CAMBRIDGE OCR

Sample Assessment Material

A Level Biology A

H420/03 Unified biology

SAMPLE MARK SCHEME

MAXIMUM MARK 70

Duration: 1 hour 30 minutes

Version – 3.0
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This document consists of 21 pages

MARKING INSTRUCTIONS

Preparation For Marking

1. RM Assessor

- Access and complete the on-screen marking training packages: OCR Examiner Training (RMA3).
- Read the mark scheme and question paper for this component or unit.
- The mark scheme and question paper are available in RM Assessor or on your Component Page if you use the Training Platform for standardisation.
- Log in to RM Assessor and mark the **required number** of practice scripts and the **required number** of standardisation scripts.

Marking

2. General Guidance

- Mark strictly to the mark scheme.
- Marks awarded must relate directly to the marking criteria.
- If you are in any doubt about applying the mark scheme, consult your Team Leader by phone, email or via the RM Assessor messaging system.
- It is **essential** that you meet the RM Assessor 50% and 100% batch deadlines. For traditional marking this will be 40% and 100%. If you experience problems, contact your Team Leader without delay.
- 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 the annotation '**SEEN**' to confirm that the work has been seen and mark any responses using the annotations.
- The RM Assessor **comments box** is used by your Team Leader to explain the marking of the practice responses. Use these comments when checking your practice responses. **Do not use the comments box for any other reason.**
- **Before the end of the marking period** send ***a brief report on the performance of candidates to your Team Leader via email. The report should contain notes on strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.***

3. No Response and Crossed-out Answers

Using the No Response (NR) option. Only mark as NR if:

- the answer space is blank
- there is only a comment not related to the question (e.g., 'can't do', 'don't know')
- there is only a mark (e.g., a dash, a question mark) which is not an attempt at the question.

Note: Enter 0 marks for an attempt that earns no credit (including copying out the question). Do **not** use NR.

Crossed-out answers

If a candidate has crossed out an answer and written a clear alternative, do **not** mark the crossed-out answer.

If a candidate has crossed out an answer and **not** written a clear alternative, mark the crossed-out answer if it is readable.

4. Responses with more answers than needed

- **Multiple-choice question answers**

  When a multiple-choice question has only **one** correct answer and a candidate has written two or more answers (even if one of these answers is correct), do **not** award a mark.

  When a multiple-choice question asks candidates to select **more than** one option the marking guidance from your Principal Examiner will ensure consistency of approach.

- **Contradictory answers in points-based questions**

  Do **not** award any marks, even if one of the answers is correct.

- **Rubric error answers – optional questions**

  Where candidates have a choice of question/s and they provide more answers than required, all responses are marked and entered into RM Assessor. The highest mark allowable within the rubric will automatically be selected.

- **Questions that ask for a set number (including 1) of short answers or points**
  Mark only the **first set number** of answers/points. (e.g. **two** reasons for something)

  First mark the answers/points against printed numbers on the answer lines. Mark the first answer/point against each printed number. **Second**, if candidates have not followed the printed numbers, mark the answers/points from left to right on each line. **Third,** mark line by line until the set number of answers/points have been marked. Do **not** mark any remaining answers/points.

  Examiners should use their own judgement to decide if a 'second answer' on the same line is adding more detail to the first answer, or if it is a completely separate answer.

- **Short Answer Questions (requiring a more developed response, worth two or more marks)**
  If the candidates are required to provide a description of, for example, three items and four items are provided, mark line by line until the set number of descriptions have been marked (it is unlikely a candidate will provide more than one response on each line in this scenario).

- **Longer Answer Questions (requiring a developed response)**
  If a candidate has written two or more answers to a question that only requires one (developed) answer, only mark the first answer (which has not been crossed out).

5. Questions using levels of response (LOR):

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 **1(g)** and **4(c)**

6. Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore
	Blank page

7. Abbreviations, annotations and conventions used in the mark scheme (including subject-specific conventions).

Abbreviation / Annotation	Meaning
/	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

8. Subject-specific Marking Instructions

Introduction

Your first task is to familiarise yourself with:

- the specification, especially the assessment objectives
- the question paper and any inserts or resource booklets
- the mark scheme, including annotation requirements
- the administrative procedures related to the marking process.

The administrative procedures are set out in the OCR booklet **Instructions for Examiners**.

