CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2013 series

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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;	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			
1 (a) (i)			[max 15]
mp1	(MMO Decision) test for <u>glucose/reducing sugar</u> **before** <u>sucrose/non-reducing sugar</u>;		
mp2	(MMO Decision) <u>tests</u> (gets a result for) only remaining solutions in next test so test 1 **<u>S1, S2</u>**, **<u>S3, S4, S5</u>** **AND** test 2 **S1, S2**, **S3, S4, S5** **minus** solution(s) identified in test 1 **AND** test 3 **S1, S2**, **S3, S4, S5** **minus** solution(s) identified in test 1 and test 2 **AND** test 4 **S1, S2**, **S3, S4, S5** **minus** solution(s) identified in test 1, test 2 and test 3;		
mp3	(MMO Decision) <u>cm^3 or ml(s) once</u>	**AND** volume of only Benedict's (solution) or sum of volumes of Fehling's A and B	equal to or more than volume of sample;
mp4	(PDO Recording) draws in all the row lines in test 1 results table only;		

	starch test	glucose test	sucrose test	
Decision on method **M** only starch, glucose, sucrose tests **ignore** protein test	✓ or X	✓ or X	✓ or X	
R and **I** only awarded in correct context of molecule being tested and reagent and for sucrose only if after glucose (mp1 awarded)	test 1	test 2	test 3	test 4
collection records **R**	✓ or X	✓ or X	✓ or X	✓ or X
conclusion identification **I**	✓ or X	✓ or X	✓ or X	✓ or X

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M,**R** and **I** are same marking points but can only be awarded in correct contexts of molecule tested and reagent for as shown below:

M decision on	(starch) *Idea of* uses <u>iodine or Lugol's</u>; **do not give mark if** heated	(<u>glucose</u> (**ignore** reducing/non-reducing) or <u>reducing sugar</u> only) <u>Benedict's</u> **AND** <u>boil</u> **or** heat to <u>degrees</u> or <u>°C</u> **AND** any whole number 80 to and including 100 or range within 80 to 100 e.g. 80 to 100;	(<u>sucrose</u> (**ignore** reducing/non-reducing) or <u>non-reducing sugar</u> only add acid/ HC*l*/ named acid **AND** heat/ warm **AND** neutralise/adds base/alkali/ named alkali;	(protein) **ignore** method
R Records	(starch + iodine) <u>only one</u> positive result blue/black or black or navy blue or dark blue;	(glucose/reducing sugar + Benedict's) <u>only one</u> positive result green or yellow or orange or red or brown or any combination;	(sucrose/non-reducing sugar + Benedict's) <u>only one</u> positive result green or yellow or orange or red or brown or any combination; **ignore** brick **only award** if test done after glucose test. **do not give mark** if S2 and S5 tested	(protein + Biuret or KOH/NaOH and copper sulphate or Biuret A and B) <u>only one</u> positive result biuret only accept lilac or purple or mauve or violet;
	the first test must have recorded results for <u>all five</u> solutions. Tests 2 and 3 must have recorded results for <u>at least two</u> solutions			
I Conclusion	(starch + iodine) **(S)<u>4</u>** and <u>starch</u>;	(glucose/reducing sugar + Benedicts) **(S)<u>5</u>** and <u>glucose</u>;	(sucrose/non-reducing test + Benedicts) **(S)<u>2</u>** and <u>sucrose</u>; only award if test done after glucose test	(protein + biuret or KOH/NaOH and copper sulphate or biuret A and B); (S)**<u>3</u>** and <u>protein</u>
Test 4 **I** is only awarded for (**S)<u>1</u>** and contains no biological molecules/ none;				
[max 15]				

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(ii)		[1]
ACE interpretation 1		S2;
(b)		[3]
ACE improvements 2	mp1	(independent variable) (using reducing sugars or named reducing sugar/glucose/standard solutions) at least 5 sugar concentrations or at least five examples of concentrations;
	mp2	serial dilution or simple dilution or described method for making different concentrations;
ACE improvements 1	mp3	(dependent variable) compare results/colour of plant extracts/samples/unknown with known (standard) solutions;
		[Total: 19]

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2 (a) (i) [2]

do not give either mark if include units other than ep(g)u(nits)

MMO collection 2	mp1	**L**	**M**	**N**	**P**
		any numbers which add up to 11or 11.5 or 12		ignore	15 or 15.5 or 16 or 16.5 or 17;
	mp1	any 4 values which add up to 30;			

(ii) [3]

PDO layout 1	mp1	suitable plan diagram **do not give mark if** • any line outside the drawn line given • any line off the grid • any shading • any ruled line	**AND** clear, sharp, unbroken lines; **do not give mark if** • less than 3 enclosed areas (ignore cells) • any part of line 1mm or thicker (use grid) • any feathery or broken or dashed line or gap • any tail or overlap	
PDO recording 1	mp2	3 bands (3 lines) which dip downwards	**AND** (completed outline at base as) an enclosed area from ends of lines provided	**AND** two converging lines to R;
MMO decision 1	mp3	(draws correct proportion and shape of layers)		
		3 lines in the top half	**AND** both of the top 2 bands are wider than 3rd band;	

(iii) [2]

PDO display 2	mp1	(inside the drawn outline) shows counting of all complete 1 cm by 1 cm squares **AND** those squares which are half or more than half;	
	mp1	number clearly linked to bundle **AND** number clearly linked to xylem	**AND** larger whole number to smaller whole number to lowest denominator **OR** as fraction larger number over smaller number to lowest denominator;

