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 **October/November 2018**

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
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ecf	error carried forward
I	ignore
AVP	alternative valid point

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Question	Answer		Marks
1(a)(i)	mp 1	draws on test-tube **B** a line level with liquid in test tube **A** and a layer indicating level of sediment at bottom **;**	**2**
	mp 2	label line and label to sediment **;**	
1(a)(ii)	mp 1	describes how to count squares on graph paper scale to measure height of sediment **;**	**1**
1(a)(iii)	mp 1	states at least 4 regular time intervals **;**	**1**
1(a)(iv)	mp 1	records results using heading pH **;**	**5**
	mp 2	uses heading height of sediment / mm **;**	
	mp 3	records heights of sediment at each time interval for each pH **;**	
	mp 4	results show expected pattern, pH 3 or pH 4 greatest height of sediment **;**	
	mp 5	results as whole numbers **;**	
1(a)(v)	mp 1	records height of sediment at each time interval for **BU** **;**	**2**
	mp 2	estimates pH according to candidate's results **;**	
1(a)(vi)	mp 1	suggests using at least 5 pH values **;**	**2**
	mp 2	suggests comparison with results for known pH values **;**	
1(a)(vii)	mp 1	suggests at the pH where greatest sedimentation occurred yeast cells were more attracted towards each other causing yeast to stick together and drop to bottom **;**	**1**
1(a)(viii)	mp 1	identifies a source of error such as the difficulty of determining the boundary of the sediment **;**	**1**

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Question	Answer		Marks
1(b)(i)	mp 1	*x*-axis: labelled time / hours, *y*-axis: labelled number of yeast cells / arbitrary units cm^{-3} ;	**4**
	mp 2	scale on *x*-axis is 5 to 2 cm, scale on *y*-axis is 200 to 2 cm labelled each 2 cm ;	
	mp 3	correct plotting of 5 points with a cross or dot in circle, to within half a square ;	
	mp 4	five plots, joined point to point, with a thin line ;	
1(b)(ii)	mp 1	shows on graph how to find the number of yeast cells at 18 hours ;	**2**
	mp 2	correct answer according to candidate's graph ;	

Question	Answer		Marks
2(a)(i)	mp 1	drawing of a minimum size with a minimum number of tissue layers and no cells drawn ;	**5**
	mp 2	draws correct quarter of the stem ;	
	mp 3	draws at least 4 layers of tissue ;	
	mp 4	draws irregular outline of vascular tissue layer ;	
	mp 5	uses label line and label to identify the xylem ;	
2(a)(ii)	mp 1	drawing of a minimum size and drawn with thin, continuous lines ;	**5**
	mp 2	draws only four touching cells ;	
	mp 3	two lines drawn around each cell and one cell with angular sides ;	
	mp 4	each cell touching at least two of the other cells ;	
	mp 5	uses label line and label to identify the cell wall ;	

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Question	Answer	Marks
2(b)(i)	mp 1 measures the line **X** within range and with units **;** mp 2 shows measurement of **X** (mm) multiplied by 1000 **;** mp 3 shows division by 13 **;** mp 4 shows answer to correct degree of accuracy **;**	**4**
2(b)(ii)	mp 1 count number of eyepiece graticule units equivalent to the length of the vascular bundle and using a calibration technique to determine the actual length **;**	**1**
2(c)	mp 1 organises table into three columns with one column for feature **;** mp 2, mp 3, mp 4 three observable differences between the stem on **J1** and the stem in Fig. 2.2 such as the vascular bundles are joined in **J1** and separate in Fig. 2.2 **;;;**	**4**

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Question	Answer		Marks
1(a)(i)	mp 1	measurement radius, within range, as whole number or to 0.5 **+** mm **;**	**1**
1(a)(ii)	mp 1	curved surface area to the nearest whole number **;**	**2**
	mp 2	mm^2 or cm^2 **;**	
1(a)(iii)	mp 1	area of one circular end to the nearest whole number **;**	**1**
1(a)(iv)	mp 1	first column of Table 1.3, stating 4 then 8 number of pieces cut from one cylinder **;**	**2**
	mp 2	last column of Table 1.3, stating correct total surface area for 2 pieces cut from one cylinder **;**	
1(a)(v)	mp 1	standardises the position of the delivery tube in the test-tube of water by making a mark on the delivery tube so that the end is always the same depth in the test-tube **;**	**1**
1(a)(vi)	mp 1	records results in a table with heading for number of bubbles / seconds **;**	**5**
	mp 2	total surface area / mm^2 as a heading **;**	
	mp 3	includes 30 seconds, 60 seconds, 90 seconds and 120 seconds in table **;**	
	mp 4	collects results for at least three surface areas and three time periods **;**	
	mp 5	number of bubbles for lowest surface area less than for largest surface area **;**	
1(a)(vii)	mp 1	uses the results for largest surface area **;**	**3**
	mp 2	shows addition of results divided by number of results to find mean **;**	
	mp 3	correctly calculates the rate of activity with units (min^{-1}) **;**	

