UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

9700 BIOLOGY

9700/31 Paper 31 (Advanced Practical Skills 1), maximum raw mark 40

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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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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Expected Answers			Mark
1 a (i) Complete Fig. 1.1 to show how you will make <u>two</u> further concentrations of copper sulfate solution			[3]
MMO decisions 3	[1]	(labels under correct sequence of beakers) 0.0003 AND 0.00003; Additional guidance **Must have** • % once	
	[1]	(adds copper sulfate solution, C, to **both** beakers) 1 cm^3 of 0.003(%) or shown as arrow (from 0.003 beaker) **AND** 1 cm^3 (to next beaker); Additional guidance **Must have** • cm^3 once **ECF** • if MP1 incorrect	
	[1]	(adds (distilled) water/W, to **both** beakers) 9 cm^3 (W/water); Additional guidance **Must have** • cm^3 once **ECF for MP3** if MP1 and MP2 incorrect BUT **MUST** add previous concentration to third and fourth beakers	

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Expected Answers				Mark
(a) (ii) Prepare the space below and record your observations. ***Mark in <u>vertical line</u> in order*.**				[5]
PDO recording 2	[1]	table with all cells drawn	**AND** heading (top or left) percent(age) conc(entration);	
		Additional guidance	**Can have** • no outer boundary • % • solution or copper sulfate % or percentage copper sulfate solution **Do not give mark if** • % in cells of the headed column/row • other units e.g. mol dm^{-3}	
	[1]	(heading on **any one time column/row** including mean) <u>time</u> with s/sec(onds);		
		Additional guidance	**Do not give mark if** • units in cells of the headed column/row • min(utes) • additional columns/rows for volumes of water/copper sulfate • t or T	

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Expected Answers			Mark
MMO collection 3	[1]	records whole seconds (numbers), less than 181, for W / 0 / control **AND** 4 concentrations;	
		Additional guidance **Must have** • whole seconds only • no value over 180	
	[1]	(in concentration column) W / 0 / control and then lowest concentration of copper sulfate to highest concentration (**minimum of two concentrations**, lowest concentration and then next highest concentration);	
	[1]	lowest concentration of copper sulfate recorded is shorter time than next (higher) concentration; (mark **first** column/row of recorded time taken)	
		Additional guidance **Can have** • minimum of two recorded	

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Expected Answers			Mark
(a) (iii) Explain how your results provide evidence for the support or the rejection of this hypothesis.			[2]
ACE conclusion **max 2**	**max 2**	**1.** clear statement on hypothesis, support / true(hypothesis) OR reject / false(hypothesis);	
		2. correct statement about concentration lower than 0.03% with respect to time e.g. quote concentration and time;	
		3. correct statement about water e.g. no inhibition;	

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Expected Answers			Mark
(a) (iv) Identify <u>one</u> significant source of error in your investigation **<u>MARK</u> the first <u>TWO</u> different ideas for one correct answer.** ***Mark with tick where meet the marking point and cross if idea incorrect up to two.***			[1]
		Mark as incorrect ideas • temperature • evaporation • any errors which affect all test-tubes equally • pH	
ACE interpretation **max 1**	Cause of error		WITH idea of error
	max 1	**1.** (dependent) colour change end-point timing	difficult to judge see or identify determine is subjective may be different too quick;
		2. time intervals	(15 seconds) too long (a time interval);
		3. (standardised) air bubble in syringe	measuring not accurate;
	Additional guidance		**Do not give mark if (count as an idea)** • human reaction time • just have cause and no error • give improvement or correction of error e.g. 'should have timed each one separately' • contamination

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Expected Answers			Mark
(a) (v)	**Describe <u>three</u> other modifications to this investigation would improve the confidence in your results.** **Do not allow colorimeter.** **<u>MARK</u> the first FOUR different ideas for any THREE correct answers.** ***Mark with a tick where meet marking point and cross if idea but not correct up to 4.***		[3]
ACE improvements **max 3**	**max 3**	(dependent variable) **1.** replicate; **2.** more / closer / shorter time intervals (gaps); (**MUST BE** less than 15 seconds, but not less than 5 seconds) **3.** use of Benedict's solution **AND** timing to first colour change / clinistix;	
		Additional guidance **Can have** • repeat or more trials or more readings **Ignore** • mean	
		(standardised variables) **4.** add a buffer; **5.** idea of more accurate instruments e.g. use of graduated pipette or syringe with smaller divisions (1 cm^3) e.g. measuring cylinder;	
		Additional guidance **Ignore** (for MP5) • use burette	
		6. (independent variable) more / wide / narrow(er) / different / high(er) / low(er) / more concentrations / dilutions / solutions;	
		Additional guidance **Do not give mark if** • ref. to separate syringes • use larger volumes • put covers or lids on	

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Expected Answers			Mark
(b) (i) Draw a circle around each of the anomalous results and complete the table.			[2]
MMO decision 1	[1]	circles the two anomalous results/ for 12.5 <u>80</u> AND for 3.5 <u>84</u>;	
		Additional guidance **Do not give if** • circled more than two numbers **Ignore** • the figure 93 if in place of 96 do not count as a 'circle' if circled	
ACE Interpretation 1	[1]	calculates mean correctly/<u>59</u>;	
		Additional guidance **ECF** allow • <u>64</u> (as candidate has used anomalous result to calculate mean) **Do not give if** • 64.2 (needs to round number down) • given two answers	

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Expected Answers			Mark
(b) (ii) Plot a graph of the data shown in Table 1.1.			[4]
PDO layout 4	[1]	*x*-axis copper sulfate/mol dm^{-3} $x10^{-3}$	**AND** *y*-axis absorbance/%;
		Additional guidance	**Must have** • units on *x*-axis **AND** *y*-axis
	[1]	scale as *x*-axis 5 to 2 cm **must** label each 2 cm	AND *y*-axis 20 to 2 cm ; ECF if no labels for O **must** label each 2 cm
		Additional guidance	**Do not give mark if** • awkward scale e.g. • scale not written on each 2cm **Ignore** 0 on either axis AND 100 on *y*-axis
	[1]	correct plotting of each point <u>to</u> within half a square i.e less than 1 mm from intersection i.e. plot has to be nearer than halfway from a line - up or down OR if meant to be between two lines then must not be on line above or below;	
		Additional guidance	**Can have** • small cross or dot in circle or cross in circle • ECF if *x*-axis not 0 if scale 20 to 2 cm. even **Do not give mark if** • awkward *y*-axis scale • blobs or dots alone • cross too large with any part of line touching 4 mm by 4 mm square – check with grid dot/blob size which is 2 mm across • Mark the plot for figure 93 as for other plots, do not penalise for using the number.

