



CAMBRIDGE
OCR

Sample Assessment Material

A Level Biology A

H420/02 Biological diversity

MARK SCHEME

MAXIMUM MARK 100

Duration: 2 hours 15 minutes

Version – 3.0

Last updated: February 2026

This document consists of 22 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 **18(e)** and **20(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.

H420/02

Mark Scheme

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Section A

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

Question			Answer	Marks	Guidance
16	(a)		(shape of), proteins / glycoproteins / glycocalyx / antigens of the <u>plasma</u> / <u>cell</u> surface, membrane ✓	1	Look for (change to) that aspect of antigenic configuration that the immune system would recognise as foreign
	(b)	(i)	<i>three from</i> B cells / lymphocytes, have, <u>antigen</u> receptor / carry <u>antibody</u> (on surface) (Antigen/antibody) specific / complimentary to, only one <u>antigen</u> ✓ selected / activated, B cell, proliferates / clones / divides by mitosis ✓ forms / differentiates into, plasma / effector, cells ✓ which secrete antibodies specific / complementary, to <u>antigen</u> ✓	3	
		(ii)	(helper T cells) stimulated by antigen-presenting cells ✓ release, cytokines / interleukin 2 ✓ stimulate B-cell, proliferation / mitosis / clonal expansion ✓	max 2	
	(c)	(i)	<i>Drawn line should show:</i> higher peak and steeper initial rise ✓ line departs x axis between days 30 and 33 and concentration at 60 days above peak of printed line ✓	2	Peak should be at least 40 AU ALLOW if nearly vertical. DO NOT ALLOW if actually vertical ALLOW line start at 30 or 33 days
		(ii)	(memory cells) not acting in, first line / primary response ✓ (memory cells) remained in blood after primary response ✓ <i>one of the above linked to</i> so no wait for / faster, clonal selection ✓	max 2	

H420/02

Mark Scheme

SAM

Question			Answer	Marks	Guidance
	(d)	(i)	babies / infants ✓ elderly / infirm ✓ immuno-compromised / on immunosuppressant drugs / HIV positive ✓ known to have been exposed (to the infection) ✓	max 2	
		(ii)	(antibiotic is) <u>selective pressure</u> ✓ (bacterial) gene pool / AW, has <u>variation</u> ✓ (only) some bacteria have resistance / some bacteria are more resistant than others ✓ <i>two from</i> when exposed (to antibiotic) most resistant survive ✓ surviving bacteria continue to reproduce to make a resistant population ✓ <i>idea that</i> over many generations there is an increase in proportion of resistant bacteria (under continued antibiotic pressure) ✓ antibiotic becomes ineffective / new antibiotic needed ✓	max 4	IGNORE increase in number of resistant bacteria.
			Total	16	

Question			Answer	Marks	Guidance																								
17	(a)	(i)	<table><thead><tr><th>Sequence of Levels</th><th>Level</th><th>Name</th></tr></thead><tbody><tr><td>4</td><td>Order</td><td>Artiodactyla</td></tr><tr><td>7</td><td>Species</td><td>scrofa</td></tr><tr><td>5</td><td>Family</td><td>Suidae</td></tr><tr><td>1</td><td>Kingdom</td><td>Animalia</td></tr><tr><td>6</td><td>Genus</td><td>Sus</td></tr><tr><td>2</td><td>Phylum</td><td>Chordata</td></tr><tr><td>3</td><td>Class</td><td>Mammalia</td></tr></tbody></table> ✓ ✓✓✓	Sequence of Levels	Level	Name	4	Order	Artiodactyla	7	Species	scrofa	5	Family	Suidae	1	Kingdom	Animalia	6	Genus	Sus	2	Phylum	Chordata	3	Class	Mammalia	4	One mark for level numbers all correct in Column 1 DO NOT ALLOW “Animals”
Sequence of Levels	Level	Name																											
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		(ii)	science knowledge / it, advances / improves / grows / AW ✓	1	DO NOT ALLOW ‘development’ or ‘develops’ as is in the question																								
	(b)	(i)	<i>parental genotypes</i> TtDd TtDd ✓ <i>gametes</i> TD, Td, tD, td, (TD, Td, tD, td) ✓ <i>F₁ offspring genotypes</i> TTDD TtDD TTDd TtDd TTdd Ttdd ttDD ttDd ttdd ✓ <i>F₁ offspring phenotypes</i> curly/pink curly/black straight/pink straight/black ✓ <i>F₁ phenotype ratio</i> 9:3:3:1 ✓	5	ALLOW alternative letters only if clear key given. Mark each line independently but offspring phenotypes must be correctly linked to genotype. ALLOW phenotypes and genotypes in Punnett squares.																								

