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 2018**

MARK SCHEME

Maximum Mark: 40

Published

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;	separates marking points
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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
AVP	alternative valid point

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Question	Answer	Marks
1(a)(i)	0.8, 0.6, 0.4, 0.2 **;** correct volumes which add up to 10 **;**	**2**
1(a)(ii)	heading for percentage concentration of milk **;** expected pattern of results **;** only colours in key used **;**	**3**
1(a)(iii)	violet **;**	**1**
1(a)(iv)	correct answer according to results in **(a)(ii)** and **(a)(iii)** **;**	**1**
1(a)(v)	colorimeter or more colour standards **;** drop size of milk or **K** varies / AVP **; ;** volume using small syringe / graduated pipette / AVP **;**	**3**
1(b)(i)	heading for coagulation **;** correct patterns of coagulation using key **;**	**2**
1(b)(ii)	four **or** five crosses recorded **;**	**1**
1(b)(iii)	the percentage concentrations from Table 1.2 on the scale **;** puts **U** in the correct position for their results **;**	**2**

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Question	Answer	Marks
1(c)(i)	label on *x*-axis as temperature / °C **+** label on *y*-axis as percentage coagulation of the milk**;** scale on *x*-axis is 10 to 2 cm **+** *y*-axis is 20 to 2 cm **+** labelled each 2 cm **;** correct plotting of five points with a small cross or dot in circle **;** line sharp and joined point to point **;**	**4**
1(c)(ii)	*any two from:* with increasing temperature the enzyme and substrate have more kinetic energy **;** more ESCs formed, as temperature increases to 41 °C **;** above 41 °C the enzyme / rennet denatures **;** above 41 °C fewer ESCs formed **;**	**2**
1(c)(iii)	five or more pHs **+** buffers **;**	**1**

Question	Answer	Marks
2(a)(i)	minimum size **+** at least 3 layers of tissue **+** no cells **;** draws only midrib section shown in Fig 2.1 **;** correct position of vascular bundle to whole depth of leaf **;** draws at least one subdivision of the vascular bundle **;** label line **+** label to identify the vascular bundle **;**	**5**

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Question	Answer	Marks
2(a)(ii)	1 minimum cell size **+** lines thin and continuous **+** no shading **;** 2 only 3 whole cells drawn **+** each cell touching at least one of the other cells **+** 2 lines drawn around each cell with 3 lines where cells touch **;** 3 at least one cell with inclusions drawn **or** palisade cell at least twice as long as it is wide **;** 4 label line and label to identify the cell wall **;**	**4**
2(a)(iii)	1 trichomes / cuticle / sunken stomata / curled leaf / folded leaf / AW **;** 2 traps moisture / reduces evaporation / reduces the surface area for water loss / reduces diffusion of water **;**	**2**
2(b)(i)	(answer to step1) 0.0025 **;** displays answer from step 1 multiplied by 1000 **;** correct answer **+** µm **;**	**3**
2(b)(ii)	measures correctly in eyepiece graticule units **;** shows multiplication of eyepiece graticule measurement by answer from **(b)(i)** **;**	**2**
2(b)(iii)	*any two* correct annotations **; ;** e.g. shape of leaf folded / rolled in **J1** while in Fig. 2.5 the leaf is triangle shaped	**2**

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I	ignore

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Question	Answer	Marks
1(a)(i)	records 3 times ; seconds recorded as whole numbers ;	**2**
1(a)(ii)	calculates mean time correctly using results from **(a)(i) +** seconds ;	**1**
1(a)(iii)	*any one from:* 1 the same size of cubes not exactly the same size ; 2 cubes not put into acid at exactly the same time ; 3 AVP ;	**1**
1(a)(iv)	*any two from:* 1 standardise the size of cubes ; 2 standardise the volume of acid ; 3 standardise the temperature of acid ; 4 AVP ;	**2**
1(a)(v)	four correct volumes of 1.0 mol dm^{-3} hydrochloric acid (8, 6, 4, 2) ; four correct volumes of distilled water (2, 4, 6, 8) ;	**2**
1(a)(vi)	headings are concentration of hydrochloric acid / mol dm^{-3} **+** time / seconds ; records 4 mean times for 4 concentrations of hydrochloric acid ; the time for the highest concentration recorded as the shortest time ;	**3**
1(a)(vii)	*from the candidates' results in **(a)(vi)*** calculates correct rate of diffusion in 1.0 mol dm^{-3} hydrochloric acid **and** correct rate of diffusion for the lowest concentration of hydrochloric acid ;	**1**