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Expected Answers				
	[1]	lines point to point	**AND** • ruled, clear sharp and • quality ruled lines thinner than half square; **Do not give mark if** • less than 5 plots • any feathery line • irregular thickness extrapolated to zero	

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Expected Answers			Mark
(b) (iii) Explain the effect of copper sulfate on the protein suspension.			[2]
ACE conclusion **max 2**	**max 2**	**1.** (protein) coagulates / clots as concentration of copper sulfate increases;	
		2. denatures;	
		3. detail on the effect of changing the protein structure; e.g. bonds broken / shape changed / altered / quaternary structure / tertiary structure	
		Additional guidance **Do not give mark if** • link to enzyme for any MP	
[Total: 22]			

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Expected Answers					Mark
2 (a) Draw a large plan diagram of the part of the leaf indicated by the shaded area in Fig. 2.1. Label the xylem and an air space. *Mark in <u>vertical line</u> in order.*					[5]
PDO layout 1	[1]	clear, sharp, unbroken lines	**AND** no shading	**AND** longer than *60 mm* across middle / bulge from top to bottom;	
		Additional guidance 'tail' or overlap or gap has to be more than 1 mm to be marked as an error	**Must have** • **3** or more hand-drawn lines (not ruled) **and** one or more enclosed areas **Do not give mark if** • drawn over the print of question • any line thicker than 1mm • any feathery or broken or overlap in lines • drawn only <u>one enclosed area</u> and drawn <u>any</u> 'tail' or gap in the outline **Can have** • **1** 'tail' or overlap or gap in the outline if drawn 2/3 enclosed areas		
MMO collection 3	[1]	no cells drawn	**AND** drawn part of leaf indicated by shaded area **AND** outline of bulge at each side turns parallel to top layer*;*		
		Additional guidance	**Can have** • up to **3** enclosed areas within vascular bundle or within area where vascular bundle is situated (as drawing large xylem vessels which would make them cells)		
	[1]	vascular bundle divided into at least **2** regions;			
	[1]	definite area around hinge region drawn (at base of fold);			

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Expected Answers				
MMO decision 1	[1]	label line to central area air space drawn as distinct area which goes outside central area	**AND** labelled xylem **AND** labelled air space;	
		Additional guidance	**Do not give mark if** • any label which is biologically incorrect e.g. from incorrect organ or animal • label within drawn area	

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Expected Answers					Mark
(b) Make a large drawing of <u>six</u> cells from the part of the leaf indicated by the shaded area in Fig. 2. 2. The cells should be <u>two</u> adjacent (touching) cells from the epidermis and <u>two</u> adjacent cells from each of the next two layers. Label one epidermal cell.					[5]
PDO layout 1	[1]	clear, sharp, unbroken lines	**AND** no shading or stippling	**AND** longest dimension of any cell is 30 mm using grid;	
		Must have • **3** or more enclosed areas **Do not give mark if** • drawn over the print of question • any line thicker than 1mm • any feathery line **Can have** • **2** 'tails' or overlap or gap in the <u>outline</u> of **6** enclosed areas **(assessing outer line)**				
MMO collection 2	[1]	three pairs of <u>touching</u> cells only;			
		Additional guidance	**Do not give mark if** • other layers drawn		
	[1]	the longest dimension (top to bottom) of one of the two middle cells is longer than the shortest dimension (top to bottom) of any of the other four cells (by at least 1 mm);			
PDO recording 1	[1]	cell walls drawn as double lines with middle lamella between **any two cells**;			

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MMO decision 1	[1]	correct label with label line to <u>epidermal cell/cell from epidermis</u>;
		Additional guidance **Do not give mark** • for epidermis only • label within drawn area • for any label which is biologically incorrect e.g. organelles or from incorrect organ or animal

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Expected Answers				Mark
(c) The actual length of line Y is 785μm. Use this measurement to calculate the magnification of Fig. 2.3				[3]
MMO decision 1	[1]	measures line **Y** in mm; 22 22.5 23 23.5 24 mm		
		Additional guidance	**Can have** 2.2 2.25 2.3 2.35 2.4 cm **Must have** units somewhere only those values given	
PDO display 2	[1]	(uses mm and converts to μm by) shows <u>multiplied by</u> or <u>x</u> mm x 1000 OR x 10^3 OR (uses cm and converts to μm by) cm x 10000 x 10^4	**AND** <u>divided by</u> (785);	
		(converts (785) μm to mm or cm) shows <u>division by</u> or <u>1000</u> x 10^3 OR (converts (785) μm to mm or cm) shows <u>division by</u> or <u>10000</u> 10^4	**AND** <u>divides</u> Y <u>by</u> (0.785) OR **AND** <u>divides</u> Y <u>by</u> (0.0785);	

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		Additional guidance **Must have** multiplication and division signs/wording OR division and division signs/wording **Can have** ***** or **.** for 'multiplied by' even if no units mm or cm **ECF** using incorrect figure if MP1 wrong **Do not give mark if** uses metres anywhere
	[1]	rounds to whole number;
		Additional guidance for MP3 **ECF** from MP1 but needs to have MP2 correct

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Expected Answers						Additional guidance
(d) Prepare the space below so that it is suitable for you to record the observable differences between the specimens on J1 and that in Fig. 2.3.						[5]
PDO recording 1	[1]	organise as a table / ruled boxes	**AND** headed J1 and Fig 2.3	**AND** first difference opposite each other;		J1 Fig 2.3 Fig 2.3 J1
MMO decision 1	[1]	at least one difference and no similarities;				
ACE interpretation **max 3**	**max 3**		feature	J1	Fig. 2.3	
		1.	(mid-rib) shape	V-shaped / sharp / narrow / pointed / concave	bump / rise / rounded / circular / wide; (do not accept V-shaped)	
		2.	vascular bundle xylem / phloem position	small / nearer lower epidermis in one area	large / wide across midrib nearer upper epidermis;	

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		3.	vascular bundle sheath amount of xylem / phloem	present less	absent; more;
		4.	stomata / guard cells	present / many	absent / less / none / cannot see;
		5.	collenchyma	present	few cells / none;
		6.	upper epidermis	thick epidermis / large cells	thin epidermis / small cells;
		7.	hinge cells / rectangular cells	present	absent;
		8.	number of air spaces / lacunae / packing size of air spaces	many (cells) densely packed large	few / none (cells) loosely packed small;

Additional guidance	If reverse headings then
	Do not give mark for PDO recording mark
	– show the swapping over of headings on their table then **give marks** as if for the swapped headings.
	
	If no organisation then
	give mark only if in same sentence or following sentences
	
	Ignore
	tick and cross without a key
	refs. to size
	3-D descriptions such as spherical
	colours/staining
	
	Can have
	differences even if not opposite each other.
	differences on one side if e.g. use more or –er

	Total 18

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I	ignore
BOD	Benefit of Doubt given
ACE	Analysis, Conclusions and Evaluation (skills)
PDO	Presentation of Data and Observations (skills)
MMO	Manipulations, Measurement and Observation (skills)

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1 (a) (i) **Complete Fig. 1.1 to show how you will make a *serial* dilution to reduce the concentration by *half* between each concentration.** **[3]**		
MMO decisions 1	[1]	(labels under correct sequence of beakers) 1(.0) AND 0.5 AND 0.2(5);
		Additional guidance **Must have** • % once
MMO decisions 2	[1]	(uses serial dilution) (adds previous concentration of G to **each** of three beakers and same volume) volume of 2(%) or shown by arrow with volume **AND** the same volume transferred from first beaker to second and from second beaker to third beaker);
		Additional guidance **Must have** • cm^3 once
	[1]	(adds of (distilled) water/W to **each** of three beakers) 10 cm^3;
		Additional guidance **Must have** • cm^3 once

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(ii) Complete Table 1.1 to show the volumes of solutions you intend to use in your investigation. [2]

MMO decisions 2

[1]

[1]

solution	volume / cm^3
G and S1 and S2	all same volume;
	Additional guidance **Must have** • volume 2 cm^3 or more **AND** 15 cm^3 or less • whole number **Do not give mark for** • drops
Benedict's	(whole number) same as G and S1 and S2 OR more than G and S1 and S2 OR same or more than the largest volume from G / S1 / S2;
	Additional guidance **Do not give mark if** • for a combined volume of solution plus Benedict's of 21 or more cm^3 • if any value missing for G / S1 / S2