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(b) (i) [4]

if draw a chart then only give mp1

PDO layout 4	mp1	*x*-axis time of day(/) hours	**AND** *y*-axis rate of transpiration (/) g cm^{-2} hr^{-1} ;
	mp2	scale as *x*-axis 5:00 hours to 2 cm, labelled each 2 cm	**AND** *y*-axis 0.5 to 2 cm labelled each 2 cm ;
	mp3	correct plotting of all points as small cross or dot(in circle) or cross in circle;	
	mp4	six plots with ruled lines exactly point to point	**AND** (quality) smooth line less than 1 mm thick;

(ii) [1]

ACE interpretation 1	correct reading from graph with g cm^{-2} hr^{-1};

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(c)			[4]
PDO layout 1	mp1	suitable drawing; **do not give mark if** • any shading • draw over the print of the question • any ruled lines • less than 40 mm at widest distance across largest cell • less than six enclosed areas or if any outer lines (of enclosure) • are thicker than 1 mm • are feathery or broken/dashed or have a gap • have any tail or overlap	
MMO collection 1	mp2	only 6 complete cells drawn **AND** as two groups of 3 touching cells;	
PDO recording 1	mp3	7 or fewer cells	(cells between the layer of stained cells and the vascular bundles) widest dimension of the biggest cell is at least twice the narrowest dimension of the smallest cell (from the layer of stained cells);
MMO decision 1	mp4	in one group of three cells, all cells must be drawn with double lines all the way round **AND** where two pairs of cells touch there must be three lines (representing the middle lamella);	

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(d) [max 5]

PDO recording 1	mp1	organise as a table with only three columns or rows separated by lines	**AND** headed J1 and Fig. 2.3	**AND** third column headed feature or AW or contains at least one feature;
MMO collection 1	mp1	collected only differences;		

ACE interpretation MAX 3 — max 3

mp	feature	J1	Fig. 2.3
mp1	*vascular bundle or xylem position*	not in a ring or separate or irregular or scattered or further away from epidermis than others	in a ring or in line or regular or continuous or altogether or near epidermis
	any ref to size	(either way but must be comparative) variation in sizes (small **and** large) **Ignore** thickness	
	number	(either way but must be comparative) Idea of few(er) with more or numerous	
	shape	star-shaped or egg-shaped/AW or pointed at one end	rounded or circular;
mp2	*continuous layer/cambium*	absent or has not or no(ne)	present or has or yes;
mp3	*trichome or hairs **NOT** root hair Accept spike/thorn or hairs etc on cuticle*	absent or has not or no(ne) small(er) or few(er)	present or has or yes large(r) or more;
mp4	*hollow or gap or pith or centre or parenchyma (cells)*	present or has or yes absent or has not or no(ne)	absent or has not or no(ne) present or has or yes;
mp5	*thickened cells/layer/ collenchyma/ sclerenchyma*	present or has or yes	absent or has not or no(ne);
mp6	*layer under epidermis might be called cortex*	thin(ner)	thick(er);

[Total: 21]

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Expected Answers				
1 (a) (i)				[1]
MMO decision 1	1	level of water in large beaker shown equal to or above level of yeast suspension in small beaker	**AND** below level of top of small beaker;	
(ii)				[1]
MMO decision 1	1	<u>mark</u> (test-tube B or delivery tube);		
(iii)				[6]
If recorded as graph or bar chart, not table, only mp4 and mp6 can be scored.				
PDO recording 2	mp1	table with all cells drawn	**AND** headings (top row or left of recorded data column) **either** <u>temp</u>(erature/)°C **or** <u>time sec</u>(onds) or <u>s</u>;	
			Do not give mark if • any units (°C or sec(onds) or s) are in cells of headed row/column • two rows of data in one cell	
	mp2	heading <u>number</u> (of) <u>bubbles</u>;		
MMO collection 2	mp3	exactly 8 readings per run for higher temperature	**AND** exactly 8 readings per run for lower temperature	**AND** whole numbers only;
	mp4	first reading higher than last reading for both temperatures*;*		
MMO decision 2	mp5	higher temperature recorded first*;*		
	mp6	one temperature <u>between 40 and 45(^{0}C)</u>	**AND** second temperature <u>at least 5(^{0}C) lower</u>;	

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(iv) [max 2]

ACE Interpretation 2 — max 2

	cause of error	**AND** idea of error
mp1	(dependent variable) (counting) bubbles	bubbles too fast/very fast/too many difficult rate varies miss(ed) some;
mp2	size of bubbles	varies;
mp3	(independent variable) temperature or reaction mixture/yeast/**A**	can change/difficult to keep constant loses heat;
	Do not give mark if • state that temperature of room or water-bath/**W** or **Y** when <u>in beaker</u> changes	

(v) [max 3]

ACE improvements 3 — max 3

mp1	(dependent variable) <u>gas</u> syringe or idea of downward displacement of water <u>and</u> measure <u>volume</u> of gas or less/lower concentration or volume (<u>not</u> amount) of hydrogen peroxide or enzyme;
mp2	(standardised variables) put vaseline/grease around bung (in **A**) or replace with better-fitting bung pH (controlled using) buffer;
mp3	(independent variable) maintained in thermostat(ically controlled water-bath) or describe use of heating and cooling or hot/cold water **AND** uses thermometer (to check temperature) or describe how to insulate **<u>A</u>** or more temps/bigger range of temps (**not** two temps further apart/larger change in temps);
mp4	repeat <u>more than once</u>/replicate<u>s</u>/more times/multiple tests;

