Cambridge International AS & A Level

Cambridge Assessment International Education
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BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **October/November 2017**

MARK SCHEME

Maximum Mark: 40

Published

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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)	lose **+** less **;**	**1**
1(a)(ii)	completes Fig. 1.3 drawing all three directions correctly (up + level + down) **;**	**1**
1(b)(i)	for at least 4 suitable concentrations of **S** **;** e.g. 0.8, 0.6, 0.4 and 0.2 decides correct volume of sucrose volumes for selected concentrations **;** decides correct total volumes (40 cm^3) for each concentration **;**	**3**
1(b)(ii)	decides appropriate length of potato pieces **;** e.g. 4.0 cm	**1**
1(b)(iii)	1 table drawn **+** heading, concentration of sucrose solution / mol dm^{-3} **;** 2 heading, direction of movement **;** 3 records speed of movement in an appropriate way **;** 4 decides to do repeated drops **;** 5 results for at least 4 concentrations of sucrose **;** 6 correct sequence of directions **;**	**6**

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Question	Answer	Marks
1(b)(iv)	correct estimate of concentration of sucrose according to results in **(b)(iii)** ;	**1**
1(b)(v)	identifies one significant source of error ; e.g. difficulty of measuring and cutting pieces of potato to correct dimensions	**1**
1(b)(vi)	uses increased number of concentrations of sucrose solution ; between 2 stated concentrations appropriate to candidate's results ; read off from graph of results or replicate ;	**3**
1(b)(vii)	no net movement of water or reference to dynamic equilibrium ;	**1**
1(b)(viii)	shows on graph reading at 0.3 mol dm^{-3} to estimate the water potential ; correct estimate for water potential **+** kPa × 10^2 ;	**2**

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Question	Answer	Marks
2(a)(i)	1 quality of line (thin and continuous) for at least 6 grains drawn **;** 2 draws only 3 starch grains from **F +** only 3 starch grains from **G ;** 3 grains not overlapping **;** 4 starch grains from **F** drawn as oval shapes **+** starch grains from **G** drawn as angular shapes **;** 5 uses one label line **+** one label, **X**, to identify surface markings on grains **;**	**5**
2(a)(ii)	correct annotations describing observable differences between the starch grains from **F** and **G ;;;** e.g. size of grains from **F** larger than grains from **G**	**3**
2(b)(i)	1 (*x*-axis) time / minutes **+** (*y*-axis) reducing sugar concentration / µM **;** 2 (scale on *x*-axis) 10.0 to 2 cm, labelled at least each 2 cm **+** (scale on *y*-axis) 2.0 to 2 cm, labelled at least each 2 cm **;** 3 correct plotting of six points with a small cross or dot in circle **;** 4 six plots, joined plot to plot **+** thin line drawn **;**	**4**
2(b)(ii)	1 states correct reducing sugar concentration at 35 minutes (**x**) and 15 minutes (**y**) **;** 2 shows **x** minus **y ;** 3 shows answer to mp2 divided by **y** and multiplied by 100 **;**	**3**

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Question	Answer	Marks
2(c)	1 plan diagram of appropriate size **+** no cells **+** no shading **;** 2 correct section drawn **+** draws only 3 vascular bundles **;** 3 draws epidermis as 2 lines **;** 4 draws at least one vascular bundle divided into at least 3 sections **;** 5 uses one label line **+** one label to identify phloem **;**	**5**

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Question	Answer	Marks
1(a)(i)	regular intervals **+** at least 5 times **;**	**1**
1(a)(ii)	top of arrow to appropriate height **;** bottom of arrow to appropriate height **;**	**2**
1(b)(i)	1 table drawn **+** heading pH **;** 2 heading height of foam **+** mm **;** 3 records results for at least three times **+** 5 pH values **;** 4 height of foam recorded as whole millimetres **;**	**4**
1(b)(ii)	shows maximum height of foam for pH 5 divided by time **;** answer to the appropriate degree of accuracy **;**	**2**
1(b)(iii)	decides whether temperature was a significant source of error **;**	**1**
1(b)(iv)	states the height of foam for **U** **;**	**1**