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(b) (i)	**State one variable, other than volume, which needs to be kept the same in this investigation. Describe *how you* will keep this variable the same.**			**[1]**
ACE improvement 1	[1]	**Do not give credit if answer gives a choice.**		
		<u>temperature</u>	**AND** (idea of how kept the water-bath the same) heat or described Or add hot or cold water	**AND** boil Or to temperature 80(°C) to 100 Or checking or monitoring with thermometer BOD temperature probe/gauge;
		Additional guidance	**Do not give mark if** • ref to thermostatically controlled or electronic etc. **how will you** • heating with thermometer • temperatures below 80	

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	(ii) Prepare the space below and record your results. Allow G as 4%.		**[4]**
PDO recording 2	[1]	table with all cells drawn	**AND** heading (top or left) percent(age) conc(entration);
		Additional guidance	**Can have** • no outer boundary • % **Do not give mark if** • test-tube or beaker • other units e.g. mol dm^{-3}
	[1]	(heading for any column/row including mean) time with s or sec(onds);	
		Additional guidance	**Do not give mark if** • units in cells of this column/row • min(utes) • additional columns/rows for method e.g. volumes of glucose or water or temp • t or T
MMO collection 2	[1]	records whole seconds (numbers) less than 301 for ANY 5 concentrations **and** S1 **and** S2 (7);	
		Additional guidance	**Must have** • whole seconds only • no value over 300
	[1]	highest concentration recorded is shorter time than next concentration;	
		Additional guidance	**Can have** • minimum two recorded times

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(c) (i) Estimate the concentration of glucose in solutions S1 and S2.			**[1]**
ACE conclusion 1	[1]	correct estimate with their results for both S1 and S2	**AND** percentage or % once;
		Additional guidance	**Do not give mark if** • calculate value between concentrations **Can have** • 'lower than' or quote lower value • 'higher than' or quote higher value • 'between … and ….' Or e.g. 2–4%
(ii) State which solution, S1 or S2 is most likely to be from an untreated diabetic.			**[1]**
ACE conclusion 1	[1]	(from **(c)(i)** – **MUST** have values for both S1 and S2) correct with their estimate from **(c)(i)** i.e. the highest concentration estimate;	
		Additional guidance	**ECF** if estimates the same value then can have 'S1 and S2' Or 'S1 or S2' Or 'both' **Must have** • estimate in **(c)(i)** for both S1 and S2
			[Total: 12]

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2 (a) Plot a graph of the data shown in Table 2.1. [4]

PDO layout 4

[1]

x-axis
distance (along tube (/) cm

AND *y*-axis
diameter (of tube) (/) mm;

Additional guidance

Must have
- units on *x*-axis and *y*-axis

[1]

scale as *x*-axis
5.0 to 2 cm
Must label each 2 cm

AND *y*-axis
1.0 to 2 cm;
Must label each 2 cm

Additional guidance

Do not give mark if
- awkward scale
- scale not written on each 2 cm

[1]

correct plotting of each point;

Additional guidance

0.5	1.8
4.5	2.4
12.5	3.8
20.0	5.1
24.0	5.8

Can have
- small cross or dot in circle or cross in circle
- ECF if *x*-axis not 0 if scale 20 to 2 cm.

Do not give mark if
- awkward *y*-axis scale
- blobs or dots alone
- cross too large with any part of line touching 4 mm by 4 mm square –

[1]

lines point to point or line of best fit

AND
- ruled, clear sharp –
- quality – ruled lines thinner than half square;

Additional guidance

Can have
- extrapolation to edges of grid if line of best fit

Do not give mark if
- less than 5 plots
- any feathery line
- irregular thickness
- extrapolated when point to point line (not line of best fit)

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(b)	**(i)**	**Calculate the actual diameter of the tube shown by line x in fig. 2.1**	**[4]**
MMO collection 1	[1]	measures line X correctly in mm; *95 or 95.5 or 96 or 96.5 or 97 mm*	
		Additional guidance **Must have** • units	
PDO display 2	[1]	shows measurement divided by 22;	
		Additional guidance **Can show** • alternative division signs • incorrect measurement	
	[1]	rounds any answer of division by 22 to two or three significant figures;	
		Additional guidance **Do not give if** • in metres	
ACE interpretation 1	[1]	correct answer one of following only in mm; 4.32 or 4.34 or 4.36 or 4.39 or 4.41 or 4.3 or 4.4 mm.	
		Additional guidance **Do not give mark if** 0.43/0.44 cm or micrometres	
	(ii)	**Use the actual diameter of the tube calculated in (b)(i) and your graph in (a)(i) to estimate the distance along length of the tube.**	**[1]**
ACE interpretation 1	[1]	correct answer using their answer from **(b)(i)** and graph and cm;	

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(iii) Describe how you would find the mean diameter of the tube shown in Fig. 2.1.			**[2]**
ACE improvements 2	[1]	assume in context of the tube – **Do not give mark if** • Idea of different tubes • Just 'take readings'	
		Idea of more or e.g. 2 or higher take/find measure make readings/measurements of OR Uses/adds	diameters (from graph) measurements 5 actual figures from data or 5 points from graph – Or all diameters or values-or readings
	[1]	add/sigma/sum of (measurements can be from graph) **and** divide by the number of measurements (ecf) OR alternative description;	

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(iv) Prepare the space below so that it is suitable for you to record the observable differences between the specimens in Fig. 2.1 and in Fig. 2.2. [5]

PDO recording 2

[1] organise as a table/Venn diagram/ruled boxes **AND** headed Fig. 2.1 and Fig. 2.2 **AND** first difference opposite each other;

Additional guidance Fig. 2.1 | Fig. 2.2 OR Fig. 2.2 | Fig. 2.1

[1] observable differences only; can be incorrect
Do not give mark if any similarities or function differences or features in overlapping part of Venn diagram

ACE interpretation max 3

max 3

	feature	Fig. 2.1	Fig. 2.2
1.	lumen shape or epithelial	less / few / four folds / thick cross(-shape) or drawn	more / five / six folds / thin star or drawn
2.	lumen size	large(r)	small(er);
3.	epithelial tissue	thick(er)	thin(er);
4.	connective tissue	goes less into folds thick(er) or thin(ner)	goes more into folds thin(ner) or thick(er);
5.	muscle tissue	more / thick or less / thin striated / skeletal / voluntary	less / thin or more / thick smooth / involuntary;
6.	cells or nuclei	visible / present / seen	not visible / absent / not seen;
7.	(Overall) shape Extra layer between connective tissue and muscle	squashed / no extra layer absent	round / extra 'arm' present / has / described

[Total: 16]

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3 (a) (i) Draw a large plan diagram of the whole of the transverse section. Label the epidermis and xylem. [5]				
PDO layout 1	[1]	clear, sharp, unbroken lines	**AND** no shading	**AND** larger than 60 mm across widest point top to bottom;
		Additional guidance 'tail' or overlap or gap has to be more than 1 mm	**Must have** • three or more enclosed areas **Do not give mark if** • drawn over the print of question • any line thicker – 1 mm or more • any feathery line or broken in enclosed area	
MMO collection 2	[1]	no cells drawn	**AND** complete section drawn;	
	[1]	draws outline with at least four larger bulges;		
		Additional guidance	**Can have** • different bulge attached or additional structure outside main outline	
MMO decisions 2	[1]	inner region below bulges has at least three lines (two layers);		
		Additional guidance	**Do not give mark if** • vascular bundle(s) drawn	
	[1]	correct label with label lines to epidermis (outer two lines or touches outermost line not into area past a single line) **and** xylem (any inner region outside centre and under bulges); blob tick		
		Additional guidance	**Do not give mark if** • any label which is biologically incorrect e.g. from incorrect organ or animal • any label within drawn area except if showing ratio • upper or lower **Can have** • labels to additional bulges	

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(ii) Calculate the ratio of the total diameter of the stem to the diameter of the pith. [1]

ACE interpretation 1

[1] last answer as larger **whole** number to / : smaller **whole** number;

Additional guidance

Must have
- to smallest denominator

Can have
- as a fraction to smallest denominator

Do not give mark if
- any units/epg in answer
- if give more than one answer

(b) (i) State one observable feature of the epidermis that supports the conclusion that this is a stem from a plant growing in a dry habitat. Explain how this feature reduces water loss. [1]
Read whole answer for feature.

