Cambridge International AS & A Level

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BIOLOGY **9700/31**

Paper 3 Advanced Practical Skills 1 **October/November 2016**

MARK SCHEME

Maximum Mark: 40

Published

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Question	Answer	Mark
1(a)(i)	*(decisions on serial dilutions)* 1 correct concentrations of 0.5, 0.25, 0.125, 0.0625 + % ; 2 shows transfer of 10 cm^3 of 1% to next dilution + 10 cm^3 transferred from 2nd to 3rd beaker and from 3rd to 4th and from 4th to 5th + cm^3 ; 3 adds 10 cm^3 of water to each beaker ;	**3**
1(a)(ii)	*(decision)* volume of Benedict's solution equal to or greater than 2 cm^3 of reducing sugar ;	**1**
1(a)(iii)	*(recording results)* 1 table drawn + heading, percentage concentration of reducing sugar ; 2 heading, time + seconds ; 3 times recorded as whole seconds ;	**3**
1(a)(iv)	*(calculation)* 1 shows 1 divided by 42 ; 2 correct answer as 0.024 ;	**2**

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Question	Answer	Mark
1(a)(v)	*(decisions)* *two from* 1 states volume of Benedict's solution **;** 2 states volume of **M1 + M2 ;** 3 states temperature of water-bath **;**	**2**
1(a)(vi)	*(recording results)* records time in seconds for **M1 + M2 ;**	**1**
1(a)(vii)	*(interpretation)* 1 states percentage concentration of reducing sugar for **M1** (either known concentration or between known concentrations) **;** 2 states percentage concentration of reducing sugar for **M2** (either known concentration or between known concentrations) **;**	**2**
1(a)(viii)	*(conclusion)* **M2 +** no or very little reducing sugar **;**	**1**

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Question	Answer	Mark
1(b)(i)	*(layout of data)* 1 (*x*-axis) time after drinking milk containing lactose / minutes **+** (*y*-axis) concentration of hydrogen in exhaled air / ppm **;** 2 (scale on *x*-axis) 20 to 2 cm, labelled at least each 2 cm **+** (scale on *y*-axis) 20 to 2 cm, labelled at least each 2 cm **;** 3 correct plotting of five points with a small cross or dot in circle **;** 4 five plots either joined point to point or as a smooth curve, drawn as a thin line **;**	**4**
1(b)(ii)	*(plan drawing)* 1 large size **+** no shading **;** 2 no cells **+** correct section drawn **+** appropriate detail of inner section **;** 3 outermost layer drawn as two lines **;** 4 draws gap between outer and inner layer **;**	**4**
	Total:	**23**

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Question	Answer	Mark
2(a)(i)	*(layout of drawing)* 1 quality of line for outer wall of cells thin and sharp **+** minimum size at least 40 mm across largest cell **;** 2 only three cells drawn **+** each cell touching at least one of the other cells **;** 3 draws contents in at least one cell **;** 4 uses one label line **+** one label to cell wall **;**	**4**
2(a)(ii)	*(conclusion)* *(function)* photosynthesis **;** *(feature)* chloroplasts **;**	**2**
2(b)	*(observable differences)* organises comparison into three columns with one column for features, one headed **J1** and one headed **Fig. 2.1 ;** any three observable differences of comparison **; ; ;**	**4**
2(c)(i)	*(diameter of field of view)* records measurement within range **;**	**1**
2(c)(ii)	*(fraction of the diameter of the field of view)* estimates within range **;**	**1**

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Question	Answer	Mark
2(c)(iii)	*(depth of midrib)* 1 shows answer to **(c)(i)** multiplied by answer to **(c)(ii)** **;** 2 decision to multiply by 1000 (to convert to μm) **;**	**2**
2(c)(iv)	*(improvements)* 1 reference to eyepiece graticule **+** stage micrometer **;** 2 measurement of midrib using eyepiece graticule **;** 3 reference to calibration of eyepiece graticule **;**	**3**
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Question	Answer	Mark
1(a)	*(layout of drawing)* 1 quality of line for outer wall of cell thin and sharp + large size ; 2 only one cell drawn + shows plasmolysis ; 3 cell wall drawn as two lines close together ; 4 uses one label line + one label to cell surface membrane ;	**4**
1(b)(i)	*(decisions on serial dilutions)* 1 correct concentrations of 0.5, 0.25, 0.125, 0.0625 + mol dm^{-3} ; 2 shows transfer of 10 cm^3 of 1 mol dm^{-3} to next dilution + 10 cm^3 transferred from 2nd to 3rd beaker and from 3rd to 4th and from 4th to 5th + cm^3 ; 3 adds 10 cm^3 of water to each beaker ;	**3**
1(b)(ii)	*(recording results)* 1 table drawn + heading, concentration + sucrose + mol dm^{-3} ; 2 heading, time + seconds ; 3 records results for at least four concentrations ; 4 correct pattern of results, the highest concentration of sucrose recorded as the shortest time for colour change ; 5 times recorded as whole seconds ;	**5**

