Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **October/November 2021**

MARK SCHEME

Maximum Mark: 40

Published

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Generic Marking Principles

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- 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**:

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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).
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Science-Specific Marking Principles

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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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Mark scheme abbreviations

;	separates marking points
/	alternative answers for the same point
R	reject
A	accept (for answers correctly cued by the question, or by extra guidance)
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 given
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore

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Question	Answer	Marks
1(a)(i)	1 correct concentrations (0.5, 0.25, 0.125, 0.0625) and % **;** 2 shows transfer of 10 cm^3 to each beaker from the previous beaker **;** 3 shows addition of 10 cm^3 water to each beaker **;**	**3**
1(a)(ii)	1 *heading for independent variable*: percentage protein concentration **;** 2 *heading for dependent variable*: symbol **;** 3 records readings for all concentrations **;** 4 records results as symbols **;**	**4**
1(a)(iii)	concentration of protein **;**	**1**
1(a)(iv)	records result for **U** using symbols **;**	**1**
1(a)(v)	correct positions of protein concentrations on Fig. 1.2 **;**	**1**
1(a)(vi)	correct position of arrow for **U** on Fig. 1.2, according to the symbols in **(a)(iv)** **;**	**1**
1(a)(vii)	states medical condition matching the estimate of **U** on Fig. 1.2 **;**	**1**
1(a)(viii)	repeat the test for **U** at least 3 times **;**	**1**
1(a)(ix)	1 use at least three known concentrations of glucose **;** 2 carry out Benedict's test on these concentrations **;** 3 carry out Benedict's test on the sample and compares the result for the sample with the known concentrations of glucose **;**	**3**

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Question	Answer	Marks
1(b)(i)	1 *x*-axis: antibiotic and the labels for ciprofloxacin (C), co-trimoxazole (T), imipenem (I), nitrofurantoin (N), ampicillin (A) and amoxicillin (M) and *y*-axis: percentage of resistant bacteria ; 2 *x*-axis: even width of bars and scale on *y*-axis: 10% to 2 cm, labelled at least every 2 cm ; 3 correct plotting of six bars ; 4 vertical and horizontal lines drawn with a ruler and joining up precisely ;	**4**
1(b)(ii)	1 ampicillin has been used for longer time ; 2 more time for random mutations for antibiotic resistance (selection of resistant bacteria) ; 3 *idea that* imipenem is relatively new and not used very often ;	**3**

Question	Answer	Marks
2(a)(i)	1 minimum size and no shading ; 2 no cells and has drawn correct region ; 3 shows details of layer above vascular bundle ; 4 draws subdivision of vascular bundle ; 5 label line and label to cuticle ;	**5**
2(a)(ii)	1 minimum size and all lines continuous and thin ; 2 draws only four cells and each cell touches at least one other cell ; 3 two lines drawn around each cell and three lines where cells touch ; 4 draws correct shape of cells ; 5 label line and label to 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>three correct differences e.g.

<table><tr><th>feature</th><th>Fig. 2.3</th><th>Fig. 2.4</th></tr><tr><td>size of cells beneath vascular bundle</td><td>large cells</td><td>small cells ;</td></tr><tr><td>shape of upper epidermis</td><td>no ridges or mounds</td><td>ridges and mounds present ;</td></tr><tr><td>epidermis</td><td>thick epidermis made up of large cells</td><td>thin epidermis made up of small cells ;</td></tr></table></td><td>3</td></tr>
<tr><td>2(c)</td><td>1 states 82 eyepiece graticule divisions across width of the midrib ;
2 shows number of eyepiece graticule divisions multiplied by 13.7 μm ;
3 correct appropriate units (μm or mm) ;
4 correct answer ;</td><td>4</td></tr>
</table>