ACE conclusions 1

[1]

cuticle	**AND**	
stomata with no or BOD few or sunken epidermis with folded grooved fleshy	reduces or prevents	evaporation or water escaping or diffusing or transpiration;
	storage of water	

Additional guidance

Do not give mark if
- features not linked to epidermis
- ref. to leaf

Ignore
- ref. to surface area

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(ii) Make a large drawing of three adjacent cells from the central pith. Label the cell wall.				**[5]**
PDO layout 1	[1]	clear, sharp, unbroken lines	**AND** no shading	**AND** longer than 30 mm across widest point of largest cell;
		Additional guidance	**Must have** • at least three enclosed areas **Do not give mark if** • drawn over the print of question • any thicker line – than 1 mm • any feathery line	
MMO collection 3	[1]	only three cells drawn	**AND** as a group or as line;	
	[1]	no gaps between two pairs of touching cell walls;		
		Additional guidance	**Must have** • be in contact for whole length where adjacent	
	[1]	cell walls drawn as double lines with middle lamella between adjacent walls of any two cells;		
MMO decision 1	[1]	correct label with label line to cell wall;		
		Additional guidance	**Do not give mark if** • any label is biologically incorrect e.g. from incorrect organ or animal or EM organelles or chloroplasts • label within drawn area	
				[Total: 12]

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GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

9700 BIOLOGY

9700/33 Paper 31 (Advanced Practical Skills 1), maximum raw mark 40

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Mark scheme abbreviations:

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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
AVP	Alternative version possible
ACE	Analysis, Conclusions and Evaluation (skills)
PDO	Presentation of Data and Observations (skills)
MMO	Manipulations, Measurement and Observation (skills)

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1 (a) (i) Complete Fig. 1.1 to show how you will make a *serial* dilution to reduce the concentration by *half* between each concentration. [3]

MMO decisions 1 — [1]

(labels under correct sequence of beakers either left to right or right to left-)
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]

(uses serial dilution to complete three unlabelled)
(adds previous concentration of E to **each** of three beakers and same volume)

5(%) with volume or shown by arrow from (5%) with volume	**AND** the same volume transferred from first beaker to second and from second beaker to third beaker);

Additional guidance **Must have**
- cm^3 once

ecf
- if mp1 incorrect

MMO decisions 2 — [1]

(adds (distilled) water / W to **each** of three beakers)
10 cm^3 (W / water);

Additional guidance **Must have**
- cm^3 once

ecf
- if mp1 incorrect
- if mp2 incorrect BUT **MUST** add previous concentration to second and third beakers

(ii) Describe how you will set up this control using the apparatus provided. [1]

ACE improvement 1 — [1]

(may answer in terms of setting up test-tubes)
boil enzyme
Or replace enzyme / E with water / W
Or use water / W instead of enzyme / E
Or use urea / U and water / W
(Ignore equal volume or 2 cm^3 of each)

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(iii) Prepare the space below and record your results.			**[5]**
PDO recording 2	[1]	table with all cells drawn	**AND** heading (top or left) percent(age) conc(entration);
		Additional guidance	**Can have** • no outer boundary • % • solution % or enzyme % or percentage solution or percentage enzyme **Do not give mark if** • % in cells of the headed column/row • other units e.g. mol dm^{-3}
	[1]	(heading on **any one time column/row** including mean) time with s or sec(onds);	
		Additional guidance	**Do not give mark if** • units in cells of the headed column/row • min(utes) • additional columns/rows for volumes of enzyme or urea • t or T
MMO collection 3	[1]	(in concentration column) **lowest** concentration of E first to highest concentration minimum of three;	
		Additional guidance	**Ignore** • control or 0% or W before or after or not present **but** not in middle **Can have** • ecf **any** lowest recorded concentration
	[1]	records whole seconds (numbers) less than 601 for 5 concentrations **and** control (6); (mark **first** column/row of recorded time taken)	
		Additional guidance	**Must have** • whole seconds only • no value over 600
	[1]	highest concentration recorded is shorter time than next concentration; (mark **first** column/row of recorded time taken)	

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(iv) Calculate the rate of reaction for the 10% E concentration. **[1]**

ACE interpretation 1

[1]

(from results or mean)
correct answer (1 divided by the result for 10%) with units s^{-1};

Additional guidance

Can have
- $sec(onds)^{-1}$

Do not give mark if
- no result for 10%.
- more than 3 significant figures.

E.g. 0.00345 ✓ (3 sig. figs) **NOT** 0.003456 X (4 sig. figs)

(v) Identify *one* significant sources of error in your investigation. **[1]**

ACE interpretation max 1

max 1

Mark as incorrect ideas
temperature
pH
evaporation
any errors which affect all test-tubes equally

	Cause of error	WITH idea of error
1.	(dependent) colour change / red to blue / end-point litmus colour	difficult to judge see or identify determine is subjective may be different too quick;
2.	timing reaction starts	not same or describes only starts when added to all test-tubes or delayed or not added at same time too quick or describes more concentrated goes quickly or after reaction starts before timing;
3.	(standardised) litmus paper enzyme	 sticks to sides/bottom not dissolved;

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			Additional guidance	**Do not give mark if (count as an idea)** • human reaction time • just have cause and no idea of error • give improvement or correction of error e.g. should have timed each one separately • contamination
(vi) Suggest how you would make *two* improvements to this investigation.				**[2]**
ACE improvements max 2	max 2	**1.**	(dependent) use pH meter use datalogger **and** pH sensor liquid litmus or indicator **and** colorimeter;	
			Additional guidance	**Do not give mark if (count as an idea)** • only colorimeter (litmus paper!) • only universal indicator • use of colour charts
		2.	stagger start or do individually or use more stop clocks or use help;	
		3.	replicate;	
			Additional guidance	**Can have** • repeat or more trials or more readings **Ignore** • mean
		4.	(standardised variables) dry test-tubes (dissolve enzyme with idea of how) leave for longer or use stirrer or warm;	
			Additional guidance	**Do not give mark if** • ref. to separate syringes • use larger volumes • put covers or lids on
		5.	(independent variable) more / wide / narrow(er) / different / high(er) / low(er) / examples range of concentrations / dilutions / solutions;	
			Additional guidance	**Do not give mark if** • use burette or graduated pipette or smaller syringe or with smaller divisions

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(b) (i) Plot a chart of the data shown in Table 1.1. **[4]**

PDO layout 4

[1]

x-axis method

AND *y*-axis
nitrogen/N (/) millions ton(ne)s per year;

Additional guidance

Do not give mark if
- any units e.g. arbitrary units on *x*-axis

Must have
- units on *y*-axis

[1]

scale as *x*-axis
even widths to up to 2 cm

AND *y*-axis
20 to 2 cm and **must** label each 2 cm

AND
start at 0;

Additional guidance

Do not give mark if
- awkward scale e.g. 25 or 40 to 2 cm.
- Or bars drawn outside grid

[1]

correct plotting of each bar;

Additional guidance

ecf if *y*-axis not 0 if scale 20 to 2 cm.
Horizontal top line must be clear, sharp and ruled to show plot.