H420/02

Mark Scheme

SAM

Question			Answer	Marks	Guidance																																				
		(ii)	higher proportion, heterozygous / like parents OR <u>alleles</u> not completely re-mixed / AW ✓	1	DO NOT ALLOW genes.																																				
	(c)	(i)	FIRST CHECK ANSWER ON ANSWER LINE If answer = 4.84 (6153846) award 3 marks <table border="1"> <thead> <tr> <th>Phenotype</th><th>O</th><th>E</th><th>O - E</th><th>(O - E)²</th><th>$\frac{(O - E)^2}{E}$</th></tr> </thead> <tbody> <tr> <td>curly pink</td><td>20</td><td>26</td><td>6</td><td>36</td><td>1.38</td></tr> <tr> <td>curly black</td><td>30</td><td>26</td><td>4</td><td>16</td><td>0.62</td></tr> <tr> <td>straight pink</td><td>21</td><td>26</td><td>5</td><td>25</td><td>0.96</td></tr> <tr> <td>straight black</td><td>33</td><td>26</td><td>7</td><td>49</td><td>1.88</td></tr> <tr> <td></td><td></td><td></td><td></td><td>✓</td><td>✓</td></tr> </tbody> </table> $\chi^2 = 4.84$ ✓	Phenotype	O	E	O - E	(O - E) ²	$\frac{(O - E)^2}{E}$	curly pink	20	26	6	36	1.38	curly black	30	26	4	16	0.62	straight pink	21	26	5	25	0.96	straight black	33	26	7	49	1.88					✓	✓	3	ALLOW correct answer in the working if the answer line is left blank ALLOW correct rounding up of the number If O - E incorrect, allow ecf for (O - E)² line only If (O - E)² incorrect, allow ecf for $\frac{(O - E)^2}{E}$ line only
Phenotype	O	E	O - E	(O - E) ²	$\frac{(O - E)^2}{E}$																																				
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				✓	✓																																				
		(ii)	(conclusion cannot be supported because results) not significantly different from expected (at 95% confidence) ✓	1	ALLOW not significant IGNORE 'farmer wrong', 'due to chance' ALLOW ecf from incorrect chi-square result																																				
			Total	15																																					

Question			Answer	Marks	Guidance
18	(a)	(i)	too large / not fat soluble ✓	1	IGNORE 'no channels'
		(ii)	<u>water</u> / H_2O , and , lactase / enzyme ✓	1	Mark the first two answers. If they are correct and any other word is written that is incorrect or contradicts the correct answer then 0 marks . DO NOT ALLOW H_2O with incorrect case or subscript IGNORE refs to pH, buffers, hydrocarbonate etc.
	(b)		sequence / order, of amino acids ✓	1	ALLOW primary structure.
	(c)		(enzymes) re-used so less, money / cost (for new ones) ✓ downstream processing / purifying, cost / expense , reduced ✓ (higher temperature allows) more profit from faster yield ✓	max 2	Mark the first answer on each prompt line. If the prompt numbers are ignored, mark the first two answers as prose. Answers must refer to reduced cost / losses / expense, or increased profit. ALLOW ORA for any point if clearly stated IGNORE 'more economic' in general e.g. 'Continuous processing is more economic'. Look for the details listed.
	(d)		FIRST CHECK ANSWER ON ANSWER LINE If answer = 0.034 award 2 marks $q^2 = 0.97$ $q = \sqrt{0.97} = 0.9848857...$ $p = 1 - 0.9848857...$ $p = 0.01511421982$ $2pq = 2 \times (0.01511421982) \times (0.9848857...)$ ~ 0.02977155794 $= 0.034$ ✓✓	2	ALLOW correct answer in the working if the answer line is left blank. If the answer is 0.04, award 2 marks for rounding from calculations using more than 2 decimal places. If the answer is incorrect, award 1 mark for $(2pq =) 2 \times 0.02 \times 0.98$. MAX 1 mark if the answer is not given to 2 sig fig