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Question	Answer	Marks
1(b)(v)	estimates the correct pH using the result stated in **(b)(iv)** ;	**1**
1(b)(vi)	states at least five concentrations of hydrogen peroxide ; concentrations of hydrogen peroxide prepared by proportional dilution or serial dilution ; describes counting the number of bubbles or collecting the volume of oxygen using displacement of water or alternative correct method ;	**3**
1(c)(i)	1 (*x*-axis) temperature °C **+** (*y*-axis) rate of enzyme activity / arbitrary units ; 2 (scale on *x*-axis) 10.0 to 2 cm, labelled at least each 2 cm **+** (scale on *y*-axis) 10.0 to 2 cm, labelled at least each 2cm ; 3 correct plotting of five points with a small cross or dot in circle ; 4 five plots, joined plot to plot **+** thin line drawn ;	**4**
1(c)(ii)	correct reference to optimum temperature **+** 16°C ; as temperature increase more enzyme substrate complexes form or correct reference to kinetic energy ; after a specific temperature enzyme denatured ;	**3**

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Question	Answer	Marks
2(a)(i)	1 plan diagram of appropriate size **+** no cells **;** 2 correct section drawn **;** 3 draws tissues in the part of the vascular ring below **R ;** 4 draws detail of tissues at the top of **R** correctly **;** 5 draws tissues beneath the epidermis correctly **;** 6 uses one label line **+** one label to identify the epidermis **;**	**6**
2(a)(ii)	1 quality of line for outer wall of cells **+** cells of appropriate size **;** 2 only four cells drawn, each cell of the group touching at least two of the other cells **;** 3 cell walls drawn as two lines close together **;** 4 a cell drawn with 5 sides or more **;** 5 uses one label line **+** one label, **C**, to identify a structure made of cellulose **;**	**5**

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Question	Answer	Marks
2(b)(i)	correct measurement of line **X ;** records correct units **;** correct answer shown to appropriate degree of accuracy **;**	**3**
2(b)(ii)	states only observable differences **;** any three observable differences of comparison **;;;** e.g. on **J1** the vascular tissue is positioned in the shape of a ring while the vascular bundles in Fig. 2.2. are distributed throughout the stem	**4**

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BIOLOGY **9700/34**

Paper 3 Advanced Practical Skills 2 **October/November 2017**

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ecf	error carried forward
I	ignore
AVP	alternative valid point

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Question	Answer	Marks
1(a)(i)	every 1 minute or evenly spaced times **;**	**1**
1(a)(ii)	suitable volume between 10 and 50 **;**	**1**
1(a)(iii)	1 heading for independent variable (column to left of recorded data or top row) time **+** correct units **;** 2 heading for dependent variable colour or observation **;** 3 colours for all samples **;** 4 colours clearly described e.g. blue, blue green, green, yellow green, yellow **;** 5 0 recorded as blue **;** 6 two columns to show comparison between first 10 minutes and second 10 minutes **;**	**6**
1(a)(iv)	correct reference to time and colour for both trials **;** (compare) first 10 minutes with second 10 minutes, e.g. slower or faster or same **;**	**2**

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Question	Answer	Marks
1(b)(i)	five or more concentrations **;** made by simple dilution or serial dilution or described or named examples **;**	**2**
1(b)(ii)	compare unknown concentration time with known concentration times **or** draw a graph and read off **; R** colours	**1**
1(c)(i)	*x*-axis type of sugar **+** *y*-axis rate of metabolic reactions / au **;** scale on *x*-axis: even width of bars **+** scale on *y*-axis is 0.1au to 2 cm **+** labelled each 2 cm **;** correct plotting of bars in the order of the table **;** bars drawn with thin sharp ruled line vertical lines meeting horizontal lines **+** labelled **;**	**4**