Do not give mark if
- awkward *y*-axis scale
- bars arranged differently from order of table
- horizontal lines too thick – 1 mm/half square or not clear

[1]

each bar separate and must be 5

AND bars –
- quality – ruled vertical lines
- and labelled clearly with method;

Additional guidance

Must have
- thinner than half square vertical lines to horizontal must meet exactly
- any clear labels e.g. I/A/D/N/F – underneath, **must be** directly below correct bar or inside bar

Do not give mark if
- solid shading or line shading outside a bar
- any feathery line
- irregular thickness OR not possible to see drawn line

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(ii) Calculate the percentage decrease from 1840–1850 to 1990–2000. **[2]**

PDO display 2

[1]

123 – 108

OR
108/123X100

Additional guidance **Must have**
- minus sign or minus

[1]

(123 – 108) or 15 must have (123 – 108) or decrease 15

or
(answer from any subtraction)
Can have 10^6 or (15) 000 000

divided by /123 **and** multiplied by X 100

AND answer rounded to whole number (12) or 3 sig. figs. i.e. one decimal place (12.2);

OR
100 – 87.8
Allow if can see 123 = 100% then mp2

AND answer rounded to whole number (12) or 3 sig. figs. i.e. one decimal place (12.2);

Additional guidance **Must have**
- answer from a subtraction,
- division and multiplication signs/wording

(iii) Suggest one reason for the difference in the natural fixation between 1840–1850 and 1990–2000. **[1]**

ACE conclusions 1

[1]

IDEA OF
less uncultivated land or more cultivated
OR more crops grown
OR (more) deforestation or loss of habitat or desertification
OR building or urbanisation
OR less leguminous plants or Rhizobium or organisms involved in N fixation
OR more fertilisers so eutrophication
AVP;

Additional guidance **Do not give mark if**
- more pollution unqualified

[Total: 20]

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2 (a) (i) Draw a large plan diagram of the part of the leaf indicated by the shaded area Fig. 2.1. Label the vascular bundle and the palisade layer. [5]

PDO layout 1	[1]	clear, sharp, unbroken lines	**AND** no shading	**AND** larger than *60 mm* across widest point top to bottom;
		Must have • three or more hand-drawn (not ruled) lines **and** one or more 'enclosed areas' **Do not give mark if** • drawn over the print of question • any feathery or broken or overlaps in lines • any 'tail' or overlap or gap in the outline of enclosed areas **Can have** • 1 'tail' or overlap or gap in the outline of 2/3 enclosed areas • only lines less than 1 mm		
MMO collection 2	[1]	no cells drawn	**AND** outline of bulge at each side turns parallel to top layer;	
	[1]	(upper epidermis and palisade layer above vascular bundle or bulge (if no vascular bundle)) drawn as three lines which continue into lamina;		
MMO decision 2	[1]	vascular bundle divided into at least **two** regions If **not** an enclosed area must be within bulge	**AND** epidermal layer at lowest point of bulge thinner than opposite epidermal layer;	
	[1]	correct label with label lines to vascular bundle(area inside bulge) and palisade layer (any area closer to opposite epidermal layer to vascular bundle);		
		Additional guidance	**Do not give mark if** • any label which is biologically incorrect e.g. from incorrect organ or animal • label within drawn area	

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(ii) Make a high-power drawing of one epidermal cell with one attached, whole trichome (hair). Label epidermal cell and trichome. **[5]**

PDO layout 1	[1]	clear, sharp, unbroken lines	**AND** no shading or stippling	**AND** trichome longer than *30* mm;
		Additional guidance	**Do not give mark if** • drawn over the print of question • any feathery or broken line in outline of enclosed areas • any feathery line or squiggle for trichome • 2 'tails' or overlaps or gaps if two lines for cell wall in epidermal cell • 0 'tails' or overlaps or gaps if one line for cell wall in epidermal cell **Can have** • only lines less than 1 mm	
MMO collection 2	[1]	only one epidermal cell drawn	**AND** one whole attached trichome drawn;	
	[1]	*(Trichome(s) wide enough to see clearly)* rounded or pointed end	**AND** only one cell in each trichome;	
PDO recording 1	[1]	cell walls drawn as double lines for whole of epidermal cell;		
MMO decision 1	[1]	correct label with label lines to epidermal cell and trichome;		
		Additional guidance	**Do not give mark if** • any label is biologically incorrect e.g. from incorrect organ or animal, chloroplast, stoma(ata) or e.g. Golgi or mitochondria • label within drawn area	

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(iii) State two observable features of K1 which support the conclusion that this is a leaf from a plant growing in a dry habitat. Explain how these features reduce water loss. [2]

ACE conclusions max 2	max 2	1 mark for 2 features **mp1**	Then 1 mark (mp2 to 5) for one correct reason with the correct feature
		leaf curled/rolled	**mp 2** Idea of reduces evaporation/diffusion or traps moist(ure)/water or humidity increases;
		trichomes or hairs or hair-like	**mp 3** Idea of absorb or trap water/moist(ure) or prevent diffusion or evaporation;
		cuticle	**mp 4** Idea of prevents or reduces evaporation or described;
		stomata on lower epidermis/not on upper epidermis or sunken or few	**mp 5** Idea of prevents diffusion or reduces evaporation or described;
		Additional guidance	**Ignore** • refs. to water potential • reduces transpiration (rate);

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(b) (i) Use the magnification to calculate the *actual length* of line Y in μm.			**[3]**
MMO collection 1	[1]	measures line X correctly in mm; 87 87.5 88 88.5 89 mm	
		Additional guidance **Must have** • only those values given and units **Ignore** • use of metres	
MMO decision 1	[1]	EITHER (uses any measurement and converts to μm) (mm) measurement x1000 OR x 10^3 OR cm to μm (cm) X10 000 x 10^4 OR gives only answer e.g. 87,000 or 87,500 88,000 or 88 500 or 89,000	OR (uses any measurement and divides by 350) measurement mm / 350 e.g. 87 / 350 OR measurement cm / 350 e.g. 8.7 / 350 OR gives only answer e.g. 0.2485 or 0.02485
		Additional guidance **Do not give mark if** • use metres anywhere	
ACE interpretation 1	[1]	correct answer; any whole number **248** to **254** OR answer up to two decimal places between **248.56** and **254.30**	

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(ii) Prepare the space below so that it is suitable for you to record the observable similarities and differences between the specimens on K1 and that in Fig. 2.2. **[5]**

PDO recording1	[1]	organise as a table/Venn diagram/ruled boxes	**AND** headed K1 and Fig. 2.2	**AND** first difference opposite each other;
		Additional guidance	K1 | Fig. 2.2 OR Fig. 2.2 | K1	
MMO decision 1	[1]	attempted one similarity;		

ACE interpretation max 3 — max 3

[internal max 2 for similarities (S1–S2) and max 2 for differences (D1–D7)]

	feature	K1	Fig. 2.2
S1 S2	trichomes hairs present;	single cell; nucleus present;	epidermal cells/epidermis/epidermal layer;
D1	trichome postion	on surface/ not in pits/ not sunken	below surface/ in pits/dip/ sunken
D2	trichome packing	separate or few(er)	close together or more;
D3	trichome shape	straight	curled/bent;
D4	trichome nucleus	not seen absent	visible present
D5	cuticle	present or thin(ner)	none/absent or thick(er)
D6	cell packing	loosely/air spaces	tightly/no air spaces
D7	stomata	present or visible	absent or not visible or not seen

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		Additional guidance	**Ignore** • tick and cross without a key • refs. to size • 3-D descriptions such as spherical • colours/staining
			[Total: 20]

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GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

9700 BIOLOGY

9700/34 Paper 32 (Advanced Practical Skills 2), maximum raw mark 40

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1 (a (i) Use information in Table 1.1 to predict which substances you would expect to be present in each of the four plant extracts, complete Table 1.2. [2]

MMO decisions 2

source of plant extract	substances present in each of the plant extracts		
	starch	**sucrose**	**glucose**
root in winter/S2	✓	X or gap	X or gap
root in spring/S4	✓	(X or ✓ or gap)	✓
phloem sap in summer/S3	X or gap	✓	X or gap
phloem sap in winter/S1	X	X	X

[1] 4 ticks only in correct place for first three rows;
[1] (phloem sap in winter) all crosses/all gaps if in whole table;

Additional guidance	**Do not give if** • hybrid tick / cross • or mixture of gaps and crosses

(ii) Describe the tests that show that sucrose is present in a plant extract. [2]
Tick where mark awarded.