If you are examining for the first time, please read **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

All relevant training materials are accessed from the Training Platform.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Question			Answer	Marks	Guidance
1	(a)		*idea that* the oxygen will leak from the connectors so reduce the gas movement ✓	**max 1**	**ALLOW** seal not air tight so will not prevent gas escaping during the experiment **or** *the idea* that gas leakage is a problem and needs to be prevented.
			oxygen uptake may not be a good representation of respiration rate in germinating seedlings ✓		**ALLOW** the respiratory substrate stored in the seed will affect the oxygen needed **or** the idea that if photosynthesis has begun oxygen uptake will be disrupted.
			a small volume of gas is being measured in the capillary ✓		**ALLOW** need to record the maximum volume of gas taken up during the experiment
			measurements only taken every 30 seconds ✓		**ALLOW** alternative wording e.g. 'more frequent readings are needed'.
			difficult to read the meniscus (may be subjective) ✓		

Question	Answer	Marks	Guidance
(b)	*Variable* the mass of the seeds is not given ✓ *Improvement* take the mass of the seedlings at the start ✓ *Variable* the volume / mass of soda lime is not specified ✓ *Improvement* use a known mass/volume of soda lime each time ✓ *Variable* the size of the syringe is not given ✓ *Improvement* use a 2 cm^3 syringe ✓ *Variable* the capillary tube internal diameter is not given ✓ *Improvement* use a capillary tube of length 20 cm and a 1 mm internal diameter ✓ *Variable* temperature not controlled ✓ *Improvement* allowing apparatus to, stabilise / equilibrate to temperature, before taking readings ✓ AVP ✓	**max 2**	The improvement must be linked to the variable. **ALLOW** suggested mass values. **ALLOW** suggested mass/volume values. **ALLOW** alternative size if suitable for the activity. **ALLOW** *idea that* only a linear measurement is obtained not a volume. **ALLOW** alternative size if suitable for the activity. **ALLOW** use of a water bath and thermometer to stabilise the temperature. Must be explicit to provide valid data e.g. no scale on the capillary tube, no timing, no details of how to take the readings. Details must be workable and suitable to provide valid results e.g. scale on the capillary tube, use of timing devices, description of how to take readings from the scale etc.

Question			Answer	Marks	Guidance
	(c)		dipped into a small beaker and allowed to run ✓	**1**	**ALLOW** suitable details of how the red fluid is added.
	(d)		*Explanation, one mark* it is more than 10% from the mean ✓ it is different from the other data at 60 seconds ✓ it does not follow trend for the times for replicate 3 ✓ *Action, one mark* anomaly should be identified and excluded from processing ✓ anomaly must be identified but could be included in calculations ✓ repetition to obtain another reading ✓	**max 2**	**ALLOW** ‘it is out of line’ **ALLOW** anomaly can be excluded if this is due to an error or different conditions **ALLOW** anomaly can be included if there is no evidence that this is due to an error or different conditions
	(e)		Mean for 90s = (31 + 32 + 32.5)/3 = 31.83… Mean for 150s = (53 + 54 + 53.5) /3 = 53.5 53.5 – 31.83 = 21.67 / 60s 0.36 mm s^{-1} ✓	**1**	Rate and units required for the mark.
	(f)	**(i)**	the internal diameter of the capillary tube ✓	**1**	
		(ii)	the mass of the bean seeds ✓	**1**	

Question	Answer	Marks	Guidance
(g)*	**Level 3 (5–6 marks)** Describes a clear and detailed experiment that has been effectively adapted for use with chosen invertebrate to allow for the comparison of the rate of respiration with that of mung beans. Includes detailed statements on expected results and conclusions. *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 an experiment to compare the rate of respiration of chosen invertebrate with mung beans but there is insufficient detail of the procedure to allow a valid comparison. Includes statements on expected results and conclusions. **OR** Describes a clear and detailed experiment that has been effectively adapted for use with chosen invertebrate to allow for the comparison of the rate of respiration with that of mung beans. There are no statements outlining expected results or conclusions. *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)** An attempt to describe an experiment to investigate the respiratory rate of an invertebrate but little comparison with mung beans. If results or	6	**Indicative scientific points may include (but not limited to):** **Experiment** • mass of invertebrate and mass of beans the same • safe and ethical use of invertebrates e.g. add screen so that animal(s) cannot touch the muslin bag • bigger syringe needed (5 – 10 cm^3) • keep temperature constant / same for both assays • keep light constant / same for both assays • use same mass of soda lime in both assays • measuring distance moved by coloured, red liquid (fluid) at regular time intervals • repeat experiments. **Results and conclusions** • invertebrates rate of respiration is expected to be higher than the rate of respiration of the beans *because* • invertebrates are moving around • metabolic processes require energy / generate heat.

