UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2010 question paper for the guidance of teachers

9700 BIOLOGY

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

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UNIVERSITY of CAMBRIDGE International Examinations

Question		Expected Answers		Additional guidance
1 (a) (i)		**Decide on the concentrations of copper sulfate solution you will use in your investigation.** **[3]**		
MMO decisions 3	[1]	any 4 or more (volumes/concentrations);		
	[1]	(highest concentration) 0.3 to 0.15;		
	[1]	any three consecutive concentrations (including 0 if present) with two intervals • the same • or serial dilution by half • or serial dilution by ten;		
	(ii)	**State which variable you will need to control when preparing the plant tissue samples.** **[1]**		
MMO decision 1	[1]	length or surface area or size or dimensions or volume; **Allow** methylene blue		
	(iii)	**Describe how you will control this variable and prepare the samples of plant tissue.** **[2]**		
MMO decisions 2	[1]	(control) measure cut (methylene) rinsing/washing	the same any example of length 3 cm or less/size; excess	
	[1]	(prepare samples) use of scalpel/knife or ruler; (methylene blue) water		

(iv) Prepare the space below and record your observations. **[5]**

PDO recording 2

[1]

Reject
- if units for % in body of table
- other units e.g. mol dm^{-3}

table with all cells drawn **AND** heading (top or left)
percentage conc(entration);

[1]

Reject
- if headings/columns for method/volumes/time 5 mins or size/lengths

(heading)
colour or observations or description;

MMO collection 2

[1] (records clear separate observations/colours) after/during 5 min/before mixing **AND** after mixing (after/at 5 min);

[1] difference in the strength of colour between the first and last test-tube observations;

Key e.g. + = colour

MMO decision 1

[1] 5 or more concentrations
or observation for water
or replicate recorded;

(v) Suggest how copper sulfate solution affects plant cell membranes. **[1]**

ACE conclusion 1

[1]

In correct context of increasing or just copper sulfate Idea of		
damages or destroys		it or ((cell) membrane(s)) phospholipid(s) fluid mosaic (model/structure)
or makes more		(fully) permeable
denatures		protein
(increases copper sulfate) (decreases copper sulfate)	increases decreases	fluidity permeability
(increases copper sulfate) (decreases copper sulfate)	decreases increases	selective permeability;

(vi) Identify three significant sources of error in your investigation. **[3]**

ACE interpretation MAX 3

Reject
temperature pH
evaporation
any errors which affect all test-tubes equally

	Cause of error	Error
	(dependent)	
[1]	qualitative;	
[1] [1]	colour/colour change/observations	difficult judging seeing; qualitative;
[1]	mixing	more difficult to judge colour/colours the same;
[1]	(standardised variables) potato or position in potato or age or storage	not same different/variety old;
[1]	lengths/size/surface areas/volumes **Allow** mass	not same;
[1]	staining/washing/handling/forceps	not same loses stain damages potatoes ends not stained or middle more stain;
[1]	potato/samples (into test-tubes)	time not same/delayed time/not at same time;

max 3

	(vii)	**Suggest how you would make *three* improvements to this investigation.**	**[3]**
ACE improvements MAX 3	[1]	same potato or position in same age or storage or fresh use micrometer/cork borer/vernier callipers/ruler with smaller divisions;	
	[1]	leave in methylene blue longer/stronger concentration/more than 5 minutes idea of wash more;	
	[1]	more/wider/narrower/different/examples range of concentrations or use burette or graduated pipette or smaller syringe or with smaller divisions;	
	[1]	stagger start or do individually or use more stop clocks or use help;	
	[1]	colorimeter or datalogger with light sensor; **Reject** calorimeter	
	[1]	repeat or replicate;	max 3
		[Total: 18]	

<table>
<tr><td colspan="6">2 (a) (i) Draw a large plan diagram of a quarter of the specimen as shown in Fig. 2.1. Label the endodermis and cortex. [5]</td></tr>
<tr><td rowspan="2">PDO layout 1</td><td rowspan="2">[1]</td><td colspan="3">Reject
• if drawn over the print of question</td><td rowspan="2"></td></tr>
<tr><td>Reject
• thick lines-than grid
• feathery lines
• 3 'tails' or overlaps or gaps

clear, sharp, unbroken lines</td><td>AND
no shading</td><td>AND
uses most of space provided;</td></tr>
<tr><td rowspan="3">MMO collection 3</td><td>[1]</td><td>no additional cells drawn</td><td colspan="2">AND (epidermis shows)
only the correct quarter;</td><td rowspan="3"></td></tr>
<tr><td>[1]</td><td colspan="3">epidermis drawn with two lines 3 mm or closer for most of length;</td></tr>
<tr><td>[1]</td><td colspan="3">innermost line is wavy/undulating line;</td></tr>
<tr><td rowspan="2">MMO decision 1</td><td rowspan="2">[1]</td><td colspan="3">Reject
• if any label is biologically incorrect e.g. regions belonging to other organs or animals.
• label within drawn area</td><td rowspan="2"></td></tr>
<tr><td colspan="3">correct label with label lines to cortex and endodermis ;</td></tr>
</table>

