Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/52**

Paper 5 Planning, Analysis and Evaluation **February/March 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 February/March 2023 series for most Cambridge IGCSE™, Cambridge International A and AS Level 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.

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	<u>'List rule' guidance</u> 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 marking point
R	reject
A	accept
I	ignore
AVP	any valid point
AW	alternative wording (where responses vary more than normal)
ecf	error carried forward
underline	actual word underlined 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

Question	Answer	Marks
1(a)(i)	*any **one** from:* use coloured filter / set wavelength (of light) **;** calibrate colorimeter / set colorimeter (absorbance) to zero **;** use distilled water (to, calibrate colorimeter / set to zero) **;**	**1**
1(a)(ii)	1 5 stated concentrations **and** units **;** 2 (reasonably) evenly spaced **;** 3 method for dilution shown for **at least** 2 concentrations other than 2.0% and 0% **;**	**3**
1(a)(iii)	correct axis labels **and** orientation **;** *x*-axis label: percentage glucose concentration *y*-axis label: absorbance (no units or absorbance units or arbitrary units) appropriately shaped line **;** line with negative gradient	**2**
1(b)(i)	glucose concentration (of potato) **;**	**1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(b)(ii)</td><td>

*any **six** from:*

1 ref. to, same / stated, potatoes (used for investigation) **;**

2 ref. to, same / stated, storage conditions (of potatoes) **;**
e.g. (low) temperature
in dark
carbon dioxide concentration

3 additional stated storage condition (of potatoes) **;**

4 use minimum of 5 different storage times (of potatoes) **;**

5 ref. to stated storage times (of potatoes) **;**

6 ref. to, same / stated, volume of potato juice (for glucose assay) **;**

7 at each storage time, measure / note / record, absorbance (of potato juice used in glucose assay)
or
at each storage time carry out glucose assay **;**

8 repeat at least twice / 3 replicates for each storage time, **and** find a mean **;**

9 named hazard **and** risk **and** precaution **;**
e.g.

<table>
<tr><th>hazard</th><th>risk</th><th>precaution</th></tr>
<tr><td>Benedict’s reagent</td><td>irritant
toxic (to aquatic environment)</td><td>gloves / eye protection / PPE
don’t pour down sink</td></tr>
<tr><td>hot water (bath)
A water-bath</td><td>burns / scalds</td><td>use tongs / gloves / eye protection</td></tr>
<tr><td>potato</td><td>allergy</td><td>gloves / eye protection / PPE</td></tr>
<tr><td>knife / scalpel</td><td>injury</td><td>cut away from hand</td></tr>
</table>

</td><td>**6**</td></tr>
</table>

Question	Answer	Marks
1(c)	*any **two** from:* 1 as gamma radiation dose increases, (percentage) volatile nitrogen compounds (in raw potatoes) decrease **;** 2 (percentage) volatile nitrogen compounds (in raw potatoes), are significantly different, at different doses of gamma radiation **;** 3 *idea that* no change in percentage glucose (in raw potatoes), therefore decrease in acrylamide in cooked potato chips, is not due to glucose / must be due to asparagine **;** 4 *idea that* decrease in volatile nitrogen compounds at increased gamma radiation doses indicates decrease of asparagine (so less acrylamide is made in the Maillard reaction) **;**	**2**
1(d)(i)	(–)61 (%) **;** correct working **;**	**2**

Question	Answer	Marks
1(d)(ii)	*any **three** from:* *supports:* 1 *idea that*, gamma radiation **and** hot water treatment / treatment 2, decreases the (acrylamide) concentration (of potato chips) more than, gamma radiation only / treatment 1 **;** 2 *idea that*, 95% confidence intervals / 95% CI / error bars (for treatment 1 **and** treatment 2), do not overlap (at all gamma radiation doses), therefore treatment with radiation and hot water is significantly different from treatment with radiation alone **;** 3 paired data quote (to support) **;** *does **not** support:* 4 *idea that* hot water treatment alone decreases acrylamide concentration (of potato chips) **;** 5 *idea that*, 95% confidence intervals / 95% CI / error bars (for treatment 2), overlap (at all gamma radiation doses), therefore decrease in acrylamide due to hot water treatment **and** gamma radiation is not significantly different from hot water treatment alone) **;** 6 ref. to only one variety of potato investigated **;** 7 no statistical test **or** should carry out a, statistical test **;**	**3**

Question	Answer	Marks
2(a)(i)	distance from GM rice plants **and** direction from GM rice plants **;**	**1**
2(a)(ii)	apply herbicide to young plants **;** count the number of young plants that survive **;**	**2**
2(a)(iii)	*any **two** from:* 1 as distance from GM rice plants increases, (percentage) gene flow decreases / pollen dispersal decreases **; ora** 2 (percentage) gene flow / distance of pollen dispersal, is higher in direction of (normal) wind / NW direction (than other directions) **; ora** 3 pollen cannot disperse further than 10 m / no gene flow at 10 m (or further) **;**	**2**
2(b)(i)	0.036 **;**	**1**
2(b)(ii)	*any **three** from:* 1 critical value (for $p = 0.05$) = 2.145 **or** critical value (for $p = 0.01$) = 2.977 **;** 2 value for t / 9.043 / calculated value, is greater than critical value **;** 3 null hypothesis is rejected **;** 4 there is a <u>significant</u> difference between percentage gene flow from GM rice plants to weedy rice plants and percentage gene flow from weedy rice plants to GM rice plants **;**	**3**

Question	Answer	Marks
2(b)(iii)	*any **one** from:* 1 investigation only, carried out once / not repeated **;** 2 investigation only on, wind-pollinated crop / one crop species / (GM and weedy) rice / one non-crop species **;** 3 investigation only investigated, one / two, gene(s) **;** 4 investigation only, in one geographical area **;** 5 investigation only in, experimental trials / without herbicide use **;** 6 no long-term data / no data over several generations **;** 7 gene flow (from GM plants to wild plants), was shown to occur **;** 8 *idea that* wild plants with herbicide-resistant gene, difficult to remove / have selective advantage **;**	**1**