Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **October/November 2022**

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).
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

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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.
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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AW	alternative wording (where responses vary more than usual)
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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 volume of water stated between 15 and 30 cm^3 **;**	**1**
1(a)(ii)	1 shows three other concentrations of ascorbic acid **and** in descending order **;** 2 correct volumes of ascorbic acid and water to make 20 cm^3 **and** correct concentration **;**	**2**
1(a)(iii)	1 heading for independent variable: concentration of ascorbic acid **and** g dm^{-3} **;** 2 heading dependent variable: volume **and** iodine **and** cm^3 **;** 3 results for all concentrations **;** 4 greatest volume of iodine for highest concentration of ascorbic acid **;** 5 records results to appropriate accuracy **;**	**5**
1(a)(iv)	1 volume of iodine added <u>and</u> cm^3 **;**	**1**
1(a)(v)	1 correct estimation of concentration of ascorbic acid **;**	**1**
1(a)(vi)	1 shows division by, time / 15 (minutes) **;** 2 (correct) answer <u>and</u> units g dm^{-3} min^{-1} **;**	**2**
1(a)(vii)	*any **two** from:* 1 difficult to read scale on syringe **;** 2 lack of suitable precision / *ref. to* volume of drop being too large **;** 3 difficult to judge end-point / imprecise end-point (because whole drops are added each time) **;** 4 imprecise start time (depending on when dialysis tubing added to distilled water) **;** 5 rate of diffusion changes with time (highest at start and decreases as concentration gradient decreases) **;** 6 volume of water added to outside of dialysis tubing not precisely determined so experiment could not be reliably repeated **;**	**2**
1(a)(viii)	*any **two** from:* 1 repeat **and** find mean **;** 2 use of, burette / syringe, with narrow divisions **;** 3 colorimeter / colour chart / colour standard, for end-point **;** 4 use white card behind tube **;** 5 find mass of iodine added **;**	**2**

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Question	Answer	Marks
1(b)(i)	1 *x*-axis: time / hours **and** *y*-axis: water content / g of water for each g of melon **;** 2 scale on *x*-axis: 2 hour to 2 cm, labelled every 2 cm **and** scale on *y*-axis: 0.2 g to 2 cm, labelled every 2 cm **;** 3 correct plotting of six points using small crosses or dots in circles **;** 4 at least five plots joined with a thin line passing through all points **;**	**4**
1(b)(ii)	1 no net movement of water in or out of fruit **;** 2 *ref. to* equal, water / solute, potential / AW **;**	**2**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)(i)</td><td>1 minimum size and number of tissue layers ;
2 draws the correct region of the stem and no cells ;
3 vascular bundle subdivided ;
4 correct size of vascular bundle relative to other layers of tissue;
5 label line and label to epidermis ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1 minimum size and lines continuous, thin and sharp and no shading ;
2 draws only four whole vessel elements and each touches at least one other ;
3 two lines around each vessel element and three lines where vessel elements touch ;
4 vessel elements angular ;
5 label line and label to one vessel element wall ;</td><td>5</td></tr>
<tr><td>2(b)(i)</td><td>1 correct measurement of scale bar and length of trichome (X –Y) ;
2 correct calculation e.g. shows length of scale bar divided by 100 and divided by 0.16 ;
3 correct answer and units ;</td><td>3</td></tr>
<tr><td>2(b)(ii)</td><td>label line to one stoma ;</td><td>1</td></tr>
<tr><td>2(b)(iii)</td><td>1 table with headings for Fig. 2.2 and Fig. 2.3 and table organised to show a similarity and differences ;
2 two correct differences ;;
any two from:
<table>
<tr><th>feature</th><th>Fig. 2.2</th><th>Fig. 2.3</th></tr>
<tr><td>segments</td><td>fewer</td><td>more ;</td></tr>
<tr><td>structure at tip of trichome</td><td>more / larger</td><td>fewer / smaller ;</td></tr>
<tr><td>base of trichome</td><td>present</td><td>absent ;</td></tr>
<tr><td>width</td><td>thin</td><td>thick ;</td></tr>
</table>
3 similarity: e.g. wider at base than at tip ;</td><td>4</td></tr>
</table>

