Cambridge International AS & A Level

Cambridge Assessment International Education
Cambridge International Advanced Subsidiary and Advanced Level

BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **May/June 2019**

MARK SCHEME

Maximum Mark: 40

Published

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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
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AVP	alternative valid point

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Question	Answer	Marks
1(a)(i)	*risk* high **+** reason **;**	**1**
1(a)(ii)	1. (heading) pH **;** 2. (heading for dependent) volume of potassium manganate(VII) / **P +** units **;** 3. collects results for all pHs **;** 4. correct trend **;** 5. records volumes up to 2 decimal places or whole numbers if drops given **;** 6. records results to same precision **;**	**6**
1(a)(iii)	pH **;**	**1**
1(a)(iv)	estimates optimum pH from own results **+** least volume of **P ;**	**1**
1(a)(v)	*any 1 from:* 1. idea of difficulty in reading the volume on syringe because of the dark colour**;** 2. drops stick to the side of the tube so the volume is not accurate **;** 3. difficulty of judgement / identification of appearance colour **;** 4. drop size different / different pressure on syringe / syringe sticking **;** 5. water in named solutions evaporate / hydrogen peroxide decomposes over time **;** 6. *idea that* the time the mixture was left between step 10 and step 11 differs for each pH tested **;**	**1**

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Question	Answer	Marks
1(a)(vi)	*any 3 from:* 1. more / wider / narrower / different / examples / range of, pH (buffers) ; 2. given range of pH buffers either side of the candidates suggested optimum ; 3. use a colorimeter **or** have a colour standard to compare ; 4. replicate / repeat, to calculate a mean / identify anomalous results ; 5. use a burette / syringe / pipette with smaller divisions ; 6. do each pH separately / repeat / take more readings (each pH) ;	**3**
1(b)(i)	1. *x*-axis labelled as temperature / °C **+** *y*-axis labelled as volume of oxygen produced in 180 seconds (/) cm^{-3} ; 2. scale on *x*-axis 10 to 2 cm **+** labelled each 2 cm **+** scale on *y*-axis is 2 to 2 cm **+** labelled each 2 cm; 3. correct plotting of 5 points with a small cross or dot in circle ; 4. smooth, thin line, joined point to point, through 5 points ;	**4**
1(b)(ii)	correctly reads from graph volume of oxygen **+** units cm^3 ;	**1**
1(b)(iii)	*any 3 from:* 1. increasing kinetic energy as temperature increases ; 2. up to 38.5 °C there are more successful collisions / more substrate binds to active site / more enzyme substrate complexes formed ; 3. above 38.5 °C active site of enzyme becomes denatured ; 4. above 38.5 °C active site shape is changed ; 5. above 38.5 °C so less enzyme substrate complexes formed / substrate cannot bind ;	**3**

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Question	Answer	Marks
1(b)(iv)	use of boiled plant extract / enzyme or distilled water to replace the enzyme / plant extract ;	**1**
2(a)(i)	***J1*** *is TS Maize root* 1. minimum size **+** no shading **+** no cells ; 2. whole root drawn **+** at least 3 lines ; 3. correct root shape **+** at least 5 lines across width of section from the centre of drawing; 4. correct proportion of the diameter of the central region to the total diameter of the root ; 5. label line and label to epidermis ;	**5**
2(a)(ii)	1. lines continuous, thin and sharp **+** minimum size ; 2. draws only 4 whole cells **+** each cell touching at least two of the other cells ; 3. cell wall drawn as two lines **+** 3 lines where two cells touch ; 4. shows an air space between cells ; 5. label line and label to cell wall ;	**5**
2(b)(i)	annotates 3 correct features on Fig 2.1 using labels **Q**, **R** and **S** ; ; ; e.g. Fig 2.1 xylem tissue arranged in a cross shape, **J1** arranged in a ring	**3**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(b)(ii)</td><td>
1. correct measurement of the scale bar + units ;

2. correct measurement of length of line Z + units ;

<table>
<tr><th>method A</th><th>method B</th><th>method C</th></tr>
<tr><td>mp 3
scale bar measurement multiplied by 1000 + divided by 273 ;</td><td>mp 3
length of line Z divided by length of the scale bar ;
if line Z or the scale bar has been converted it must be shown</td><td>mp 3 (1 mm =)
273 divided by scale bar length ;
if a conversion of units is done it must be shown</td></tr>
<tr><td>mp 4
displays measurement of line Z + divided by magnification ;</td><td>mp 4
answer to mp3 multiplied by 273 ;</td><td>mp 4
answer to mp3 multiplied by length of Z ;</td></tr>
</table>

