Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/31**

Paper 3 (Advanced Practical Skills 1) **May/June 2021**

MARK SCHEME

Maximum Mark: 40

Published

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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).
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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.
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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.

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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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max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point

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Question	Answer	Marks
1(a)(i)	correct radius and mm ;	**1**
1(a)(ii)	*any **one** of:* 1 volume of hydrogen peroxide ; 2 concentration of hydrogen peroxide ; 3 temperature ; 4 same type / age / species of potato ;	**1**
1(a)(iii)	shows the surface area of one cylinder multiplied by the number of pieces ; correct total surface area ;	**2**
1(a)(iv)	1 *heading for independent variable*: number of pieces / surface area, and mm^2 / total surface area and mm^2, and before heading for dependent variable and no units in body of table ; *2 heading for dependent variable*: number of drops ; 3 results for all samples ; 4 number of drops for the smallest surface area less than for the largest surface area ; 5 total surface area recorded for the independent variable ;	**5**
1(a)(v)	total surface area ;	**1**
1(a)(vi)	*any **one** of:* 1 boiled potato ; 2 use distilled water instead of hydrogen peroxide ;	**1**
1(a)(vii)	1 identifies one error and gives reason e.g. drop size varies ; 2 describes measuring the total volume dropped as an improvement to the procedure ; 3 identifies one error and gives reason e.g. hard to cut potato pieces to equal sizes ; 4 describes the use of a more precise tool e.g. vernier caliper gauge, as an improvement to the procedure ;	**4**
1(a)(viii)	same surface area and uses 5 different temperatures ;	**1**

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Question	Answer	Marks
1(b)(i)	1 *x*-axis: percentage concentration of hydrogen peroxide and *y*-axis: distance moved in 1 minute / mm ; 2 scale on *x*-axis: 1% to 2 cm, labelled at least every 2 cm and scale on *y*-axis: 20 mm to 2 cm, labelled at least every 2 cm ; 3 correct plotting of all six points using small crosses or dots in circles ; 4 six plots joined with thin line passing through all points ;	**4**
1(b)(ii)	more successful collisions or more enzyme substrate complexes formed ; all active sites are saturated ;	**2**

Question	Answer	Marks
2(a)(i)	1 uses most of the available space and no shading ; 2 no cells drawn ; 3 correct proportions of vascular bundle ; 4 draws sunken stomata in the epidermis ; 5 label line and label to epidermis ;	**5**
2(a)(ii)	1 uses most of the available space and all lines sharp and continuous ; 2 draws only four whole cells and each cell touches at least one other cell ; 3 two lines around each cell and three lines where cells touch ; 4 draws correct shape of cells ; 5 label line and label to one cell wall ;	**5**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(b)(i)</td><td>records correct differences:
any three of, e.g.:

<table><tr><th>feature</th><th>J1</th><th>Fig. 2.2</th></tr><tr><td>number of vascular bundles</td><td>many</td><td>fewer ;</td></tr><tr><td>ring of cells around vascular bundle</td><td>present</td><td>absent</td></tr><tr><td>shape of stem</td><td>diamond</td><td>curved ;</td></tr><tr><td>trichomes</td><td>absent</td><td>present ;</td></tr></table></td><td>3</td></tr>
<tr><td>2(b)(ii)</td><td>trichomes / rolled leaf, <u>and</u> traps a layer of water vapour <u>and</u> reduces the water potential gradient ;</td><td>1</td></tr>
<tr><td>2(c)(i)</td><td>count squares that are half full and more than half full <u>and</u> full as 1 ;</td><td>1</td></tr>
<tr><td>2(c)(ii)</td><td>counts and records the area of the palisade layer ;
counts and records the total area of the leaf ;</td><td>2</td></tr>
<tr><td>2(c)(iii)</td><td>shows area of palisade layer divided by area of leaf multiplied by 100 ;</td><td>1</td></tr>
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Question	Answer	Marks
1(a)(i)	1 100, 50, 25, 12.5, 6.25 (labels under correct sequence of beakers) and, % / percentage, once **;** 2 shows transfer of 5 (cm^3) to each beaker from the previous beaker **;** 3 shows 5 (cm^3) added to each beaker **;**	**3**
1(a)(ii)	1 *heading for independent variable*: percentage concentration / %, of tea, and before heading for dependent variable and no units in body of table ; 2 *heading for dependent variable*: time and minutes and no units in body of table ; 3 readings for all samples ; 4 time for the highest concentration of tea more than for the lowest concentration of tea ; 5 results recorded in whole minutes ;	**5**
1(a)(iii)	describes correct trend in the results **;**	**1**
1(a)(iv)	1 inhibitor competes with the substrate for the active site ; *any **two** of:* 2 tea has a similar shape to starch ; 3 tea is complimentary to the active site ; 4 fewer enzyme substrate complexes formed ;	**3**
1(a)(v)	use a syringe ;	**1**
1(a)(vi)	*any **two** errors and an improvement for each error identified:* 1 starch solution not at same temperature as T and E and incubate at 40 °C ; 2 starch is added at different times and carry out each test separately ; 3 uneven mixing of solutions and mix for a stated time ;	**4**
1(b)(i)	0.56 ;	**1**