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Question	Answer	Marks
1(a)(viii)	correct statement concerning the rejection or supporting the hypothesis based on the results **;** correct explanation of how results provide evidence for rejection or supporting the hypothesis **;**	**2**
1(a)(ix)	correct suggestion for concentration of acid to be used with a reason for that choice e.g.1.0 mol dm^{-3} **+** fastest time to change colour / AVP **;**	**1**
1(a)(x)	use different sizes of cube **;** uses at least 5 different sizes of cubes **or** *ref. to* size of cubes and SA:VOL ratio **;**	**2**
1(b)(i)	label on *x*-axis as type of pathogenic bacteria **+** label on *y*-axis as diameter of zone of inhibition / mm **;** even width of bars **+** scale on *y*-axis is 5 to 2 cm **+** labelled each 2 cm **;** correct plotting of 5 bars **;** separate bars drawn with vertical lines meeting horizontal lines **+** labelled **P**, **Q**, **R**, **S**, **T ;**	**4**
1(b)(ii)	bacterium **Q** **+** **C** most effective at inhibiting reproduction / AVP **;**	**1**

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Question	Answer	Marks
2(a)(i)	1 minimum size **+** no shading **+** no cells **;** 2 at least 4 layers of tissue drawn **;** 3 includes details of tissue beneath vascular bundle **;** 4 shows subdivision of vascular bundle **;** 5 label line and label **X** to identify a region containing xylem tissue **;**	**5**
2(a)(ii)	1 minimum cell size **+** lines thin and continuous **;** 2 three cells drawn **+** drawn with each cell touching at least one of the other cells in the group **;** 3 inclusion shown within palisade cell or epidermal cell **;** 4 label line and label **P** to identify chloroplast **;**	**4**
2(b)(i)	count the number of squares completely filled **and** count the number of squares more than half-filled **;**	**1**
2(b)(ii)	records the total area of the leaf showing in Fig. 2.2 to a whole number **or** to 0.5 within limits **;** records the area of the leaf section occupied by the vascular bundle **V** to a whole number **or** to 0.5 within limits **;**	**2**
2(b)(iii)	shows the value for the area of **V** divided by the value for the area of the leaf section × 100 **;** answer to the correct degree of accuracy **;**	**2**
2(b)(iv)	using a grid with smaller squares / AVP **;**	**1**
2(c)	*any three* observable differences **; ; ;** e.g. **M1** few trichomes and Fig. 2.2 many trichomes **M1** many air spaces and Fig. 2.2 few air spaces **M1** presence of palisade mesophyll tissue and Fig. 2.2 absence of palisade mesophyll cells	**3**

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Question	Answer	Marks
1(a)(i)	correct volumes of **S5** for three concentrations of sucrose, **S4**, **S3** and **S2** (8, 6,4) **;** correct volumes of water for **S4**, **S3** and **S2** (2, 4, 6) **;**	**2**
1(a)(ii)	heading for percentage concentration of sucrose **;** heading for time / seconds **;** times for all concentration of sucrose (**S5**, **S4**, **S3**, **S2**) **;** time for the highest concentration of sucrose recorded as the shortest time **;** seconds recorded as whole numbers **;**	**5**
1(a)(iii)	states time for **U +** decides on the estimate of the percentage concentration of sucrose solution for **U +** shows **U** on the scale **;**	**1**
1(a)(iv)	scale on *x*-axis 1.0 to 2 cm **+** sensible scale used for *y*-axis**;** thin line passing through plots **;**	**2**
1(a)(v)	correct estimate for the percentage concentration of sucrose in **U** from the graph **;**	**1**
1(a)(vi)	difficulty of identifying appearance of the first colour change / AVP **;**	**1**
1(a)(vii)	increase the number of percentage concentrations of sucrose solution below 2% **;** use at least 5 percentage concentrations of sucrose solution below 2% **;** AVP **;** e.g. difference between concentrations to be as small as possible	**3**
1(b)(i)	shows addition of the five figures (13.6, 12.2, 3.4, 2.0, 0.4) **;** divides total by 55 **and** multiplies by 100 **;** answer given to the correct degree of accuracy **;**	**3**

