

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.

This document consists of **10** printed pages.

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.

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.

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.

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)
<u>underline</u>	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

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

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

Question	Answer			Marks										
1(c)(iv)	<p>hazard and risk and precaution ;</p> <table border="1" data-bbox="332 282 1567 612"> <thead> <tr> <th data-bbox="339 287 669 343">hazard</th><th data-bbox="669 287 999 343">risk</th><th data-bbox="999 287 1567 343">precaution</th></tr> </thead> <tbody> <tr> <td data-bbox="339 343 669 398">algae / beads</td><td data-bbox="669 343 999 398">irritant / allergy</td><td data-bbox="999 343 1567 398">gloves / mask / goggles / PPE</td></tr> <tr> <td data-bbox="339 398 669 501">hydrogencarbonate indicator (solution)</td><td data-bbox="669 398 999 501">irritant / allergy</td><td data-bbox="999 398 1567 501">gloves / mask / goggles / PPE</td></tr> <tr> <td data-bbox="339 501 669 612">heat from light source</td><td data-bbox="669 501 999 612">burns</td><td data-bbox="999 501 1567 612">do not touch bulb / turn off lamp before handling</td></tr> </tbody> </table>	hazard	risk	precaution	algae / beads	irritant / allergy	gloves / mask / goggles / PPE	hydrogencarbonate indicator (solution)	irritant / allergy	gloves / mask / goggles / PPE	heat from light source	burns	do not touch bulb / turn off lamp before handling	1
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1(d)(i)	<p><i>any one from:</i></p> <ol style="list-style-type: none"> <li data-bbox="339 708 999 747">1 comparing the means of two (sets of data) ; <li data-bbox="339 771 999 811">2 continuous data (collected) ; <li data-bbox="339 835 999 874">3 (data are from populations that are) normally distributed ; <li data-bbox="339 898 999 938">4 standard deviations are approximately the same ; 	1												
1(d)(ii)	<p>there is no difference, in the pH of samples (taken from the small bottles / of indicator solution), between <i>R. salina</i> and <i>S. costatum</i> ;</p>	1												

Question	Answer		Marks															
2(a)	<p>1 peat bog A has a higher number of species and a higher Shannon index (than peat bog B) ; ora</p> <p><i>examples of suitable wording for mp1:</i></p> <table border="1" data-bbox="339 314 1769 616"> <thead> <tr> <th data-bbox="339 314 1051 374">number of species</th><th data-bbox="1051 314 1769 374">Shannon index</th></tr> </thead> <tbody> <tr> <td data-bbox="339 374 1051 435">peat bog A has a higher number of species ora</td><td data-bbox="1051 374 1769 435">peat bog A has a higher Shannon index ora</td></tr> <tr> <td data-bbox="339 435 1051 536">peat bog A has 12 species, peat bog B has <u>only</u> 8 species</td><td data-bbox="1051 435 1769 536"><i>idea that</i> number of species / species richness, is more important for Shannon index</td></tr> <tr> <td data-bbox="339 536 1051 616">no (individuals of) species T, U, W, V in peat bog B</td><td data-bbox="1051 536 1769 616"></td></tr> </tbody> </table> <p>2 peat bog B has a smaller range of species abundance and a higher Simpson's index (than peat bog A) ; ora</p> <p><i>examples of suitable wording for mp2:</i></p> <table border="1" data-bbox="339 747 1769 1113"> <thead> <tr> <th data-bbox="339 747 1051 809">relative species abundance</th><th data-bbox="1051 747 1769 809">Simpson's index</th></tr> </thead> <tbody> <tr> <td data-bbox="339 809 1051 901">peat bog B has a smaller range of species abundance ora</td><td data-bbox="1051 809 1769 901">peat bog B has a higher Simpson's index ora</td></tr> <tr> <td data-bbox="339 901 1051 994">peat bog B has a higher (total) number of individuals ora</td><td data-bbox="1051 901 1769 994"><i>idea that</i> (range of) species abundance / species evenness / total number of individuals, is more important for Simpson's index</td></tr> <tr> <td data-bbox="339 994 1051 1113">peat bog B has 135 (total) number of individuals, peat bog A has <u>only</u> 99</td><td data-bbox="1051 994 1769 1113"></td></tr> </tbody> </table> <p><i>if mp1 and mp2 not awarded, then award 1 mark for:</i></p> <p>peat bog A has a higher number of species and peat bog B has a smaller range of species abundance ; ora</p>	number of species	Shannon index	peat bog A has a higher number of species ora	peat bog A has a higher Shannon index ora	peat bog A has 12 species, peat bog B has <u>only</u> 8 species	<i>idea that</i> number of species / species richness, is more important for Shannon index	no (individuals of) species T, U, W, V in peat bog B		relative species abundance	Simpson's index	peat bog B has a smaller range of species abundance ora	peat bog B has a higher Simpson's index ora	peat bog B has a higher (total) number of individuals ora	<i>idea that</i> (range of) species abundance / species evenness / total number of individuals, is more important for Simpson's index	peat bog B has 135 (total) number of individuals, peat bog A has <u>only</u> 99		2
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2(b)(i)	<p><i>any three from:</i></p> <ol style="list-style-type: none"> <li data-bbox="332 711 1230 747">1 sample at different times of the year (not only over one month) ; <li data-bbox="332 774 1388 811">2 sample at, night / different times of day (not only between 13:00 and 16:00) ; <li data-bbox="332 838 961 874">3 sample at sites other than along the path ; <li data-bbox="332 901 1185 938">4 use of (another) named technique to sample invertebrates ; <li data-bbox="332 965 1432 1002">5 use an expert / (identification) app / guidebook (instead of an identification key) ; 	3								
2(b)(ii)	<ol style="list-style-type: none"> <li data-bbox="332 1044 1118 1081">(for <i>Tipula limbata</i>) $n/N = 0.083$ and $(n/N)^2 = 0.007$; <li data-bbox="332 1124 557 1160">$\Sigma = 0.270$; <li data-bbox="332 1187 557 1224">$D = 0.730$; 	3								
2(b)(iii)	peat bog A has (slightly) <u>higher</u> biodiversity than peat bog B ; ora	1								