Question	Answer	Marks	Guidance
(e)*	Level 3 (7–9 marks) Detailed reference has been made to the (pre-) historical circumstances of both populations. Inferences have been clearly drawn in terms of natural selection. A holistic grasp of the Darwinian theory and the information given is demonstrated, reaching reasoned conclusions that explain how the different phenotypic frequencies occurred. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (4–6 marks) Reference has been made to the (pre-) historical circumstances of both populations. Some inferences have been drawn in terms of natural selection. There is partial structuring of the ideas, with the connections between Darwinian theory and the information generally clear. Conclusions are used to explain how the different phenotypic frequencies occurred. <i>There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.</i>	9	Indicative scientific principles may include: Europeans: • (pre-agricultural) gene pool/genetic variation, included mutant / non-intolerance, allele • availability of milk acted as (positive) selection pressure • individuals / groups, with mutant / non-intolerance, allele had better, chance of survival / success in reproduction • directional selection • mutant / non-intolerance, allele accumulated (in gene pool) • genetic drift (in small prehistoric population) • mutant / non-intolerance, allele is dominant • so expressed in heterozygotic individuals (increasing phenotype frequency). Australian aborigines: • ancestral population pre-agricultural • so no selection for mutant / non-intolerance, allele • no suitable mammals to domesticate / milk • island, so no borders for suitable mammals to come in • no contact / breeding, with non-Aboriginal peoples • no gene flow (from other human populations) • no selection pressure • to increase mutant / non-intolerance, allele / phenotype, frequency.

H420/02

Mark Scheme

SAM

		Level 1 (1–3 marks) Reference has been made to the (pre-) historical circumstances of at least one of the populations. At least one inference has been stated in terms of natural selection. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks No response or no response worthy of credit.		
	(f)	<u>electrophoresis</u> ✓	1	
		Total	17	

H420/02

Mark Scheme

SAM

Question		Answer	Marks	Guidance
19	(a)	work in an inoculating cabinet / maintain minimum plate-opening time ✓ flame inoculating loop / use sterile, pipette tip / implement of transfer ✓ seal the plates for incubation ✓	max 2	IGNORE refs to safety IGNORE autoclave, irradiation etc., as done before technician gets sample
	(b)	<u>thermostable</u> OR does not, denature / AW, at <u>95 °C</u> (during DNA strand separation) ✓ so PCR can be cycled repeatedly without stopping (to reload with enzyme) ✓	2	ALLOW temperature values 90 – 97 °C in correct context DO NOT ALLOW 'killed' for denatured IGNORE refs to optimum working temperature, which would apply equally to less thermostable polymerases
	(c)	(paper) <u>chromatography</u> ✓ Set, blots / AW, of the two (urine) samples ✓ separate / AW, with (aqueous / hydrophilic) solvent ✓ (use a) stain / ninhydrin to visualise the spots ✓ compare patterns (of separated components / colours) ✓	max 3	Max 2 marks if chromatography is not mentioned. IGNORE further detail of blot placement. The idea of overall pattern is wanted here, not just 'compare colours, streaks' etc.
		Total	7	

Question		Answer	Marks	Guidance
20	(a)	<i>Fertility</i> breed GM stock with non-modified stock ✓ see if offspring fertile ✓ if so they should be classed as the same species ✓ ora <i>Morphology</i> Compare several individuals from GM and non-GM groups ✓ in respect of several physical structures ✓ if similar they should be classed as one species ✓ ora <i>Ecology</i> observe how both function in the wild ✓ occupy the same or different <u>niche(s)</u> ✓ if same niche they should be classed as one species ✓ ora <i>Genetics</i> compare DNA ✓ by electrophoresis ✓ same pattern should be classed as one species ✓ ora	max 3	Marks awarded should be from one outlined investigation and the conclusion from its results. If more than one investigation suggested, mark the first investigation and IGNORE the others.
	(b)	spray may not reach all larvae / larvae are inside plant (stem) / shielded from spray ✓ (GM plant) less expensive in the long term / spray may need to reapply, costs involved / expensive used repeatedly ✓ (GM plant) will not be affected by weather conditions / spray needs to have suitable weather conditions to apply / susceptible to weather (rain) ✓	max 1	

