UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2011 question paper for the guidance of teachers

9700 BIOLOGY

9700/36 Paper 3 (Advanced Practical Skills 2), maximum raw mark 40

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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 excepted)
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
ACE	Analysis, Conclusions and Evaluation (skills)
MMO	Manipulations, Measurement and Observation (skills)
PDO	Presentation of Data and Observations (skills)

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1 (a) (i)		[3]
MMO decisions 1	[1] mp1	(labels under correct sequence of beakers) 2.5 AND 1.2(5) AND 0.6(25);
		Additional guidance **Must have** • % once • concentrations to at least 1 decimal place
MMO decisions 2	[1] mp2	**EITHER** (uses serial dilution) (adds previous concentration of S to **each** of three beakers and same volume) 10 cm^3 of 5(%) or shown by arrow with 10 cm^3 **AND** 10 cm^3 transferred from third beaker to fourth and from fourth beaker to fifth beaker;
		Additional guidance **Must have** cm^3 once **ecf** if mp1 is incorrect
	[1] mp3	(adds (distilled) water / **W** to **each** of three beakers BUT **MUST** add previous concentration to fourth and fifth beakers) water / **W** and 10 cm^3;
		Additional guidance **Must have** cm^3 once **ecf** if mp1 is incorrect and/or if mp2 is incorrect

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OR

max 1

for mp2 and mp3

(uses simple dilution)					
<u>10</u>% (**S**)	2.5 and	**AND**	1.25 and	**AND**	0.625 and 9.375
W	7.5		8.75		
OR					
<u>10</u> % (**S**)	5 and	**AND**	2.5 and	**AND**	1.25 and
W	15		17.5		18.75

Additional guidance

Must have
- cm^3 once
- <u>10</u>(%) for each test-tube with % once or arrow from first beaker to each one

ecf if mp1 is incorrect
R rounded volumes up or down.
R just **S**.

(ii) **[1]**

ACE improvement 1

[1]

boil enzyme (and sucrose)
Or replace enzyme / **E** with water or use water / **W** instead of enzyme / **E**
Or replace sucrose with water / **W** or use water instead of sucrose
Or use sucrose and <u>water / **W**</u>
Or use enzyme and <u>water / **W**</u> ;
(Ignore equal volume or 2 cm^3 of each)

Additional guidance

A ref. to use of test-tube **AND** ref. to idea of only water e.g. in beaker or 20 cm^3 BOTH correct
R ref. to water only with Benedict's
R <u>only 10%</u> sucrose or sucrose AND enzyme AND Benedict's in any combination
R give more than one
Ignore denature enzyme (needs how)

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	(iii)	**[4]**
PDO recording 2	[1]	table with all cells drawn **AND** heading percent(age)conc(entration);
		Additional guidance **A** no outer boundary **A** % or percent(age) **A** test-tube / additional columns or rows or **U** separate **R** units in cells of this column or row **R** other units e.g. mol dm^{-3}
	[1]	(heading for any column or row including mean) time (/) s or sec(ond)s;
		Additional guidance **A** columns / rows for test-tubes or observations **A** notes outside the area of table **R** units in cells of this column or row **R** min(utes) **R** additional method **R** t or T
MMO collection 2	[1]	records whole seconds (numbers) 'less than 601' for ANY 5 concentrations **and U and W** / control (7) anywhere; (mark first column or row of recorded time taken)
		Additional guidance **Must have** • whole numbers • values 600 or less • organised into concentration order or time order ignore **U** and control **Ignore** mean times or .0 results
	[1]	records correct pattern highest concentration recorded is shorter time than next concentration ; (mark first column or row of recorded time taken)
		Additional guidance **A** any values e.g. seconds with tenths or min:sec **A** minimum two recorded times including 'more than 600' once

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	(iv)	[1]
ACE interpretation 1	[1]	correct two concentrations from their results as times; (should be 3% so between 5 and 2.5)
	Additional guidance	**Must be** • between two neighbouring concentrations • if same as one concentration then between lower or higher concentration and value given **R** calculate any value between concentrations