			conclusion suggested, likely to be muddled or inaccurate. *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.		
			Total	**15**	

Question			Answer	Marks	Guidance
2	(a)	(i)	DNA / RNA / nucleic acid ✓	1	**ALLOW** deoxyribonucleic acid / ribonucleic acid
		(ii)	lower / reduce / make more negative ✓	1	
		(iii)	**1** strip is impervious to**,** water / solutions ✓ **2** forces water / solutions**,** to pass through**,** plasma / cell surface, membrane ✓ **3** phospholipid (bilayer)**,** repels / AW**,** ions / charged particles ✓	max 2	**1** **IGNORE** ref to suberin **3** The idea of charge / ion impermeability is wanted here. **ALLOW** answer in terms of ions / charged particles needing channels because phospholipid bilayer does not allow charged particles through
	(b)	(i)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer =** 3.75 (mm) **award 2 marks** 3µm × 1250 = 3750 µm ✓ 3750 / 1000 = 3.75 ✓	2	**ALLOW** 3,750 µm or 0.375 cm for **one** mark. **ALLOW** 1 mark for correct working e.g. 3 × 1250
		(ii)	(with light microscope) no further resolution (at ×1250) ✓	1	**IGNORE** ref to further detail, as implied in question **ALLOW** ref to resolution not the same as magnification
		(iii)	stay indoors / increase ventilation / wear masks ✓ measures to, exclude / not attract / kill**,** rats/fleas ✓ strict / immediate quarantine for persons with symptoms ✓	max 2	**ALLOW** (longer term) measures to reduce overcrowding
	(c)	(i)	(stimulates) cell**,** elongation / division ✓	1	**IGNORE** ref to action outside the cell, or to unqualified “growth” etc.

Question			Answer	Marks	Guidance
		(ii)	**1** reduced / no, proton pumping / proton motive force / chemiosmosis ✓ **2** photophosphorylation stops ✓ **3** less / no, ATP produced ✓ **4** less / no, reduced NADP produced ✓ **5** no, Calvin cycle / carbon fixation / light independent stage ✓ **6** no, TP / (hexose) sugars, made ✓ **7** no respiratory substrate / respiration ceases ✓	**max 4**	**3 ALLOW** cessation of vital process that needs ATP **IF** ATP mentioned but **IGNORE** respiration (as credited in mp 7).
			Total	**14**	

Question			Answer	Marks	Guidance
3	(a)	(i)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer =** 13.61 **award 3 marks** $\frac{[31.3 - 20.0]}{}$ = 11.3 ✓ $\frac{4.1^2}{50} + \frac{4.2^2}{50} = \frac{16.81}{50} + \frac{17.64}{50}$ = 0.3362 + 0.3528 = 0.689 ✓ = 11.3 / √0.689 = 11.3 / 0.830 = 13.61 ✓	3	**If answer is not in 2 decimal places award 2 marks** **ALLOW** correct working for 1 mark
		(ii)	calculated *t* value is greater than the critical value at 0.05 **and** the null hypothesis can be rejected ✓	1	**ALLOW** 0.01 or 0.001 instead of 0.05 ECF from answer to (a)(i)
	(b)		histogram correctly plotted for the values ✓ two sets of data distinguished by a key or other suitable method to identify them ✓ *x* axis labelled 'height (mm)' **and** *y* axis labelled 'number of dog whelks / *Nucella lapillus* / shells / class ' ✓ makes good use of the graph paper **and** both axes are correctly scaled with ascending equidistant intervals ✓	4	**DO NOT ALLOW** a bar chart or a line graph as neither would represent the data correctly **ALLOW** a frequency polygon **ALLOW** '% of the sample' or 'Frequency density' for the *y* axis if this has been calculated

Question			Answer	Marks	Guidance
	(c)		positive correlation (between the height of the whelk shell and the type of the shore) ✓ (histogram / data, indicates that) shore exposure has an impact on height ✓ *Nucella* show adaptation to harsher wave action ✓ shells measured may not all be exposed to wave action ✓	max 3	**ALLOW** correlation is strong or a reference to relationship such as: taller shell height and sheltered shore or shorter shell height and exposed shore **ALLOW** little overlap on the histogram bars **ALLOW** the idea that the differences may be due to direct wave action or adaptation
	(d)		**Limitation:** no detail for the random sampling technique was given / *Nucella* from the whole population may not have been sampled ✓ **Improvement:** use(two) metre tapes to set out a grid and use randomly generated coordinates ✓ **Limitation:** no measuring instrument specified ✓ **Improvement:** use vernier callipers with a precision of more than 0.5 mm ✓ **Limitation:** incorrect identification of *Nucella* / several types of shelled molluscs that are similar to *Nucella* ✓ **Improvement:** use a seashore key to correctly identify the whelk ✓ **Limitation:** classification of the shore as sheltered or exposed was subjective ✓ **Improvement:** use an approved shore classification (such as Ballantine's) ✓	max 2	**The improvement mark should be awarded only when linked to the correct limitation**