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Question	Answer	Marks
1(b)(ii)	label on *x*-axis type of sugar in the fruit **+** label on *y*-axis mass of sugar in 55 g fruit / g **;** correct plotting of 5 bars **;**	**2**
1(b)(iii)	(source) leaves / AVP **;** (process) active transport / AVP **;**	**2**

Question	Answer	Marks
2(a)(i)	1 minimum size **+** no shading **+** no cells **;** 2 draws sector including epidermis and vascular bundles **;** 3 draws one outer vascular bundle **+** 3 inner vascular bundles **;** 4 shows subdivision of vascular bundles **;** 5 label line and label to identify the cortex **;**	**5**
2(a)(ii)	measurement of **L** and **D** as instructed **+** records as whole **or** to half number **;**	**1**
2(a)(iii)	1 minimum cell size **+** lines thin and continuous **;** 2 only 4 cells drawn **+** each cell touching at least one of the other cells **;** 3 correct proportion (depth and length) of cells **;** 4 correct shape of cells **;** 5 label line and label to identify the cell wall **;**	**5**
2(a)(iv)	aquatic habitat / AVP **;**	**1**
2(b)	states the correct number of eyepiece graticule units for **X**–**Y** **;** shows multiplication of the number of eyepiece graticule units for **X**–**Y** by 29.5 **;** answer to the correct degree of accuracy + µm **;**	**3**
2(c)	*any three* correct annotations **; ; ;** e.g. in **K1** vascular bundles touching while in Fig. 2.3 vascular bundles separated from each other	**3**

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Question	Answer	Marks
1(a)(i)	shows 4 concentrations of ethanol as 7.5 **+** 3.75 **+** 1.875 **+** 0.9375 **+** % **;** shows transfer of 20 cm^3 of ethanol solution from beaker to beaker **;** shows addition of 20 cm^3 water to each beaker **;**	**3**
1(a)(ii)	1 heading for percentage concentration of ethanol **;** 2 heading for colour **+** pH **;** 3 records colours for all concentrations at both 3 **and** 9 minutes **;** 4 records pH values for all concentrations at both 3 **and** 9 minutes **;** 5 pH values recorded as whole numbers **;**	**5**
1(a)(iii)	correct estimate based on candidates results **;**	**1**
1(a)(iv)	correct statement to reject or accept hypothesis **;** correct reference to data from **(a)(ii)** **;**	**2**
1(a)(v)	difficulty in judgement of colour and matching to pH **;**	**1**
1(b)(i)	label on *x*-axis time / minutes **+** label on *y*-axis volume of CO_2 / arbitrary units (au) **;** scale on *x*-axis is 2 to 2 cm **+** *y*-axis is 0.2 to 2 cm **+** labelled each 2 cm **;** correct plotting of five points with a small cross or dot in circle **;** line sharp and joined point to point **;**	**4**
1(b)(ii)	collects correct values from graph for volumes at 10 minutes **and** 7 minutes **;** shows changes in volume divided by 3 **;**	**2**

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Question	Answer	Marks
1(b)(iii)	thermostatically controlled water-bath **;** at least 5 temperatures **;** mass / volume of yeast the same **or** concentration of glucose the same **;**	**3**