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Question	Answer	Marks
1(a)(i)	1 states 35, 40, 45 **;**	**1**
1(a)(ii)	1 contents of the test-tubes reaching the temperature of the water in the water-bath **;**	**1**
1(a)(iii)	1 heading for independent variable: temperature / °C **and** before heading for dependent variable **and** no units in body of table and heading for dependent variable: time / seconds **;** 2 records times for all temperatures **;** 3 for the highest temperature the fastest time **;** 4 records repeats **;** 5 records to the nearest whole second **;**	**5**
1(a)(iv)	1 states independent variable as temperature **;**	**1**
1(a)(v)	1 uses boiled and cooled enzyme or replaces enzyme with water **;**	**1**
1(a)(vi)	1 standardise temperature by using a stated temperature **;** 2 uses at least five concentrations of milk **;** 3 uses proportional or serial dilution (as appropriate) **;**	**3**
1(b)(i)	1 1. *x*-axis: % enzyme concentration **and** *y*-axis: activity of enzyme (/) au **;** 2 scale on *x*-axis: 0.05 to 2 cm, labelled at least every 2 cm **and** scale on *y*-axis: 20 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 smooth curve or joined plot to plot **;**	**4**
1(b)(ii)	1 correct estimate based on candidate's graph **;** 2 shows intercepts on the graph **;**	**2**
1(b)(iii)	1 as enzyme concentration increases the enzyme activity increases **;**	**1**
1(b)(iv)	1 more enzyme present, more active sites **;** 2 more enzyme substrate complexes form / more ESCs **;**	**2**

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<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)(i)</td><td>1 minimum size and number of tissue layers ;
2 draws a quarter of the stem and no cells ;
3 draws minimum number of vascular bundles ;
4 vascular bundle subdivided ;
5 label line and label to xylem ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1 lines continuous, thin and sharp and no shading ;
2 draws only four cells each one touching two others ;
3 two lines around each cell and three lines where cells touch ;
4 both cells beneath the epidermis deeper than the cells in the epidermis ;
5 label line and label to cell wall ;</td><td>5</td></tr>
<tr><td>2(b)</td><td>1 organises comparison into 2 / 3 columns ;
2 three correct differences ;;;
any three from:
<table>
<tr><th>feature</th><th>K1</th><th>Fig. 2.2</th></tr>
<tr><td>number of vascular bundles</td><td>fewer</td><td>more ;</td></tr>
<tr><td>location of vascular bundles</td><td>in a ring towards periphery</td><td>scattered ;</td></tr>
<tr><td>arrangement of xylem / phloem</td><td>inner xylem / outer phloem</td><td>random ;</td></tr>
<tr><td>pith</td><td>present</td><td>absent ;</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 shows counting on photomicrograph ;
2 correct number of vascular bundles counted ;
3 shows number of vascular bundles in quarter multiplied by 4 ;
4 correct answer ;</td><td>4</td></tr>
<tr><td>2(c)(ii)</td><td>1 helps to transport water etc. or helps support stem ;</td><td>`1</td></tr>
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BIOLOGY **9700/34**

Paper 3 Advanced Practical Skills 2 **October/November 2022**

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Question	Answer	Marks
1(a)(i)	1 correct concentrations (0.05, 0.025, 0.0125, 0.00625) **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 ascorbic acid concentration (before heading for dependent variable) **and** no units in body of table **;** 2 heading for dependent variable: volume of iodine / cm^3 **and** no units in body of table **;** 3 results for all concentrations **and** to at least one decimal place **;** 4 volume of iodine recorded for the highest concentration of ascorbic acid greater than for the lowest concentration of ascorbic acid **;**	**4**
1(a)(iii)	*any **one** error:* 1 difficult to judge the end-point **;** 2 difficult to read the syringe as the iodine solution is too dark **;**	**1**
1(a)(iv)	1 records a volume for **U** and **C and U** is greater than **C ;**	**1**
1(a)(v)	1 correctly labels scale bar with different concentrations of ascorbic acid **;**	**1**
1(a)(vi)	1 estimates the correct concentrations of **U** and **C** by placing **U** and **C** in the correct positions on the scale bar **;**	**1**
1(a)(vii)	*any **one** improvement:* 1 narrower range of concentrations **;** 2 repeat and calculate a mean **;** 3 use a micropipette **;**	**1**
1(a)(viii)	*any **one** from:* 1 heating breaks down ascorbic acid **;** 2 heating has no effect on ascorbic acid **;**	**1**
1(a)(ix)	*any **three** from:* 1 same concentration **;** 2 same temperature **;** 3 thermostatically controlled water-bath **;** 4 5 different times **;** 5 times evenly spaced **;**	**3**

