Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **October/November 2023**

MARK SCHEME

Maximum Mark: 40

Published

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GENERIC MARKING PRINCIPLE 3:

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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 at least five temperatures below 65 °C **;** 2 states units as °C **;**	**2**
1(a)(ii)	1 *heading for independent variable:* temperature / °C **;** 2 *heading for dependent variable:* number of bubbles **;** 3 records number of bubbles for stated temperatures in **(a)(i)** **;** 4 correct trend **;** 5 number of bubbles recorded to nearest whole number **;**	**5**
1(a)(iii)	number of bubbles **;**	**1**
1(a)(iv)	yellow / orange **;**	**1**
1(a)(v)	pH falling / becoming more acidic **;**	**1**
1(a)(vi)	*any **two** from:* 1 (error) using same indicator each time **;** (improvement) use separate indicator each time **;** 2 (error) bubble size varies **;** (improvement) measure volume of gas instead of counting bubbles **;** 3 (error) temperature of yeast not measured directly **;** (improvement) place thermometer in test-tube **;** 4 (error) difficult to identify colour of indicator **;** (improvement) use a colorimeter **;**	**2**

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Question	Answer	Marks
1(b)(i)	1 label on *x*-axis: concentration of copper ions (/) ppm and label on *y*-axis: mass of yeast (/) g **;** 2 scale on *x*-axis: 0.2 to 2 cm, labelled at least every 2 cm and scale on *y*-axis: 4 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 and line is either smooth curve or joined plot to plot **;**	**4**
1(b)(ii)	1 shows on *y*-axis reading taken at 10 g **;** 2 correct reading according to candidate's graph **;**	**2**
1(b)(iii)	1 *ref. to* changes to shape of active site **;** 2 *idea of* fewer, ESCs / yeast enzymes, unable to bind to substrate **;**	**2**
1(b)(iv)	copper will, reduce growth of yeast / reduce fermentation **;**	**1**

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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 no shading ;
2 draws correct region of stem and no cells ;
3 correct proportions of tissues ;
4 draws at least one subdivision of the vascular bundle ;
5 label line and label to the vascular bundle ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1 lines continuous, thin and sharp ;
2 draws one large xylem vessel element ;
3 two lines around each cell and three lines where cells touch ;
4 draws detailed shapes of xylem vessel elements ;
5 label line and label to cell wall ;</td><td>5</td></tr>
<tr><td>2(b)(i)</td><td>1 counts number of stomata in the photomicrograph in Fig. 2.2 ;
2 shows 2000 divided by 0.04 ;
3 correctly calculates number of stomata by multiplying number of stomata in section by 50 000 ;</td><td>3</td></tr>
<tr><td>2(b)(ii)</td><td>repeat / sample more areas ;</td><td>1</td></tr>
<tr><td>2(b)(iii)</td><td>describes only differences that are observable in the photomicrographs ;

any three from:

<table>
<tr><th>feature</th><th>Fig. 2.3.</th><th>Fig. 2.4.</th></tr>
<tr><td>location of, guard cells / stomata</td><td>sunken</td><td>on surface ;</td></tr>
<tr><td>epidermal cell walls</td><td>have thickenings</td><td>no thickenings ;</td></tr>
<tr><td>size of epidermal cells</td><td>cells all similar size</td><td>cells vary in size ;</td></tr>
<tr><td>cuticle</td><td>thick / present</td><td>thin / absent ;</td></tr>
<tr><td>AVP ;</td><td></td><td></td></tr>
</table>
</td><td>4</td></tr>
<tr><td>2(b)(iv)</td><td>dry environment / AW ;</td><td>1</td></tr>
</table>

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Question	Answer	Marks
1(a)(i)	states 80 or more <u>and</u> °C **;**	**1**
1(a)(ii)	*1 heading for independent variable:* number of beads **;** *2 heading for dependent variable:* time / seconds **;** 3 timings for five sets of beads **;** 4 correct trend **;** 5 time / seconds, recorded in whole numbers **;**	**5**
1(a)(iii)	number of beads **;**	**1**
1(a)(iv)	*any **one** from*: 1 beads are different sizes **;** 2 beads are not all left for the same time in sucrose ; 3 sodium alginate and yeast may not be mixed well **;**	**1**
1(a)(v)	boiled, yeast / enzyme **;**	**1**
1(a)(vi)	*any **two** from*: 1 use a set number of yeast beads **;** 2 prepare at least five concentrations of sucrose **;** 3 by, proportional / serial, dilution **;**	**2**
1(b)(i)	1 label on *x*-axis: temperature (/) °C <u>and</u> label on *x*-axis: volume of fruit juice (/) cm^3 **;** 2 scale on *x*-axis: 20 to 2 cm, labelled at least every 2 cm <u>and</u> scale on *y*-axis: 20 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 <u>and</u> line is either smooth curve or joined plot to plot **;**	**4**

