OCR
Oxford Cambridge and RSA

…day June 20XX– Morning/Afternoon

A Level Biology A

H420/02 Biological diversity

SAMPLE MARK SCHEME

Duration: 2 hours 15 minutes

MAXIMUM MARK 100

This document consists of 20 pages

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris 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 scoris and mark the **required number** of practice responses ("scripts") and the **required number** of 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 scoris 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 scoris messaging system.

5. Work crossed out:

   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks

   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

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 scoris **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 scoris 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.
- Decide the level that **best fits** the answer – match the quality of the answer to the closest level descriptor.
- To select a mark within the level, consider the following:

  Higher mark: A good match to main point, including communication statement (in italics), award the higher mark in the level
  Lower mark: Some aspects of level matches but key omissions in main point or communication statement (in italics), award lower mark in the level.

Level of response questions on this paper are **18(e)** and **20(c)**.

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

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.

Section A

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

Section B

Question			Answer	Marks	Guidance
16	(a)		(shape of), proteins / glycoproteins / glycocalyx / antigens of the plasma / cell surface, membrane ✓	1	Look for (change to) that aspect of antigenic configuration that the immune system would recognise as foreign.
	(b)	(i)	*three from* B cells / lymphocytes, have, antigen receptor / carry antibody, on surface, specific / complimentary to, only one antigen ✓ selected / activated, B cell, proliferates / clones / divides by mitosis ✓ forms / differentiates into, plasma / effector, cells ✓ which secrete antibodies specific / complementary, to antigen ✓	3	
		(ii)	*two from* (helper T cells) stimulated by antigen-presenting cells ✓ release, cytokines / interleukin 2 ✓ stimulate B-cell, proliferation / mitosis / clonal expansion ✓	2	
	(c)	(i)	*Drawn line should show:* 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)	*one from* (memory cells) not acting in, first line / primary response ✓ (memory cells) remained in blood after primary response ✓ *one of the above linked to* so no wait for / faster, clonal selection ✓	2	

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

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>17</td><td>(a)</td><td>(i)</td><td>
<table>
<tr><th>Sequence of Levels ✓</th><th>Level</th><th>Name</th></tr>
<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>Animal(ia) ✓</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>
</table>
</td><td>4</td><td>One mark for level numbers all correct in Column 1.

DO NOT ALLOW if scrofa is given capital S.

ALLOW “Animals”

DO NOT ALLOW if Sus is given lower-case initial s.</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>science knowledge / it, advances / improves / grows / AW ✓</td><td>1</td><td>“Develop” is in the question.</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>parental genotypes
TtDd TtDd ✓

gametes
TD, Td, tD, td, (TD, Td, tD, td) ✓

offspring genotypes
TTDD TtDD TTDd TtDd TTdd Ttdd ttDD ttDd ttdd ✓

offspring phenotypes
curly/pink curly/black straight/pink straight/black ✓

phenotype ratio
9:3:3:1 ✓</td><td>5</td><td>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.</td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td></td><td>(ii)</td><td>higher proportion, heterozygous / like parents
OR
<u>alleles</u> not completely re-mixed / AW ✓</td><td>1</td><td>DO NOT ALLOW genes.</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>
<table>
<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>
<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>
</table>
χ^2 = 4.84 ✓</td><td>3</td><td>Correct answer with no working shown = 3 marks.

ALLOW correct answer in the working if the answer line is left blank.

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</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>(conclusion cannot be supported because results) not significantly different from expected (at 95% confidence) ✓</td><td>1</td><td>ALLOW not significant.
IGNORE ‘farmer wrong’, ‘due to chance’.
ALLOW ecf from incorrect chi-square result.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>15</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
18	(a)	(i)	too large / not fat soluble ✓	1	**IGNORE** 'no channels''
		(ii)	water / 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)		*two from* (enzymes) re-used so less, **money** / **cost** (for new ones) ✓ downstream processing / purifying, **cost** / **expense**, reduced ✓ (higher temperature allows) more **profit** from faster yield ✓	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)		0.04 ✓✓	2	**ALLOW** correct answer in the working if the answer line is left blank. If the answer is 0.03, **award 2 marks** for rounding from calculations using more than 2 decimal places. If the answer is incorrect, **award 1 mark** for (2pq =) 2 x 0.02 x 0.98. If the answer is not given to 2 decimal places, **max 1 mark**.