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Question	Answer	Marks
1(a)(i)	1 correct concentrations (1.0, 0.5, 0.25, 0.125) and % ; 2 shows transfer of 10 cm^3 to each beaker from the previous beaker ; 3 shows addition of 10 cm^3 of water to each beaker ;	**3**
1(a)(ii)	1 *heading for independent variable*: percentage concentration enzyme ; 2 *heading for dependent variable*: intensity of colour ; 3 records readings for all enzyme concentrations ; 4 correct trend ; 5 records results as symbols ;	**5**
1(a)(iii)	concentration of enzyme that matches results in **(a)(ii)** which removed the colour most effectively ;	**1**
1(a)(iv)	more enzyme substrate complexes form at high concentration of enzyme ;	**1**
1(a)(v)	pH ;	**1**
1(a)(vi)	*source of error* *any **two** from:* 1 temperature difficult to control ; 2 enzyme not equilibrated ; 3 colour difficult to judge ; 4 mixing of solutions different for each concentration ; *improvements* *any **three** from:* 1 carry out tests individually ; 2 use thermostatically controlled water-bath ; 3 equilibrate the enzyme ; 4 use colorimeter ; 5 shake for a set time ;	**5**

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Question	Answer	Marks
1(b)(i)	1 *x*-axis: type of sugar and *y*-axis: sugar content / g per 100 g of grapes and the labels for glucose, fructose, sucrose, fresh and dried **;** 2 *x*-axis: even width of bars and scale on *y*-axis: 5 to 2 cm, labelled at least every 2 cm **;** 3 correct plotting of six bars **;** 4 vertical and horizontal lines drawn with a ruler and joining up precisely **;**	**4**
1(b)(ii)	shows subtraction of 6.5 from 27, shows division by 6.5 and shows multiplication by 100 **;** correct answer **;**	**2**
1(b)(iii)	dried grapes have less water **;**	**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 minimum size <u>and</u> no shading ;
2 no cells and draws a quarter of the stem ;
3 shows details of outer layer ;
4 draws at least 5 layers of tissue ;
5 label line <u>and</u> label to epidermis ;</td><td>5</td></tr>
<tr><td>2(a)(ii)</td><td>1 minimum size <u>and</u> all lines continuous and thin ;
2 draws only four cells <u>and</u> each cell touches the large xylem vessel and at least one of the other cells ;
3 two lines drawn around each cell <u>and</u> three lines where cells touch ;
4 draws correct shape of cells ;
5 label line <u>and</u> label to one cell wall ;</td><td>5</td></tr>
<tr><td>2(b)</td><td>features only observable differences ;
three correct differences e.g.
<table>
<tr><th>feature</th><th>Fig. 2.3</th><th>Fig. 2.4</th></tr>
<tr><td>epidermis</td><td>not intact</td><td>intact ;</td></tr>
<tr><td>location of vascular tissue</td><td>nearer the epidermis</td><td>central ;</td></tr>
<tr><td>central tissue</td><td>parenchyma cells present
not vascular tissue</td><td>vascular tissue present ;</td></tr>
</table></td><td>4</td></tr>
<tr><td>2(c)</td><td>1 states 78 eyepiece graticule divisions across actual diameter of section ;
2 shows number of eyepiece graticule divisions multiplied by 67 ;
3 correct answer and units (μm or mm) ;</td><td>3</td></tr>
</table>

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BIOLOGY **9700/34**

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Question	Answer	Marks
1(a)(i)	1 correct concentrations (1.0, 0.1, 0.01, 0.001) and % ; 2 shows transfer of 1 cm^3 to each beaker from the previous beaker ; 3 shows addition of 9 cm^3 water 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 to first colour change and seconds and no units in body of table ; 3 results for all samples ; 4 time for the highest concentration of reducing sugar less than for the lowest concentration of reducing sugar ; 5 results recorded in whole numbers ;	**5**
1(a)(iii)	time for **P2** is longer than time for **Q2** ; shows units at least once ;	**2**
1(a)(iv)	correct estimate for **P2** based on candidate's results ; correct estimate for **Q2** based on candidate's results ;	**2**
1(a)(v)	**Q2** has more kinetic energy so faster diffusion ;	**1**
1(a)(vi)	time taken to first colour change ;	**1**
1(a)(vii)	*any **one** error and matching improvement* *error:* difficult to judge the first colour change ; *improvement:* use a colour chart ; **or** *error:* unequal mixing ; *improvement:* mix for a set time ;	**2**
1(a)(viii)	*any **two** from:* 1 more concentrations ; 2 (concentrations) between a stated range specific to estimates ; 3 plot a graph and read off values for **P2** and **Q2** ;	**2**