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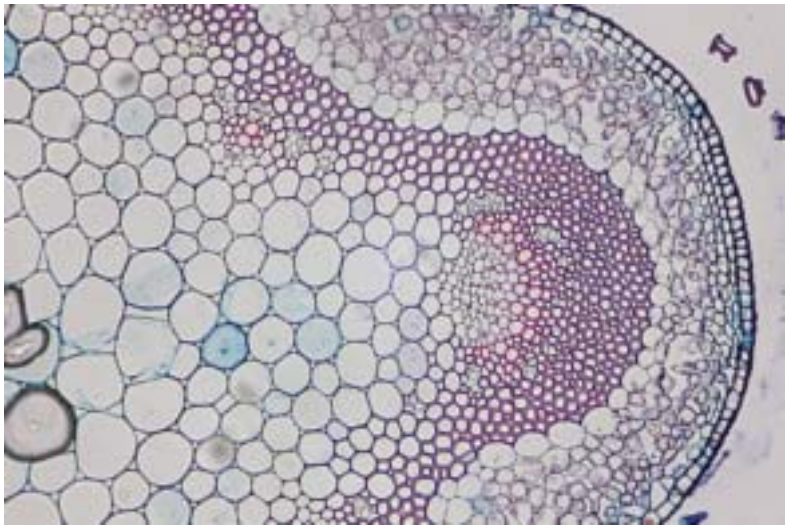
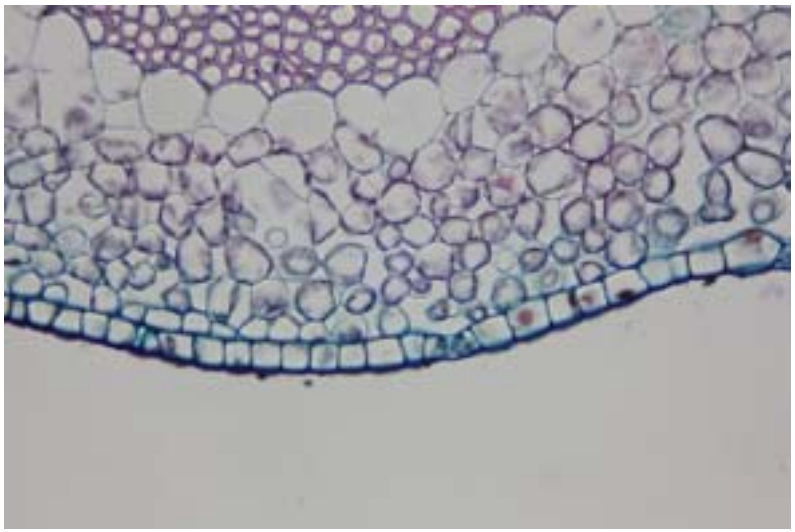
Question	Answer	Marks
1(c)(ii)	1 quicker in glucose than sucrose ; 2 sucrose is a disaccharide and glucose is a monosaccharide ; 3 sucrose needs breaking down (glucose does not) ; 4 (into) glucose and fructose ; 5 (metabolic reactions with) sucrose do not release as much CO_2 ; 6 glucose can fit into the enzymes active site (sucrose / fructose cannot) **or** more enzyme substrate complexes ; 7 more enzymes for metabolising glucose ;	**4**

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Question	Answer	Marks
2(a)(i)	1 minimum size + no shading + no cells **;** 2 drawn correct (bulge / curved) area **;** 3 draws tissues in vascular bundle correctly in the correct position **;** 4 draws bulge and correct shape of tissues **;** 5 label line and label to pith **;**	**5**
2(a)(ii)	1 size at least 40 mm across the largest cell at the widest point **+** quality of lines are continuous, thin and sharp **;** 2 draws only four cells **+** each cell touching at least two of the other cells **;** 3 two lines drawn around each cell **+** three lines where cells touch **;** 4 (epidermal cell) at least one cell with a convex surface **;** 5 identifies and draws correct cells, e.g. different shapes and sizes **;** 6 label line and label to cell wall **;**	**6**

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Question	Answer	Marks
2(b)(i)	1 correct measurements of root and vascular tissue using line **P**–**Q** **;** 2 both measurements using same units **;** 3 larger number to smaller number **;** 4 to lowest common denominator **;**	**4**
2(b)(ii)	collects **only** observable differences **;** three correct differences **;;;**	**4**