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(b) (i)			[1]
MMO decision 1	1	circles 6% trial 3: 20	**AND** circles 12% trial 4: 9;
(b) (ii)			[1]
ACE interpretation 1	1	13 (entered in gap in table or by question);	
			Do not give mark if • 13.0/13.00/13.25 • 12/12.4/12.40
(iii)			[4]
PDO layout 4	mp1	*x*-axis: percent(age) **or** % conc(entration) (of) hydrogen peroxide **or** H_2O_2	**AND** *y*-axis: (mean) time (taken) to collect (20 cm^3 of) oxygen **or** O_2 (/) sec(onds) **or** s ;
		Must have units for both axes	
	mp2	scale on *x*-axis: 5 to 2 cm, labelled each 2 cm	**AND** scale on *y*-axis 10 to 2 cm, labelled each 2 cm;
	mp3	• check there are six points • all six as small cross (does not go outside square on grid) **or** dot in circle **or** cross in circle • correct plotting of points,	
	mp4	six plots with **either** ruled lines exactly point to point or hand-drawn smooth curve for whole graph • starts and ends exactly at end points • also passes through at least two other points exactly • within half a small square of any remaining points	**AND** (quality) smooth line less than 1 mm thick (check with grid);

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(iv) [2]

ACE conclusion 2	mp1	at high/increasing concentrations: • more/many <u>active sites</u> used/occupied/bind/join/ used **or** • more/many <u>enzyme-substrate complexes</u>/<u>E-S complexes</u>	**OR** at low concentrations: • less/fewer <u>active sites</u> occupied/bind/join/used **or** • less/fewer <u>enzyme-substrate complexes</u>/<u>E-S complexes</u>;
	mp2	idea of why reaches maximum rate (limiting factor) • not enough enzyme/active sites **or** • limiting factor is enzyme concentration **or** • <u>all</u> active sites occupied • active sites saturated;	

[Total: 21]

2 (a) (i) [5]

PDO layout 1	mp1	**Do not give mark if** • any shading • drawn over the print of the question • any ruled lines	**Do not give mark if** less than <u>40mm</u> from outmost line to base of corner vascular bundle	**AND** clear, sharp, unbroken lines **Do not give mark if** • less than two lines and less than four enclosed areas (ignore cells) **or any lines with** • any part of line 1mm or thicker (use grid) • any feathery or broken or dashed line or gap • any tail or overlap;
MMO collection 3	mp2	<u>no</u> cells drawn	**AND** top right sector drawn;	
	mp3	draws at least <u>seven</u> lines across any point of width of section (outside to inside);		
	mp4	corner vascular bundle: • wider than deep **and** • outer line not straight or concave	**AND** divided into at least 3 regions (ignore cells and vertical rays);	
MMO decision 1	mp5	labels pith with label line either touching or further to the centre than the innermost line **or** ending further to the centre than the inside edge of the vascular bundle;		

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(ii)				[5]
PDO layout 1	mp1	Suitable drawing;		
		Do not give mark if • any shading • drawn over the print of the question • any ruled lines in lines of <u>corner</u> cells	**Do not give mark if** • less than 40 mm at widest distance across largest cell	**Do not give mark if** • less than six outer enclosed areas **or if any outer lines (of enclosures)** • are thicker than 1 mm (use grid) • are feathery, broken/dashed or have gaps • have tails or overlaps;
MMO collection 3	mp2	only <u>6</u> complete cells drawn	**AND** as two groups of 3 touching cells;	
	mp3	seven or fewer cells in total	**AND** (cells from tissue in centre) widest dimension of the biggest cell is at least <u>2</u> times the narrowest dimension of the smallest cell (from cells in the corner);	
	mp4	in <u>either</u> group of three cells: • all cells must be drawn with double lines all the way round **and** • where two pairs of cells touch there must be 3 lines (representing the middle lamella);		
MMO decision 1	mp5	<u>one</u> correct label "<u>cell wall</u>", with <u>one</u> label line which must touch outermost line of a cell or finish between the two cell wall lines;		

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<table>
<tr><td></td><td colspan="4">(iii)</td><td>[3]</td></tr>
<tr><td rowspan="2">MMO decision 1</td><td>mp1</td><td>shows measurements for <u>both</u> types of cell</td><td>AND as whole numbers or x.5 only</td><td colspan="2">AND units as “eyepiece”, (e)gu or epu or “units” or “divisions” or “lines” or “marks” written anywhere;</td></tr>
<tr><td colspan="3">Can have
• values recorded in any context, e.g. in addition
• ½ instead of 0.5
• decimals in means</td><td colspan="2">Do not give mark if
• no units
• units in m, cm, mm, μm, nm
• not clear which measurements correspond to which type of cell</td></tr>
<tr><td rowspan="2">PDO display 2</td><td>mp2</td><td colspan="4">shows division by number of cells (3 or more), for both cell types;</td></tr>
<tr><td>mp3</td><td colspan="2">for final answer only:
larger whole number to smaller whole number (larger number first)
OR
as fraction, with larger whole number over smaller whole number</td><td colspan="2">AND

to the lowest common denominator;</td></tr>
<tr><td></td><td colspan="4">(iv)</td><td>[max 1]</td></tr>
<tr><td>ACE conclusion 1</td><td>max 1</td><td colspan="4">one from:
thick walls
large walls
small cells/lumen
closely packed cells
no spaces between cells
high ratio of wall to cell
(much) staining;</td></tr>
</table>

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(b) [5]

PDO recording 2	mp1	organise as table with <u>three</u> columns or rows separated by lines (no cells needed)	**AND** two columns headed <u>M1/slide</u> and <u>Fig 2.2</u> in any order	**AND** third column contains features;
	mp2	only observable differences (at least two) recorded;		
	Do not give mark if describes "cell" rather than "section" or "stem" for incorrect tissues			