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Question	Answer	Marks
1(b)(i)	1 *x-axis*: concentration of hydrochloric acid / mol dm^{-3} and *y-axis*: distance acid diffused in 2 minutes / mm ; 2 *scale on x-axis*: 0.2 mol dm^{-3} to 2 cm, labelled at least every 2 cm and *scale on y-axis*: 2 mm to 2 cm, labelled at least every 2 cm ; 3 correct plotting of five points using small crosses or dots in circles ; 4 (five) plots joined with thin line passing through all points ;	**4**

Question	Answer	Marks
2(a)(i)	1 minimum size and no shading ; 2 no cells drawn ; 3 correct position of vascular tissue ; 4 label line and label to layer containing xylem ;	**4**
2(a)(ii)	1 stem ; 2 vascular tissue not in the centre ;	**2**
2(a)(iii)	1 minimum size and all lines sharp and continuous ; 2 draws only four whole cells and two lines around each cell and three lines where cells touch ; 3 draws correct shapes of cells ; 4 label line and label to one cell wall ;	**4**

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<tr><td>vascular tissue</td><td>joined</td><td>separate ;</td></tr>
<tr><td>shape of stem</td><td>wavy</td><td>round ;</td></tr>
<tr><td>vascular cap</td><td>present</td><td>absent ;</td></tr>
<tr><td>epidermis</td><td>thicker</td><td>thinner ;</td></tr>
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<tr><td>2(c)(i)</td><td>count squares that are half full <u>and</u> 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 vascular bundle A ;
counts and records the total area of the section ;</td><td>2</td></tr>
<tr><td>2(c)(iii)</td><td>shows area of vascular bundle A divided by vascular bundle B ;
shows multiplication by 100 ;</td><td>2</td></tr>
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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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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.

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
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A	accept (for answers correctly cued by the question, or by extra guidance)
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underline	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore

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Question	Answer	Marks
1(a)(i)	1 correct concentrations (1.5, 0.75, 0.375, 0.1875) and % ; 2 shows transfer of 10 cm^3 to each beaker from the previous beaker ; 3 shows addition of 10 cm^3 water 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*: number of bubbles ; 3 results for all samples ; 4 number of bubbles for the highest concentration of hydrogen peroxide more than for the lowest concentration of hydrogen peroxide ; 5 results recorded in whole numbers ;	**5**
1(a)(iii)	number is less than for 3.0% ;	**1**
1(a)(iv)	correct estimate based on candidate's results ;	**1**
1(a)(v)	identifies **one** error e.g. size of bubble varies ;	**1**
1(a)(vi)	*any **one** from:* use a gas syringe ; use an up-turned measuring cylinder over water ;	**1**
1(a)(vii)	same concentration of hydrogen peroxide ; five different pH buffers ;	**2**
1(b)(i)	1 *x-axis*: temperature / °C and *y-axis*: activity of enzyme / au ; 2 *scale on x-axis*: 10 °C to 2 cm, labelled at least every 2 cm and *scale on y-axis*: 2 au 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**
1(b)(ii)	correct estimate based on candidate's graph ;	**1**

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Question	Answer	Marks
1(b)(iii)	*any **three** from:* 1 at 37.5 °C more enzyme substrate complexes are formed than at 55.0 °C **;** **ora** *above 37.5 °C* 2 enzyme is denatured **;** 3 active site changes shape **;** 4 substrate and active site are no longer complementary **;**	**3**