Question	Answer	Marks
1(b)(ii)	1 *x*-axis: type of drink and bars labelled appropriately and *y*-axis: concentration of caffeine / mg cm^{-3} ; 2 scale on *x*-axis: even width of all six bars and scale on *y*-axis: 0.4 mg cm^{-3} to 2 cm, labelled at least every 2 cm ; 3 correct plotting of all six bars ; 4 six separate bars drawn and with horizontal and vertical lines joined precisely ;	4
1(c)	Benedict's ;	1

Question	Answer	Marks
2(a)(i)	1 uses most of the available space size and no shading ; 2 no cells drawn ; 3 correct proportions of vascular bundle compared to the diameter of the stem ; 4 draws vascular bundles connected to each other ; 5 label line and label to epidermis ;	5
2(a)(ii)	1 uses most of the available space and all lines sharp and continuous ; 2 draws only four whole cells and each cell touches at least one other cell ; 3 two lines around each cell and three lines where cells touch ; 4 draws correct shape of cells ; 5 label line and label to one cell wall ;	5
2(b)(i)	1 records the length of the scale bar ; 2 shows conversion of the measurement of the scale bar to the same units as the actual length of the scale bar ; 3 shows division of the length of the scale bar by the actual length of the scale bar ;	3

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<tr><td>epidermis</td><td>thick</td><td>thin ;</td></tr>
</table></td><td>4</td></tr>
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Question	Answer	Marks
1(a)(i)	1 Benedict's solution and colour(s) stated, e.g. red, brown, green, yellow ; 2 equal volumes or greater volume of Benedict's solution than sample ; 3 boil or heat to a temperature of 80°C or higher ;	**3**
1(a)(ii)	iodine solution and blue-black colour ;	**1**
1(a)(iii)	1 *heading for independent variable*: sample ; *2* *heading for dependent variable*: colour **or** observation ; 3 records four (colours) for protein test, three (colours) for reducing sugar test, two (colours) for starch test ; 4 records, colours / observations, for all the tests ;	**4**
1(a)(iv)	identifies correct biological molecule for each solution ; ; ; **S1** none **S2** reducing sugar **S3** protein **S4** starch	**3**
1(a)(v)	*protein test* – violet / AW *reducing sugar test* – blue *starch test* – blue-black ;	**1**
1(a)(vi)	protein and starch ;	**1**
1(b)(i)	add ethanol and water to sample (and shake) ; *observation*: white layer of emulsion ;	**2**
1(b)(ii)	no conclusion possible as result for reducing sugar test same as for non-reducing sugar test ;	**1**
1(b)(iii)	1 mix solution **Z** with starch ; 2 leave for a (stated) time ; 3 test for starch / described ;	**3**