Question	Answer	Marks
		
	TS Plantain stem	
		

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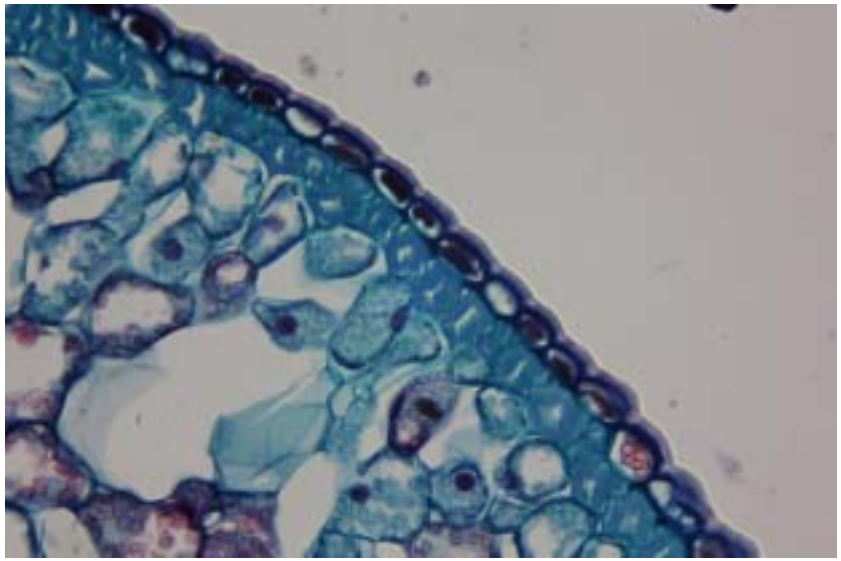
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Question	Answer	Marks
1(a)(i)	1 heading for independent variable (column to left of recorded data or top row headed) sample / mock urine / solution **;** 2 time to first colour change / seconds **;** 3 colours and times for **U1**, **U2**, and **U3 ;** 4 records whole numbers only **;**	**4**
1(a)(ii)	interprets correct answer from results **;**	**1**
1(a)(iii)	mock urine sample with shortest time to first colour change **;**	**1**
1(a)(iv)	interprets correct answer from results **;**	**1**
1(a)(v)	decides volume of 2% glucose solution is 2.5 cm^3 **;** decides total volume of glucose concentration is 10.0 cm^3 **;**	**2**
1(a)(vi)	interprets correct answer from results **;**	**1**
1(a)(vii)	time for 0.5% glucose **;** time for mock urine sample stated in **(a)(iv)** **;**	**2**
1(a)(viii)	tick in correct place based on candidates results **;**	**1**

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Question	Answer	Marks
1(a)(ix)	use more concentrations **;** named concentrations in narrower range / described method of dilution of 2% glucose solution **;** plot a graph and read off graph **;**	**3**
1(b)	1 minimum size **+** no shading **+** no cells **;** 2 at least 4 layers (minimum of five lines drawn) **;** 3 inner layer of tissue made of 2 lines drawn showing lobed shape **;** 4 half a star shape of central lumen **;**	**4**

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Question	Answer	Marks
2(a)	1 size at least 40 mm across the largest cell at the widest point **+** quality of lines are continuous, thin and sharp **;** 2 draws only four cells **+** drawn as a chain**;** 3 two lines drawn around each cell **+** three lines where cells touch **;** 4 at least one cell contains an inclusion **;** 5 label line and label to **C** / cell wall / cellulose **;**  *TS Juniper leaf*	**5**

Question	Answer	Marks
2(b)(i)	1 *x*-axis <u>time of day</u> **+** *y-axis* <u>mean rate of transpiration</u> **;** 2 scale on *x*-axis: <u>02.00 to 2 cm</u> **+** scale on *y*-axis <u>0.5 au to 2 cm</u> **+** labels origin **;** 3 correct plotting of five points with a small cross or dot in circle **;** 4 five plots with **either** ruled sharp thin lines point to point **or** smooth curve with sharp thin line **;**	**4**
2(b)(ii)	displays value at 11:30 **+** value at 08:30 **;** records answer to appropriate number of decimal places **+** units **;**	**2**
2(b)(iii)	*three from* 1 increased temperature **;** 2 (so) faster evaporation or water from leaf / faster diffusion of water vapour **;** 3 increased light intensity **;** 4 (so) stomata open wider / more stomata open **;** 5 AVP **;**	**3**

