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

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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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.

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) } increases (decreases copper sulfate) } decreases		fluidity permeability
		(increases copper sulfate) } decreases (decreases copper sulfate) } increases		selective permeability;

(vi) Identify three significant sources of error in your investigation.

ACE interpretation MAX 3

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

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

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.					
PDO layout 1	[1]	**Reject** • if drawn over the print of question			
		Reject • thick lines-than grid • feathery lines • 3 'tails' or overlaps or gaps	**AND** no shading	**AND** uses most of space provided;	
		clear, sharp, unbroken lines			
MMO collection 3	[1]	no additional cells drawn	**AND** (epidermis shows) only the correct quarter;		
	[1]	epidermis drawn with two lines 3 mm or closer for most of length;			
	[1]	innermost line is wavy/undulating line;			
MMO decision 1	[1]	**Reject** • if any label is biologically incorrect e.g. regions belonging to other organs or animals. • label within drawn area			
		correct label with label lines to cortex and endodermis ;			

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

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 a in Fig. 2.2.

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.
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 concentra calcium ions in the phloem sieve tube elements.			
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]		