



# Cambridge International AS & A Level

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**BIOLOGY**

**9700/03**

Paper 3 Advanced Practical Skills

**For examination from 2022**

MARK SCHEME

Maximum Mark: 40

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**Specimen**

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This document has **8** pages. Blank pages are indicated.

**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 | <p><u>'List rule' guidance</u> (see examples below)</p> <p>For questions that require <b>n</b> responses (e.g. State <b>two</b> reasons ...):</p> <ul style="list-style-type: none"> <li>• The response should be read as continuous prose, even when numbered answer spaces are provided</li> <li>• Any response marked <i>ignore</i> in the mark scheme should not count towards <b>n</b></li> <li>• Incorrect responses should not be awarded credit but will still count towards <b>n</b></li> <li>• Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should <b>not</b> 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</li> <li>• Non-contradictory responses after the first <b>n</b> responses may be ignored even if they include incorrect science.</li> </ul> |

|   |  |
|---|--|
| 6 | <p><u>Calculation specific guidance</u></p> <p>Correct answers to calculations should be given full credit even if there is no working or incorrect working, <b>unless</b> the question states 'show your working'.</p> <p>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.</p> <p>For answers given in standard form, (e.g. <math>a \times 10^n</math>) in which the convention of restricting the value of the coefficient (<math>a</math>) 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.</p> <p>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.</p> |
| 7 | <p><u>Guidance for chemical equations</u></p> <p>Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.</p> <p>State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.</p>  |

Mark scheme abbreviations:

; separates marking points  
 / separates alternatives within a marking point  
**R** reject  
**I** ignore mark as if this material was not present  
**A** accept (a less than ideal answer which should be marked)  
**COND** indicates mark is conditional on previous marking point  
**OWTTE** or words to that effect (accept other ways of expressing the same idea)  
**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 awarded  
**ECF** credit a correct statement that follows a previous wrong answer  
**MP** marking point (with relevant number)  
**( )** the word / phrase in brackets is not required, but sets the context  
**ORA** or reverse argument

**Examples of how to apply the list rule**

State three reasons ... [3]

**A**

|            |   |          |
|------------|---|----------|
| 1. Correct | ✓ | <b>2</b> |
| 2. Correct | ✓ |          |
| 3. Wrong   | ✗ |          |

**B (4 responses)**

|                     |        |          |
|---------------------|--------|----------|
| 1. Correct, Correct | ✓, ✓   | <b>3</b> |
| 2. Correct          | ✓      |          |
| 3. Wrong            | ignore |          |

**C (4 responses)**

|                   |        |          |
|-------------------|--------|----------|
| 1. Correct        | ✓      | <b>2</b> |
| 2. Correct, Wrong | ✓, ✗   |          |
| 3. Correct        | ignore |          |

**D (4 responses)**

|                         |                 |          |
|-------------------------|-----------------|----------|
| 1. Correct              | ✓               | <b>2</b> |
| 2. Correct, CON (of 2.) | ✗, (discount 2) |          |
| 3. Correct              | ✓               |          |

**E (4 responses)**

|                   |   |          |
|-------------------|---|----------|
| 1. Correct        | ✓ | <b>3</b> |
| 2. Correct        | ✓ |          |
| 3. Correct, Wrong | ✓ |          |

**F (4 responses)**

|                           |                   |          |
|---------------------------|-------------------|----------|
| 1. Correct                | ✓                 | <b>2</b> |
| 2. Correct                | ✓                 |          |
| 3. Correct<br>CON (of 3.) | ✗<br>(discount 3) |          |

**G (5 responses)**

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

**H (4 responses)**

|                           |                   |          |
|---------------------------|-------------------|----------|
| 1. Correct                | ✓                 | <b>2</b> |
| 2. Correct                | ✗                 |          |
| 3. CON (of 2.)<br>Correct | (discount 2)<br>✓ |          |

**I (4 responses)**

|                           |                   |          |
|---------------------------|-------------------|----------|
| 1. Correct                | ✓                 | <b>2</b> |
| 2. Correct                | ✗                 |          |
| 3. Correct<br>CON (of 2.) | ✓<br>(discount 2) |          |

| Question  | Answer   | Marks |
|-----------|--|-------|
| 1(a)(i)   | any value in range from 12 cm <sup>3</sup> (minimum) to 50 cm <sup>3</sup> (maximum) ;   | 1     |
| 1(a)(ii)  | 1 0.5, 0.25, 0.125, 0.0625 (labels under correct sequence of beakers) and % / percentage once ;<br>2 shows transfer of 10 (cm <sup>3</sup> ) to each beaker from the previous beaker ;<br>3 shows 10 (cm <sup>3</sup> ) of <b>W</b> added to each beaker ;<br>max 2 if cm <sup>3</sup> omitted from mp2 and mp3  | 3     |
| 1(a)(iii) | 1 <i>heading for independent variable:</i><br>percentage concentration / % concentration, <u>and</u> before heading for dependent variable ;<br>2 <i>heading for dependent variable:</i><br>time <u>and</u> s or seconds <u>and</u> no units in body of table ;<br>3 readings for all samples ;<br>4 time for first colour change with Benedict's solution increases with decreasing concentration ;<br>5 results recorded to nearest whole second ; | 5     |
| 1(a)(iv)  | <i>any one from:</i><br>1 difficulty in judging when the first colour change occurs ;<br>2 AVP ;   | 1     |
| 1(a)(v)   | time taken for first colour change recorded <u>and</u> s or seconds <u>and</u> time greater than the result for, <b>R</b> / 1.0% ;   | 1     |
| 1(a)(vi)  | 1 correctly labels scale bar with different glucose concentrations ;<br>2 places <b>X</b> on the scale bar in the correct position ;   | 2     |
| 1(a)(vii) | <i>any three from:</i><br>1 more concentrations between the two concentrations that lie each side of the estimate ;<br>2 use white card to help judge the colour change / AW ;<br>3 use video to record the progress of the experiment and review judgement of time to the first colour change / AW ;<br>4 draw graph of knowns to read off sample ;<br>5 AVP ;  | 3     |