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Question	Answer		Marks
1(a)(viii)	mp 1	completes Table 1.4 by suggesting that the volume of oxygen released could be measured using a gas syringe or by displacement of water ;	3
	mp 2	completes Table 1.4 by suggesting a significant source of error such as different amounts of the enzyme catalase in different potatoes ;	
	mp 3	completes Table 1.4 by suggesting an improvement would be to use potato cylinders from the same potato ;	
1(a)(ix)	mp 1	changes the independent variable, concentration of substrate, by using at least 5 concentrations prepared by proportional or serial dilution ;	1

Question	Answer		Marks
2(a)(i)	mp 1	drawing of a minimum size with a minimum number of tissue layers and no cells drawn ;	5
	mp 2	whole leaf drawn ;	
	mp 3	correct leaf shape with at least three layers of tissue ;	
	mp 4	correct position of vascular bundle ;	
	mp 5	uses label line and label to identify the palisade tissue ;	
2(a)(ii)	mp 1	drawing of a minimum cell size and drawn with thin, continuous lines ;	5
	mp 2	draws three touching epidermal cells and a trichome ;	
	mp 3	two lines drawn around each cell ;	
	mp 4	draws trichome or epidermal cell with an inclusion ;	
	mp 5	uses label line and label to identify the cell wall ;	

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Question	Answer		Marks
2(a)(iii)	mp 1	suggests a suitable feature such as the rolled leaf ;	**2**
	mp 2	explanation of how feature prevents water loss such as traps moisture ;	
2(b)	mp 1	shows evidence of counting whole stomata on Fig. 2.1 ;	**3**
	mp 2	shows evidence of counting half stomata on Fig. 2.1 ;	
	mp 3	correct number of stomata within range ;	
2(c)(i)	mp 1	*x*-axis: time of day, *y*-axis percentage of open stomata ;	**4**
	mp 2	scale on *x*-axis: 2 to 2 cm scale, on *y*-axis is 20.0 to 2 cm labelled each 2 cm ;	
	mp 3	correct plotting of five points with small cross or dot in circle ;	
	mp 4	plots joined point to point with thin line ;	
2(c)(ii)	mp 1	explains that between 02:30 and 05:00 more stomata open and the rate of transpiration increases ;	**2**
	mp 2	more evaporation of water and faster diffusion ;	

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BIOLOGY **9700/34**

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Question	Answer		Marks
1(a)(i)	mp 1	records a higher volume of iodine for sample **A** than **W** ;	**1**
1(a)(ii)	mp 1	0.08, 0.06, 0.04, 0.02 ;	**2**
	mp 2	correct volumes of **A** and **W**, that add up to 20 cm^3 ;	
1(a)(iii)	mp 1	heading for 'percentage concentration of ascorbic acid / **A**', to left of data and separated by a line from data ;	**4**
	mp 2	heading for 'volume of iodine / cm^3 ' ;	
	mp 3	volumes for at least 5 concentrations **+** correct trend ;	
	mp 4	records volumes to 1 or 2 decimal places ;	
1(a)(iv)	mp 1	records volume of **X** being larger than the volume of **Y +** units ;	**1**
1(a)(v)	mp 1	concentrations from Table 1.2 written on the line **+** correct estimation of concentration of **X** and **Y** on scale bar from candidates results ;	**1**
1(a)(vi)	*any one from*		**1**
	mp 1	drops stick to the side of the tube so the volume is not accurate ;	
	mp 2	difficulty of judgement / identification of appearance of first colour change ;	
	mp 3	drop size / different pressure on syringe / syringe sticking / mixing ;	
	mp 4	iodine evaporating / exposed to light ;	
	mp 5	(ascorbic acid) evaporates or mixes with air so the concentration changes ;	
	mp 6	to narrow a range of ascorbic acid concentrations ;	
	mp 7	iodine came out faster than water ;	

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Question	Answer	Marks
1(a)(vii)	*any three from* mp 1 more concentrations or narrower range of concentrations (ascorbic acid) **;** mp 2 use graduated pipette / syringe / burette, with smaller divisions **;** mp 3 use colorimeter or have a standard colour to compare **;** mp 4 put drops in nearer to mixture or use a smaller, test-tube / container **;** mp 5 replicate / repeat / take more readings (each concentration) **;** mp 6 plot a graph and read off from the graph **;** mp 7 use a, wider / larger test-tube / boiling tube / beaker **;** mp 8 idea of keeping iodine away from light **;**	**3**
1(b)(i)	mp 1 label on *x*-axis, 'percentage concentration of ascorbic acid' **+** label on *y*-axis, 'mass of maltose produced / mg' **;** mp 2 scale on *x*-axis is 0.002 to 2 cm **+** *y*-axis is 20 to 2 cm **+** labelled at least each 2 cm **;** mp 3 correct plotting of six points with a small cross or dot in circle **;** mp 4 line sharp and joined point to point **;**	**4**
1(b)(ii)	mp 1 shows on graph how to read off from 0.005% **;** mp 2 correctly reads from graph the mass of maltose **+** mg **;**	**2**

