Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/31**

Paper 3 (Advanced Practical Skills 1) **May/June 2023**

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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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.

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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'.

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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.

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AW alternative wording (where responses vary more than usual)
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

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Question	Answer	Marks
1(a)(i)	1 heading for independent variable: pH (before heading for dependent variable) **;** 2 heading dependent variable: time for beads to rise / seconds **and** no units in body of table **;** 3 two results for each pH **;** 4 time taken for pH3 is longer than the time taken for pH7 **;** 5 results recorded in whole seconds **;**	**5**
1(a)(ii)	pH **;**	**1**
1(a)(iii)	identifies one error e.g. difficult to judge when the bead reaches the top, size of bead varies **;**	**1**
1(a)(iv)	records a time for **U** between that recorded for pH4 and pH7 **and** seconds **;**	**1**
1(a)(v)	correct estimate for **U** **;**	**1**
1(a)(vi)	*any **two** from:* 1 same pH **;** 2 5 different concentrations of hydrogen peroxide **;** 3 serial or proportional dilution **;**	**2**
1(b)(i)	*20 mmol dm^{-3} and 40 mmol dm^{-3}* 1 lactose concentration increases so more enzyme substrate complexes **;** *60 mmol dm^{-3} and 140 mmol dm^{-3}* 2 all <u>active</u> <u>sites</u> are saturated, so maximum rate of reaction is reached **;**	**2**
1(b)(ii)	1 shows V_{max} on graph **;** 2 shows ½ V_{max} on graph **;** 3 18 **;**	**3**

Question	Answer	Marks
1(c)	1 *x*-axis: type of mammal **and** bars labelled RA, SE, GO, SH and HO **and** *y*-axis: concentration of lactose / mmol dm^{-3} **;** 2 scale on *x*-axis: even width of bars **and** scale on *y*-axis: 50 mmol dm^{-3} to 2 cm **and** labelled at least every 2 cm **;** 3 correct plotting of all five bars **;** 4 five separate bars drawn and with horizontal and vertical lines joined precisely **;**	**4**

Question	Answer	Marks
2(a)(i)	1 minimum size **;** 2 correct section of the leaf drawn **and** no cells drawn **;** 3 draws correct shape of the midrib **;** 4 draws one large vascular bundle **and** large layer above it in the midrib **;** 5 label line **and** label to lower epidermis **;**	**5**
2(a)(ii)	1 minimum size **and** all lines sharp and continuous **and** no shading **;** 2 one large and three small xylem vessel elements **and** each xylem vessel element touches at least two other xylem vessel elements **;** 3 two lines around each xylem vessel element **and** three lines where xylem vessel elements touch **;** 4 correct shape of xylem vessel elements **;** 5 label line and label to the lumen of one xylem vessel element **;**	**5**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(b)(i)</td><td>only observable differences ;

any three from e.g.:

<table>
<tr><th>feature</th><th>Fig. 2.2</th><th>J1</th></tr>
<tr><td>trichomes</td><td>present</td><td>absent ;</td></tr>
<tr><td>large central cells</td><td>absent</td><td>present ;</td></tr>
<tr><td>shape</td><td>curved</td><td>straight ;</td></tr>
<tr><td>cuticle</td><td>thick</td><td>thin ;</td></tr>
</table></td><td>4</td></tr>
<tr><td>2(b)(ii)</td><td>any two from:

1 trichomes and traps water vapour inside the leaf ;
2 curled leaf and increases humidity to reduce the water potential gradient ;
3 sunken stomata and exposed to the humid atmosphere with a low water potential gradient ;
4 thick cuticle and reduces water loss by transpiration ;</td><td>2</td></tr>
<tr><td>2(c)</td><td>1 correct measurement of scale bar and structure X ;
2 shows length of scale bar divided by 430 ;
3 shows length of structure X divided by the answer to MP2 ;
4 correct answer and units ;</td><td>4</td></tr>
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Question	Answer	Marks
1(a)(i)	1 correct concentrations (4.0, 2.0, 1.0, 0.5) **and** % at least once **;** 2 shows transfer of 10 (cm^3) to each beaker from the previous beaker **;** 3 shows 10 (cm^3) of water added to each beaker **;**	**3**
1(a)(ii)	1 heading for independent variable: percentage concentration of reducing sugar (before heading for dependent variable) **and** no units in body of table **;** 2 heading for dependent variable: time **and** seconds **and** no units in body of table **;** 3 results for all concentrations **;** 4 time for the highest concentration of reducing sugar less than time for the lowest concentration of reducing sugar **;** 5 results recorded in whole seconds **;**	**5**
1(a)(iii)	difficult to judge the first colour change **;**	**1**
1(a)(iv)	2 cm^3 **;**	**1**
1(a)(v)	records a time for **G** between that recorded for 4.0% and 1.0% **and** seconds **;**	**1**
1(a)(vi)	1 scale on x-axis: 2% to 2 cm, labelled at least every 2 cm **and** scale on y-axis: according to candidate results **;** 2 points joined with a thin ruled line of best fit **;**	**2**
1(a)(vii)	1 shows interpolation of result for **G** on the graph **;** 2 correct estimate from the graph **;**	**2**
1(a)(viii)	*any **two** suggestions:* 1 more concentrations around the value for the estimate in **(a)(vii)** **;** 2 repeat and find the mean **;** 3 use a white card behind the test-tube **;**	**2**
1(b)(i)	1 x-axis: age of grapes **and** days **and** y-axis: percentage concentration of reducing sugars **;** 2 correct plotting of all six points using small crosses or dots in circles **;**	**2**

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Question	Answer	Marks
1(b)(ii)	correct age estimated from graph ;	**1**
1(c)	1 the concentration of amylase and reducing sugar increase as grapes age ; 2 amylase hydrolyses starch into reducing sugars ; 3 more amylase leads to an increase in reducing sugar ;	**3**

Question	Answer	Marks
2(a)(i)	1 minimum size ; 2 correct section of the root drawn **and** no cells drawn ; 3 draws the correct number of tissues ; 4 correct shape of the section ; 5 label line **and** label to xylem ;	**5**
2(a)(ii)	1 minimum size **and** all lines sharp and continuous **and** no shading ; 2 draws only four whole xylem vessel elements **and** each xylem vessel element touches at least two other xylem vessel elements ; 3 two lines around each xylem vessel element **and** three lines where xylem vessel elements touch ; 4 correct shape of xylem vessel elements ; 5 label line and label to one cell wall ;	**5**
2(b)(i)	three correct differences ; *any **three** from e.g.:*	**3**

feature	K1	Fig. 2.2
shape outline	wavy	circular ;
number of xylem vessels	fewer	more ;
relative size of vascular tissue	small	large ;
cortex	wider	narrower ;

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Question	Answer	Marks
2(b)(ii)	1 correct measurement of scale bar **and** line **A**–**B and** units **;** 2 measurement of line **A**–**B** multiplied by 500 **and** divided by measurement of scale bar **;** 3 correct answer **and** units **;**	**3**
2(b)(iii)	correct answer recorded to two significant figures **;**	**1**

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2 volumes of M and W add up to 10 ;</td><td>2</td></tr>
<tr><td>1(a)(ii)</td><td>1 heading for percentage concentration of milk ;
2 heading for time and seconds ;
3 records result for each concentration prepared ;
4 records at least two results for each concentration prepared ;
5 results recorded as whole seconds ;</td><td>5</td></tr>
<tr><td>1(a)(iii)</td><td>describes the trend correctly ;</td><td>1</td></tr>
<tr><td>1(a)(iv)</td><td>medium risk and copper sulfate is an irritant ;</td><td>1</td></tr>
<tr><td>1(a)(v)</td><td><table><tr><th>error</th><th>improvement</th></tr><tr><td>drops sometimes stick to the side of test-tube ;</td><td>use a wider vessel ;</td></tr><tr><td>drops of milk remain in the milk ;</td><td>use fresh copper sulfate each time ;</td></tr></table></td><td>4</td></tr>
<tr><td>1(b)(i)</td><td>1 x-axis: temperature / °C and y-axis density of milk / arbitrary units ;
2 x-axis: scale 5 to 2 cm, labelled at least every 2 cm
and
y-axis: scale 4 or 5 to 2 cm, labelled at least every 2 cm, 20 at origin ;
3 correct plotting of 6 points ;
4 6 plots joined with thin line passing through all points, line is either a smooth curve or joined point to point with a straight line ;</td><td>4</td></tr>
<tr><td>1(b)(ii)</td><td>correct answer for the density of milk at 23 °C ;</td><td>1</td></tr>
<tr><td>1(b)(iii)</td><td>1 between 10 °C and 20 °C the density of milk decreases by 2au (supports hypothesis) ;
2 between 20 °C and 30 °C the density of milk does not decrease by 2au (does not support hypothesis) ;</td><td>2</td></tr>
</table>