(ii) Make a high-power drawing of one large xylem vessel and the single layer of cells touching a quarter of the vessel's circumference. Labels are not required. [5]

PDO layout 1	[1]	**Reject** • if drawn over the print of question			
		Reject • thick lines – than on grid • feathery lines • 4 'tails' or overlaps or gaps if double lines for all cells • 1 if single line for any cell	**AND** no shading	**AND** uses most of space provided;	
		clear, sharp, unbroken lines			
MMO collection 3	[1]	one xylem vessel drawn **Ignore** band inside	**AND** only single layer of surrounding cells ;		
	[1]	**Reject** if layer of cells all round xylem vessel If xylem vessel not circular/polygonal			
		(surrounding cells) (single layer) three to eight cells in a layer only; **Allow** not touching.			
	[1]	**Reject** any spaces if single line for cell walls. any gaps between cell walls – floating cells			
		(all cells including xylem vessel) no enclosed spaces more than 1mm between adjacent double cell walls;			
PDO recording 1	[1]	cell walls drawn as double lines with middle lamella between three adjacent cells from surrounding cells;			

(b) Prepare the space below so that it is suitable for you to record the observable differences between the specimens on K1 and that in Fig. 2.2. [4]

PDO recording 1	[1]	organise as a table/Venn diagram/ruled boxes		**AND** headed K1 and Fig 2.2	**AND** first difference opposite each other;	K1 | Fig 2.2
ACE interpretation 3						**Ignore** • tick and cross without a key • ref. to non-observable features • 3D shapes
			feature	K1	Fig.2.2	
	[1]	1	epidermis	hairs/trichomes **Ignore** root	no hairs/trichomes;	
	[1]			thick(er) or more/2 layers	thin(ner) or few(er);	
	[1]	2	cortex	yes/present/more	no(one)absent/less;	
	[1]	3	endodermis	yes/present	no(one)/absent;	
	[1]	4	pericycle	yes/present	no(one)/absent;	
	[1]	5	vascular bundles xylem	ring/centre/no(one)/absent/ fewer	scattered/AW/towards edge/yes/present/more;	
	[1]	6	thickened cells/ sclerenchyma **Allow** collenchymas bundle sheath/AW	either way round for present/absent/under epidermis;		
	[1]			no(one)/absent	yes/present;	
	[1]	7	pith pith/centre cells	yes/present	no(one)/absent;	
	[1]			rounded	angular/pentagonal/AW;	
	[1] [1]	8	air spaces/lenticels stomata	yes/present no(one)/absent	no(one)/absent; yes/present;	max 3

(c) (i) Plot a chart of the data shown in Table 2.1. [4]
MAX 2 for O and S if line graph drawn

PDO layout 4

O [1]	*x*-axis content(s)	**AND** *y*-axis conc(entration in) phloem or sieve tube/element (/) μg cm^{-3};	Must have units
S [1]	scale as even widths to 2 cm	**Reject** scale on *y*-axis any other than 20 to 2 cm. AND *y*-axis <u>20 to 2 cm</u>;	
P [1]	**Reject** if *y*-axis scale is awkward if bars arranged differently from order of table if horizontal lines are too thick – 1mm/half square or not clear **Allow** bars if scale 20 to 2 cm. even if not 0 25 to 2 cm correct plotting of each bar;	horizontal top line must be clear, sharp and ruled to show plot line must be on horizontal line for sucrose line must be between two lines for all other contents	
L [1]	each bar separate if vertical lines only then must be at least 1 cm apart.	**AND** quality – vertical lines no thicker than on grid, not feathery for the complete line; bars – • <u>ruled lines **Reject** irregular thickness</u> • labelled clearly with contents – any clear labels e.g. chemical formulae NH_4, Ca, Mg, Na or mixture – underneath, must be directly below correct bar or inside bar or shaded with key.	**Reject** solid shading If line shading outside a bar

	(ii) Calculate the percentage difference between the concentration of calcium ions in the xylem vessels and the concentration of calcium ions in the phloem sieve tube elements.			**[2]**
PDO display 2	[1]	shows subtraction (190 – 85) divided by 190 multiplied by 100; (190/190 – 85/190) × 100 or (1 – 85/190) × 100		
	[1]	**Reject** if no working **Allow** any answer less than 100 to no more than 3 significant figures 1 decimal place	**AND** percentage/%;	
	(d) Suggest why there is 120 µg cm^{-3} of sucrose in the phloem sieve tube elements.			**[2]**
ACE conclusions MAX 2	[1]	(phloem sieve tube elements) (sucrose) transported leaf(ves)/allow type of leaf cell/source to roots/other tissues/sink(s);		
	[1]	(detail) load(ed) (in source) or (transported by) mass flow/bulk transport/translocation (sucrose) too large to move out of phloem or sieve tubes or xylem walls impermeable;		
		[Total: 22]		