ACE interpretation 2			feature	Slide M1	Fig. 2.2
	max 1	mp1	vascular bundles/vascular tissue/xylem/phloem	any comparative statement **except** size, or distance in from outside	any comparative statement **except** size, or distance in from outside, or in corners;
	max 2	mp2	pith/centre	not hollow/(has) cells/more cells/big(ger) (**not** "present")	hollow/no cells/less cells/small(er) (**not** "absent")*;*
		mp3	thickened cells/ collenchyma/ sclerenchyma/fibres/ described	in corners/not (on) vascular bundles/idea of more (**not** present/absent)	not in corners/(on) vascular bundles/idea of less (**not** present/absent);
		mp4	cortex/(layer) under epidermis	no/less/small(er) <u>air spaces</u>	yes/more/large(r) <u>air spaces;</u>
		mp5	outer layer/epidermis	thick(er) or more/2 layer(s) of cells or no gaps/stomata/guard cells or trichomes/hairs (**not** root hairs) (**not** smaller)	thin(ner) or less/1 layer of cells or gaps/stomata/ guard cells or no trichomes/hairs (**not** root hairs) (**not** bigger)

[Total: 19]

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1 (a) [max 11]

Summary:

(MMO Decision) test for glucose/reducing sugar **before** sucrose/non-reducing sugar;

(MMO Decision) tests only solution(s) not identified;

(MMO Decision) appropriate volumes of Benedict's and sample;

marking point		test 1	test 2		test 3
MMO decisions 3	mp1		glucose/reducing sugar		sucrose/non-reducing sugar
		glucose/reducing sugar	sucrose/non-reducing sugar		
		glucose/reducing sugar			sucrose/non-reducing sugar;
	mp2	**S1**, **S2**, **S3**	**AND** any two of **S1**, **S2**, **S3** without test 1		**AND** only one of **S1**, **S2**, **S3** without test 1 and 2;
	mp3	check glucose/reducing sugar test	cm^3	**AND** Benedict's solution volume	equal to or more than volume (of test solution);

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correct context of molecule tested and reagent shown by brackets.

<table>
<tr><td rowspan="2">MMO Decision on method</td><td>(starch)
idea of:
uses <u>iodine</u></td><td>(<u>glucose</u>)

<u>Benedict's</u></td><td colspan="2">AND
<u>boil</u>
or
or boil/heat to <u>degrees</u> or <u>°C</u> AND any whole number 80 to and including 100 or range within 80 to 100 e.g. 80 to 100;</td><td>(sucrose)
add HCl/named acid AND boil AND neutralise with $NaHCO_3$ or named alkali;</td></tr>
<tr><td>Do not give mark if
• heat</td><td colspan="4"></td></tr>
<tr><td rowspan="2">MMO Collection records results</td><td>(starch+iodine)
<u>only one</u> positive result

Blue/black or black</td><td colspan="2">(glucose + Benedict's)
<u>only one</u> positive result

green or yellow or orange or red or brown or any combination;</td><td>(sucrose+Benedict's)
only for test 2 or test 3 where after glucose test

<u>only one</u> positive result
green or yellow or orange or red or brown or any combination; ignore brick

Do not give mark if
• S1 and S3 tested</td></tr>
<tr><td colspan="4">The first test must have recorded results for <u>all three</u> solutions.</td></tr>
<tr><td>I ACE interpretation 1</td><td>(starch + iodine)

(S)<u>2</u> and <u>starch</u>;</td><td colspan="2">(glucose/ reducing sugar+Benedicts)

(S)<u>3</u> and <u>glucose</u>;</td><td>(sucrose+Benedicts)

<u>only for test 2 if test 1 is glucose</u>
(S)<u>1</u> and <u>sucrose</u>;</td></tr>
</table>

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(b) (i) [1]

ACE interpretation 1	1	glucose;

(ii) [4]

PDO recording 2	mp1	table with all cells drawn	**AND** heading (top row or left column of recorded observations) solution (tested) or mixture or sample;
	mp2	(heading for any column/row) (observation of or change in) observation(s) or colour ;	
		allow recorded just a description of result e.g. yellow solution or no change	
MMO collection 2	mp3	recorded only for **S1**/sucrose **AND S2**/starch any results;	
			Do not give mark if • recorded **S3** anywhere
	mp4	(result for) just **S2**/starch	(glucose/Benedict's/reducing sugar test) green/ yellow/orange/red/brown or any mixture of these colours; **If no reducing sugar test then** (with iodine/starch test) yellow, orange, red, brown or any mixture of these colours
		Must have • colour recorded	**Do not give mark if** • no change or positive or ticks unless key for colour

(b) (iii) [1]

ACE conclusion 1	1	**S2** or starch	**AND** either *idea of* has glucose/ reducing sugar	**AND** (glucose/Benedict's/reducing sugar test) turned green/yellow/orange/red/brown or positive;
			OR *idea of* no starch or starch broken down or starch/did before hydrolysis	**AND** (as starch iodine/test) did not turn blue/black or negative or stays yellow/orange/red/brown or no change

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(c) [3]

		R if change another variable, e.g. use **S1**, **S2** and **S3**. **R** if change of temperature in context of Benedict's test, e.g. add Benedict's then change temperature	
ACE improvements **2**	mp1	(independent variable) *idea of* at least 5 temperatures or examples (can have even if no units) (within range 5 to 100);	
	mp2	(in context of temperature change) Idea of (maintained) in thermostatic(ally-controlled) water-bath or describe use of heating and cooling or hot/cold water **AND** uses thermometer (to check temperature) ;	
		A thermoregulatory electr(on)ic or digital incubator	***Do not give mark if*** • air-conditioned or temperature-controlled rooms
AND <u>*one*</u> *of the following only in context of changing temperature:* ***ignore*** *number with* ***S*** ***A*** *any* ***S*** *or sucrose* ***Do not give mark if*** glucose			
ACE improvements max 1	mp3	*(standardise variables)* keep volumes of E/enzyme **AND** S/substrate/starch/sucrose the same or any volume any volume between 2 cm^3 and 25 cm^3 (units once);	
	mp4	equilibrate E/enzyme and **S**/substrate/starch/sucrose separately described **AND** then mix;	
	mp5	(dependent variable) *idea of* test with iodine or test for starch or *idea of* test with Benedict's or test for glucose/reducing sugar;	
			[Total: 20]

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2 (a) (i) [2]

Do not give either mark if include units other than ep(g) u(nits)

MMO collection 2

mp1	**L**	**M**		**N**	**P**
	two of 2 or 2.5 or 3 or 3.5 any number can be used twice			**AND** any two of 6 or 6.5 or 7 or 7.5 or 8; any number can be used twice	
	Can have ½				
mp2	any four values which add up to 20*;*				
	Can have 0.5 or ½			**Do not give mark if** • any other decimals or fractions, e.g. 0.1 or 0.2 or ¼, etc.	