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Question	Answer	Marks
1(b)(i)	1 *x*-axis: ascorbic acid concentration / mM **and** *y*-axis: mass of *B. subtilis* / mg **;** 2 scale on *x*-axis: 10 mM to 2 cm **and** labelled at least every 2 cm **and** scale on *y*-axis: 2.0 mg to 2 cm **and** 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 **;**	**4**
1(b)(ii)	1 correct figures for 10mM **and** 35 mM from graph **;** 2 shows the difference divided by the figure for 10mM and multiplied by 100 **;**	**2**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)(i)</td><td>1 minimum size ;
2 correct section of the root drawn and no cells drawn ;
3 draws two lines for the epidermis or the endodermis ;
4 correct position of endodermis ;
5 label line and label to endodermis ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1 minimum size and all lines continuous, thin and sharp and no shading ;
2 draws only four whole cells and each cell touches at least two other cells ;
3 two lines around each cell and three lines where cells touch ;
4 correct shape of cells ;
5 label line and label to one cell wall ;</td><td>5</td></tr>
<tr><td>2(b)(i)</td><td>1 correct measurement of X–Y ;
2 shows division by 22 ;
3 appropriate units ;</td><td>3</td></tr>
<tr><td>2(b)(ii)</td><td>1 xylem and reason ;</td><td>1</td></tr>
<tr><td>2(b)(iii)</td><td>1 only observable differences ;
2 three correct differences ;;;
any three e.g.:
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<tr><th>feature</th><th>L1</th><th>Fig. 2.2</th></tr>
<tr><td>vascular bundle distribution</td><td>centre</td><td>scattered ;</td></tr>
<tr><td>root hairs</td><td>present</td><td>absent ;</td></tr>
<tr><td>endodermis</td><td>present</td><td>absent ;</td></tr>
<tr><td>number of vascular bundles</td><td>one</td><td>many ;</td></tr>
</table></td><td>4</td></tr>
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Question	Answer	Marks
1(a)(i)	1 correct concentrations (3.0, 1.5, 0.75, 0.375) **and** % at least once **;** 2 shows transfer of 10 (cm^3) to each beaker from the previous beaker **;** 3 shows 10 (cm^3) added to each beaker **;**	**3**
1(a)(ii)	1 heading for independent variable: percentage concentration of hydrogen peroxide (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 hydrogen peroxide less than for the lowest concentration of hydrogen peroxide **;** 5 results recorded in whole seconds **;**	**5**
1(a)(iii)	1 identifies one error e.g. difficult to judge when the bead reaches the top, size of bead varies, only one bead was used for each concentration **;**	**1**
1(a)(iv)	*improvement to the error identified in (a)(iii):* 1 draw a line on the test-tube to show the surface more clearly / use a black card **;** 2 measure the size of each bead and use the same size beads **;** 3 repeat and calculate the mean **;**	**1**
1(a)(v)	1 records a time for **U** between that recorded for 3.0% and 0.75% **and** seconds **;**	**1**
1(a)(vi)	1 correct estimate for **U ;**	**1**
1(a)(vii)	*any **two** from:* 1 same concentration of hydrogen peroxide **;** 2 5 different temperatures **;** 3 thermostatically controlled water-bath **;**	**2**
1(b)(i)	1 *x*-axis: bead diameter / mm **and** *y*-axis: percentage concentration of lactose after 5 minutes **;** 2 scale on *x*-axis: 2 mm to 2 cm, labelled at least every 2 cm **and** scale on *y*-axis: 10% 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 **;**	**4**

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Question	Answer	Marks
1(b)(ii)	1 correct concentration based on candidate's graph **;**	**1**
1(b)(iii)	1 larger beads have a smaller total surface area **;** ORA *plus any **two** explanations (ORA):* 2 less enzymes in contact with lactose **;** 3 less <u>active</u> <u>sites</u> for the substrate to bind to **;** 4 fewer enzyme substrate complexes / ESCs **;** 5 decreased rate of lactose hydrolysis **;**	**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 minimum size ;
2 draws correct section of the stem drawn and no cells drawn ;
3 draws three whole vascular bundles ;
4 draws vascular bundles with three layers ;
5 label line and label to xylem ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1 minimum size and all lines continuous, thin and sharp and no shading ;
2 draws only four whole cells and each cell touches at least two other cells ;
3 two lines around each cell and three lines where cells touch ;
4 correct shape of cells ;
5 label line and label to one cell wall ;</td><td>5</td></tr>
<tr><td>2(b)</td><td>1 only observable differences ;
2 three correct differences ;;;
any three from e.g.:
<table>
<tr><th>feature</th><th>Fig. 2.2</th><th>M1</th></tr>
<tr><td>vascular bundles</td><td>joined</td><td>separate ;</td></tr>
<tr><td>shape of stem</td><td>square</td><td>jagged ;</td></tr>
<tr><td>trichomes</td><td>present</td><td>absent ;</td></tr>
<tr><td>central region</td><td>hollow</td><td>filled with cells ;</td></tr>
</table></td><td>4</td></tr>
<tr><td>2(c)</td><td>1 correct measurement of scale bar and X–Y and units ;
2 shows length of scale bar divided by 253.5 ;
3 shows length of line X–Y divided by answer to MP2 ;
4 correct answer and units ;</td><td>4</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 2022**