	(v)	[max 2]
ACE interpretation **max 2**	**max 2** mp1	(independent variable) Idea of use concentration(s) (more / repeat with more / narrower(ignore wider) **AND** have answer for **(a)(iv)** then either (using estimate) between ... and ... or between 10 and 0.625 / lower / higher in correct context); **ecf** from own results above / below if no answer to **(a)(iv)** **A** only between 10 and 0.625
	mp2	examples given relevant to their estimate or smaller intervals or repeat **U**;
	Additional guidance	Give mp1 and mp2 if list at least two more concentrations between correct values or examples of smaller intervals or implies all differences e.g. 0.5% **ecf** from own estimates for above or below range
	mp3	(dependent variable) heat each test-tube separately; **Ignore** ref. to colorimeter
	mp4	(tests / readings for each concentration) replicate;
	Additional guidance	**A** more times or repeats or repeat or *repeat **U*** **Ignore** 'take more readings'
	mp5	(standardised variables) use thermostatically-controlled water-bath for Benedict's test or at named temperature for test;
	Additional guidance	**A** digital or electronic **A** description of use of heating and cooling with Bunsen or hot and cold water

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(b) (i)		[4]
PDO layout 4	O	*x*-axis labelled as storage (/) days **AND** *y*-axis labelled as percentage of <u>vitamin</u> (C content);
		Additional guidance **Must have** units on *x*-axis and *y*-axis **A** %
	S	scale as *x*-axis <u>10 to 2 cm</u> **AND** *y*-axis <u>20 to 2 cm</u> ;
		Additional guidance **A** no 0 label at origin and no end label **R** awkward scale
	P	correct plotting of each point (except 100) to <u>within</u> half a square i.e. less than1 mm from intersection; i.e. plot has to be nearer than halfway from a line – up or down or sideways OR if meant to be between two lines then must not be on line
		Additional guidance **A** small cross or dot in circle or cross in circle **ecf** if *x*-axis not 0 if scale 20 to 2 cm. **R** awkward *y*-axis scale **R** extra plot for reading off (26) using the same symbol as graph plots **R** blobs or dots alone **R** cross too large
	L	<u>(both lines on one set of axes) ruled</u> lines point to point or <u>ruled</u> line of best fit (two plots on line and then one either side of line) **AND** quality clear sharp; **R** extrapolated when point to point **A** extrapolation from line of best fit to vertical or horizontal lines of plotted point only **Must have** key or line labelled with temp.; **R if** • less than 5 plots • line 1 mm or thicker • any feathery line • irregular thickness • line meets top more then 2 mm from 100
		Additional guidance **A ecf** from incorrect P

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	(ii)			**[2]**
ACE conclusion 2	[1]	Idea of comparison between –12 and –6		
		–12 / lower temp	lose less vit C higher vit C at –12	
		OR –6 / higher temp	lose more vit C or decreases more steeply or more significant decrease lower at –6	
		OR as temp. increases / rises	less vit C;	
	[1]	no / partially / can't predict	results provide no evidence / only results for –12 and –6 / no results for 10 / still 13%/some vit C at –6;	
		yes	quote of data –12 (° C) (at 60 days) 86% **AND** –6 (° C) 13%;	
			OR difference 73%	
		Additional guidance	**Must have** percentage / % once	

	(iii)		**[2]**
ACE interpretation 2	[1]	Shows on graph two readings 26 days for –6 and –12; Readings to whole number only	
	[1]	(has used correct readings from graph) to obtain correct answer rounded to whole number; *e.g. 94 – 62 = 32*	
			[Total: 19]

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2 (a) (i)		[6]
		Ignore trichomes and **ignore** cells for mp1 only.
PDO layout 1	[1]	no shading **AND** larger than 60 mm across widest point **AND** (clear, sharp, unbroken lines) ; **Must have** four or more hand drawn lines and/or enclosed areas (not cells) **R** if drawn over the print of question **R** any line 1 mm or thicker **R** any feathery or three gaps or overlaps in line **R any** ruled or dashed lines in drawing
MMO collection 2	[1]	no cells drawn **AND** only half stem **AND** two corners;
	[1]	bulge on at least one corner **OR** definite region epidermis to epidermis of collenchyma across corner;
	[1]	(epidermis) drawn with two lines closer than 4 mm at widest point **AND** at least one continuous line to show boundary of pith drawn;
MMO decision 2	[1]	*(one vascular bundle drawn in both corners)* at least three regions **AND** vascular bundle drawn within each corner;
		Additional guidance **Must have** both outer and inner lines curved towards the epidermis
	[1]	correct label, with label line to <u>enclosed</u> area, xylem; (should be inner area within vascular bundle)
		Additional guidance **R if** • any label which is biologically incorrect e.g. from incorrect organ or animal • any label within drawn area • any label to open space