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2 draws whole leaf <u>and</u> no cells ;
3 correct shape of leaf ;
4 correct proportion of vascular tissue to width of leaf ;
5 label line and label to identify the palisade layer ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1 uses most of the available space <u>and</u> lines thin and continuous ;
2 draws only four cells in a line <u>and</u> each cell touching at least one other cell ;
3 two lines drawn around each cell <u>and</u> three lines where cells touch ;
4 cells with thick walls ;
5 label line and label to identify the cell wall ;</td><td>5</td></tr>
<tr><td>2(b)(i)</td><td>(L1) thick cuticle or thick epidermal cell wall ;
(Fig.2.1) trichomes or sunken stomata ;</td><td>2</td></tr>
<tr><td>2(b)(ii)</td><td>any one from:
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central in location
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in mid-rib and in a line ;
V-shaped ;</td></tr></table></td><td>1</td></tr>
<tr><td>2(c)(i)</td><td>1 x-axis: type of tree
<u>and</u>
y-axis: percentage of total trees in the forest ;
2 x-axis has bars of the same width, evenly spaced
<u>and</u>
scale on y-axis: 10 to 2 cm, labelled at least every 2 cm ;
3 correct plotting of five bars ;
4 five separate bars, with ruled horizontal lines <u>and</u> labelled correctly ;</td><td>4</td></tr>
<tr><td>2(c)(ii)</td><td>1 uses 13.5 (10.5 + 3.0) ;
2 shows division by 100 ;
3 shows multiplication by 2344 ;
4 correct answer to whole number ;</td><td>4</td></tr>
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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).
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7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

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Mark scheme abbreviations:

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max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point

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Question	Answer	Marks
1(a)(i)	1 *heading for independent variable*: pH ; 2 *heading for dependent variable*: time taken / s ; 3 records times for each pH ; 4 records expected pattern of results ; 5 records all times as whole seconds ;	**5**
1(a)(ii)	time ;	**1**
1(a)(iii)	use boiled yeast **or** replace hydrogen peroxide solution / yeast with water ;	**1**
1(a)(iv)	states the time for **U** with appropriate units ; correct estimate of pH using results in Question **1(a)(i)** ;	**2**
1(a)(v)	states one error, e.g. liquids in syringe not mixed ; states an improvement, e.g. rotates or moves the syringe to mix the contents ;	**2**
1(a)(vi)	keep pH constant ; use (at least) five concentrations of hydrogen peroxide solution ;	**2**
1(b)(i)	1 *x*-axis: temperature / °C and *y*-axis: volume of potassium manganate(VII) used / cm^3 ; 2 scale on *x*-axis: 10°C to 2 cm, labelled at least every 2 cm and scale on *y*-axis: 2 cm^3 to 2 cm, labelled at least every 2 cm 3 six points plotted accurately with a small cross or a small dot in a circle ; 4 six points connected plot to plot or joined with a smooth line through all points ;	**4**
1(b)(ii)	correct volume from the graph when the temperature was 45°C ;	**1**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(b)(iii)</td><td>any two from:

1 (at 58.5°C) more hydrogen peroxide remaining ;
2 fewer enzyme substrate complexes ;
3 enzyme becoming denatured ;</td><td>2</td></tr>
<tr><td>2(a)(i)</td><td>1 uses most of the available space <u>and</u> draws at least two layers of tissue ;
2 draws whole root <u>and</u> no cells ;
3 correct proportion of vascular tissue to diameter of root ;
4 shows vascular tissue enclosed by a layer of endodermis ;
5 shows a layer of tissue beneath epidermis ;
6 label line and label to identify the cortex ;</td><td>6</td></tr>
<tr><td>2(a)(ii)</td><td>1 uses most of the available space <u>and</u> lines thin and continuous ;
2 draws only four cells <u>and</u> each cell touching at least two other cells ;
3 two lines drawn around each cell, three lines where cells touch ;
4 walls of cells straight ;
5 label line and label to identify the cell wall ;</td><td>5</td></tr>
<tr><td>2(b)(i)</td><td>describes one similarity between M1 and Fig.2.1, e.g. both are circular in outline ;</td><td>1</td></tr>
<tr><td>2(b)(ii)</td><td>any three from:

<table>
<tr><th>feature</th><th>M1</th><th>Fig.2.1</th></tr>
<tr><td>vascular tissue position</td><td>central in location</td><td>closer to the epidermis ;</td></tr>
<tr><td>vascular tissue number</td><td>one</td><td>many ;</td></tr>
<tr><td>trichome / hairs</td><td>present</td><td>absent ;</td></tr>
<tr><td>endodermis</td><td>present</td><td>absent ;</td></tr>
</table>
</td><td>3</td></tr>
</table>

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Question	Answer	Marks
2(c)(i)	1 division of 0.8 mm by 40 **;** 2 multiplies answer in mm by 1000 (to convert to μm) **;** 3 correct answer with appropriate units **;**	**3**
2(c)(ii)	83 eyepiece graticule units **;** shows 83 multiplied by the answer from Question **2(c)(i) ;**	**2**

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Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/35**

Paper 3 (Advanced Practical Skills 1) **May/June 2021**

MARK SCHEME

Maximum Mark: 40

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 2021 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 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: 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.

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Question	Answer	Marks
1(a)(i)	medium **or** high and reason, e.g. idea of damaging skin **;**	**1**
1(a)(ii)	1 *heading for independent variable*: reducing sugar solution and *heading for dependent variable*: time / s **;** 2 records times as whole seconds; **;** 3 records **U2** as the shortest time **;**	**3**
1(a)(iii)	correctly identifies the sample with the highest concentration according to candidate's result for **U ;**	**1**
1(a)(iv)	1 1.00, 0.5, 0.25 and 0.125 (labels under correct sequence of beakers) and,% / percentage, once **;** 2 shows transfer of 10 (cm^3) from first beaker to second beaker and 1 (cm^3) from second beaker to third beaker and 1 (cm^3) from third beaker to fourth beaker **;** 3 shows 10 (cm^3) of **W** added to second, third and fourth beakers **;**	**3**
1(a)(v)	1 *heading for independent variable:* percentage concentration of reducing sugar **;** 2 *heading for dependent variable:* colour **or** observation **;** 3 records colours for five concentrations using the colours stated **;** 4 records expected pattern of results **;**	**4**
1(a)(vi)	correct estimate of reducing sugar concentration according to candidate's results **;**	**1**
1(a)(vii)	1 add hydrochloric acid **;** 2 heat **;** 3 add sodium hydrogencarbonate (then carry out Benedict's test) **;**	**3**
1(b)	1 *x*-axis: stage of ripening and the labels: glucose, fructose, unripe, ripening, ripe and *y*-axis: percentage concentration of reducing sugar **;** 2 *x*-axis: bars the same width, evenly spaced and scale on *y*-axis: 5 to 2 cm, labelled every 2 cm **;** 3 correct plotting of six bars **;** 4 grouping of bars, with ruled horizontal lines and labelled correctly **;**	**4**

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Question	Answer	Marks
2(a)(i)	1 uses most of the available space and at least two layers of tissue and no shading ; 2 draws part of plant organ and no cells ; 3 draws correct shape of plant organ ; 4 shows subdivision of the vascular tissue ; 5 label line and label to identify the xylem tissue ;	**5**
2(a)(ii)	1 uses most of the available space and lines thin and continuous ; 2 draws only four cells and each cell touching at least two other cells ; 3 two lines drawn around each cell, three lines where cells touch ; 4 correct shape of cells ; 5 label line and label to identify the cell wall ;	**5**
2(b)(i)	1 length of scale bar in μm divided by 240 μm to calculate magnification ; 2 length of the vascular bundle divided by value for magnification ; 3 answer stated to the appropriate degree of accuracy ;	**3**
2(b)(ii)	1 identifies organ as a stem ; 2 vascular bundles in a ring around the edge ; 3 central pith ;	**3**
2(b)(iii)	only observable features stated ; records the observable differences between **N1** and Fig.2.2 ; ; ; e.g. **N1** rectangular shape and the shape of Fig.2.2 is circular **N1** has bulges in the corners and Fig.2.2 has no bulges **N1** has fewer vascular bundles and Fig.2.2 has more vascular bundles	**4**

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