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Question	Answer	Marks
1(b)(ii)	1 shows on *x*-axis reading taken at 55°C **;** 2 correct reading according to candidate's graph **;**	**2**
1(b)(iii)	1 from 30°C to 60°C and volume of juice increases **;** 2 after 60°C and volume of juice decreases **;**	**2**
1(b)(iv)	*any **one** from*: 1 free enzyme can more easily come into contact with apple pulp **;** 2 less apple pulp can come into contact with yeast beads **;**	**1**
1(b)(v)	1 free pectinase denatures at a lower temperature **or** yeast beads denature at a higher temperature **;** 2 yeast beads have a higher tolerance of high temperatures **;**	**2**

Question	Answer	Marks
2(a)(i)	1 uses most of the available space and no shading **;** 2 draws whole leaf and no cells **;** 3 draws minimum number of stomatal crypts **;** 4 at least one subdivision of vascular bundle **;** 5 label line and label to the epidermis **;**	**5**
2(a)(ii)	1 lines continuous, thin and sharp **;** 2 draws each cell touching at least one of the other cells **;** 3 two lines around each cell and three lines where cells touch **;** 4 draws detailed shapes of cells **;** 5 label line and label to cell wall **;**	**5**

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<tr><td>2(b)(i)</td><td>1 organises comparison into 3 columns;

any three differences from:

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<tr><th>feature</th><th>K1</th><th>Fig. 2.1</th></tr>
<tr><td>number of vascular bundles</td><td>one vascular bundle</td><td>more vascular bundles ;</td></tr>
<tr><td>size of vascular bundles</td><td>small</td><td>large ;</td></tr>
<tr><td>size of xylem vessels</td><td>smaller</td><td>larger ;</td></tr>
<tr><td>epidermal layer</td><td>thinner</td><td>thicker ;</td></tr>
<tr><td>trichomes</td><td>present</td><td>absent ;</td></tr>
</table></td><td>4</td></tr>
<tr><td>2(c)(i)</td><td>1 measures length of vascular bundle P and units ;
2 measures length of vascular bundle Q and units ;</td><td>2</td></tr>
<tr><td>2(c)(ii)</td><td>1 shows the length of Q minus the length of P divided by the length of Q multiplied by 100 ; A other suitable methods
2 records answer to two significant figures ;</td><td>2</td></tr>
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BIOLOGY **9700/34**

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Question	Answer	Marks
1(a)(i)	*all three correct:* **E**: medium **S**: low **iodine**: medium **;**	**1**
1(a)(ii)	1 (percentage concentration of amylase) 1.6, 1.2, 0.8 **;** 2 correct volumes of **E** and **W** to make 10 cm^3 **;**	**2**
1(a)(iii)	1 *heading for independent variable*: percentage concentration of amylase and before heading for dependent variable **;** *2 heading for dependent variable*: time (*/*) seconds / s and no units in body of table **;** 3 records a time for all concentrations **;** 4 time to end-point for the lowest concentration of amylase is greater than for the highest concentration of amylase **;** 5 records only times in **Fig. 1.1 ;**	**5**
1(a)(iv)	concentration of amylase **;**	**1**
1(a)(v)	records a time for **U ;**	**1**
1(a)(vi)	estimates the correct concentration of **U ;**	**1**
1(a)(vii)	*any **one** error from:* 1 sample times are too far apart **;** 2 difficult to judge the end-point **;** 3 drop size of sample varies **;**	**1**
1(a)(viii)	***one** improvement to match the error stated in (a)(vii):* 1 use closer times **;** 2 use colour standards **;** 3 use a pipette **;**	**1**
1(a)(ix)	1 use same concentration of amylase **;** 2 use five different pH **;**	**2**

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Question	Answer	Marks
1(b)(i)	1 *x*-axis: concentration of substrate / mol dm^{-3} and *y*-axis: rate of reaction / arbitrary units (au) **;** 2 scale on *x*-axis: 0.2 (mol dm^{-3}) to 2 cm and labelled at least every 2 cm and scale on *y*-axis: 0.5 (au) to 2 cm and 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)	(from graph) correct rate of reaction at 0.45 mol dm^{-3} **;**	**1**
1(b)(iii)	competitive inhibitor *any **two** from:* 1 reaches the same V_{max} **;** 2 inhibitor competes with substrate for the active site **;** 3 increasing the substrate concentration decreases the effect of the inhibitor **;**	**2**