MMO decisions 2

[1] (with Benedict's / reducing sugar test)
negative test or no result / reaction or no change or stays blue;

[1]	add (hydrochloric) acid and boil/heat	**AND** neutralise OR add sodium hydrogen (bi)carbonate sodium carbonate sodium/potassium hydroxide alkali	**AND** <u>Benedict's</u>;
	Additional guidance	**Do not give mark if** • warm or just put in water-bath	

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(iii) Prepare the space below and record your observations. **[4]**
Use vertical line of ticks

PDO recording 2	[1]	table with all cells drawn	**AND** heading (top or left) sample(s) ;
		Additional guidance	**Ignore** • test-tube/additional columns **Can have** • no outer boundary • solution(s) or extract
	[1]	(heading to show results of tests being recorded) colour or observations or description or result(s) AW;	
		Additional guidance	**Do not give mark if** • heading for description of test or test only needs to be what is being recorded • additional columns/rows with volumes of reagents or temperatures • if 'result' heading is actually for conclusion/identification
MMO collection 2	[1]	shows **only** tests for starch, reducing sugar and non-reducing sugar	**AND** (for starch and reducing sugar) show have done the test for ALL four samples;
		Additional guidance	**Do not give mark if** • Biuret or protein test with results anywhere
	[1]	(non-reducing sugar result for **S3)** (reducing sugar Benedict's) blue or no change	**AND** (after hydrolysis) any correct colour (green / yellow / orange / brown / red);
		Additional guidance	**Can have** • combination of colours greeny yellow **Do not give mark if** • just positive and negative or ticks and crosses

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(iv) Complete Table 1.4 to match the samples, S1, S2, S3 and S4, with each plant extract. [1]

ACE interpretation 1

[1]

Source of plant extract	sample
root in winter	(S)2
root in spring	(S)4
phloem sap in summer	(S)3
phloem sap in winter	(S)1;

all correct only one per box;

(b) (i) State *three* variables which the student should keep the same in this investigation. Describe how the student would keep each of these variables the same. [4]

MMO decision 1	[1]	three relevant variables selected from below	
ACE improvements **max 3**	max 3	**1.** size / dimensions / e.g. of dimensions / length OR (surface) area or / to volume OR mass / weight (of root tissue) OR **2.** root or plant	use (metre) ruler or Vernier callipers or describes use of knife / blade / scalpel / cork borer to cut discs / cylinders OR use balance to keep mass the same; same plant or species / type or same root or part of root or same age;
		3. volume of (sodium chloride) solution or example of volume (10 or more) with units (**Ignore** amount)	uses syringe / measuring cylinder / graduated pipette or graduated test-tube or burette to keep same / example of volume;
		4. evaporation (from solutions or test-tubes/ beakers)	cover the containers / bungs into test-tubes;
		5. temperature	use thermostatic(ally-controlled) water-bath or describes method; **Give mark for** incubator or temperature controlled room **Do not give mark if** air-conditioned room
		6. example of time more than 20 mins;	(time only)use stop clock or stopwatch or clock or timer / chronograph / chronometer;

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(ii) Plot a graph of the data shown in Table 1.1. [4]
If CHART then max 2 for O and S

PDO layout 4

[1]

x-axis
conc(entration) of sodium chloride / NaCl
(/) mol dm^{-3} or mol / dm^3

AND *y*-axis
change in / Δ volume (of solution)
(/) cm^3 ;
Do not give mark if V

Additional guidance **Must have**
- units on *x*-axis and *y*-axis

[1]

scale as *x*-axis
<u>0.20 to 2 cm</u>
Must label each 2 cm

AND *y*-axis
<u>2.0 to 2 cm</u>;
Must label each 2 cm

Additional guidance **Do not give mark if**
- awkward scale e.g. 0.25 to 2 cm *x*-axis
- scale not written on each 2 cm
- if numbers to right of *y*-axis

Must have
- negative below 0 **and** positive above 0

[1]

correct plotting of each point;

Additional guidance

0.00	(–)6.0
0.25	(+)1.0
0.50	(+)4.5
0.80	(+)5.2
1.00	(+)5.2

Can have
- small cross or dot in circle or cross in circle
- ecf if *x*-axis not 0 if scale 20 to 2 cm. even

Do not give mark if
- awkward *y*-axis scale
- blobs or dots alone
- cross too large with any part of line touching 4 mm by 4 mm square –
- an **additional plotted point at 0.0** volume same as other plotted points

[1]

lines point to point or smooth curve through all points and horizontal line between last two points

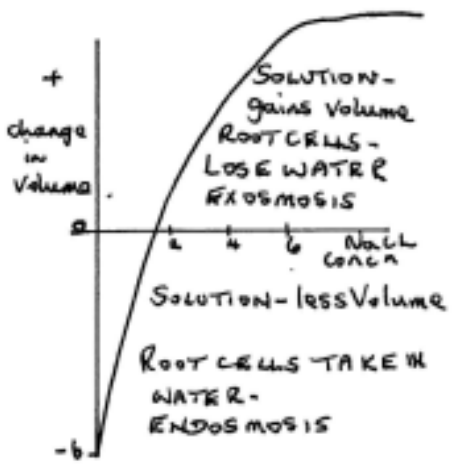
AND
- ruled, clear sharp –
- quality – ruled lines thinner than half square;

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		Additional guidance	**Do not give mark if** • less than 5 plots • line of best fit • any feathery line • irregular thickness • no extrapolation or meets axes 2 mm or more
(iii) Show on graph the sodium chloride concentration where there is no change in volume of solution. [1] **Use to estimate the sodium chloride concentration. [1]**			
ACE interpretation 2	[1]	clearly shows with line(s) or point on line shown at 0 change in volume;	
	[1]	estimate correct from graph at 0 change in volume;	
		Additional guidance	**Must have** • rounding down to two decimal places e.g. 0.20 or with (0.025 scale) e.g. 8.5 x 0.025 = 0.2125 so must be 0.21 **Do not give mark if** • any estimate if shown on graph if between 0.8 and 1.0 • estimate any scale precision is to half square e.g. 0.2 to 2 cm therefore 2 mm = 0.02 and half square is 0.01 so answers can only be to 2 decimal places. So on the awkward scale of 0.25 to 2 cm therefore 2 mm = 0.025 and half square is 0.0125 therefore can only read to half square values, not in between.
(iv) Use your graph to explain the effect of the different concentrations of sodium chloride solution on root cells. [3]			
ACE conclusions max 3	max 3	**1.** *(water)* moves from high / less negative to low / more negative water potential OR from higher / less negative water potential OR to lower / more negative water potential OR down a water potential gradient;	