Question	Answer	Marks	Guidance
(c)*	Level 3 (5–6 marks) A complete explanation detailing objections and improvements for validity, accuracy and control. The evaluation of the data / procedures is critical, providing refinements that address all the significant issues concerned. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) A partial explanation detailing objections and improvements for some of the teachers concerns OR objections and improvements for all of the teachers concerns. A range of aspects of the data / procedures are evaluated resulting in sound but not comprehensive refinements. <i>There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.</i> Level 1 (1–2 marks) A simple explanation, linking some objections or improvements to some of the teachers concerns. Evaluation and/or refinement, links to data / procedure in some respects but links are not clearly shown.	6	Indicative scientific points may include: <u>Results not valid</u> Objections: • cause of collapse not recorded / plants may have collapsed for different reasons • number of collapsed less meaningful than percent Improvements: • determine which plants collapsed due to corn borer • dissect stems to seek larvae • use percent collapsed out of, original / still standing, numbers. <u>Results may not be accurate</u> Objections: • collapsed plants may have been counted twice from plot-edge • some collapsed plants may not have been noticed from plot-edge • students may have counted differently from each other Improvements: • remove / mark, collapsed when counted • use narrow strips as plots so that collapsed not missed • have all plots counted by the same student • have more than one student counting • average the counts.

H420/02

Mark Scheme

SAM

		<i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks No response or no response worthy of credit.		<u>Variables not controlled</u> Objections: • no account of natural variation in plant susceptibility • genetic variations between Bt and regular corn Improvements: • use, cloned / genetically identical, plants in each plot. • perform genetic modification to Bt on same clones as used for other plots. ALLOW references to repeating the procedure.
	(d)	cutting needs less / micropropagation needs more, (expensive) equipment ✓ cutting needs less / micropropagation needs more, (expensive) skills / staff / AW ✓ cutting produces less / micropropagation produces more, clone offspring ✓ AVP ✓	max 2	Answers must be comparative Look for two separate ideas IGNORE refs to time, one or other method may be quicker. e.g. cutting needs less / micropropagation needs more aseptic discipline.
		Total	12	

Question			Answer	Marks	Guidance
21	(a)	(i)	FIRST CHECK ANSWER ON ANSWER LINE If answer = $110\,000 / -1.1 \times 10^5 \text{ kJ km}^{-2} \text{ y}^{-1}$ award 2 marks Energy converted to biomass = $0.105 + 0.005 \text{ kJ m}^{-2} \text{ y}^{-1}$ Convert to $\text{kJ km}^{-2} \text{ y}^{-1} = 0.110 \times 10^6$ (i.e., $1 \text{ km}^2 = 1000000 \text{ m}^2 / 10^6 \text{ m}^2$) $110\,000 / -1.1 \times 10^5 \checkmark$ $\text{kJ km}^{-2} \text{ y}^{-1} \checkmark$	2	ALLOW the word or any reasonable symbol for year ALLOW $\text{kJ y}^{-1} \text{ km}^{-2}$
		(ii)	FIRST CHECK ANSWER ON ANSWER LINE If answer = 2.5 award 2 marks $0.005 / 0.2 = 0.025 \checkmark$ $0.025 \times 100 = 2.5 \checkmark$	2	ALLOW correct answer in the working if the answer line is left blank
	(b)	(i)	<u>Measures</u> fishing quotas $\checkmark$ mesh size $\checkmark$ species restriction $\checkmark$ trawler size / days at sea $\checkmark$ penalties / sanctions $\checkmark$ monitoring / surveillance $\checkmark$ publicity / public education $\checkmark$ <u>Difficulties</u> area too large $\checkmark$ expense of monitoring $\checkmark$ monitoring hampered by, weather / seasons $\checkmark$ false reporting of, catches / trawler size / mesh size / days $\checkmark$ death of fish caught but not kept (because of restrictions) $\checkmark$	max 4	The difficulties must relate to the measures proposed.

H420/02

Mark Scheme

SAM

		(ii)	<i>argument for:</i> comparison of the energy in large fish and krill shows humans would get 100x more kJ/energy from krill than large fish ✓ <i>argument against:</i> would require large change to fishing industry / consumer habits or could impact ecosystem at first trophic level ✓	2	ALLOW the use of figures to illustrate the data comparison.
			Total	10	

Question			Answer	Marks	Guidance
22	(a)		(pond community is) final / stable / not subject to further succession ✓	1	IGNORE 'permanent'
	(b)		<u>light</u> microscope ✓ graticule ✓	2	
	(c)	(i)	urea / uric acid ✓	1	ALLOW ammonia, ammonium (ions)
		(ii)	Nitrosomonas ✓ nitrite ✓ Nitrobacter ✓ nitrate ✓	4	
			Total	8	