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<table>
<tr><td colspan="5">(ii) [3]</td></tr>
<tr><td></td><td></td><td colspan="3">suitable plan diagram;</td></tr>
<tr><td rowspan="2">PDO layout 1</td><td>mp1</td><td>Do not give mark if
any line outside the drawn line given
any line off the grid
any shading
any ruled line</td><td colspan="2">AND clear, sharp, unbroken lines
Do not give mark if
less than <u>three</u> enclosed areas (ignore cells)
or any lines have
any part of line 1 mm or thicker
any feathery or broken or dashed line or gap
any tail or overlap</td></tr>
<tr><td rowspan="2">PDO recording 1</td><td rowspan="2">mp2</td><td>second layer from R/bottom must be convex shape at top edge (curves up)</td><td>AND
(completed outline at base as) an enclosed area from <u>ends of lines</u> provided (line)</td><td>AND
(line drawn from <u>right edge</u>) bulges out then curves in through three boxes below to right of R AND reaches <u>to R</u>;</td></tr>
<tr><td></td><td colspan="2">Do not give mark if
cells drawn
more than four regions/enclosed areas
if drawn outside grid</td></tr>
<tr><td rowspan="2">MMO decision 1</td><td rowspan="2">mp3</td><td colspan="3">(draws correct proportion and shape of layers)
measured along line from J to R,
length of first layer (near J) is less than half the length of the second layer from R;</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="5">(iii) [2]</td></tr>
<tr><td rowspan="3">PDO display 2</td><td>mp1</td><td colspan="3">(inside the drawn outline)
shows counting of all the complete 1 cm by 1cm squares AND those squares which are half or more;</td></tr>
<tr><td rowspan="2">mp2</td><td>number clearly linked to bundle
AND number clearly linked to xylem</td><td colspan="2">AND
larger whole number to smaller whole number
or
as fraction larger number over smaller number;</td></tr>
<tr><td colspan="2">Must have
whole number <u>71 or lower</u>
to lowest denominator</td><td>Do not give mark if
units in ratio
xylem and phloem</td></tr>
</table>

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(b) [3]

		suitable plan diagram;		
PDO layout 1	mp1	**Do not give mark if** • any shading • drawn over the print of the question • any ruled lines (ignore sector boundaries)	**Do not give mark if** • less than 60 mm from epidermis to base of centre vascular bundle	***AND*** *clear, sharp, unbroken lines* **Do not give mark if** • less than 2 lines and less than 4 enclosed areas • open-ended break in epidermis lines or any lines • any part of line 1 mm or thicker (use grid) • any feathery or broken or dashed line or gap
MMO collection 1	mp2	no cells	**AND** drawn only a sector • epidermis • at least three small vascular bundles under epidermis • at least one large vascular bundle nearer centre • at least one other observable feature, e.g. air space or triangular feature or stoma/ta gap(s) or break(s) in epidermis;	
			Do not give mark if • drawn whole stem • drawn two opposite epidermal layers • if 6 or more enclosed areas within any one region in any one vascular bundle	
MMO decision 1	mp3	draws at least three vascular bundles each with at least three enclosed areas (regions)*;*		
			Do not give mark if drawn just a band across	

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(c)				[max 4]
do not give mark if ref. to cell structures, e.g. (cell) wall or vacuoles or nuclei or membrane				
PDO recording 1	mp1	organise as a table with columns and rows		**AND** heading feature ;
ACE interpretation max 3	max 3		feature	description of **K1** (Fig 2.1)
		mp1	epidermis	smooth or no bumps or regular;
		mp2	thickening/collenchyma sclerenchyma/ or triangles/red cells	triangular or present or has or yes present or has or yes;
		mp3	vascular bundles size	different sizes or small and large;
			(position)	idea of scattered or 'ring and others' or 'near/close to epidermis and in middle' or random;
			(shape or sheath/cells around vascular bundle)	oval shape or present or has or yes;
			(number)	more or large(r);
			(xylem (vessels/cells) **N**)	idea of large(r) or big(ger);
		mp4	air spaces or gaps or holes **R** vacuoles	large(r)or present or has or yes;
		mp5	stomata or guard cells or gaps or holes or grooves or ridges	present or has or yes;
		mp6	cuticle or idea of extra outer layer	present or has or yes;
	ignore • 3-D descriptions, e.g. rugby ball shape • tick or cross without a key • diagrams • ref. to size except where shown			if no organisation then give mark only if description in same sentence as feature

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(d) (i) [4]

if draw a chart then only mp1 for orientation.