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Question	Answer	Marks
1(b)(iii)	*any three from* *idea of inhibitor* mp 1 idea of ascorbic acid acts as an inhibitor ; mp 2 binds to the enzyme / active site ; mp 3 changes the shape of the active site (if non-competitive inhibitor) / or competes with substrate for active site (if competitive inhibitor) ; mp 4 prevents the substrate from binding ; mp 5 less enzyme substrate complexes formed ; **or** *Idea of ascorbic acid changing the pH* mp 1 more ascorbic acid present lowers the pH ; mp 2 enzyme becomes inactive / denatured as pH is lowered ; mp 3 changes the shape of the active site ; mp 4 prevents the substrate from binding ; mp 5 less enzyme substrate complexes formed ;	**3**

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Question	Answer	Marks
2(a)(i)	TS Maize root mp 1 minimum size **+** at least three lines **+** no cells **;** mp 2 draws at least 5 layers **;** mp 3 correct proportion of vascular tissue to width of whole root **;** mp 4 label line and label to identify the cortex **;**	**4**
2(a)(ii)	mp 1 minimum cell size **+** lines thin and continuous **+** no shading **;** mp 2 only 4 cells drawn **+** each cell touching at least one of the other cells **;** mp 3 cell walls drawn as two lines **;** mp 4 two lower cells wider than each of the epidermal cells **;** mp 5 label line and label to identify the cell wall **;**	**5**
2(b)	mp 1 correct measurement of vascular tissue **;** mp 2 correct measurement of the whole root **;** mp 3 all measurements using the same units (mm / cm) **;** mp 4 shows a larger number to a smaller number **;** mp 5 displays ratio to the lowest common denominator **;**	**5**
2(c)	mp 1 organises comparison into three columns with one column for features, one headed **M1** and one headed Fig. 2.1 **+** recording only differences not similarities **;** mp 2, mp 3, mp4 three correct differences **;;;** e.g. air spaces smaller in M**1** while in Fig 2.1 they are larger	**4**

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Question	Answer		Marks
1(a)(i)	mp 1	60 + 50 + 40 + °C at least once **;**	**1**
1(a)(ii)	mp 1	heading for temperature / °C, to left of data and separated by a line from data **;**	**5**
	mp 2	heading for time / seconds **;**	
	mp 3	result recorded for 70°C **+** 30 °C and three chosen temperatures **;**	
	mp 4	correct trend of (mean) results **;**	
	mp 5	seconds recorded as whole numbers or repeats **;**	
1(a)(iii)	mp 1	displays rate as 1 / 75 **;**	**2**
	mp 2	correct answer (0.013(33)) **;**	
1(a)(iv)	mp 1	put a mark (*e.g. a cross or some text*) and time to see it / film it / use a data logger / use a colour standard to compare with sample **;**	**2**
	mp 2	use a thermostatically controlled water bath **;**	
1(a)(v)	mp 1	use distilled water instead of enzyme **or** use boiled enzyme **;**	**1**
1(b)(i)	mp 1	pH **;**	**1**
1(b)(ii)	mp 1	label on *x*-axis, 'pH' **+** label on *y*-axis, 'activity of enzyme / arbitrary units' **;**	**4**
	mp 2	scale on *x*-axis is 1 to 2 cm **+** *y*-axis is 20 to 2 cm **+** labelled at least each 2 cm **;**	
	mp 3	correct plotting of five points with a small cross or dot in circle **;**	
	mp 4	line sharp and joined point to point **;**	

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Question	Answer		Marks
1(b)(iii)	mp 1	activity rises, then drops slightly, then drops more sharply **;**	**2**
	mp 2	states at least two pH values and the correct corresponding activity **+** units **;**	
1(b)(iv)	mp 1	causes denaturation / changes tertiary structure, of enzyme / milk protein **or** changes the shape of the active site of the enzyme **;**	**2**
	mp 2	so fewer enzyme substrate complexes formed or substrate cannot bind to the active site **;**	
1(b)(v)	mp 1	use a narrower range of pH values **;**	**2**
	mp 2	from 1.5 to 3 **;**	

