

**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

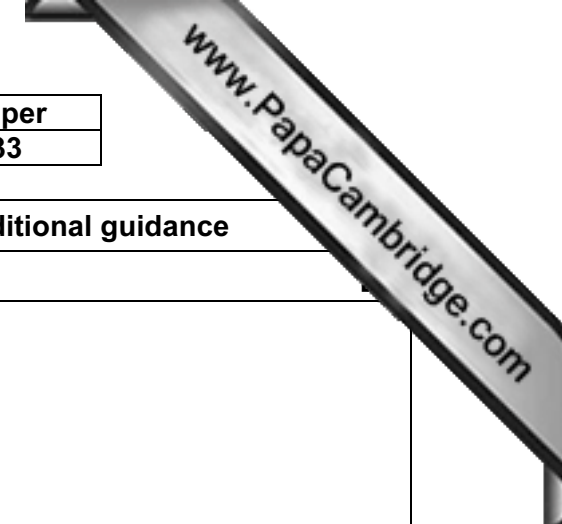
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Question	Expected Answers		Additional guidance
1 (a) (i) Decide on the concentrations of copper sulfate solution you will use in your investigation.			
MMO decisions 3	[1]	any 4 or more (volumes/concentrations);	
	[1]	(highest concentration) 0.3 to 0.15;	
	[1]	any three consecutive concentrations (including 0 if present) with two intervals <ul style="list-style-type: none"> • 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	
	[1]	(prepare samples) use of scalpel/knife or ruler; (methylene blue) water	
		the same any example of length 3 cm or less/size; excess	

(iv) Prepare the space below and record your observations.			
PDO recording 2	[1]	Reject	
		<ul style="list-style-type: none"> 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	
	<ul style="list-style-type: none"> 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 denatures	(fully) permeable 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.

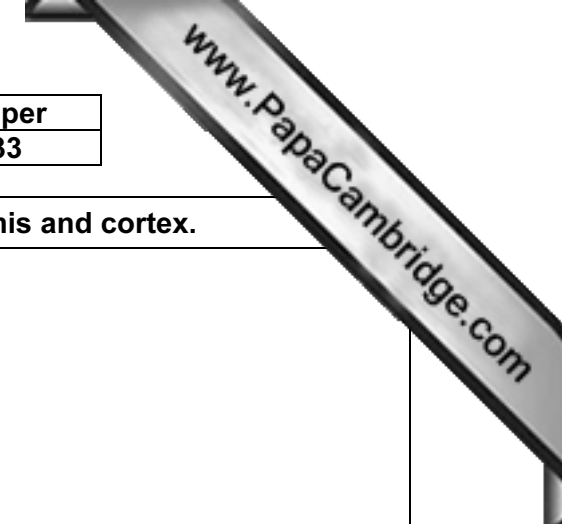
ACE interpretation MAX 3	Reject temperature pH evaporation any errors which affect all test-tubes equally		
	Cause of error		Error
		(dependent)	
	[1]	qualitative;	
	[1] [1]	colour/colour change/observations	difficult judging seeing; qualitative;
	[1]	mixing	more difficult to judge colour/colours the 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

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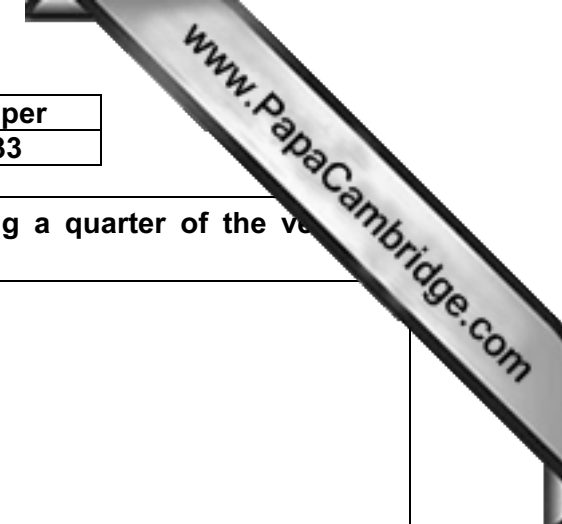
(vii) Suggest how you would make <i>three</i> improvements to this investigation.		
ACE improvements MAX 3	[1]	same potato or position in same age or storage or fresh use micrometer/cork borer/vernier callipers/ruler with smaller divisions;
	[1]	leave in methylene blue longer/stronger concentration/more 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;
[Total: 18]		max 3