Question	Answer	Marks
2(a)(i) 2(a)(ii) 2(a)(iii)	draws yeast cells of different shapes and sizes **;** draws only whole cells **;** draws only 3 cells per box **;**	**3**
2(a)(iv)	correct annotation describing an observable difference between **Y** and **M** **;** correct annotation describing an observable difference between **Y** and **I** **;**	**2**
2(b)	minimum cell size **+** lines thin and continuous **;** only 5 whole cells drawn **;** at least two yeast cells with inclusions **;** cells drawn as in Fig. 2.2 **;**	**4**
2(c)(i)	minimum size **+** no cells **;** draws at least 2 layers of tissue in **B1** **;** draws tissues in correct proportions **;** draws inner layer of **B1** crinkled **;**	**4**

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Question	Answer	Marks
2(c)(ii)	**B1** walls thicker than **B2 ;** **B1** innermost layer is crinkled, **B2** innermost layer smooth **;** **B2** has a larger lumen than **B1 ;**	**3**
2(c)(iii)	**B1 +** thick(er) wall / more muscle tissue / AW **;**	**1**
2(c)(iv)	shows measurement of scale bar in mm **+** multiplication by 1000 **+** division by 535 **;** displays answer as a whole number **;**	**2**

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1(a)(i)	shows 4 concentrations of sucrose as 5 **+** 2.5 **+** 1.25 **+** 0.625 **+** % **;** shows transfer of 5 cm^3 of sucrose solution from beaker to beaker **;** shows addition of 5 cm^3 water to each beaker **;**	**3**
1(a)(ii)	1 heading for percentage concentration of sucrose **;** 2 heading for time / seconds **;** 3 records raw and processed results for each concentration **;** 4 time for the highest concentration of sucrose recorded as shortest time **;** 5 seconds recorded as whole numbers **;**	**5**
1(a)(iii)	rate worked as 1 / t **;** calculates correct rate of enzyme activity in 10% sucrose solution **+** answer given in standard form to the appropriate degree of accuracy **;**	**2**
1(a)(iv)	use same concentration of substrate **;** use at least five pH values **;** use of buffers **;**	**3**
1(b)(i)	label on *x*-axis percentage substrate concentration **+** label on *y*-axis rate of enzyme activity / arbitrary units **;** scale on *x*-axis is 2 to 2 cm **+** *y*-axis is 2 to 2 cm **+** labelled each 2 cm **;** correct plotting of five points with a small cross or dot in circle **;** line sharp and joined point to point **;**	**4**

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Question	Answer	Marks
1(b)(ii)	as the substrate concentration increases rate of enzyme activity increases **;** more enzyme substrate complexes form **;** reference to inhibition **+** binding to active site **;**	**3**
1(b)(iii)	competitive (inhibitor) **;**	**1**

Question	Answer	Marks
2(a)(i)	1 minimum size **+** no shading **+** no cells **;** 2 draws epidermis **+** 3 vascular bundles **;** 3 shows at least 2 layers of tissue **;** 4 shows subdivision of vascular bundle **;** 5 vascular bundle and other tissues of stem drawn in the correct proportion **;** 6 label line and label to identify the phloem **;**	**6**
2(a)(ii)	1 minimum cell size **+** lines thin and continuous **;** 2 4 cells drawn **+** each cell touching at least two of the other cells **;** **3** cell walls drawn as two lines **;** **4** correct shape of cells **;** 5 label line and label to identify the cell wall **;**	**5**
2(b)	differences are observable **+** uses label lines **+** uses letters **P**, **Q** and **R** **;** *any three* correct differences **;;;** e.g. label line to vascular bundle **+** (Fig. 2.2) vascular bundles arranged in 2 rings while in **L1** vascular bundles in one ring	**4**
2(c)(i)	units given as µm **;** multiplies 0.01 by 1000 **;**	**2**
2(c)(ii)	correctly measures length of **X**–**Y** as eyepiece graticule divisions **;** shows length of **X**–**Y** multiplied by 10 **+** µm **;**	**2**

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