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Question	Answer	Mark
1(b)(iii)	*(records time for **U**)* appropriate number for time **+** seconds **;**	**1**
1(b)(iv)	*(interpretation of estimate)* correct answer in accordance with recorded times **;**	**1**
1(b)(v)	*(improvements to procedure)* *three from* 1 increased number of concentrations **;** 2 between named concentrations or use simple (proportional) dilution **;** 3 repeat or replicate **;** 4 weigh mass of precipitate **;**	**3**
1(c)(i)	*(layout of data)* 1 (*x*-axis) concentration of sucrose solution / mol dm^{-3} **+** (*y*-axis) water potential / kPa **;** 2 correct plotting of five points with a small cross or dot in circle **;** 3 five plots joined point to point or as a line of best fit drawn as a ruled thin line **;**	**3**
1(c)(ii)	*(interpretation of concentration)* correctly reads value for the water potential of the concentration of sucrose at 0.66 mol dm^{-3} **+** minus sign **;**	**1**

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Question	Answer	Mark
1(c)(iii)	*(conclusions)* 1 (cells) reference to higher water potential than solution ; 2 water moves out of cells ; 3 by osmosis ;	2
	Total:	**23**

Question	Answer	Mark
2(a)(i)	*(decisions)* 1 same number of drops or stated number of drops or volume (of sample) ; 2 add same number of drops or stated number of drops or volume (of iodine) ;	2
2(a)(ii)	*(recording results)* 1 heading, colour or observation ; 2 records colour results for three samples ; 3 records **P2** as darkest blue (or black) ;	3
2(a)(iii)	*(conclusion)* **P2** ;	1

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Question	Answer	Mark
2(b)	*(plan drawing)* 1 large size **+** no shading **;** 2 no cells **+** at least three lines drawn **;** 3 draws outline of root cap **+** draws outline of stele **;** 4 stele shown in correct proportion **;** 5 uses one label line **+** one label, the letter **T**, to region of cortex **;**	**5**
2(c)(i)	*(actual width of cells)* 1 measures length of scale bar **+** units **;** 2 for calculation shows length of scale bar used with measurements of cells **;** 3 correct answers to calculation for all cells **;**	**3**
2(c)(ii)	*(mean actual width of cells)* 1 shows addition of five measurements from **(c)(i)** **+** divided by 5 **;** 2 correct answer to appropriate degree of accuracy **;**	**2**
2(c)(iii)	*(interpretation)* one observable difference between the cell **D** and cell **E** **;**	**1**
	Total:	**17**

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Paper 3 Advanced Practical Skills 2 **October/November 2016**

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Question	Answer	Mark
1(a)(i)	*(conclusion)* least ;	1
1(a)(ii)	*(decision)* cut length at least 50 mm / 5 cm ;	1
1(a)(iii)	*(decision)* repeat (with same piece or replicate with both pieces of plant tissue) ;	1
1(a)(iv)	*(recording results)* 1 table drawn + heading, solutions ; 2 heading, angle of bend + correct units ; 3 readings recorded for all three samples of potato + repeats ; 4 correct pattern of results ; 5 records as whole numbers or to half a degree ; ;	5
1(a)(v)	*(interpretation of results)* correct identification of **S1**, **S2** and **S3** according to results ;	1
1(a)(vi)	*(collects angle of bend for **S4**)* records as a whole number or to half a degree ;	1

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Question	Answer	Mark
1(a)(vii)	*(interpretation of result)* correct estimate according to results from **(iv)** and **(v)** **;**	**1**
1(a)(viii)	*(layout of data)* 1 (*x*-axis) concentration of sodium chloride / mol dm^{-3} **+** (*y*-axis) angle of bend / degree(s) or ° **;** 2 (scale on *x*-axis) 0.2 to 2 cm, labelled at least each 2 cm **+** (scale on *y*-axis) reasonable scale with results, labelled at least each 2 cm **;** 3 five plots either joined point to point or as a line of best fit, drawn as a thin line **;**	**3**
1(a)(ix)	*(collects and interprets angle of bend)* 1 shows on graph at **S4** angle of bend using at least one line to *x*-axis or a plotted point **;** 2 records correct concentration from graph **+** units **;**	**2**
1(b)	*(improvements to procedure)* *three from* 1 increased number of concentrations **;** 2 use proportional or simple or serial dilution **;** 3 repeat or replicate **;** 4 AVP **;**	**3**