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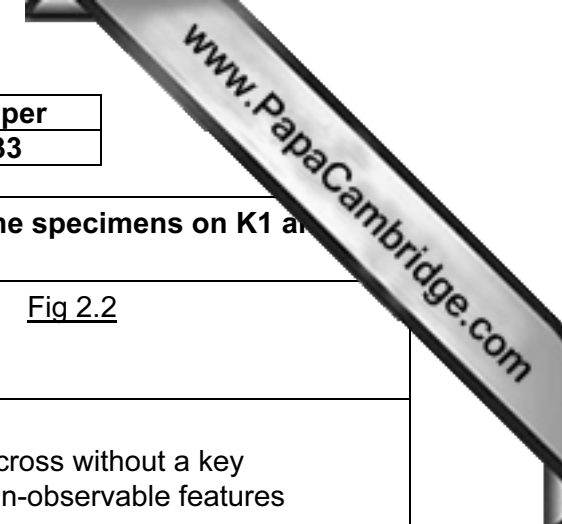
2 (a) (i) Draw a large plan diagram of a quarter of the specimen as shown in Fig. 2.1. Label the endodermis and cortex.

PDO layout 1	[1]	Reject		
		<ul style="list-style-type: none"> if drawn over the print of question 		
		Reject <ul style="list-style-type: none"> thick lines-thin 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		
		<ul style="list-style-type: none"> 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 vessel 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;		

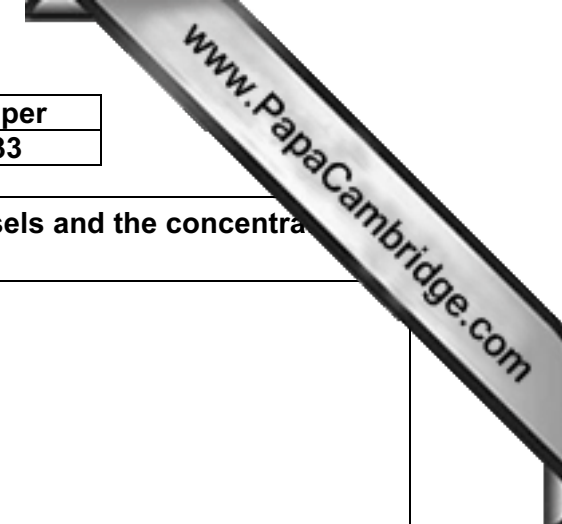


(b) Prepare the space below so that it is suitable for you to record the observable differences between the specimens on K1 and Fig. 2.2.

PDO recording	[1]	organise as a table/Venn diagram/ruled boxes	AND headed <u>K1</u> and <u>Fig 2.2</u>	AND first difference opposite each other;	<u>K1</u> <u>Fig 2.2</u>	
	ACE interpretation 3	[1]	feature	K1	Fig.2.2	Ignore <ul style="list-style-type: none"> • tick and cross without a key • ref. to non-observable features • 3D shapes
[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]	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(entrations in) phloem or sieve tube/element (/) $\mu\text{g cm}^{-3}$;	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 – <ul style="list-style-type: none"> ruled lines Reject irregular thickness 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

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(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.			
PDO display 2	[1]	shows subtraction $(190 - 85)$ divided by 190 multiplied by 100; $(190/190 - 85/190) \times 100$ or $(1 - 85/190) \times 100$	
	[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 $120 \mu\text{g cm}^{-3}$ 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) <u>load</u> (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]