Cambridge Assessment International Education

# Cambridge International AS & A Level

**BIOLOGY** **9700/52**

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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**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 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:<br><br>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:<br><br>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<br><br>For questions that require ***n*** responses (e.g. State **two** reasons …):<br><br>• The response should be read as continuous prose, even when numbered answer spaces are provided.<br>• Any response marked *ignore* in the mark scheme should not count towards ***n***.<br>• Incorrect responses should not be awarded credit but will still count towards ***n***.<br>• 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.<br>• 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<br>CON (of 3.) | ×<br>(discount 3) | |

**G (5 responses)**

| | | |
|---|---|---|
| 1. Correct | ✓ | **3** |
| 2. Correct | ✓ | |
| 3. Correct<br>Correct<br>CON (of 4.) | ✓<br>ignore<br>ignore | |

**H (4 responses)**

| | | |
|---|---|---|
| 1. Correct | ✓ | **2** |
| 2. Correct | × | |
| 3. CON (of 2.)<br>Correct | (discount 2)<br>✓ | |

**I (4 responses)**

| | | |
|---|---|---|
| 1. Correct | ✓ | **2** |
| 2. Correct | × | |
| 3. Correct<br>CON (of 2.) | ✓<br>(discount 2) | |

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**Mark scheme abbreviations**

| | |
|---|---|
| **;** | separates marking points |
| **/** | alternative answers for the same point |
| **R** | reject |
| **A** | accept (for answers correctly cued by the question, or by extra guidance) |
| **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 |
| **I** | ignore |

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| Question | Answer | Marks |
|---|---|---|
| 1(a) | 1 part enzyme extract/polyphenol oxidase with 9 parts of water / buffer **;** | **1** |
| 1(b)(i) | pH **;** | **1** |
| 1(b)(ii) | *any **one** from:*<br>1 temperature of, solutions / tubes **;**<br>2 wavelength of, light / (light) filter (of 470 nm) **;**<br>3 concentration of enzyme / polyphenol oxidase **;**<br>4 total length of time /time reading interval **;** | **1** |
| 1(c)(i) | 1 figures from printed line at or below 0.26 au and 30 s<br>**or**<br>figures from correct tangent **;**<br>2 correct calculation / 0.0083 to 0.0089 / $8.3 \times 10^{-3}$ to $8.9 \times 10^{-3}$ **;** | **2** |
| 1(c)(ii) | sketched line below printed line starting at origin and constantly increasing to 180 s **;** | **1** |

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| Question | Answer | Marks |
|---|---|---|
| 1(d) | 1 state at least 5 dilutions (0.0–0.2%) of dopamine hydrochloride solution / substrate ;<br>2 describe a correct method to making at least 2 dilutions ;<br>3 add tubes to a water bath / incubator, at a, set / constant temperature (10–40 °C) ;<br>4 enzyme and substrate / (all) solutions equilibrated separately ;<br>5 state 2 different variables that are kept constant (volumes of enzyme and substrate or mixture / pH / filter or wavelength) ;<br>6 set to zero / calibrate, colorimeter using a, blank / water, at the start / between each reading ;<br>7 mix substrate and (buffered) enzyme and immediately add (colorimeter tube) to colorimeter ;<br>**or**<br>mix substrate and (buffered) enzyme and immediately start timing ;<br>8 measure absorbance at set time intervals (for set time) ;<br>**or**<br>record time at which red colour (first) appears ;<br>9 3 replicates / 2 repeats for same / one concentration and calculate a mean<br>**or**<br>2 repeats, of experiment / each concentration, and calculate the means ;<br>10 calculate / find / work out rate (of reaction) ; | **7** |