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	(ii)	**[6]**
PDO layout 1	[1]	no shading **AND** trichome larger than 30 mm at longest point **AND** (clear, sharp, unbroken lines for outer cell line only); **Must have** five or more enclosed areas **R if** • drawn over the print of question • any line 1mm or thicker • any feathery or broken/dashed line • 0 'tails' or overlaps or gaps • **any** ruled lines
MMO collection 2	[1]	<u>one</u> whole trichome drawn **AND** attached to at least one epidermal cell;
		Additional guidance **R if** any gap between trichome and attached cell **R any** ruled lines
	[1]	five adjacent epidermal cells made of different shapes in a line;
		Additional guidance **R if** internal structures inside cells e.g. vacuole / nuclei **R any** ruled lines
PDO recording 1	[1]	*(any one trichome)* rounded or pointed end **AND** along **MOST** of one cell or across more than one cell **AND** only one cell in each trichome;
MMO decision 2	[1]	cell walls drawn as double lines with middle lamella between at least three adjacent epidermal cells;
	[1]	correct label with label line to <u>trichome</u> and one epidermal <u>cell</u> ;
		Additional guidance **R if** any label is biologically incorrect e.g. epithelium or from incorrect organ or animal or cell organelles **R** any label within drawn area

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	(iii)		**[1]**
		Ignore surface area unless in incorrect context.	
ACE conclusion 1	[1]	absorb or trap water / moisture / moist / air OR prevent predators eating stem OR protection / protects from (mechanical) damage OR prevents 'loss of water' / transpiration / evaporation / 'diffusion of water' OR increase humidity;	

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(b) (i) **[3]**

MMO collection 1 — [1]

measures scale bar correctly in mm;
11.5 or 12(.0) or 12.5 or 13(.0) or 13.5 or 14(.0);

Additional guidance **Can have** 1.15 or 1.2 or 1.25 or 1.3 or 1.35 or 1.4 cm
Must have units somewhere that is clear

EITHER

PDO display 2 — [1]

shows conversion of scale bar measurement to μm
(measurement mm) × 1000
OR
(measurement cm) × 10 000

OR shows conversion of μm to mm or cm
700 ÷1000
OR
700 ÷10 000

Additional guidance **Can have** alternative signs for multiplication and division

PDO display 2 — [1]

shows

measurement of scale bar ÷ scale	Allow range in mm/cm/μm 11.5, 12, 12.5, 13, 13.5, 14		
	in mm e.g. 13	in cm e.g. 1.3	in μm e.g. 13 000
	0.07	0.7	700

AND rounds to whole number ;

(11.5)	× 16
(12)	× 17
(12.5)	× 18
(13)	× 19
(13.5)	× 19
(14)	× 20

OR

PDO display 2 — [1]

shows length of Fig. 2.2 divided by length of scale bar **AND** multiplied by 700 OR multiplied by length of Fig 2.2;
(700 divided by length of scale bar)
Can have between 80 mm / 80.5 to 90 mm ÷ 11.5 to 14 (to 0.5 mm only)
OR 8.0 / 8.05 cm to 9 cm ÷ 1.15 to 1.4 (to 0.05 cm only)

PDO display 2 — [1]

same length of Fig 2.2 in μm divided by answer **AND** rounded to whole number;
A × 16 to × 20 in correct context of length of scale bar

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	(ii)		**[5]**
		Mark first **three** differences only.	
PDO recording 1	[1]	organise as a table / Venn diagram / ruled boxes **AND** headed N1 and (Fig.) 2.2 **AND** first difference opposite each other;	
MMO decision 1	[1]	only **three** observable **differences** recorded ;	

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ACE Interpretation **max 3**

max 3

mp	feature	N1	Fig. 2.2
mp1	*(overall shape or ref. to lumen or pith centre)* ***R** 'not circular' or folded*	lobed or star-shape or has bulges or AW e.g. irregular, square / rectangular, folded	oval or round or circular or AW; **R** regular
mp2	*(corners or collenchymas or sclerenchyma or thickened cells)*	present or yes or has	absent or no(ne) or has not;
mp3	*(vascular bundle position or shape)*	in lobes or bulges or *corners* separate / scattered (at edge) if idea of 'all over' / curved	in a ring or circle or around or surrounding
mp4	*(vascular bundle number)*	few(er) **R** xylem or phloem	lots or more;
mp5	*(vascular bundle sizes vary)*	large <u>and</u> small or vary / different	similar / same size;
mp6	*(<u>trichome(s)</u>)* ***R** smooth / rough*	yes or present or has	no(ne) or absent or has no
mp7	*(centre or pith)* ***R** vacuole*	*not hollow* *(lumen / air space absent or no(ne))*	*hollow* *(lumen air space present or yes or has)*
mp8	*(stomata / pores / openings / lenticels)* *Ignore sunken*	*absent or has not or no(ne) or few*	*present or has or yes or more;*

[Total: 21]

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