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 2022 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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[Turn over

PUBLISHED

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max	indicates the maximum number of marks that can be given
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Question	Answer	Marks
1(a)(i)	1 volume recorded between 5 and 20 (cm^3) **;**	**1**
1(a)(ii)	1 heading for independent variable: time and minutes **and** no units in body of table **;** 2 heading for dependent variable: colour **;** 3 colour for each minute for 10 minutes or until end-point reached for two consecutive times **;** 4 uses only colours from Fig. 1.1 **;**	**4**
1(a)(iii)	*any **three** from:* 1 use a colour chart **;** 2 use a colorimeter **;** 3 use smaller intervals of time e.g. 30 s **;** 4 use a pH meter **;** 5 use a carbon dioxide probe **;** 6 repeat and find mean **;** 7 use set volume of B or W instead of using drops **;**	**3**
1(a)(iv)	*any **three** from:* 1 starch takes longer to break down **;** 2 less enzymes to break down starch to produce carbon dioxide **;** 3 fewer active sites **;** 4 so less successful collisions **;** 5 fewer enzyme-substrate complexes / ESCs **;**	**3**
1(b)(i)	1 states independent variable as temperature **;**	**1**
1(b)(ii)	1 *x*-axis: time / minutes **and** *y*-axis: rate of production of CO_2 / au **;** 2 scale on *x*-axis: 10 minutes to 2 cm, labelled every 2 cm **and** scale on *y*-axis: 1 au to 2 cm, labelled every 2 cm **;** 3 correct plotting of all six points using small crosses or dots in circles **;** 4 plots joined with a thin line passing through all points **;**	**4**

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Question	Answer	Marks
1(b)(iii)	1 the rate of carbon dioxide production increases as time increases **;** 2 sharp increase of rate of carbon dioxide production between stated times **;** 3 comparison of two data points (time and rate of carbon dioxide production) **;**	**3**
1(b)(iv)	1 correct value from candidate's graph **;**	**1**

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<tr><td>2(a)(i)</td><td>1 minimum size and number of tissue layers ;
2 draws the correct region of the stem and no cells ;
3 correct proportion of stele compared to the diameter of the root ;
4 draws shape of xylem ;
5 label line and label to phloem ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1 minimum size and lines continuous, thin and sharp and no shading ;
2 draws only four whole cells and each touches at least two others ;
3 two lines around each cell and three lines where cells touch ;
4 cells angular ;
5 label line and label to air space ;</td><td>5</td></tr>
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2 any three differences as annotations from: ;;;
<table>
<tr><th>feature</th><th>Fig. 2.1</th><th>N1</th></tr>
<tr><td>cortex</td><td>smaller</td><td>larger ;</td></tr>
<tr><td>cortex</td><td>cells more compact</td><td>cells less compact ;</td></tr>
<tr><td>xylem vessels</td><td>more spread out from centre</td><td>small area in centre ;</td></tr>
<tr><td>xylem vessels</td><td>scattered</td><td>cross-shape ;</td></tr>
<tr><td>xylem vessels</td><td>more</td><td>less ;</td></tr>
<tr><td>endodermis</td><td>not visible</td><td>visible ;</td></tr>
</table></td><td>4</td></tr>
<tr><td>2(c)(i)</td><td>1 uses at least 2 measurements of the diameter ;
2 uses at least three measurements of the diameter ;
3 (adds measurements <u>and</u> divides by number of measurements) <u>and</u> shows division by 13 ;</td><td>3</td></tr>
<tr><td>2(c)(ii)</td><td>1 shows answer from (c)(i) divided by 2 and squared ;
2 shows multiplication by 3.14 ;
3 whole number <u>and</u> mm^2 ;</td><td>3</td></tr>
</table>

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