Question	Answer		Marks
2(a)(i)	mp 1	minimum size **+** at least two lines **+** no cells **;**	**5**
	mp 2	draws epidermis **+** at least 3 vascular bundles **;**	
	mp 3	shows at only 2 whole smaller vascular bundles and 1 whole larger inner vascular bundle **;**	
	mp 4	shows subdivision of vascular bundle **;**	
	mp 5	label line and label to identify the xylem **;**	
2(a)(ii)	mp 1	minimum cell size **+** lines thin and continuous **+** no shading ;	**5**
	mp 2	only 4 cells drawn in a line **+** each cell touching at least one of the other cells **;**	
	mp 3	cell walls drawn as two lines **;**	
	mp 4	correct shape of cells (convex top and bottom) **;**	
	mp 5	label line and label to identify the cell wall **;**	

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Question	Answer	Marks
2(a)(iii)	mp 1 for buoyancy or support **;**	**1**
2(b)	mp 1 correct measurement of **J1** and **J2 ;** mp 2 correct measurement of **J3 ;** mp 3 all measurements using the same units (mm / cm) **;** mp 4 shows a larger number to a smaller number and to the lowest common denominator **;**	**4**
2(c)	mp 1, mp 2, mp 3 three correct differences **;;;** e.g. cuticle present in **L1** while in Fig. 2.1 it is absent	**3**

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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)	mp 1	completes Table 1.2 by stating three further concentrations of ethanol **;**	**2**
	mp 2	volumes of **A** and **W** add up to ten for each concentration **;**	
1(a)(ii)	mp 1	records results using heading percentage concentration of ethanol **;**	**5**
	mp 2	uses heading cloudiness **;**	
	mp 3	records results for 5 concentrations of ethanol, using key **;**	
	mp 4	results show expected pattern, it is cloudiest for the highest concentration of ethanol **;**	
	mp 5	shows mean result for each concentration of ethanol **;**	
1(a)(iii)	mp 1	states independent variable as concentration of ethanol **;**	**1**
1(a)(iv)	mp 1	identifies a significant source of error such as difficulty of judging cloudiness **;**	**2**
	mp 2	suggests an improvement such as using a colorimeter **;**	
1(a)(v)	mp 1	statement supporting or rejecting hypothesis according to candidate's results **;**	**3**
	mp 2	refers to the results of two concentrations of ethanol **;**	
	mp 3	refers to the results of two concentrations with supporting data **;**	
1(a)(vi)	mp 1	reference to how to measure the volume of ethanol such as using a burette **;**	**2**
	mp 2	suggestion of when to stop adding ethanol, such as the disappearance of the layer above the emulsion **;**	
1(b)(i)	mp 1	shows 10.75 divided by 34.25 (addition of 10.75 and 23.5) multiplied by 100 **;**	**3**
	mp 2	correct answer **;**	
	mp 3	final answer to the correct degree of accuracy **;**	

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Question	Answer	Marks
1(b)(ii)	mp 1 *x*-axis: labelled food sample, *y*-axis: labelled mass of fat in 100 g of food / g ; mp 2 even width of bars, scale on *y*-axis is 5.0 to 2 cm labelled each 2 cm ; mp 3 correct plotting of bars in the order of the table ; mp 4 6 bars drawn, with separation between food samples and all bars drawn with vertical lines meeting horizontal lines exactly, labelled (**X**, **Y**, **Z**, **U**, **S**) ;	**4**

Question	Answer		Marks
2(a)(i)	mp 1	drawing of a minimum size with minimum number of tissue layers and no cells drawn ;	**5**
	mp 2	draws only 2 vascular bundles ;	
	mp 3	draws one closed end ;	
	mp 4	draws two caps on a vascular bundle ;	
	mp 5	uses label line and label **C** to identify tissue containing chloroplasts ;	
2(a)(ii)	mp 1	drawing of a minimum size and drawn with thin, continuous lines ;	**5**
	mp 2	draws only 4 touching xylem vessel elements ;	
	mp 3	two lines drawn around each xylem vessel element ;	
	mp 4	at least one xylem vessel element with angular sides ;	
	mp 5	uses label line and label to identify the lumen ;	
2(a)(iii)	mp 1	uses label **T** to identify xylem wall or lumen ;	**2**
	mp 2	explanation of how xylem wall or lumen enables water to be transported through element, such as the wall preventing vessel collapsing or the lumen having no contents so less resistance to flow of water ;	
2(b)(i)	mp 1	uses label line and the label **Q** to identify the area of cartilage as the feature preventing tube from collapsing ;	**1**

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Question	Answer		Marks
2(b)(ii)	mp 1	uses same units to measure **P1**, **P2** and **P3 ;**	**5**
	mp 2	collects measurements within range for **P1** and **P2 ;**	
	mp 3	collects measurements within range for **P3 ;**	
	mp 4	shows answer as larger whole number to smaller whole number **;**	
	mp 5	answer to lowest common denominator **;**	

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