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Question	Answer	Mark
1(c)	*(conclusions)* 1 water has higher water potential than cells / tissue / **ora** ; 2 water moves into cells by osmosis ;	**2**
	Total:	**21**

Question	Answer	Mark
2(a)(i)	*(plan drawing)* 1 large size **+** no shading ; 2 no cells **+** correct section drawn **+** appropriate detail ; 3 correct proportions ; 4 vascular tissue divided into at least three layers ; 5 outermost layer drawn as two lines (on both surfaces of leaf) ; 6 label line and label to epidermis ;	**6**

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Question	Answer	Mark
2(a)(ii)	*(high power drawing)* 1 quality of line for outer wall of cells thin and sharp **+** minimum size at least 40 mm across largest cell **;** 2 only four cells drawn **+** each cell touching at least one of the other cells **;** 3 cell walls drawn as two lines close together **;** 4 at least one cell drawn with at least five sides **;** 5 width of one cell smaller than another cell **or** an inclusion present in at least one cell **;** 6 uses one label line **+** one label to cell wall **;**	**6**
2(b)(i)	*(collects and shows display of working)* 1 correct measurements for <u>all five</u> lines **+** as whole numbers or to 0.5 only **+** units as mm **;** 2 shows division by 75 **;**	**2**
2(b)(ii)	*(shows display of working and interpretation)* 1 shows addition of measurements from **(b)(i) +** division by 5 **;** 2 correct answer to appropriate degree of accuracy **+** units μm **;**	**2**

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Question	Answer	Mark
2(c)	*(observable differences)* organises comparison into three columns with one column for features, one headed **L1** and one headed Fig. 2.2 **;** any three observable differences of comparison **; ;**	**3**
	Total:	**19**

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Question	Answer	Mark
1(a)(i)	*(decisions on simple dilutions)* 1 correct percentage concentration of **E** as 0.75, 0.5, 0.25 **;** 2 correct volumes of **E ;** 3 correct total volume of **E** and **W** for each concentration **;**	**3**
1(a)(ii)	*(recording results)* 1 table drawn **+** heading, percentage concentration of ethanol **;** 2 heading, intensity of colour **;** 3 results recorded four or five concentrations **;** 4 uses symbols on scale **+** correct trend in results **; ;**	**4**
1(a)(iii)	*(collects and interprets result for unknown)* 1 records a result for **U** in correct format **;** 2 appropriate concentration for **U** (as one of concentrations prepared or between two of prepared concentrations) **+** units **;**	**2**

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Question	Answer	Mark
1(a)(iv)	*(conclusions)* 1 more concentrated the ethanol the more (methylene) blue is released from the plant cells ; 2 cell membrane is damaged / more permeable ; 3 <u>proteins</u> in the cell membrane are denatured / AW or <u>phospholipids</u> are dissolved in the ethanol or the methylene blue is able to leave the cell by <u>diffusion</u> ;	**3**
1(a)(v)	*(modification to investigate another variable)* 1 (to standardise concentration of ethanol) same concentration of ethanol ; 2 (changes independent variable – temperature) at least five temperatures ; 3 (method) uses thermostatically controlled water-bath ;	**3**
1(b)(i)	*(interpretation)* <u>9.0</u> ;	**1**

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Question	Answer	Mark
1(b)(ii)	*(layout of data)* 1 (*x*-axis) concentration of sucrose / mol dm^{-3} + (*y*-axis) change in mass / % ; 2 (scale on *x*-axis) 0.2 to 2 cm, labelled at least each 2 cm + (scale on *y*-axis) 10 to 2 cm, labelled at least each 2 cm ; 3 correct plotting of five points with a small cross or dot in circle ; 4 five plots either joined point to point or as a line of best fit, drawn as a thin line ;	**4**
1(b)(iii)	*(collects from graph and correct interpretation)* 1 shows on graph at 0.7 mol dm^{-3} using at least one line to *y*-axis ; 2 records correct percentage change in mass from graph ;	**2**
	Total:	**22**

