Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/51**

Paper 5 Planning, Analysis and Evaluation **May/June 2023**

MARK SCHEME

Maximum Mark: 30

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.
5	'List rule' guidance For questions that require ***n*** responses (e.g. State **two** reasons …): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked *ignore* in the mark scheme should not count towards ***n***. • Incorrect responses should not be awarded credit but will still count towards ***n***. • Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response. • Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

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6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

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Examples of how to apply the list rule

State **three** reasons … [3]

A

1. Correct	✓	**2**
2. Correct	✓	
3. Wrong	×	

B (4 responses)

1. Correct, Correct	✓, ✓	**3**
2. Correct	✓	
3. Wrong	ignore	

C (4 responses)

1. Correct	✓	**2**
2. Correct, Wrong	✓, ×	
3. Correct	ignore	

D (4 responses)

1. Correct	✓	**2**
2. Correct, CON (of 2.)	×, (discount 2)	
3. Correct	✓	

E (4 responses)

1. Correct	✓	**3**
2. Correct	✓	
3. Correct, Wrong	✓	

F (4 responses)

1. Correct	✓	**2**
2. Correct	✓	
3. Correct CON (of 3.)	× (discount 3)	

G (5 responses)

1. Correct	✓	**3**
2. Correct	✓	
3. Correct Correct CON (of 4.)	✓ ignore ignore	

H (4 responses)

1. Correct	✓	**2**
2. Correct	×	
3. CON (of 2.) Correct	(discount 2) ✓	

I (4 responses)

1. Correct	✓	**2**
2. Correct	×	
3. Correct CON (of 2.)	✓ (discount 2)	

Mark scheme abbreviations

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;	separates marking points
/	alternative answers for the same point
A	accept (for answers correctly cued by the question, or by extra guidance)
R	reject
I	ignore
( )	the word / phrase in brackets is not required, but sets the context
AW	alternative wording (where responses vary more than usual)
underline	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
AVP	alternative valid point

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Question	Answer	Marks
1(a)	*any **one** from:* volume of (pH7) buffer **;** speed of centrifuge **;** time in centrifuge **;**	**1**
1(b)	*idea that* time for disc rising decreases as catalase activity increases **; ora**	**1**
1(c)(i)	distance from base of shoot **;**	**1**
1(c)(ii)	*any **six** from:* 1 method to cut, tissue from carrot (root) **;** 2 minimum of 5 distances chosen (or stated distances) **;** 3 same / stated, mass / volume, of cut carrot (used to make the extract) **;** 4 mix / stir, liquid carrot extract (before dipping filter paper discs) **;** 5 method of maintaining temperature (10°C – 40°C if stated) **;** 6 same / stated, height / depth / (stated) volume, of hydrogen peroxide (solution) **;** 7 measure / note / record, the time the filter paper disc takes to rise to the surface (of hydrogen peroxide solution) **;** 8 use at least three measurements for each distance **and** calculate a mean **;** 9 safety: hazard **and** risk **and** mitigation **;** 10 carrying out a control with disc, dipped / AW, in water / buffer (to show rise of the discs is due to the carrot extract) **;**	**6**
1(d)(i)	volume of gas collected (after 1 minute) **;**	**1**

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Question	Answer	Marks
1(d)(ii)	distilled water / deionised water / water, in table heading **;** correct volumes of stock solution and water (in Table 1.1) **;**	**2**
1(d)(iii)	*supports conclusions:* 1 paired data quotes / manipulated data (from Fig. 1.7), to show increase in hydrogen peroxide concentration increases the volume of gas collected **;** *doesn't support – **max 2** marks:* 2 *idea that* range (of hydrogen peroxide concentrations) is limited **;** 3 *idea that* graph has not, plateaued / reached a maximum / AW, so we do not know the value of V_{max} **;** 4 *idea that* gas collected might not be only oxygen **;** 5 no replicates / no repeats of investigation / no mean calculated **;**	**3**