PDO layout 4	mp1	*x*-axis time of day (/) h(s) or hr(s) or hour(s)	**AND** *y*-axis flow rate in xylem (tissue /) mg min^{-1} or mg/$min^{(1)}$; **R** mg/min^{-1}
	mp2	scale as *x*-axis 5:00 or 5.00 to 2 cm labelled each 2 cm (**ignore** origin and 24:00 and 25:00)	**AND** *y*-axis (0).1(00) to 2 cm labelled each 2 cm (**ignore** 0.0(00) at origin and 0.5(00));
	mp3	correct plotting of • five points • as small cross (lines less than 4 mm each) or dot(in circle) or cross in circle to within half a square;	
	mp4	five plots with ruled lines exactly point to point	**AND** (quality) smooth line less than 1 mm thick;

Additional guidance:

mp1		**Do not give mark if** change units for either axis
mp2	**ecf** if no labels for axes or if reverse axes then scale is the same for time and flow rate **Can award mark if** origin on *y*-axis is not zero as long as labelled with correct value e.g. 0.1(00)	**Do not give mark if** • awkward scale
mp3	plots (crosses or centre of dot) must be nearer than halfway line	
	Can have • **ecf** if *x*-axis and *y*-axis reversed • **ecf** if lose scale for simply the labelling e.g. 5, 10, etc.	**Do not give mark if** • awkward scale • blobs or dots alone • blob in circle is bigger than circle on grid • cross too large with any part of cross outside the square on the grid
mp4	**Can have** • **ecf** from incorrect plots	**Do not give mark if** • any extrapolation

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(ii)				[2]
ACE interpretation 2	mp1	*idea of:* (between 10.00 and 17.00 hours) flow rate increases;		
			Do not give mark if • ref. to decrease before increase • ref. to 6:00 increase • ref. to time increases or daylight	
	mp2	quotes data at 10.00 as reading from their graph	**AND** 17.00 as <u>0.455</u>;	**AND** must have units once <u>mg min^{-1} or $mg/min^{(1)}$</u>;
		A increase of 0.455 minus their reading at 10:00 e.g. 0.225 = 0.235 mg/min	**ecf** units used on graph	
[Total: 20]				

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GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2013 series

9700 BIOLOGY

9700/34 Paper 34 (Advanced Practical Skills 2), 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
AVP	Alternative valid point (examples given as guidance)

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1 (a) (i) [1]

MMO decision 1	1	volume of **W**/water	**AND** (number of) drops of **(P/**indicator);
		(for **W**/water) **R** amount	

(ii) [1]

MMO decision 1	1	add drops of **A/**alkali (solution) (not amount) or add same number of drops/stated number of drops of **A/**alkali (solution)	**AND** same colour as/matches (Fig. 1.1) first (test-tube)/all tubes;
			A (use the original 5 cm^3) putting 1 cm^3 into the other test-tubes;

(a) (iii) [1]

MMO decision 1	1	mark (draw a line on each/all test-tube(s) or tubing) or position the tubing at bottom of test-tube;
		R measuring distance above bottom/below surface without ref. to marking

(a) (iv) [1]

MMO decision 1	1	seconds or s;

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(v) [3]

MMO collection 1	mp1	records times for 'start of reading' and 'end-point' in Table 1.1;
MMO decision 1	mp2	records end time for before (less than) the start time of the next reading;
PDO recording 1	mp3	records times for all readings to same precision;

(vi) [1]

ACE interpretation 1	1	time taken to reach end-point with whole numbers and correct units seconds/s;

Table 1.3

1 st start time	0:00	0
1 st end-point time	1:45	105
time taken to reach end-point = 105 seconds		

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(vii) [4]

PDO recording 2	mp1	table with all cells drawn	**AND** heading (top or left) test-tube or reading or number of test or sample;
		Do not give mark if 'heading' in cells of headed/rows	
	mp2	(heading) time (taken to end-point) (/) s or seconds in any one column;	
		Do not give mark if • units in cells of this column/row • minutes • additional method information either headings for columns/rows or in cells e.g. volumes	
MMO collection 2	mp3	for all 10 (processed/end-point) times records only processed results as whole numbers;	
		Must have • whole seconds only	**Do not give mark if** • raw results
	mp4	[comparing Table 1.1 (first five readings) with Table 1.2 (readings after 10 minutes)] for results showing same trend;	
		Must have • processed data	**Do not give if** • raw results (start and end times)

(b) [max 3]

ACE interpretation max 3		cause of error	with idea of error
	mp1	any reference to colour/end-point	difficult to judge/distinguish//identify/ is subjective/varies may be different;
	mp2	quantity/amount of **A**/alkali	different or varies;
	mp3	**Y**/yeast (enters tubing)	so goes cloudy/ different amount of yeast for subsequent test-tubes;
	mp4	position of tubing	changes (as shake);
	mp5	shaking	different/varies/not same;

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(c) [max 3]

ACE improvement max 3 — max 3

mp1	(standardised variables) (start colour) mix **W**/water and **P**/indicator and **A**/alkali in one beaker and then put into test-tubes;
mp2	(instead of using one syringe containing yeast) have one syringe(with yeast) per reading/end-point or idea of individual timing/set each one up separately/fixed time between each transfer or another person to help record time or identify end-point or gather data/use 'laptime' on timer;
mp3	(dependent variable) use a colorimeter;
	Do not give mark for • use of white tile • calorimeter
mp4	(to obtain at least three sets of data) repeat more than once;
mp5	machine to standardise shaking;
mp6	(from alkali to neutral/acid) use pH meter to detect change;

(d) [2]

ACE conclusion 2

mp1	(for 10 figures processed results) supports/'yes' as <u>all data</u> consistent or cannot tell/'no' if data not consistent;	
mp2	(for 10 figures processed results) (supports/'yes') in line with some trend in their results	<u>end-point times</u> become <u>longer</u> or quotes correctly any selective comparative data;
	OR	
	(for 10 figures processed results) (rejects/'no'/cannot tell) in line with some trend in results	no consistent pattern/<u>end-point times</u> become <u>shorter</u> or quotes correctly any selective comparative data;

[Total: 20]

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2 (a) [5]