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Question	Answer	Mark
2(a)(i)	*(plan drawing)* 1 large size + no shading ; 2 no cells + correct section drawn + appropriate detail ; 3 endodermis layer drawn as two lines ; 4 label line and label to xylem ;	**4**
2(a)(ii)	*(high power drawing)* 1 quality of line for outer wall of cells thin and sharp + minimum size at least 40 mm across largest cell ; 2. only four cells drawn + each cell touching at least two of the other cells ; 3 cell walls drawn as two lines close together ; 4 at least one air space **or** at least one cell drawn with at least five sides ; 5 uses one label line + one label to cell wall ;	**5**
2(b)(i)	*(shows display of working)* 1 correct measurements for all five air spaces + as whole numbers or to 0.5 only + units as mm ; 2 shows division by 36 ; 3 multiplies by 1000 ;	**3**

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Question	Answer	Mark
2(b)(ii)	*(calculation)* 1 shows addition of measurements from **(b)(i)** + division by 5 **;** 2 correct answer to appropriate degree of accuracy + units μm **;**	**2**
2(c)	*(observable differences)* organises comparison into three columns with one column for features, one headed **K1** and one headed Fig. 2.2 **;** any three observable differences of comparison **; ; ;**	**4**
	Total:	**18**

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Question	Answer	Mark
1(a)	*(risk assessment)* irritant + medium risk ;	**1**
1(b)(i)	*(decisions on serial dilutions)* 1 correct concentrations of 0.5, 0.25, 0.125, 0.0625 + % ; 2 shows transfer of 20 cm^3 of 1% to next dilution + 20 cm^3 transferred from 2nd to 3rd beaker and from 3rd to 4th and from 4th to 5th + cm^3 ; 3 adds 20 cm^3 of water to each beaker ;	**3**
1(b)(ii)	*(recording results)* 1 table drawn + heading, percentage concentration of antibiotic ; 2 heading, time + seconds ; 3 records results for at least four concentrations ; 4 correct pattern of results, the highest concentration of antibiotic recorded as the shortest time for colour change ; 5 times recorded as whole seconds ;	**5**
1(b)(iii)	*(records time for **U**)* appropriate number for time + seconds ;	**1**
1(b)(iv)	*(interpretation of estimate)* correct estimate in accordance with recorded times ;	**1**

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Question	Answer	Mark
1(b)(v)	*(source of error with reason)* appropriate error with reason e.g. colour + difficult to judge ;	1
1(b)(vi)	*(modification to investigate another variable)* 1 (to standardise concentration of antibiotic) uses stated concentration of antibiotic or uses same concentration of antibiotic ; 2 (changes independent variable – temperature) at least five temperatures ; 3 (method) uses thermostatically controlled water-bath ;	3
1(c)(i)	*(layout of data)* 1 (*x*-axis) external concentration of glucose / mmol dm^{-3} + (*y*-axis) rate of glucose uptake by cells / mmol cm^{-3} hr^{-1} ; 2 (scale on *x*-axis) 5 to 2 cm, labelled at least each 2 cm + (scale on *y*-axis) 100 to 2 cm, labelled at least each 2 cm ; 3 correct plotting of five points with a small cross or dot in circle ; 4 five plots joined point to point, drawn as a thin line ;	4
1(c)(ii)	*(interpretation)* correctly reads value for rate of glucose uptake from graph at 7 mmol dm^{-3} ;	1

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Question	Answer	Mark
1(c)(iii)	*(conclusion)* 1 reference to carrier proteins / channel proteins ; 2 (at low concentrations of external glucose) carrier proteins available or (at high concentrations of external glucose) limited availability of carrier proteins ;	**2**
	Total:	**22**

Question	Answer	Mark
2(a)(i)	*(plan drawing)* 1 large size + no shading ; 2 no cells + at least three lines or two lines and part of vascular tissue + correct section drawn ; 3 part of vascular tissue + epidermis drawn as two lines drawn closely together ; 4 uses one label line + one label to phloem ;	**4**

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Question	Answer	Mark
2(a)(ii)	*(layout of drawing)* 1 quality of line for outer wall of cells thin and sharp + minimum size at least 40 mm across largest cell ; 2 only four cells drawn, each cell touching at least one other cell + no shading ; 3 cell walls drawn as two lines close together ; 4 at least one cell drawn with at least five sides ; 5 uses one label line + one label to cell wall ;	**5**
2(b)(i)	*(simplest ratio)* 1 measures depth of the midrib + length of the vascular bundle ; 2 records whole numbers (mm) or to 0.5 (mm) for both measurements ; 3 displays, in final ratio, larger number to smaller number ; 4 final answer as simplest ratio ;	**4**
2(b)(ii)	*(conclusion)* thick cuticle or air spaces or AVP ;	**1**

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Question	Answer	Mark
2(c)	*(observable differences)* organises comparison into three columns with one column for features, one headed **M1** and one headed **Fig. 2.2 ;** any three observable differences of comparison **; ; ;**	**4**
	Total:	**18**

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