Question	Answer	Marks
2(a)	1 *idea of*: add lice to container **and** counting lice (on trout) at death **or** add lice to trout (in a container) **and** counting lice (on trout) at death **or** capture trout with lice attached **and** count lice (on trout) at death **or** trout(s) with (known) different number of lice attached (in separate containers) **and** see which die **;** 2 *idea of* repeat with container (of trout) / trout (in a container) with no lice present **;** 3 named environmental condition in container maintained as constant (for, experimental / control / both, conditions) **or** named feature of trout / lice maintained as constant (for, experimental / control / both, conditions) **;**	**3**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(b)(i)</td><td>any one from:
location of, boat / sampling site ;
(electric) current ;
time of year ;</td><td>1</td></tr>
<tr><td>2(b)(ii)</td><td>any one from:
idea that young / small, trout will not be caught / AW ; ora
idea that there will be more lice on the fish, caught / AW (as they are older / larger) ; ora</td><td>1</td></tr>
<tr><td>2(c)(i)</td><td>allows for valid comparison;
(because) number (of sea trout), sampled / AW, varies ;</td><td>2</td></tr>
<tr><td>2(c)(ii)</td><td>paired data quote / manipulated data (to show year 1 to 2 increase) ;
Data quotes:
<table>
<tr><th>year</th><th>mean % with ≥ 13 attached lice</th></tr>
<tr><td>1</td><td>2.6</td></tr>
<tr><td>2</td><td>14.9</td></tr>
<tr><td>more / higher</td><td>12.3</td></tr>
<tr><td>times increased</td><td>x5.7</td></tr>
</table></td><td>1</td></tr>
</table>

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Question	Answer	Marks
2(c)(iii)	*any **two** from:* 1 no difference between year 1 and year 2 of production cycle in 2004–2005 **;** 2 number of sea trout sampled was small **;** 3 (data from) only, 5 production cycles / 10 years **;** 4 no statistical test carried out **;**	**2**
2(d)(i)	there is no, relationship / correlation, between the number of lice (on trout) and the distance from the (nearest) fish farm **;**	**1**
2(d)(ii)	(Ireland) significant / yes / ✓ / AW **and** (Scotland) not significant / no / **×** / AW **;**	**1**
2(d)(iii)	there is a negative correlation **or** as distance from (nearest) fish farm increases, (mean) number of lice (per trout) decreases **; ora**	**1**

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Question	Answer	Marks
2(d)(iv)	*Max **one** from MP1–3 reasons for 95% CI:* 1 95%, probability / confidence that / chance that, the, true / actual / population / parametric, mean lies within, this range / these limits **or** 2 to test whether the means (for number lice per trout at different distances from fish farms) are (significantly) different **or** to see / test, whether the, error bars / 95% CI / they, overlap **or** 3 to get a measure of how close the, calculated / AW, mean is likely to be to the, true / AW, mean **or** shorter, error bars / 95% CI, show true mean is likely to be closer to the calculated mean **or** longer, error bars / 95% CI, show true mean is likely to be further from the calculated mean **;** ***One** mark for exemplification:* Exemplification of MP 2 or 3 from Fig. 2.3: *MP2 Exemplification:* *idea that* no / less overlap of (95% CI) error bars for Ireland, so (difference), is / may be, significant **or** *idea that* overlap of (95% CI) error bars for, Scotland / Ireland, so (difference), is not / may not be, significant **;** **I** direct comparison between Ireland with Scotland *MP3 Exemplification:* *idea that* the, shorter / narrower, error bars for Ireland the closer the calculated mean is (likely to be) to the true mean **or** *idea that* the, larger / longer, error bars for Scotland, the further the calculated mean is (likely to be) from the true mean **or** shorter / narrower, error bars / confidence limits, with increasing distance (to nearest fish farm) in, Ireland / Scotland, shows the calculated mean is, getting / AW, closer to the true mean **;** **I** direct comparison between Ireland with Scotland	**2**

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