CAMBRIDGE
International Education

Cambridge International AS & A Level

BIOLOGY **9700/51**

Paper 5 Planning, Analysis and Evaluation **October/November 2024**

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 October/November 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

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PUBLISHED

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 descriptions 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.

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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Mark scheme abbreviations

;	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)(i)	0.40 **;**	**1**
1(a)(ii)	fucoxanthin **;** diadinoxanthin **;**	**2**
1(b)	*blue light:* 1 *S. costatum* (will have), greater / faster / AW , (rate of photosynthesis than *R. salina*) **; ora** *green light:* 2 *S. costatum* (will have), slightly / AW, greater / faster / AW , (rate of photosynthesis than *R. salina*) **; ora** *red light:* 3 *S. costatum* (will have), the same / similar / AW, (rate of photosynthesis as *R. salina*) **;**	**3**
1(c)(i)	*any **one** from:* 1 *idea that* absorbance measured (with colorimeter) / colour of indicator solution, is not affected by algae **;** 2 indicator solution can be separated from algal balls **;** 3 (more accurate) standardisation of, mass / volume / AW, of algae **;**	**1**
1(c)(ii)	*independent variables:* species / type, (of algal beads) **;** wavelength / colour, of light **;** *dependent variable:* absorbance / pH (of solution) **;**	**3**

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Question	Answer	Marks
1(c)(iii)	*any **eight** from:* 1 method for use of filters (to give blue, green, red coloured light) **;** 2 use, same / stated, number / mass / volume, of algal beads (in each bottle) **;** 3 place light source the, same / stated, distance (from algal beads) **;** 4 carry out experiment in a darkened room **;** 5 use, same / stated, volume / concentration, of indicator (in each bottle) **;** 6 (use of a control bottle) replace the algal beads with, glass / plastic / AW, beads **;** 7 use, red / pH 8.4, hydrogencarbonate indicator solution (at start) **;** 8 detail of method to take sample (of indicator solution) from bottle **;** 9 use a, same / stated, coloured, filter / light, in the colorimeter **;** 10 method to calibrate colorimeter **;** 11 *ref. to*, suitable time to leave algal beads and indicator solution (before measuring absorbance) **;** 12 for each colour (filter) and species, measure / record / AW, absorbance, at same / stated, time(s) **;** 13 use at least three measurements for each colour (filter) and species, **and** calculate a mean **;**	**8**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(c)(iv)</td><td>hazard and risk and precaution ;

<table>
<tr><th>hazard</th><th>risk</th><th>precaution</th></tr>
<tr><td>algae / beads</td><td>irritant / allergy</td><td>gloves / mask / goggles / PPE</td></tr>
<tr><td>hydrogencarbonate indicator (solution)</td><td>irritant / allergy</td><td>gloves / mask / goggles / PPE</td></tr>
<tr><td>heat from light source</td><td>burns</td><td>do not touch bulb / turn off lamp before handling</td></tr>
</table></td><td>1</td></tr>
<tr><td>1(d)(i)</td><td>any one from:

1 comparing the means of two (sets of data) ;

2 continuous data (collected) ;

3 (data are from populations that are) normally distributed ;

4 standard deviations are approximately the same ;</td><td>1</td></tr>
<tr><td>1(d)(ii)</td><td>there is no difference, in the pH of samples (taken from the small bottles / of indicator solution), between R. salina and S. costatum ;</td><td>1</td></tr>
</table>

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>
1 peat bog A has a higher number of species and a higher Shannon index (than peat bog B) ; ora

examples of suitable wording for mp1:
<table>
<tr><th>number of species</th><th>Shannon index</th></tr>
<tr><td>peat bog A has a higher number of species ora

peat bog A has 12 species, peat bog B has <u>only</u> 8 species

no (individuals of) species T, U, W, V in peat bog B</td><td>peat bog A has a higher Shannon index ora

idea that number of species / species richness, is more important for Shannon index</td></tr>
</table>
2 peat bog B has a smaller range of species abundance and a higher Simpson’s index (than peat bog A) ; ora

examples of suitable wording for mp2:
<table>
<tr><th>relative species abundance</th><th>Simpson’s index</th></tr>
<tr><td>peat bog B has a smaller range of species abundance ora

peat bog B has a higher (total) number of individuals ora

peat bog B has 135 (total) number of individuals, peat bog A has only 99</td><td>peat bog B has a higher Simpson’s index ora

idea that (range of) species abundance / species evenness / total number of individuals, is more important for Simpson’s index</td></tr>
</table>
if mp1 and mp2 not awarded, then award 1 mark for:

peat bog A has a higher number of species and peat bog B has a smaller range of species abundance ; ora
</td><td>2</td></tr>
</table>

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>examples of suitable wording:
<table>
<tr><th>number of species</th><th>relative species abundance</th></tr>
<tr><td>peat bog A has a higher number of species ora

peat bog A has 12 species, peat bog B has <u>only</u> 8 species

no (individuals of) species T, U, W, V in peat bog B</td><td>peat bog B has a smaller range of species abundance ora

peat bog B has a higher (total) number of individuals ora

peat bog B has 135 (total) number of individuals, peat bog A has <u>only</u> 99</td></tr>
</table></td><td></td></tr>
<tr><td>2(b)(i)</td><td>any three from:

1 sample at different times of the year (not only over one month) ;

2 sample at, night / different times of day (not only between 13:00 and 16:00) ;

3 sample at sites other than along the path ;

4 use of (another) named technique to sample invertebrates ;

5 use an expert / (identification) app / guidebook (instead of an identification key) ;</td><td>3</td></tr>
<tr><td>2(b)(ii)</td><td>1 (for Tipula limbata) n / N = 0.083 and (n / N)^2 = 0.007 ;

2 Σ = 0.270 ;

3 D = 0.730 ;</td><td>3</td></tr>
<tr><td>2(b)(iii)</td><td>peat bog A has (slightly) high<u>er</u> (biodiversity than peat bog B) ; ora</td><td>1</td></tr>
</table>

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