	(e)		increase the number of**,** *Nucella* used in the data collection / samples ✓ replicate / repeat**,** the entire experiment again **and** calculate the mean ✓	**max 1**	**ALLOW** a value given such as increasing number to 100 from each shore **ALLOW** an understanding of the *idea* that the procedure has only been carried out once for each shore
	(f)		*not valid:* a small percentage of *Nucella* sampled from each area ✓ some areas not sampled at all which would lead to skewed data ✓ age of *Nucella* sampled was not considered ✓ genetic variations or sub species not taken into account ✓ *valid:* random sampling techniques mean no bias in collection ✓ 100 *Nucella* sampled in total (50 in each area) so large sample size ✓ precise instructions for consistent measurement of shell height ✓	**max 3**	**ALLOW** reverse arguments made *idea that* conclusion will be distorted
			Total	**17**	

Question			Answer	Marks	Guidance
4	(a)	(i)	it (only) respires in the absence of oxygen ✓	1	Must imply that the absence of oxygen is the preferred/essential condition e.g. 'can respire in the absence of oxygen' does not really imply this, as this statement also applies to aerobic organisms
		(ii)	it hydrolyses a peptide bond between two amino acids (residues) which are joined by a disulfide bond ✓	1	
	(b)	(i)	amount that is required to kill the 50th mouse when they are arranged in order of lethal dose ✓	1	
		(ii)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer =** 4.25 (μg) **award 2 marks** 50 x 85 = 4250 ✓ 425 /1000 = 4.25 μg ✓	2	**ALLOW** 1 mark for correct working using, least lethal dose is 50 ng kg^{-1}
		(iii)	intercostal muscles are / diaphragm muscle is**,** weakened / paralysed ✓ *idea that* ventilation and oxygenation of blood is**,** reduced / compromised ✓ cells / (named) organ(s)**,** cannot**,** obtain oxygen for respiration/ carry out aerobic respiration ✓	max 2	

Question	Answer	Marks	Guidance
(c)*	**Level 3 (5–6 marks)** A full explanation of why strains are immunologically distinct **AND** a description of more than one method of action of the immune system. *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 full explanation of why strains are immunologically distinct **AND** an attempt to describe a method of action of the immune system. **OR** A description of more than one method of action of the immune system **AND** an attempt to explain why strains are immunologically distinct. *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)** An attempt to explain why strains are immunologically distinct **AND** an attempt to describe a method of action of the immune system. *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**	**Indicative scientific points may include (but are not limited to):** **Immunologically distinct** • toxins produced by each strain will be (slightly) different • each (botulinum) toxin will have different 3D shape / amino acid sequence / DNA nucleotide coding sequence • toxin acts as / is antigen • immune response determined by shape of antigen • different compounds will have different shapes **Immune system** • antigen presenting cells ingest antigen and display antigen on their surfaces • interaction between APCs and T-helper cells causes production of interleukins • B cells activated by T-helper cells • clonal selection and clonal expansion • B cells differentiate into plasma cells • plasma cells produce antibodies / immunoglobulins • by protein synthesis antibodies bind to and neutralise toxins.
	Total	**13**	

Question			Answer	Marks	Guidance
5	(a)	(i)	fossils in, known-age / 150 years old, strata / rocks ✓	1	
		(ii)	DNA / cytochrome c ✓	1	
	(b)	(i)	carbon dioxide diffuses down concentration gradient out of the respiring cell ✓ carried through body from cell (to tracheoles) by haemolymph ✓ passing out via tracheoles / trachea / spiracles ✓ respiration generates heat ✓ hot gases expand and are less dense so rise up by convection through the mound to vents at mound-top ✓	4	
	(b)	(ii)	*shape,* large or increased surface area to volume ratio ✓ smallest area exposed to greatest heat ✓	2	Response **must** be linked to context of avoiding overheating / needing to get rid of heat.
	(c)		β / beta glucose ✓	1	
	(d)		*reason for* important, (N or C) recyclers / saprotrophs ✓ *reason against* not a predator ✓ **or** large in abundance/ biomass (so effect on environment not disproportionate) ✓	2	
			Total	11	

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