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)(i)</td><td>1 uses most of the available space and draws minimum number of tissues ;
2 draws the whole root and no cells ;
3 shows two lines around stele ;
4 shows subdivision of stele ;
5 label line and label to the cortex ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1 uses most of the available space and lines continuous, thin and sharp ;
2 each xylem vessel element touching at least two other vessel elements ;
3 draws one large xylem vessel element and three smaller vessel elements ;
4 two lines around each cell ;
5 label line and label to the cell wall ;</td><td>5</td></tr>
<tr><td>2(a)(iii)</td><td>thick walls or large lumen ;</td><td>1</td></tr>
<tr><td>2(b)(i)</td><td>uses only observable differences ;

any three from :

<table><tr><th>feature</th><th>L1</th><th>Fig. 2.1</th></tr><tr><td>overall shape</td><td>circular</td><td>angular ;</td></tr><tr><td>trichomes</td><td>present</td><td>absent ;</td></tr><tr><td>palisade mesophyll</td><td>absent</td><td>present ;</td></tr><tr><td>stomata</td><td>absent</td><td>present ;</td></tr></table></td><td>4</td></tr>
<tr><td>2(b)(ii)</td><td>vascular bundle in centre ;</td><td>1</td></tr>
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2 shows length of scale bar divided by 150 ;
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4 correct answer and appropriate units ;</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).
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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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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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 usual)
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

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Question	Answer	Marks
1(a)(i)	1 states the four concentrations, 2.5, 1.25, 0.625, 0.3125 **and** % **;** 2 shows transfer of 10cm^3 to each beaker from the previous beaker **;** 3 shows 10cm^3 of water added to each beaker **;**	**3**
1(a)(ii)	1 heading for percentage concentration of protein / milk **and** heading for colour **;** 2 colours in key used **;** 3 colour for the highest concentration a darker purple then the lowest concentration **;**	**3**
1(a)(iii)	states the colour for sample **U** as dark purple / purple **;**	**1**
1(a)(iv)	estimates the protein concentration in **U** according to candidate's results **;**	**1**
1(a)(v)	*source of error* 1 colour change is subjective **;** *improvement* 2 use colorimeter **;**	**2**
1(a)(vi)	1 use Benedict's solution **;** 2 heat to at least 80°C **;** 3 time to first colour change or compare the result to standard or known concentrations **;**	**3**
1(b)	1 label on x-axis: type of milk **and** label on y-axis: protein content / g per 100 cm^3 **and** the labels C, A, H, O, S **;** 2 even width of bars **and** scale on y-axis: 0.5 to 2 cm, labelled at least every 2cm **;** 3 correct plotting of 5 bars **;** 4 separate bars drawn with vertical lines and meeting horizontal lines exactly **;**	**4**
1(c)(i)	correct indication on graph **and** 5.4 **;**	**1**
1(c)(ii)	5.8 **;**	**1**
1(c)(iii)	1 more enzyme molecules so more active sites available **;** 2 more successful collisions **;** 3 more enzyme-substrate complexes form **;**	**3**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)(i)</td><td>1 uses most of the available space and draws a minimum number of vascular bundles ;
2 draws the stem becoming thinner at the end and no cells ;
3 draws the epidermis as a double line ;
4 shows subdivision of vascular bundles ;
5 label line and label to the xylem in one vascular bundle ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1 uses most of the available space and lines continuous, thin and sharp ;
2 each of the four cells touching at least two other cells ;
3 draws two lines around each cell and three lines where cells touch ;
4 correct shape of cells with straight sides ;
5 label line and label to the cell wall of one cell ;</td><td>5</td></tr>
<tr><td>2(b)</td><td>states only differences ;

any three from:

<table><tr><th>feature</th><th>N1</th><th>Fig. 2.2</th></tr><tr><td>epidermis</td><td>thinner</td><td>thicker ;</td></tr><tr><td>number of vascular bundles</td><td>more</td><td>fewer ;</td></tr><tr><td>trichomes</td><td>absent</td><td>present ;</td></tr><tr><td>shape</td><td>triangular</td><td>circular ;</td></tr></table></td><td>4</td></tr>
<tr><td>2(c)(i)</td><td>1 shows 0.5 divided by 40 ;
2 states correct answer (12.5) ;</td><td>2</td></tr>
<tr><td>2(c)(ii)</td><td>1 states correct number of eyepiece graticule units within range (41–32) ;
2 multiplies by answer from (c)(i) ;</td><td>2</td></tr>
</table>

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Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/35**

Paper 3 (Advanced Practical Skills 1) **May/June 2023**

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 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.

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ora or reverse argument
mp marking point

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Question	Answer	Marks
1(a)(i)	1 at least 3 additional concentrations ; 2 volumes of **S and W** add up to 40 ;	**2**
1(a)(ii)	1 heading for concentration of salt **and** mol dm^{-3} ; 2 headings for initial length **and** final length **and** mm ; 3 records result for each concentration prepared ; 4 records changes in length ; 5 records correct trend, lowest concentration has greatest increase ;	**5**
1(a)(iii)	1 0.0 mol dm^{-3} salt solution has higher water potential than potato cells ; 2 water moves into potato cells by osmosis ;	**2**
1(a)(iv)	measuring the change in length of a single disc more inaccurate than measuring a line of 10 discs ;	**1**
1(a)(v)	not all the discs were exactly 3 mm in thickness ;	**1**
1(a)(vi)	correct estimate of salt concentration where there was no net movement of water into or out of the potato ;	**1**
1(a)(vii)	1 using smaller intervals of salt concentrations around the value of the candidates' estimate ; 2 use a more precise method of cutting discs ;	**2**
1(b)(i)	1 labels on x-axis: food type **and** labelled P, T, B, C, S **and** label on y-axis: salt content of unprocessed food / mg per 100 g food ; 2 even width of bars and scale on y-axis: 20 to 2 cm, labelled at least every 2 cm ; 3 correct plotting of 5 bars ; 4 separate bars drawn with vertical lines and meeting horizontal lines exactly ;	**4**
1(b)(ii)	1 shows (1800 – 95) divided by 95 **and** multiplied by 100 ; 2 correct answer to two significant figures ;	**2**
1(b)(iii)	food type **or** processed and unprocessed food ;	**1**

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<tr><td>2(a)(i)</td><td>1 uses most of the available space and draws minimum number of tissues ;
2 draws only the midrib and no cells ;
3 shows a V-shaped midrib ;
4 shows a large central vascular bundle below a distinct area of cells ;
5 label line and label to the lower epidermis ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1 uses most of the available space and lines continuous, thin and sharp ;
2 each of four xylem vessel elements touching at least two other vessel elements ;
3 draws two lines around each cell and three lines where cells meet ;
4 correct shape of xylem vessel elements, angular with straight walls ;
5 label line and label to the wall of one xylem vessel element ;</td><td>5</td></tr>
<tr><td>2(b)(i)</td><td>1 states correct number of graticule units per 1 mm division (19) ;
2 shows one divided by 19 ;
3 correct answer and units ;</td><td>3</td></tr>
<tr><td>2(b)(ii)</td><td>1 states correct number of graticule units across leaf depth (38) ;
2 correct calculation and answer to two significant figures ;</td><td>2</td></tr>
<tr><td>2(b)(iii)</td><td>suggests a correct function of the large air spaces as being related to gases in the leaf or buoyancy ;</td><td>1</td></tr>
<tr><td>2(b)(iv)</td><td>any three from:
<table><tr><th>feature</th><th>M1</th><th>Fig. 2.3</th></tr><tr><td>epidermis</td><td>thick</td><td>angular ;</td></tr><tr><td>palisade mesophyll</td><td>present</td><td>no distinct palisade mesophyll ;</td></tr><tr><td>stomata</td><td>present</td><td>absent ;</td></tr><tr><td>vascular bundle</td><td>central in midrib</td><td>no central vascular bundle ;</td></tr></table></td><td>3</td></tr>
</table>

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