5. correct answer + units ;
</td><td>5</td></tr>
</table>

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BIOLOGY **9700/32**

Paper 3 Advanced Practical Skills 2 **May/June 2019**

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Question	Answer	Marks
1(a)(i)	1. four stated percentage concentrations of sucrose solution, 8.0 / 8%, 6.0 / 6%, 4.0 / 4% and 2.0 / 2% **;** 2. correct volumes of **S** and **W** to make up the four stated concentrations **;**	**2**
1(a)(ii)	1. heading for percentage concentration of sucrose **;** 2. heading for time / seconds **;** 3. records results for at least four concentrations of sucrose **;** 4. shows correct trend **;** 5. records whole seconds **;**	**5**
1(a)(iii)	states the result for **U +** units **;**	**1**
1(a)(iv)	states whether **U** is taken from the phloem of a plant treated with fusicoccin **+** reference to the concentration of sucrose in **U** ;	**1**
1(a)(v)	1. makes a range of concentrations of sucrose with narrower intervals **;** 2. uses proportional dilution **;**	**2**
1(a)(vi)	**G** was acting as a control **;**	**1**
1(b)(i)	1. *x*-axis labelled as time / min **+** *y*-axis labelled as rate of mass flow / $cm^3 min^{-1}$ **;** 2. scale on *x*-axis is 50 to 2 cm, labelled at least every 2 cm **+** scale on *y*-axis is 5 to 2 cm, labelled at least every 2 cm **;** 3. five points plotted accurately with a small cross or a small dot in a circle **;** 4. five points connected plot to plot or with a line of best fit **;**	**4**
1(b)(ii)	1. 20 $cm^3 min^{-1}$ **;** 2. shows on graph from *y*-axis to *x*-axis **;**	**2**

Question	Answer	Marks
1(b)(iii)	increase the rate of mass flow ;	**1**
1(b)(iv)	*any two from:* 1. *ref. to* transport of sucrose via plasmodesmata ; 2. *ref. to* fusicoccin binding to receptors of companion cell ; 3. *ref. to* active transport of hydrogen ions protons ; 4. *ref. to* cotransporters (sucrose and hydrogen ions) ;	**2**

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Question	Answer	Marks
2(a)(i)	***M1*** *is TS Bryony stem* 1. minimum size **+** at least two layers of tissue ; 2. draws part of stem **+** only three vascular bundles ; 3. correct proportion of vascular tissue to the width of the plant organ ; 4. draws at least three layers of tissue ; 5. label line and label to identify the epidermis ;	**5**
2(a)(ii)	1. minimum cell size **+** lines thin and continuous ; 2. draws only four cells **+** each cell touching at least two others ; 3. draws two epidermal cells **+** two adjacent cells on the layer below the epidermis ; 4. two lines drawn around each cell, three lines where cells touch ; 5. label line and label to identify the cell wall ;	**5**
2(b)(i)	organ identified as a stem **+** one observable feature supporting identification e.g. vascular bundles located around outside / near the epidermis ;	**1**
2(b)(ii)	1 uses line **Z** to measure the length of the vascular bundle within range ; 2 show conversion from mm to µm (×1000) ; 3 shows division by 20 ; 4 decides to give answer in µm or mm ; 5 answer stated to the appropriate degree of accuracy ;	**5**

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Question	Answer	Marks
2(b)(iii)	graticule **or** stage micrometer **;**	**1**
2(c)	records two observable differences between **M1** and Fig. 2.1 **; ;** e.g. **M1** has fewer vascular bundles than Fig. 2.1 **M1** has scattered vascular tissue while in Fig. 2.1 it is located towards the epidermis	**2**

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Question	Answer	Marks
1(a)(i)	1. labels under the 2nd, 3rd, 4th and 5th beakers 10(.00)%, 1(.00)%, 0.1(0)%, and 0.01% **;** 2. shows transfer of 1 cm^3 from 1st beaker to 2nd beaker and 1 cm^3 from 2nd beaker to 3rd beaker and 1 cm^3 from 3rd beaker to 4th beaker **;** 3. shows 9 cm^3 of **W** added to 2nd, 3rd and 4th beakers **;**	**3**
1(a)(ii)	1. heading for percentage concentration of milk **;** 2. heading for symbol or colour **;** 3. records results for at least four concentrations of milk **;** 4. shows correct trend **;**	**4**
1(a)(iii)	records result for **X** using one of the symbols in the key **;**	**1**
1(a)(iv)	estimates the concentration of protein in **X** **;**	**1**
1(a)(v)	identifies a source of error such as the difficulty in judging the exact shade of colour **;**	**1**
1(a)(vi)	1. makes a range of concentrations of milk with narrower intervals **;** 2. uses a colorimeter **;** 3. carry out the testing of **X** at the same time as the test for proteins on each concentration of milk **;**	**3**