| Question | Answer  | Marks |
|----------|---|-------|
| 1(b)(i)  | <p>1 x-axis: temperature (°) °C<br/><u>and</u><br/>y-axis: light absorbance ;<br/>2 scale on x-axis: 10 °C to 2 cm, labelled every 2 cm and starts at 30 °C<br/><u>and</u><br/>scale on y-axis: 0.4 to 2 cm, labelled every 2 cm ;<br/>A 0.25 to 2 cm, labelled every 2 cm starting at 0.6<br/>3 correct plotting of all five points using small crosses or dots in circles ;<br/>4 five plots joined with thin line passing through all points <u>and</u> line is either smooth curve or joined plot to plot ;</p> | 4     |
| 1(b)(ii) | <p><b>any three from:</b><br/><b>accept ora</b> at 49 °C throughout at 70 °C:<br/>1 alters or changes the shape of the enzyme or active site or denatures enzyme ;<br/>2 substrate no longer fits active site / fewer or no enzyme–substrate complexes are formed / AW ;<br/>3 lower concentration of glucose produced ;<br/>4 smaller concentration gradient across dialysis tubing so lower rate of diffusion / AW ;</p>  | 3     |
| Question | Answer  | Marks |
| 2(a)(i)  | <p>1 uses most of the available space <u>and</u> no shading <u>and</u> no cells ;<br/>2 draws only the region indicated ;<br/>3 correct position of vascular bundle ;<br/>4 draws tissues in vascular bundle ;<br/>5 label line and label to vascular bundle ;</p>  | 5     |
| 2(a)(ii) | <p>1 lines continuous, thin and sharp <u>and</u> at least four enclosed areas ;<br/>2 draws only four cells <u>and</u> each cell touches at least one other ;<br/>3 correct shape and proportion of each cell ;<br/>4 two lines around each cell <u>and</u> three lines where cells touch ;<br/>5 label line and label to one cell wall ;</p>   | 5     |
| 2(b)(i)  | <p>1 division by 40 ;<br/>2 multiplication by 1000 ;<br/>3 2.5 ;</p>  | 3     |

| Question          | Answer  | Marks                            |          |    |       |               |               |         |                                   |                                  |                   |        |           |         |         |               |     |           |             |   |
|-------------------|---|----------------------------------|----------|----|-------|---------------|---------------|---------|-----------------------------------|----------------------------------|-------------------|--------|-----------|---------|---------|---------------|-----|-----------|-------------|---|
| 2(b)(ii)          | measures correctly in eyepiece graticule units ;<br>multiplies by answer from (b)(i) ;  | 2                                |          |    |       |               |               |         |                                   |                                  |                   |        |           |         |         |               |     |           |             |   |
| 2(b)(iii)         | <p>any <b>two</b> from:</p> <table border="1" data-bbox="352 1128 699 1935"> <thead> <tr> <th data-bbox="352 1697 403 1935">feature</th> <th data-bbox="352 1397 403 1697">Fig. 2.5</th> <th data-bbox="352 1128 403 1397">J1</th> </tr> </thead> <tbody> <tr> <td data-bbox="403 1697 454 1935">shape</td> <td data-bbox="403 1397 454 1697">not as folded</td> <td data-bbox="403 1128 454 1397">more folded ;</td> </tr> <tr> <td data-bbox="454 1697 544 1935">cuticle</td> <td data-bbox="454 1397 544 1697">thinner<br/>A absent / not visible</td> <td data-bbox="454 1128 544 1397">thicker<br/>A present / visible ;</td> </tr> <tr> <td data-bbox="544 1697 595 1935">trichomes / hairs</td> <td data-bbox="544 1397 595 1697">absent</td> <td data-bbox="544 1128 595 1397">present ;</td> </tr> <tr> <td data-bbox="595 1697 646 1935">stomata</td> <td data-bbox="595 1397 646 1697">few(er)</td> <td data-bbox="595 1128 646 1397">many / more ;</td> </tr> <tr> <td data-bbox="646 1697 699 1935">AVP</td> <td data-bbox="646 1397 699 1697">described</td> <td data-bbox="646 1128 699 1397">described ;</td> </tr> </tbody> </table> | feature                          | Fig. 2.5 | J1 | shape | not as folded | more folded ; | cuticle | thinner<br>A absent / not visible | thicker<br>A present / visible ; | trichomes / hairs | absent | present ; | stomata | few(er) | many / more ; | AVP | described | described ; | 2 |
| feature           | Fig. 2.5  | J1                               |          |    |       |               |               |         |                                   |                                  |                   |        |           |         |         |               |     |           |             |   |
| shape             | not as folded   | more folded ;                    |          |    |       |               |               |         |                                   |                                  |                   |        |           |         |         |               |     |           |             |   |
| cuticle           | thinner<br>A absent / not visible   | thicker<br>A present / visible ; |          |    |       |               |               |         |                                   |                                  |                   |        |           |         |         |               |     |           |             |   |
| trichomes / hairs | absent  | present ;                        |          |    |       |               |               |         |                                   |                                  |                   |        |           |         |         |               |     |           |             |   |
| stomata           | few(er)   | many / more ;                    |          |    |       |               |               |         |                                   |                                  |                   |        |           |         |         |               |     |           |             |   |
| AVP               | described   | described ;                      |          |    |       |               |               |         |                                   |                                  |                   |        |           |         |         |               |     |           |             |   |