Question	Answer	Marks	Guidance
(e)*	**Level 3 (7–9 marks)** Extensive reference has been made to the (pre-) historical circumstances of both populations. Inferences have been clearly drawn in terms of natural selection. Learner demonstrates a holistic grasp of the Darwinian theory and the information given; reaching reasoned conclusions that explain how the different phenotypic frequencies occurred. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **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 information generally clear. Conclusions are used to explain how the different phenotypic frequencies occurred. *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 (1–3 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.	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.

Question			Answer	Marks	Guidance
			The ideas expressed are poorly structured but some relevant points are made. *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.		
	(f)		electrophoresis ✓	**1**	
			Total	**17**	

Question			Answer	Marks	Guidance
19	(a)		*two from* 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 ✓	2	**IGNORE** refs to safety – question is about sterile practice. **IGNORE** autoclave, irradiation etc., as done before technician gets sample.
	(b)		thermostable **OR** does not, denature / AW, at 95 °C (during DNA strand separation) ✓ so PCR can be cycled repeatedly without stopping (to reload with enzyme) ✓	2	**ALLOW** temperature values 93 – 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)		*three from* (paper) chromatography ✓ 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) ✓	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)		*Fertility* breed GM stock with non-modified stock ✓ see if offspring fertile ✓ if so they should be classed as the same species ✓ **ora** *Morphology* 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** *Ecology* observe how both function in the wild ✓ occupy the same or different niche(s) ✓ if same niche they should be classed as one species ✓ **ora** *Genetics* compare DNA ✓ by electrophoresis ✓ same pattern should be classed as one species ✓ **ora**	**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)		recommend GM Bt corn, because spray may not reach all larvae / larvae are inside plant (stem) / shielded from spray ✓	**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. *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 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. *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)** 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. *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.*	6	**IGNORE** professions of agreement with the tutor. **Indicative scientific points may include:** **Results not valid** **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. **Results may not be accurate** **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. **Variables not controlled** **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.

Question			Answer	Marks	Guidance
			0 marks No response or no response worthy of credit.		• perform genetic modification to Bt on same clones as used for other plots. **ALLOW** references to repeating the procedure.
	(d)		*two from* 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 ✓	**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)	110 000 / 1.1×10^5 ✓ kJ km^{-2} y^{-1} ✓	2	**ALLOW** the word or any reasonable symbol for year **ALLOW** kJ y^{-1} km^{-2}
		(ii)	25 ✓✓	2	**ALLOW** correct answer in the working if the answer line is left blank. If answer is incorrect, **award 1 mark** for $0.05 \div 0.2 \times 100$
	(b)	(i)	*Measures* fishing quotas ✓ mesh size ✓ species restriction ✓ trawler size / days at sea ✓ penalties / sanctions ✓ monitoring / surveillance ✓ publicity / public education ✓ *Difficulties* area too large ✓ expense of monitoring ✓ monitoring hampered by, weather / seasons ✓ false reporting of, catches / trawler size / mesh size / days ✓ death of fish caught but not kept (because of restrictions) ✓	4	**The difficulties should relate to the measures proposed.**
		(ii)	*argument for* comparison of the energy in large fish and krill shows humans would get 100x more kJ/energy from krill than large fish ✓ *argument against* 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', it is in the rubric.
	(b)		light microscope ✓ graticule ✓	2	
	(c)	(i)	urea / uric acid ✓	1	**ALLOW** ammonia, ammonium (ions).
		(ii)	Nitrosomonas ✓ nitrite ✓ Nitrobacter ✓ nitrate ✓	4	
			Total	8	