saline solution</td></tr>
<tr><td>B</td><td>runt</td><td>saline solution</td></tr>
<tr><td>C</td><td>runt</td><td>Ad-LacZ</td></tr>
<tr><td>D</td><td>runt</td><td>Ad-IGF-1</td></tr>
</table>
</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
6	(a)	(i)	**E** = xylem ✓ **F** = phloem ✓	**2**	2.3 2.3	
6	(a)	(ii)	connects the <u>phloem</u> to the root nodule ✓ to allow movement of , sugars / AW , into the nodule ✓ and movement of (named) nitrogen-containing compounds to the , root / plant ✓	**3**	3.2 3.2 3.2	**ALLOW** bacteria / *Rhizobia* for nodule
6	(b)	(i)	grown under the same (named) conditions ✓	**1**	3.4	**ALLOW** light intensity, temperature, soil pH, amount / availability of water **IGNORE** type / variety of soil
6	(b)	(ii)	plants might not develop nodules if too much , nitrogen / nutrient , was present ✓	**1**	3.4	
6	(b)	(iii)	seeds treated with charcoal but no , bacteria / *Rhizobia* ✓ to control for / AW , that the charcoal is not the cause of increased growth ✓	**2**	3.4 3.4	
6	(b)	(iv)	*t*-test / it , compares , mean values / two sets of data ✓ paired *t*-test , should compare the same group (of plants) / does not compare different groups ✓	**2**	2.8 2.8	**ALLOW** should have used unpaired *t*-test because it compares different groups / two sets of data (**MP1 + MP2**)
6	(b)	(v)	11 ✓	**1**	2.8	

Question			Answer	Marks	AO element	Guidance
6	(b)	(vi)	**any three from:**	**3**		
			treatment increases all measured variables / AW ✓		3.1	**DO NOT ALLOW** increased growth unqualified, difference in growth
			use of comparative data, e.g two numbers quote or calculation of % increase ✓		3.1	
			fresh weight may be influenced by water uptake ✓		3.2	
			should have measured dry mass ✓		3.2	
			no information about , number of seeds / number of pods / mass of crop ✓		3.2	
			treated seeds may be expensive ✓		3.2	
6	(c)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer grass = 3.3% and grain = 7.7% award 2 marks**	**2**	2.6	
			for grass: increase in mass on grass = 320 kg efficiency = 320 ÷ 9 600 = 3.3% ✓			**ALLOW** 1 mark for correct working where answers are not to 2 sig figs
			for grain: increase in mass on grain = 560 – 320 = 240 kg efficiency = 240 ÷ 3 120 = 7.7% ✓			

Question			Answer	Marks	AO element	Guidance
6	(c)	(ii)	**any three from:** (agree because) energy input / fossil fuel use , in production of grain likely to be higher (than grass) ✓ (agree because) humans can't eat grass but can eat , grain / beef ✓ (disagree because) efficiency (of transfer to cattle) is greater on grain (than grass) / ORA ✓ (disagree because) raising entirely on grass may take longer ✓	**3**	3.2 3.2 3.2 3.2	**ALLOW ECF** from candidate's incorrect % efficiency
6	(d)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer Longdong in range 64 – 77 and Algonquin in range 72 – 114 award 3 marks** number of stomata in field of view: Longdong = 11 and Algonquin = 14 ✓ 50 µm scale bar is 6(.5) mm (no mark for this) *calculation of area of view* $\left(\left(\frac{53}{6}\right) \times 0.05\right) \times \left(\left(\frac{47}{6}\right) \times 0.05\right) = 0.173$ mm² ✓ *calculation of density* Longdong 11 ÷ 0.173 = 64 (stomata mm^{-2}) **AND** Algonquin 14 ÷ 0.173 = 81 (stomata mm^{-2}) ✓	**3**	2.8 2.8 2.8	**ALLOW** answers to 3 sig figs *Algonquin: acceptable range is 13 – 16* *53 – 54 mm wide, 46 – 47 mm high* *Acceptable range of areas = 0.140 – 0.180 mm²* **ALLOW ECF** from candidate's incorrect area ***Range = 64 – 77*** ***Range = 72 – 114***

Question			Answer	Marks	AO element	Guidance
7	(a)		**any two from:** feature = microvilli ✓ adaptation = increase surface area for reabsorption ✓ **OR** feature = mitochondria ✓ adaptation = provide energy / ATP for active transport ✓	**2**	 2.1 2.5 2.1 2.5	**feature and adaptation must match** **IGNORE** osmosis **DO NOT ALLOW** reabsorption of waste substances
7	(b)	(i)	TRUE FALSE FALSE 3 correct ✓ ✓ 2 correct ✓	**2**	1.2 2.5 2.5	
7	(b)	(ii)	**any two from:** dialysis (only) treats the symptoms of kidney failure, AW / is not a cure ✓ transplant surgery removes the need for dialysis ✓ but may not be permanent (cure) ✓ problems with surgery include , need for tissue matching / rejection / immunosuppression ✓	**3**	 3.2 3.2 3.2 3.2	 **ALLOW** immune response

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