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Question	Answer	Marks
1(b)	1. *x*-axis labelled as type of mammal **+** *y*-axis labelled as percentage mass of protein **;** 2. equal width of bars **+** scale on *y*-axis is 1 to 2 cm, labelled at least every 2 cm **;** 3. correct plotting of five bars in the order in the table **;** 4. five separate bars, drawn with vertical lines meeting horizontal lines exactly **+** labelled correctly **;**	**4**
1(c)(i)	describes trend as pH increases the percentage mass of protein remaining increases **;**	**1**
1(c)(ii)	*any three from:* 1. enzyme becomes denatured as pH increases (above pH2) **;** 2. the shape of the active site changes **;** 3. substrate cannot bind to the active site **;** 4. fewer enzyme substrate complexes form **;**	**3**

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Question	Answer	Marks
2(a)(i)	***K1** is TS Erica stem* 1. minimum size **+** at least two layers of tissue **;** 2. draws whole stem **+** at least three layers of tissue **;** 3. correct shape of stem **;** 4. correct proportion of inner vascular area to the other tissues **;** 5. label line and label to identify the epidermis **;**	**5**
2(a)(ii)	1. minimum cell size **+** lines thin and continuous **;** 2. draws only four cells **+** each cell touching at least two others **;** 3. draws at least one cells with at least five sides **;** 4. two lines drawn around each cell, three lines where cells touch **;** 5. label line and label to identify the cell wall **;**	**5**
2(b)(i)	1. measures scale bar within range **;** 2. measures length of line **Z** within range **;** 3. measurement of scale bar multiplied by 1000 **+** divided by 317 **;** 4. shows measurement of line **Z** divided by the answer to mp3 **;** 5. uses correct units **;**	**5**

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Question	Answer	Marks
2(b)(ii)	organises comparison into three columns with one column for features, one headed **K1** and one headed Fig 2.1 **;** records observable differences between **K1** and Fig. 2.1 **; ; ;** e.g. **K1** has fewer layers of tissues than Fig. 2.1 **K1** has a smooth, continuous outer layer while Fig. 2.1 has a rough outer layer cells of **K1** are larger than the cells of Fig. 2.1	**4**

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Question	Answer	Marks
1(a)(i)	1. *objective lens* (×)40 **+** *number of cells* 5 or above **;** 2. *idea of* cells being large enough to see plasmolysis clearly with ×40 lens **or** *idea of* having a large number of cells there are enough to count cells in different stages of plasmolysis **;**	**2**
1(a)(ii)	1. heading for solution / sample / slide **;** 2. (heading for dependent) state of plasmolysis **;** 3. collects results for each solution **;** 4. correct trend **;** 5. records a number for each solution and each state of plasmolysis (at least 16 numbers in total) **;**	**5**
1(a)(iii)	correct results from candidates table **;**	**1**
1(b)	1. lines are continuous, thin and sharp **+** minimum size **;** 2. draws only 4 whole cells **+** each cell touching at least one of the other cells **+** at least two cells showing some degree of plasmolysis **;** 3. cell wall drawn as two lines, 3 lines where two cells touch **;** 4. label line and label to cell membrane **;**	**4**
1(c)(i)	1. below 0.4 mol dm^{-3} water moved into the potato tissue **or** above 0.4 mol dm^{-3} water moved out of the potato tissue **;** 2. no net movement of water at 0.4 mol dm^{-3} **;**	**2**
1(c)(ii)	1. (the sucrose solution / 0.2 mol dm^{-3} solution) had a higher water potential than the potato cells / tissue **;** 2. (so) water moved into the potato / cells / tissue by osmosis**;**	**2**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(c)(iii)</td><td>one mark per row

any three from:

<table>
<tr><th>variable</th><th>how variable may be standardised</th></tr>
<tr><td>potato</td><td>(same) age / from same plant / type / species / cut from the same potato ;</td></tr>
<tr><td>surface area</td><td>use ruler / calipers / cork borer ;</td></tr>
<tr><td>length / width / diameter / cross section</td><td>use measuring equipment, e.g. ruler, calipers ;</td></tr>
<tr><td>volume (of sucrose solution)</td><td>use a measuring cylinder / syringe / burette / graduated pipette to measure volume ;</td></tr>
<tr><td>time</td><td>timer ;</td></tr>
<tr><td>temperature</td><td>thermostatically controlled water-bath ;</td></tr>
</table>
</td><td>3</td></tr>
</table>