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Question	Answer	Marks
2(c)(i)	collects four measurements **+** correct units **;** divides by 59 **;**	**2**
2(c)(ii)	displays addition of measurements and division by the number of measurements **;** correct answer **;**	**2**
2(d)	two correct differences **; ;**	**2**

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Question	Answer	Marks
1(a)(i)	refers to the contents of the test-tubes reaching the temperature of the water-bath **;**	**1**
1(a)(ii)	appropriate statement concerning temperature as a significant source of error with reference to the difference in temperature at the end of the investigation **;**	**1**
1(a)(iii)	table drawn **+** heading, trial or test-tube **;** records 3 times **;**	**2**
1(a)(iv)	Suggests appropriate advantage of carrying out a trial test **;** e.g. learning to identify when the end-point reached	**1**
1(a)(v)	time taken to reach end-point **;**	**1**
1(a)(vi)	correct concentrations of 50, 25, 12.5 **+** % **;** shows transfer of 20 cm^3 of 100 (%) to next dilution **+** 20 cm^3 transferred from 2^{nd} to 3^{rd} beaker and from 3^{rd} to 4^{th} **+** cm^3 **;** adds 20 cm^3 of water to each beaker **;**	**3**
1(a)(vii)	1 table drawn **+** heading, concentration of milk / % **+** time to reach the end-point / seconds **;** 2 records at least 3 times for 3 substrate concentrations **;** 3 records the fastest time for the highest concentration of milk **;** 4 records times as whole seconds **;**	**4**
1(a)(viii)	replaces milk with water or replaces enzyme with water or uses boiled and cooled enzyme **;**	**1**
1(a)(ix)	states an appropriate concentration of milk **;** uses at least five temperatures **;** use of thermostatically controlled water-bath **;**	**3**

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Question	Answer	Marks
1(b)(i)	1 (*x*-axis) source of milk **+** (*y*-axis) percentage mass of protein **;** 2 (*x*-axis) even width of bars **+** (scale on *y*-axis) 2.0 to 2 cm, labelled at least each 2 cm **;** 3 correct plotting of five bars **+** bars in order of table **;** 4 five separate bars **+** bars drawn with thin lines **+** labelled appropriately **;**	**4**
1(b)(ii)	states that seal milk has the highest concentration of protein **;** more enzyme substrate complexes formed or more substrates bind to active sites of enzymes **;**	**2**

Question	Answer	Marks
2(a)(i)	1 plan diagram of appropriate size **+** no cells **+** no shading **;** 2 correct section drawn **+** draws at least 3 different layers of tissue **;** 3 draws 3 layers of tissue for the central stele or for the edge of the root **;** 4 draws air spaces in the cortex **;** 5 uses one label line **+** one label to identify the endodermis **;**	**5**
2(a)(ii)	1 quality of line for the outer wall of xylem vessels **+** cells of appropriate size **;** 2 draws only four xylem vessels **+** with the large xylem vessel touching each of the other 3 smaller vessels **;** 3 cell walls drawn as two lines close together **;** 4 draws the largest xylem vessel lumen at least twice the size of the smallest xylem vessel lumen **;**	**4**
2(a)(iii)	correct annotation to lumen (e.g. unrestricted flow of water) **or** to wall (e.g. prevents xylem vessel collapsing) **;**	**1**

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Question	Answer	Marks
2(b)	1 correct measurement of scale bar **;** 2 shows length of scale bar in μm, divided by 2499 **;** 3 shows length of line, **X**–**Y**, divided by answer to mp2 **;** 4 decides to record answer in μm **;** *alternative ways to calculate actual diameter accepted*	**4**
2(c)	any three observable differences of comparison **;;;** e.g. on **M1** air spaces present while in Fig. 2.2. air spaces absent	**3**

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