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(d)</td><td>11 named hazard and risk and precaution ;
<table>
<tr><th>Hazard</th><th>Risk</th><th>Precaution</th></tr>
<tr><td rowspan="2">dopamine hydrochloride</td><td>Toxic</td><td>don’t drink<br>don’t pour down the sink<br>wear gloves</td></tr>
<tr><td>Irritant / allergy</td><td rowspan="3">wear gloves / goggles / mask/ PPE</td></tr>
<tr><td>polyphenol oxidase / enzyme</td><td>Irritant / allergy</td></tr>
<tr><td>buffer</td><td>Irritant / allergy</td></tr>
</table>
12 use water/boiled enzyme instead of enzyme as the control ;</td><td></td></tr>
</table>

| Question | Answer | Marks |
|---|---|---|
| 1(e) | 1 enzyme: from different (plant) sources / only from plants / enzyme not used from bananas ;<br>2 sources of information: maybe out of date / maybe unreliable / not comparable ;<br>3 variables: 2 variables not controlled / not standardised / no information (temperatures, pH, timings, volumes, concentrations) ;<br>4 stats: no statistical test / analysis ;<br>5 substrate: no information, on what substrate was used / whether tested on bananas or other fruits ;<br>6 inhibitor: do not know type of inhibition (competitive v. non-competitive) ;<br>7 anti-browning agents: *idea that* other anti-browning agents maybe more or less effective / may impact differently ;<br>8 anti-browning agents should be tested on all sources of enzyme / each only tested on one source of enzyme / may act differently on other sources of enzyme ;<br>9 validity: 2 independent variables ; | **2** |
| 1(f) | sketched line (starts at origin) levels out showing lower Vmax ; | **1P** |

| Question | Answer | Marks |
|---|---|---|
| 2(a)(i) | *any **two** from:*<br>type /species of tree / type of bark ;<br>height (of grid) above ground ;<br>side / aspect of tree ;<br>age / size of tree ;<br>AVP grid placed horizontally / orientated as diamond shape ; | **2** |

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)(ii)</td><td>
<table>
<tr><th colspan="2">Hazard and risk – 1 mark ;</th><th>Precaution – 1 mark ;</th></tr>
<tr><td>Trees / plants / leaves / bark / pollen</td><td>scratches / allergy / irritation<br>toxins</td><td>suitable<br>PPE / medication<br>don’t ingest</td></tr>
<tr><td>Animals /Animal waste</td><td>dangerous / allergy / bites / to xoplasmosis</td><td>medication / work in a group / travel with an expert /suitable PPE</td></tr>
<tr><td>Fungi / Lichen</td><td>irritation / allergic reaction<br>toxic / poisonous</td><td>suitable PPE<br>do not ingest</td></tr>
<tr><td>Inhaling fungal spores</td><td>(lung) infection</td><td>wear a mask</td></tr>
<tr><td>Traffic</td><td>collision / fumes / air pollution</td><td>cone off the road / hi vis vest / look +<br>listen / suitable PPE</td></tr>
<tr><td>Woods / holes /trip hazards</td><td>Injury from trips / falling / falling branches / getting lost / hypodermic needles</td><td>look where you’re stepping / hard hat / don’t climb trees / GPS / map</td></tr>
</table>
</td><td>2</td></tr>
<tr><td>2(b)</td><td>1 39 / 90 (×100) ;<br>2 43 / 43.3 (%) ;</td><td>2</td></tr>
<tr><td>2(c)(i)</td><td>D = 2 and $D^2$ = 4 ;</td><td>1</td></tr>
</table>

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| Question | Answer | Marks |
|---|---|---|
| 2(c)(ii) | 0.760 / 0.759 **; ;**<br><br>If answer is incorrect<br>allow 1 mark for evidence of correct calculation<br>238.5 / 990 or 0.241 | **2** |
| 2(c)(iii) | strong (correlation) **;**<br><br>positive (correlation) **;**<br><br>(showing that) as distance from road increases, cover / abundance of lichen increases / **ora ;** | **3** |
| 2(c)(iv) | use critical values (of $r_s$), at $p$= 0.05 or less **;**<br><br>if calculated $r_s$ is greater than critical $r_s$ value (correlation) is not due to chance<br>**or**<br>if calculated value of $r_s$ is less than the critical $r_s$ value (correlation) is due to chance **;** | **2** |

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