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Additional guidance



Can have
- even if direction is incorrect from roots to solution

Ignore
- refs. to hypertonic and hypotonic even if incorrect

2. (in context of water)
by (endo) / (ex) <u>osmosis</u>;

Additional guidance

Can have
- even if direction is incorrect from roots to solution

3. *(in correct context of)* describes correct direction of movement of water;
e.g. (when volume decreases –6 from 0.0 to where it crosses line 0.2+ NaC*l*)
idea of water moving into cells or correct use of endosmosis (into cells)
OR
(when volume increases all + values from 0.2+ to 1.00 NaC*l*)
idea of water moving out of cells or correct use of exosmosis (out of cells)

4. (in context of zero change in volume **ECF** from graph)
ref. to idea of no net movement of water;

[Total: 22]

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2 (a) Draw a large plan diagram of the specimen shown in Fig. 2.1. Label the epidermis.				**[6]**
PDO layout 1	[1]	clear, sharp, unbroken lines	**AND** no shading	**AND** larger than **50** mm across bottom of arc to top;
		Additional guidance	**Must have minimum of** • three or more hand-drawn lines and at least two enclosed area/vascular bundles in a semicircle or less **Do not give mark if** • drawn over the print of question • any line thicker – 1 mm or more • any feathery line or broken or overlaps in the lines	
MMO collection 2	[1]	no cells drawn	**AND** section drawn with **four/five** complete vascular bundles;	
	[1]	(inner layer) drawn irregular (not smooth);		
PDO recording 1	[1]	(stoma) drawn as gap or feature	**AND** at lowest point of epidermis;	
MMO decision 2	[1]	*(vascular bundles* observed and drawn the (incomplete) vascular bundle at left hand side;		
	[1]	correct label with label line or adjacent to correct layer to <u>epidermis;</u>		
		Additional guidance	**Do not give mark if** • lower or upper or cells • labelled top irregular line epidermis • no top or bottom line drawn (no context) • any label which is biologically incorrect e.g. from incorrect organ or animal • any label within drawn area	

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(b) (i) Prepare the space below so that it is suitable for you to record the observable differences between the specimens on Fig. 2.1 and that in Fig. 2.2. [4]

Mark first *four* differences only for THREE marks.

PDO recording 1

[1] organise as a table/Venn diagram/ruled boxes | **AND** headed Fig. 2.1 and Fig. 2.2 | **AND** first difference opposite each other;

Additional guidance (Fig.) 2.1 | (Fig.) 2.2 (Fig.) 2.2 | (Fig.) 2.1

ACE interpretation max 3

max 3

	feature	Fig. 2.1.	Fig. 2.2
1.	vascular tissue / xylem / phloem	bundles / more / separate near middle / pith / edge	(no) bundle / one / less; middle / centre;
3.	hollow centre / pith	present / has / yes	absent / none / no
4.	OR stele OR endodermis / bundle sheath / Casparian strip / suberised / pericycle	absent / none / no absent / none / no	present / has / yes present / has / yes;
5.	air spaces OR chains of cells shape of cells	small(er) / not large / less absent / none / no round / circular	large(r) / more present / has / yes long;
6.	thickened cell layer / collenchyma or epidermis(layers)	absent / none / no thin(ner) or 2 / few layers thick(er) or 2	present / has / yes thick(er) or 3 / more layers thin(ner) or 1
7.	epidermis or cuticle cuticle	regular / smooth absent / none / no	irregular / rough (do not give damaged) present / has / yes;
8.	gap / stomata / guard cells	present / has / yes / one	absent / none / no;
9.	cortex / cells	present / has / yes / more	absent / none / no few(er);
10.	one ref. to size of any of features above but not air spaces or specimens	small(er)	large(r);

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	Additional guidance	**Ignore** • tick and cross without a key • diagrams • 3-D descriptions such as spherical • colours/staining
(ii) Actual length of line Y is 495 µm. Use this to calculate the *magnification* of Fig.2.2.		**[4]**
MMO collection 1	[1]	measures line Y in mm; *80 or 80.5 or 81 or 81.5 or 82 <u>mm</u>*
	Additional guidance	**Must have** • units somewhere that is clear • Check **Fig.** For measurement
MMO decision 1	[1]	(converts to same units) (mm to μm) X 1000 Or 80 000 or 80 500 or 81 000 or 81 500 or 82 000;
		OR (converts μm to mm) 495/1000 or 0.495;
	Additional guidance	**Do not give mark if** • metres anywhere or conversion to metres **Can have** • even if **no units** mm or cm anywhere • if incorrect measurement
PDO display 2	[1]	shows division of converted measurement in μm by 495 OR division of actual measurement in mm / 0.495;
	Additional guidance	**Can have** • if no units or incorrect measurement or no or incorrect conversion e.g. metres.
	[1]	answer as whole number <u>only</u>; 162 or 163 or 164 or 165 or 166

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		Additional guidance		Mark final answer as given on the line provided. If no answer on the line then accept the final number shown BOD. **Do not give mark if** • two or more answers • any units given • more significant figs e.g. 0
(iii) Make large drawings of two different patterns of thickening in the walls of the xylem vessels. Label the part of the vessel where lignin is found. **[4]**				
PDO layout 1	[1]	no shading anywhere everything drawn	**AND** any line **longer** length is 50 mm or more	**AND** (clear, sharp, unbroken lines) **Do not give mark if** • any ruled lines • any line too thick (thinner than 1 mm) • drawn over the print of question
MMO collection 3	[1]	**EITHER** **only** xylem vessels with thickening (same or two types) **OR** **only** two different bandings (on any number of vessels);		
		Additional guidance		**Can have** • differences in pattern e.g. rings to spiral or in spacing • bandings circular, spirals or reticulate or shows as pits/circles or walls showing clear extra thickening as in section of bands **Do not give mark if** • any cell(s) or bundles of lines drawn
	[1]	drawn any **one** set of bandings as two lines or shaded bands or if no bands then allow circles for pits;		
	[1]	correct label with label line to lignin which can be the wall or band;		
		Additional guidance		**Do not give mark if any label** • to a middle of a pit • any label which is biologically incorrect e.g. from incorrect organ or animal • label within drawn area **Must have** • line to touch wall or band
[Total: 18]				

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

9700 BIOLOGY

9700/35 Paper 31 (Advanced Practical Skills 1), maximum raw mark 40

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2011 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

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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)
PDO	Presentation of Data and Observations (skills)
MMO	Manipulations, Measurement and Observation (skills)

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1 (a) (i) Complete Fig. 1.1 to show how you will make three further concentrations of ethanol, E solution. [3]

MMO decisions 3

[1]

(labels under correct sequence of beakers)
2.5 AND 1.25 AND 0.6(25);

Additional guidance

Must have
- % once
- Concentrations at least 1 decimal place

MMO decision 2

[1]

(uses serial dilution to complete three unlabelled beakers)
(adds previous concentration of E to each of three beakers)

5 (%) with volume
Or shown by arrow from 5(%) with volume

AND the same volume transferred from first beaker to second and from second beaker to third;

Additional guidance

Must have
- cm^3 once

ecf
- if mp 1 incorrect

[1]

(adds (distilled) water / W to **each** of three beakers)
10 cm^3 (W/water);

Additional guidance

Must have
- cm^3 once

ecf
- if mp1 incorrect
- if mp2 incorrect BUT **MUST** add previous concentration to second and third beakers

(ii) Describe how you will set up this control using the apparatus provided. [1]

ACE improvement 1

[1]

(test-tube)
replace E / ethanol with equal or same or 10 cm^3 volume of water
OR
(beaker)
20 cm^3 or only water;