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Question	Answer	Marks
2(a)(i)	no plant / fake plant **or** plant with no leaves **or** accept use only one / same plant (and put in each condition) / AW **;**	**1**
2(a)(ii)	use (calcium / sodium / potassium) hydroxide / chloride / oxide **or** silica gel / drying agent **or** use dehumidifier **;**	**1**
2(a)(iii)	1. volume for P1, P2 and P3 + cm^3 **;** 2. records correct calculated values for each of the solutions for volume lost **;**	**2**
2(a)(iv)	correct answer from their results **+** least volume of water loss **;**	**1**
2(b)(i)	1. correct answer 240 **;** 2. shows 242 + 237 + 235 + 246 divided by 4 **or** shows 242 + 237 + 297 + 235 + 246 divided by 5 **; ecf**	**2**
2(b)(ii)	1. *x*-axis labelled as carbon dioxide concentration / ppm **+** *y*-axis labelled as number of stomata (/)mm^{-2} **;** 2. scale on *x*-axis 20 to 2 cm **+** labelled each 2 cm **+** scale on *y*-axis is 20 to 2 cm **+** labelled each 2 cm **;** 3. correct plotting of points with a small cross or dot in circle **;** 4. smooth, thin line, joined point to point, through 5 points / curve **or** line of best fit **;**	**4**
2(b)(iii)	as the concentration of carbon dioxide increases the number of stomata decreases **;**	**1**
2(b)(iv)	correct answer from candidates graph **;**	**1**

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Question	Answer	Marks
2(c)	1. minimum size **+** no shading **+** no cells **;** 2. whole leaf drawn **+** at least 3 lines **;** 3. correct leaf shape **+** at least 3 lines across width of vascular tissue in the centre **;** 4. correct proportion of the diameter of the central region to the total diameter of the leaf section **;** 5. label line and label to epidermis **;**	**5**
2(d)	1. 17 (eyepiece graticule units) **;** 2. shows multiplication of eyepiece graticule units by 39.7 **;** 3. correct answer **+** correct units **;**	**3**

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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 2019 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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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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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
AVP	alternative valid point

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Question	Answer	Marks
1(a)(i)	1. 0.5%, 0.25%, 0.125% and 0.0625% (labels under the 2nd, 3rd, 4th and 5th beakers) **;** 2. shows transfer of 10 cm^3 from 1st beaker to 2nd beaker and 10 cm^3 from 2nd beaker to 3rd beaker and 10 cm^3 from 3rd beaker to 4th beaker **;** 3. shows 10 cm^3 of **W** added to 2nd, 3rd and 4th beakers **;**	**3**
1(a)(ii)	1. heading for percentage concentration of protein ; 2. heading for colour ; 3. records results for at least four concentrations of protein ; 4. uses letters for the colours for all the concentrations ; 5. shows correct trend ;	**5**
1(a)(iii)	states the colour for **U** ;	**1**
1(a)(iv)	shows an estimate of the concentration of protein in **U ;**	**1**
1(a)(v)	1. makes a range of concentrations of protein solutions with narrower intervals **;** 2. uses proportional dilution **;**	**2**
1(a)(vi)	colorimeter **;**	**1**
1(b)(i)	84 ;	**1**

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Question	Answer	Marks
1(b)(ii)	1. *x*-axis labelled as time / days **+** *y*-axis labelled as concentration of protein in blood plasma / g dm^{-3} ; 2. scale on *x*-axis is 2 to 2 cm, labelled at least every 2 cm **+** scale on *y*-axis is 20 to 2 cm, labelled at least every 2 cm ; 3. points plotted accurately with a small cross or a small dot in a circle ; 4. five points connected plot to plot **or** with a line of best fit ;	**4**
1(b)(iii)	*any 3 from:* 1. the increase in the concentration of protein in blood plasma was caused by bacteria / bacterium / virus / foreign antigen **;** 2. correct reference to plasma cells **;** 3. production of antibodies **;** 4. antibodies are proteins **;**	**3**

Question	Answer	Marks
2(a)(i)	***L1** is TS beech leaf* 1. minimum size **+** at least two layers of tissue **;** 2. draws only the midrib **;** 3. correct proportion of the vascular area to the other tissues **;** 4. shows subdivision of the vascular tissue **;** 5. draws at least three layers of tissue **;** 6. label line and label to identify the upper epidermis **;**	**6**
2(a)(ii)	1. minimum cell size **+** lines thin and continuous **;** 2. draws only four cells **+** each cell touching at least one other cell **;** 3. draws at least one cell longer than it is deep **;** 4. two lines drawn around each cell, three lines where cells touch **;** 5. label line and label to identify the cell wall **;**	**5**
2(b)	1. measures depth of midrib along line **X** within range **+** units **;** 2. shows conversion from mm to µm by multiplying by 1000 **;** 3. shows division by 14 **;** 4. correct answer **;** 5. answer stated to the appropriate degree of accuracy **;**	**5**

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Question	Answer	Marks
2(c)	records three observable differences between **L1** and Fig. 2.3 **; ; ;** e.g. **L1** has more vascular bundles than Fig. 2.3 **L1** has more midribs than Fig. 2.3 **L1** has a thicker epidermis than Fig. 2.3	**3**

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