Question	Answer	Marks
2(a)(i)	1 minimum size and no shading **;** 2 no cells drawn **;** 3 correct position of vascular tissue **;** 4 draws correct shape of vascular tissue **;** 5 label line and label to epidermis **;**	**5**
2(a)(ii)	1 minimum size and all lines sharp and continuous **;** 2 draws only four whole cells and each cell touches at least two other cells **;** 3 two lines drawn around each cell and three lines where cells touch **;** 4 draws correct shape of cells and at least one air space **;** 5 label line and label to one cell wall **;**	**5**
2(b)	any **three** differences *e.g.* **feature** / **K1** / **Fig. 2.2** vascular bundles / joined / separate **;** shape of stem / wavy / round **;** number of layers / less / more **;** ring of cells below epidermis / absent / present **;**	**3**

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Question	Answer	Marks
2(c)(i)	count squares that are half full and more than half full and full as 1 **;**	**1**
2(c)(ii)	counts and records the size of the vascular bundle **A ;** counts and records the size of the vascular bundle **B ;**	**2**
2(c)(iii)	shows area of vascular bundle **A** divided by vascular bundle **B ;** shows multiplication by 100 **;**	**2**

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Cambridge Assessment International Education

Cambridge International AS & A Level

BIOLOGY **9700/36**

Paper 3 Advanced Practical Skills 2 **October/November 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 October/November 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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ora	or reverse argument
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Question	Answer	Marks
1(a)(i)	1 correct concentrations (5.0, 2.5, 1.25, 0.625) and % ; 2 shows transfer of 10 cm^3 to each beaker from the previous beaker ; 3 shows addition of 10 cm^3 of water to each beaker ;	**3**
1(a)(ii)	1 *heading for independent variable*: percentage concentration enzyme ; 2 *heading for dependent variable*: height of foam and mm ; 3 records readings for all concentrations ; 4 correct trend ;	**4**
1(a)(iii)	records height for **F1** as higher than the height for **F2** ; units shown (mm / cm) ;	**2**
1(a)(iv)	correct estimate from results of the concentration of catalase in sample **F1** ; correct estimate from results of the concentration of catalase in sample **F2** ;	**2**
1(a)(v)	measure volume of gas using, gas syringe / apparatus using water displacement ;	**1**
1(a)(vi)	to act as a control **or** to show that the enzyme breaks down the hydrogen peroxide ;	**1**
1(a)(vii)	*any **one** from:* use more intermediate concentration of catalase solutions ; plot a graph and read off the values ;	**1**
1(b)(i)	1 *x-axis*: glucose concentration / mg dm^{-3} and *y-axis*: glucose uptake rate / mg min^{-1} ; 2 *scale on x-axis*: 20 mg to 2 cm and *scale on y-axis*: 1 mg min^{-1} to 2 cm, labelled at least every 2 cm ; 3 correct plotting of six points ; 4 thin smooth line, joined point to point or a curve through all points ;	**4**
1(b)(ii)	facilitated diffusion or active transport ; glucose uptake in direct proportion to glucose concentration ;	**2**

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Question	Answer	Marks
1(b)(iii)	glucose uptake in *C. heintzii* higher than *E. coli* at 40 mg dm^{-3} ; more glucose for division ;	**2**

Question	Answer	Marks
2(a)(i)	1 minimum size and no shading ; 2 no cells and drawn the correct region of the leaf ; 3 shows area above the vascular bundle ; 4 shows area under vascular bundle ; 5 label line and label to vascular bundle ;	**5**
2(a)(ii)	1 minimum size and lines continuous and thin ; 2 draws only four cells and each cell touches the large xylem vessel element and at least one of the smaller cells ; 3 two lines drawn around each cell and three lines where two cells touch ; 4 correct shape of cells ; 5 label line and label to the cell wall ;	**5**
2(b)(i)	1 shows conversion of cm^2 to mm^2 ; 2 shows division of leaf area by 0.04 ; 3 shows multiplication by 4 ;	**3**
2(b)(ii)	use more fields of view ;	**1**
2(b)(iii)	features only observable differences ; *any **three** differences e.g.* **feature** / **Fig. 2.2** / **Fig. 2.3** nuclei in guard cells / nuclei not visible / nuclei visible ; chloroplasts in guard cells / chloroplasts visible / chloroplasts not visible ; nuclei in leaf cells / nuclei not visible / nuclei visible ;	**4**