Question	Answer	Marks
2(a)(i)	1 suitable size using most of the available space **;** 2 correct section of the leaf drawn and no cells drawn **;** 3 draws an area of tissue above the vascular bundle in the midrib **;** 4 draws a flattened, subdivided vascular bundle in the midrib **;** 5 label line and label to the palisade layer **;**	**5**
2(a)(ii)	1 suitable size and all lines sharp and continuous and no shading **;** 2 draws only four whole cells and each cell touches at least one other cell and two lines around each cell and three lines where cells touch **;** 3 draws correct shape of cells **;** 4 label line and label to one cell wall **;**	**4**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(b)</td><td>1 only observable differences <u>and</u> more than one observable difference ;
2, 3, 4 three correct differences:

any three from:

<table>
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<tr><td>trichomes</td><td>present</td><td>absent ;</td></tr>
<tr><td>shape of vascular bundle</td><td>round</td><td>crescent ;</td></tr>
<tr><td>number of vascular bundles</td><td>more</td><td>less ;</td></tr>
<tr><td>palisade tissue</td><td>thicker</td><td>thinner ;</td></tr>
<tr><td>AVP ;</td><td></td><td></td></tr>
</table>
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<tr><td>2(c)(i)</td><td>1 divides 1 by 40 ;
2 shows multiplication by 1000 or 10^3 ;
3 correct answer ;</td><td>3</td></tr>
<tr><td>2(c)(ii)</td><td>correct number of eyepiece graticule units <u>and</u> shows multiplication of eyepiece graticule units by the answer to (c)(i) ;</td><td>1</td></tr>
<tr><td>2(c)(iii)</td><td>any one from:
1 traps water vapour ;
2 reduces transpiration ;
3 idea of defence ;</td><td>1</td></tr>
</table>

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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.

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 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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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:

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Question	Answer	Marks
1(a)(i)	1 three correct concentrations (7.5, 5.0, 2.5) **;** 2 correct volumes of **S** and **W** for each concentration **; ecf**	**2**
1(a)(ii)	1 *heading for independent variable*: percentage concentration of sodium chloride and before heading for dependent variable **;** 2 *heading for dependent variable*: angle of bend and degrees and no units in body of table **;** 3 results for all concentrations **;** 4 0% has smallest angle of bend **;**	**4**
1(a)(iii)	concentration of sodium chloride **;**	**1**
1(a)(iv)	angle of bend stated for **U2** is smaller than the angle of bend for **U1 ;**	**1**
1(a)(v)	1 correct estimate for **U1** based on candidate's results **;** 2 correct estimate for **U2** based on candidate's results **;**	**2**
1(a)(vi)	1 **U1** has a lower water potential than **U2 ; ora** 2 more water moved out of the potato tissue from **U1** than **U2 ; ora** 3 by osmosis **;**	**3**
1(a)(vii)	*any **three** from:* 1 narrower range of stated concentrations either side of the estimates for **U1** and **U2 ;** 2 measure the mass of potato instead of the angle of bend **;** 3 do each test one at a time **;** 4 repeat the whole experiment and calculate the mean **;** 5 cut potato pieces to the same dimensions **;** 6 use a method to apply the same force to each potato piece **;** 7 AVP **;**	**3**

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Question	Answer	Marks
1(b)(i)	1 x-axis: type of vegetable extract and bars labelled GG, CA, CE, BR, GC and y-axis: concentration of sodium chloride / mg 100 cm^{-3} **;** 2 scale on x-axis: bars drawn with even width and scale on y-axis: 20 (mg) to 2 cm, labelled at least every 2 cm **;** 3 correct plotting of all five bars **;** 4 five separate bars and with horizontal and vertical lines joined precisely **;**	**4**
1(b)(ii)	celery **;**	**1**

Question	Answer	Marks
2(a)(i)	1 suitable size using most of the available space **;** 2 correct section and no cells drawn **;** 3 draws the epidermis with a wavy outline **;** 4 draws at least one subdivided vascular bundle **;** 5 label line and label to epidermis **;**	**5**
2(a)(ii)	1 suitable size and all lines sharp and continuous and no shading **;** 2 draws one large xylem vessel element **;** 3 draws two lines around each xylem vessel element and three lines where xylem vessel elements touch **;** 4 draws only four whole xylem vessel elements and correct shape of xylem vessel elements **;** 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)</td><td>1 only observable differences ;
2, 3, 4 three correct differences:

any three from.:

<table>
<tr><th>feature</th><th>Fig. 2.2.</th><th>M1</th></tr>
<tr><td>number of vascular bundles</td><td>more</td><td>less ;</td></tr>
<tr><td>trichomes</td><td>absent</td><td>present ;</td></tr>
<tr><td>shape of stem</td><td>round</td><td>wavy ;</td></tr>
<tr><td>number of tissue layers</td><td>less</td><td>more ;</td></tr>
<tr><td>AVP ;</td><td></td><td></td></tr>
</table>
</td><td>4</td></tr>
<tr><td>2(c)(i)</td><td>1 correct measurement of the diameter of the whole stem <u>and</u> units ;
2 correct measurement of the central region (X–Y) <u>and</u> units ;</td><td>2</td></tr>
<tr><td>2(c)(ii)</td><td>1 shows the diameter of the stem divided by 2 <u>and</u> the diameter of the central region divided by 2 ;
2 correct answers <u>and</u> units ;</td><td>2</td></tr>
<tr><td>2(c)(iii)</td><td>shows the ratio of the area of the whole stem to the area of the central region ;</td><td>1</td></tr>
</table>

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Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/36**

Paper 3 Advanced Practical Skills 2 **October/November 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 October/November 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

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1(a)(i)	1 states five concentrations: 1.0, 0.5, 0.25, 0.125 mol dm^{-3} **;** 2 states four transfers of 5 cm^3 to each beaker from the previous beaker **;** 3 shows four additions of 5 cm^3 water to each beaker **;**	**3**
1(a)(ii)	draws four circles with one in each quadrant and labels each with the concentration of acid **;**	**1**
1(a)(iii)	1 *heading for independent variable*: concentration of hydrochloric acid / mol dm^{-3} **;** 2 *heading for dependent variables*: distance / mm **;** 3 records a distance for stated concentrations in **(a)(i)** and for both Petri dishes **;** 4 correct trend **;** 5 records distance in whole millimetres **;**	**5**
1(a)(iv)	1 shows distance for 2 mol dm^{-3} divided by 20 **;** 2 correct answer and appropriate units **;**	**2**
1(a)(v)	1 use one concentration of hydrochloric acid **;** 2 for five time intervals **;** 3 calculate the rate of diffusion of the acid for each time interval **;**	**3**
1(b)(i)	1 label on *x*-axis: percentage concentration of alanine and label on *y*-axis: rate of absorption (/) μm h^{-1} **;** 3 scale on *x*-axis: 20 to 2 cm, labelled at least every 2 cm and scale on *y*-axis: 500 to 2 cm, labelled at least every 2 cm **;** 3 correct plotting of all five points using small crosses or dots in circles **;** 4 five plots joined with thin line passing through all points and line is either a smooth curve or joined plot to plot **;**	**4**
1(b)(ii)	1 states that the higher the concentration of alanine the higher the rate of absorption **;** 2 correct reference to transport proteins **;** 3 transport proteins saturated at 50 to 70 per cent concentration of alanine **;**	**3**

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<tr><td>2(a)(i)</td><td>1 uses most of the available space <u>and</u> no shading ;
2 draws correct region of stem <u>and</u> no cells ;
3 correct proportions of tissues ;
4 correct shape of the vascular bundle ;
5 label line and label to the epidermis ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1 lines continuous, thin and sharp ;
2 draws a line of four xylem vessel elements <u>and</u> each touches at least on other vessel element ;
3 two lines drawn around each cell <u>and</u> three lines where cells touch ;
4 detailed shapes of xylem vessel elements ;
5 label line and label to lumen ;</td><td>5</td></tr>
<tr><td>2(b)(i)</td><td>1 states only observable structures that are similar ;
2, 3 and 4 three correct similarities:

any three from:

<table><tr><th>similar structure</th><th>how the structures are similar</th></tr><tr><td>shape of stem</td><td>both stems are square ;</td></tr><tr><td>size of vascular bundles</td><td>both have vascular bundles that are large and small ;</td></tr><tr><td>number of vascular bundles</td><td>4 or 8 vascular bundles in total ;</td></tr><tr><td>position of vascular bundles</td><td>one vascular bundle in each corner ;</td></tr></table></td><td>4</td></tr>
<tr><td>2(c)(i)</td><td>1 records width of whole section P–Q ;
2 records width of middle layer ;
3 shows measurement of middle layer divided by the length P–Q and multiplication by 100 ;
4 correct answer to two significant figures ;</td><td>4</td></tr>
<tr><td>2(c)(ii)</td><td>take measurements at different positions around the stem, add them together and divide by number of measurements ;</td><td>1</td></tr>
</table>

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