PDO layout 1	mp1	suitable plan diagram;		
		Do not give mark if • any shading • drawn over the print of the question • any ruled line	**Do not give mark if** • less than 60mm at widest point (across mid-rib upper to lower epidermis)	**AND** clear, sharp, unbroken lines for outermost line; **Do not give mark if** • less than 3 enclosed areas • open-ended in epidermis lines • any part of the line 1mm or thicker (use grid) • any feathery or broken or dashed line or gap • any 'tail' or overlap in line
MMO collection 3	mp2	no cells	**AND** drawn whole section	
	mp3	draws vascular bundle (in central area) with interior subdivided into at least three enclosed areas or at least 3 stomata;		
	mp4	at least one circle at end OR clear double line for outside of vascular bundle;		
MMO	mp5	labels the epidermis with label line ending either within three lines of epidermis;		
		Do not give mark if • any label within drawn area		

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(b) [4]

PDO layout 1

mp1 suitable plan diagram;

Do not give mark if • any shading • drawn over the print of the question • any ruled lines	**Do not give mark if** • less than 40 mm at widest distance across largest cell	**Do not give mark if** • less than four enclosed areas **or if any outer lines (of enclosures)** • any feathery or broken/dashed line or have gaps • have tails or overlaps

MMO collection 2

mp2 only 4 complete cells drawn **AND** adjacent (touching) cells as a group;

mp3 the 2 end cells should touch only one other cell;

Do not give mark if
- more than 4 cells

MMO decision 1

mp4 the cells must be drawn with double lines all the way round
AND
where two pairs of cells touch there must be 3 lines (representing the middle lamella);

Do not give mark if
- organelles e.g. mitochondria, Golgi, etc.

(c) [2]

PDO display 2

mp1	shows measurement of diameter (with reference to vascular bundle)	**AND** shows measurement of width (with reference to xylem)	**AND** shows both measurements as whole numbers or 0.5 only	**AND** units;

mp2 (in context of measurements)
answer as larger whole number to/: smaller whole number (no units in final ratio)
or
as fraction as larger whole number over smaller whole number (no units in final ratio);

Must have • to lowest denominator	**Do not give if** • if no measurements shown anywhere

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(d) [max 4]

PDO recording 1

mp1: organise as a table with only three columns or rows separated by lines **AND** headed N1 and Fig. 2.1 **AND** third column contains features;

MMO decision 1

mp2: only differences;

Do not give mark if
- any similarities recorded
- any functions
- any non-observable differences

ACE interpretation max 2

max 2

	feature	N1	Fig. 2.1
mp3	cuticle/epidermis	any comparative comment	any comparative comment;
mp4	number of stomata	many/more/present	few(er)/less/none;
mp5	air space/ spongy mesophyll arrangement of air space/ spongy mesophyll	few(er)/less small(er)	many/more/ larg(er);
mp6	packing of palisade cells /layer below epidermis position of palisade cells /layer below epidermis shape of palisade cells	loose/less compact all around leaf rectangular or long(er)	compact upper part of leaf round(er) or short(er);
mp7	shape of vascular bundle ring of cells around vascular bundle	circular present/has/yes	oval absent/none/no;
mp8	extra circles/canals	yes/has/present	no(ne)/absent;
mp9	any (overall) comparative shape	rounded ends or midrib as 'bump'	pointed ends or has pointy midrib;
mp10	any reference to size (whether overall shape or internally)	big(ger)	small(er);

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(e) (i) [4]

PDO layout 4

mp1	*x*-axis time of day (/) hours	**AND** *y*-axis water potential in leaf (cells)/MPa;
mp2	scale as *x*-axis 5.00 or 5:00 to 2 cm labelled each 2 cm	**AND** *y*-axis -1.0 to 2 cm labelled each 2 cm;
mp3	**must be negative scale** • check presence of seven points • all seven as small cross or dot(in circle) or cross in circle; • correct plotting	
mp4	seven plots with ruled lines exactly point to point	**AND** (quality) smooth sharp line;
	ecf from incorrect plots	**Do not give mark if** • any feathery line • irregular thickness

(e) (ii) [1]

ACE conclusion 1

1		**AND**	**AND**
	time	(rate of) transpiration	water potential
	12:00 hours (day)	high	low most negative
	22:00 hours (night)	low	high least negative
	between 12:00 hours and 22:00 hours	decreases	increases/becomes less negative

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GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2013 series

9700 BIOLOGY

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

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1 (a) (i) [2]

MMO decisions 2

mp1 (shows correct use of 20 % glucose)
adds 6, 8, and 10 cm^3 of 20 % glucose to prepare correct final concentration of glucose;

volume of 20 % glucose solution / cm^3	final percentage concentration of glucose
6	6
8	8
10	10

mp2 (shows the correct use of distilled water)
adds 14, 12 and 10 cm^3 of (distilled) water/W to prepare correct final concentration of glucose;

volume of distilled water / cm^3	final percentage concentration of glucose
14	6
12	8
10	10

(ii) [1]

MMO decisions 1

1 sec (onds) or s;

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(iii)		[1]
MMO decisions 1	1	volume of **S** or **PM** or **U1** or **U2** or (glucose) solution OR 5 cm^3 **S** or 2 cm^3 **PM** or 10 cm^3 **U1 / U2** / solutions ;
(iv)		[4]
ACE improvements 1	mp1	use syringe ;
MMO collection 1	mp2	records start and end-point times for **U1** and **U2**;
MMO decisions 1	mp3	start time for **U1** is before **U2**;
PDO recording 1	mp4	all readings to the same precision;