Additional guidance

Do not give mark if
- 10% ethanol / E

Ignore
- 0% must have what this is i.e. water

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(iii) Prepare the space below and record your observations.				**[4]**
PDO recording 2	[1]	table with all cells drawn	**AND** heading (top or left) percent(age) conc(entration) ;	
		Additional guidance	**Can have** • % **Do not give mark if** • % in cells of the headed column / row • other units e.g. mol dm^{-3}	
	[1]	(heading) colour or observations or description or result(s) AW;		
		Additional guidance	**Do not give mark if** • additional columns/rows for method/volumes of E / lengths	
MMO collection 2	[1]	records colour / no change for 5 concentrations **AND** control / 0 (6);		
	[1]	records highest concentration with deeper blue than next concentration;		
		Additional guidance	**Can have** • minimum two recorded colours	
(iv) State the volume of the smallest division on syringe. State degree of uncertainty.				**[1]**
ACE interpretation 1	[1]	+/–	**AND** half smallest division	**AND** cm^3 / ml;
		Additional guidance	**Can have** • rounding up or down • percentage error if shows calculation as half division / 10 or any volume X 100 **Must have** percentage or %	

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	(v) Explain the effect of the ethanol on the plant tissue.	**[3]**
ACE conclusion max 3	max 3	**1.** (ethanol) Idea of breaks down / destroys/damages cell or cell surface / plasma membrane;
		2. Idea of decreases <u>selective</u> permeability or increases permeability;
		3. <u>Idea of</u> effect on protein (in cell membrane) <u>denatures</u> or opens channels;
		4. Idea of effect on phospholipid(s);
	(vi) If the ends had not been cut off how would the results have been affected?	**[1]**
ACE interpretation max 1	max 1	**1.** lengths not same;
		2. more colour from ends;
		3. colour not same;

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(b) (i) Plot a graph of the data shown in Table 1.1. [4]

PDO layout 4

[1]

x-axis pH of buffer solutions **AND** *y*-axis absorbance / %;

Additional guidance

Must have
- units

Do not give mark if
- any units for pH e.g. arbitrary units

[1]

(scale on *x*-axis) 4.0 at 0 AND one pH to 2 cm **must** label each 2 cm **AND** (scale on *y*-axis) 20 to 2 cm **must** label each 2 cm;

Additional guidance

ecf if no labels for O
If reverse O scale must have still have 20 to 2 cm

Do not give mark if
- awkward scale e.g. 25 to 2 cm, 40 to 2 cm

[1]

correct plotting of each point;

Additional guidance

4.0	83
6.0	39
7.3	10
7.8	38
8.5	78

Can have
- small cross or dot in circle

Do not give mark if
- awkward *y*-axis scale
- blobs or dots alone
- cross too large with any part of line touching 4 mm by 4 mm square –

[1]

lines point to point **AND**
- ruled, clear sharp and
- quality ruled lines, thinner than half square;

Additional guidance

Do not give mark if
- any feathery line
- irregular thickness
- extrapolation at either end

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(ii) ... the absorbance was 46%. Use your graph to estimate the pH of the buffer solution at this absorbance. **[2]**			
ACE interpretation 1	[1]	one correct reading from graph;	
MMO decision 1	[1]	readings of any TWO values from graph;	
(iii) State two variables that need to be kept the same in this investigation. Describe how to keep each of these variables the same. **[3]**			
MMO decision 1	[1]	(selects **TWO** variables for **one** mark) **1.** Idea of size of plant material **2.** type or part of plant or condition	(Suitable method to keep the same) using ruler / use cork borer / Vernier callipers; use <u>same</u> type or <u>same</u> part or fresh;
ACE improvements max 2	max 2	**1.** volume of buffer	use syringe / measuring cylinder / graduated pipette burette;
		2. temperature;	use thermostatically-controlled water-bath;
		3. time	staggered start or separate experiments;
[Total: 22]			

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2 (a) Draw a large plan diagram of the quarter shown in Fig. 2.1. Label the xylem.				**[5]**
PDO layout 1	[1]	clear, sharp, unbroken lines	**AND** no shading	**AND** larger than *60 mm* by *60 mm*;
		Additional guidance	**Must have** • four or more lines **Do not give mark if** • drawn over the print of question • any line thicker – than 1mm • any feathery line • 1 'tail' or overlap or gap	
MMO collection 3	[1]	no cells drawn		**AND** correct quarter drawn;
	[1]	*(outer layer(s)outside stele)* drawn as two / three lines wider than 5mm for most of layer;		
	[1]	*(central vascular tissue)* drawn with two lines for endodermis **AND** triangular regions / extra layer adjacent;		
MMO decision 1	[1]	correct label with label line to xylem;		
		Additional guidance	**Do not give mark if** • any label which is biologically incorrect e.g. from incorrect organ or animal • label within drawn area	

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(b) (i) Prepare the space below so that it is suitable for you to record the observable differences between the specimens on Fig. 2.1 and that in Fig. 2.2. [4]

PDO recording 1 — [1]

organise as a table/ruled boxes	**AND** headed Fig. 2.1 and Fig. 2.2	**AND** first difference opposite each other;
Additional guidance	Fig. 2.1 | Fig. 2.2 OR Fig. 2.2 | Fig. 2.1	

ACE interpretation max 3 — [max 3]

	feature	Fig. 2.1	Fig. 2.2
1	vascular tissue / xylem	small(er) / only one;	large(r) or seven or more;
2		round / circular or middle / in centre	star-shape / (seven) different area / not circular or more spread;
3	endodermis	present / around stele	absent / none;
4	cortex or parenchyma cells	large(r) / wid-er circular / round / more even sizes	small(er) / narrow(er) irregular / different sizes;
5	thickened / layer under or epidermis	thick(er) / wide(r) / large(r)	curled / bent;
6	epidermis or hairs / trichomes	present / has hairs / trichomes / many	absent / no / few hairs / trichomes or rough;
7	radius / size	1.25mm / smaller	1.7 mm / larger;
8	AVP;		

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	(ii) Use the scale bar to calculate the magnification of Fig. 2.2.		**[4]**
MMO collection 1	[1]	measures scale bar in mm; 14 or 14.5 or 15 or 15.5 or 16 mm	
		Additional guidance **Do not give mark if** • metres	
MMO decision 1	[1]	(converts to same units) (mm to μm) X 1000 14 000 or 14 500 or 15 000 or 15 500 or 16 000 ecf if mp1 incorrect	
		OR (converts μm to mm) 620/1000	
PDO display 2	[1]	shows division of converted scale bar measurement by 620; OR scale bar measurement in mm / 0.620;	
		Additional guidance ecf if no units or incorrect measurement or no or incorrect conversion	
	[1]	whole number only; 22 or 23 or 24 or 25 or 26	

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(c) ... find three cells with different shapes. Make a large drawing of these cells. Label the cell wall and any observable internal structures of these cells. **[5]**

PDO layout 1	[1]	clear, sharp, unbroken lines	**AND** no shading	**AND** largest cell 50 mm at widest point;
		Additional guidance	**Must have** • three or more enclosed areas **Do not give mark if** • drawn over the print of question • any line thicker – than 1 mm • any feathery line • 0 'tails' or overlaps or gaps if one line for cell walls check cell walls only.	
MMO collection 2	[1]	only three cells drawn **AND** all different shapes;		
	[1]	three cells with cell walls drawn as double lines;		
PDO recording 1	[1]	at least one cell contains three or more substantial inclusions drawn;		
MMO decision 1	[1]	correct label with label lines to cell wall **AND** starch (grain) or nucleus;		
		Additional guidance	**Do not give mark if** • any label which is biologically incorrect e.g. from incorrect organ or animal • label within drawn area	

[Total: 18]

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