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(v)				[1]
ACE interpretation 1	1	time taken for the 6 % glucose solution to reach end-point in <u>sec(onds)</u> or <u>s</u> ;		
(vi)				[4]
PDO recording 2	mp1	table with all cells drawn	**AND** heading (top or left) <u>percent(age) conc(entration) of glucose;</u>	
		Can have • no outer boundary • % • test tube/ additional columns or rows • notes outside the area	**Do not give mark if** • units in cells of headed column/row • other units e.g. mol dm^{-3} • no units	
	mp2	(heading) <u>time</u> (/) s or sec(onds);		
MMO collection 2	mp3	for 6 concentrations including **U1** and **U2** records <u>only</u> processed results as <u>whole numbers</u>;		
	mp4	highest concentration of glucose solution is shortest time compared to 6 %, 8 % and 10 % glucose solution;		

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(b) [1]

ACE interpretation 1	1	glucose tolerance test solution;

(c) (i) [1]

ACE interpretation max 1			cause of error	WITH idea of error
		mp1	(dependent) change to colourless/end-point	difficult to judge see or identify or determine or is subjective may be different;
		mp2	(standardised) measuring the potassium manganate (**PM**)	difficult to read the syringe due to darkness of **PM**;
		mp3	(standardised) mixing of **S** and glucose	not the same or varies or different;
		mp4	(idea of) reaction	too quick or describes more concentrated solution goes too quickly;

(ii) [max 2]

ACE improvements max 2	max 2	mp1	(independent variable) (concentration of glucose) *idea of* use more or different or wider/narrower range of concentrations;
		mp2	repeat more than once/replicates to obtain three readings;
		mp3	use a colorimeter or *idea of* individual timing/ set each one up separately;

[Total: 17]

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2 (a) (i) [2]

MMO collection 2

mp1 (collects correct values for each tissue, **J**, **K**, **L** and **M**)

J	M	N	P
Ignore	4–6	26–28	4–6;

mp2 any four values which add up to 43;

(ii) [3]

Ignore any labels / label lines / brackets

PDO Layout 1

mp1 suitable plan diagram **AND** clear, sharp, unbroken lines;

Do not give mark if
- any line outside the two given drawn lines left and right
- any line off the grid
- any shading
- any ruled line

Do not give mark if
- less than 3 lines

or if any line
- any part of the line 1 mm or thicker
- any feathery or broken or dashed line or gap
- any tail or overlap

PDO recording 1

mp2 any line completing the top edge of the vascular bundle between the two drawn lines;

MMO decision 1

mp3 (draws correct proportions and shape of layers)
width of layers **N** is at least double the combined width of **J** and **M** measured along line;

(iii) [2]

PDO display 2

mp1 shows counting of all the 1 cm × 1 cm squares half or more only within the completed outline on Fig. 2.2;

mp2 number clearly linked to bundle
and number clearly linked to xylem

AND
larger whole number to smaller whole number
or
as fraction larger number over smaller number;

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(b)		[5]
PDO layout 1	mp1	suitable drawing;
		Do not give mark if • any shading • draw over the print of the question • any ruled lines • less than 40 mm at widest distance across largest cell • less than six enclosed areas **or if any outer lines (of enclosure)** • are thicker than 1 mm • are feathery or broken / dashed or have gaps • have tails or overlaps
MMO collection 3	mp2	only 6 complete cells drawn **AND** as two groups of 3 touching cells;
	mp3	the largest dimension of the biggest cell from near the centre of the stem is at least 3 times the smallest dimension of the smallest cell from the corner *;*
	mp4	in one group of three cells, all cells must be drawn with double lines all the way round **AND** where two pairs of cells touch there must be 3 lines (representing the middle lamella);
MMO decision 1	mp5	one correct label cell wall, with one label line which must touch outermost line of a cell or finish between the two cell wall lines;

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(c)					[max 4]
PDO recording 1	1	organise as a table with only three columns or rows separated by lines (no cells needed)	**AND** headed L1 and Fig. 2.3	**AND** third column contains features;	
		Additional guidance: column/row with features can be left, right or in middle and does not require heading J1 Fig. 2.3			
ACE interpretation max 3	max 3		feature	L1	Fig.2.3
		mp1	vascular bundles tissue/xylem	fewer/few separate bundles/ring/in the corners	many/more ring/separate bundles;
		mp2	hollow centre/pith (some slides)	present or has or yes	absent or does not have or no(ne);
		mp3	thickening/collenchyma sclerenchyma/ fibres/described	present or has or yes or in corner or forms bumps	absent or does not have or no(ne);
		mp4	Idea of gaps/air spaces	absent or does not have or no(ne)	present or has or yes;
		mp5	outer layer(s)/cortex/ epidermis	thick(er) or idea of regular cells	thin(er) or idea of irregular cells;

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(d) (i) [4]

if line graph drawn award only mp1

PDO layout 4

mp1	*x*-axis type of plant tissue	**AND** *y*-axis concentration of glucose arbitrary units or [glucose] arbitrary units;
mp2	even width of blocks	**AND (**0 at origin) 1.0 a.u. to 1 cm labelled 2.0, 4.0, 6.0 (ignore 0.0 at the origin or 8.0);
mp3	correct plotting of each blocks in the order in the table with a • horizontal, • ruled, • even line, less than 1 mm;	
mp4	all blocks separated by a space (could be uneven) quality – vertical lines • ruled, • smooth line less than 1 mm • meets horizontal line exactly	**AND** labelled with any clear labels A,B,C,D,E e.g. must be directly below correct bar or inside bar or shaded with key;

A	2.0
B	6.5
C	4.2
D	5.6
E	3.2

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(ii)			[3]
ACE interpretation 1	mp1	*idea of* concentration of glucose (inside the cells) is different/not the same (for each type of plant tissue) or gives figure for each plant tissue or compares two different tissues using figures or concentration of glucose is highest in cells in plant tissue B and lowest in plant tissue A;	
ACE conclusion 2	mp2	glucose is absorbed against a concentration or diffusion gradient/glucose did not move out of cells;	
	mp3	<u>active transport</u> or no <u>diffusion</u> or <u>diffusion</u> prevented;	
			[Total: 23]

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