

**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)	<b>Decide on the concentrations of copper sulfate solution you will use in your investigation.</b>	
		<b>[3]</b>
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"> <li>• the same</li> <li>• or serial dilution by half</li> <li>• or serial dilution by ten;</li> </ul>	
<b>(ii) State which variable you will need to control when preparing the plant tissue samples.</b>		<b>[1]</b>
MMO decision 1	[1] length or surface area or size or dimensions or volume; <b>Allow</b> methylene blue	
<b>(iii) Describe how you will control this variable and prepare the samples of plant tissue.</b>		<b>[2]</b>
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	

<b>(iv) Prepare the space below and record your observations.</b>				<b>[5]</b>
PDO recording 2	[1]	<b>Reject</b>		
		<ul style="list-style-type: none"> <li>if units for % in body of table</li> <li>other units e.g. mol dm<sup>-3</sup></li> </ul>		
	table with all cells drawn	<b>AND</b> heading (top or left) percentage conc(entration);		
	[1]	<b>Reject</b>		
		<ul style="list-style-type: none"> <li>if headings/columns for method/volumes/time 5 mins or size/lengths</li> </ul>		
		(heading) colour or observations or description;		
MMO collection 2	[1]	(records clear separate observations/colours) after/during 5 min/before mixing	<b>AND</b> 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;		
<b>(v) Suggest how copper sulfate solution affects plant cell membranes.</b>				<b>[1]</b>
ACE conclusion 1	[1]	<p>In correct context of increasing or just copper sulfate Idea of damages or destroys</p> <p>or makes more</p> <p>denatures</p> <p>(increases copper sulfate) } increases (decreases copper sulfate) } decreases</p> <p>(increases copper sulfate) } decreases (decreases copper sulfate) } increases</p>	<p>it or ((cell) membrane(s)) phospholipid(s) fluid mosaic (model/structure)</p> <p>(fully) permeable</p> <p>protein</p> <p>fluidity permeability</p> <p>selective permeability;</p>	

(vi) Identify three significant sources of error in your investigation.			[3]
ACE interpretation MAX 3	<b>Reject</b> temperature    pH evaporation any errors which affect all test-tubes equally		
	Cause of error		Error
		(dependent)	
	[1]	qualitative;	
	[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 <b>Allow</b> 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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<b>(vii) Suggest how you would make <i>three</i> improvements to this investigation.</b>			<b>[3]</b>
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;	max 3
	[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; <b>Reject</b> calorimeter	
	[1]	repeat or replicate;	
<b>[Total: 18]</b>			

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<b>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]</b>			
PDO layout 1	[1]	<b>Reject</b> • if drawn over the print of question	
		<b>Reject</b> • thick lines-thin grid • feathery lines • 3 'tails' or overlaps or gaps	<b>AND</b> no shading
		clear, sharp, unbroken lines	<b>AND</b> uses most of space provided;
MMO collection 3	[1]	no additional cells drawn	<b>AND</b> (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]	<b>Reject</b> • 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's circumference. Labels are not required. <span style="float: right;">[5]</span>			
PDO layout 1	[1]	<b>Reject</b> <ul style="list-style-type: none"> <li>if drawn over the print of question</li> </ul>	
		<b>Reject</b> <ul style="list-style-type: none"> <li>thick lines – than on grid</li> <li>feathery lines</li> <li>4 'tails' or overlaps or gaps if double lines for all cells</li> <li>1 if single line for any cell</li> </ul>	<b>AND</b> no shading
		clear, sharp, unbroken lines	<b>AND</b> uses most of space provided;
MMO collection 3	[1]	one xylem vessel drawn <b>Ignore</b> band inside	<b>AND</b> only single layer of surrounding cells ;
	[1]	<b>Reject</b> 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; <b>Allow</b> not touching.	
	[1]	<b>Reject</b> 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]	organise as a table/Venn diagram/ruled boxes	<b>AND</b> headed <u>K1</u> and <u>Fig 2.2</u>	<b>AND</b> first difference opposite each other;	<u>K1</u>   <u>Fig 2.2</u>	
	ACE interpretation 3	[1]	feature	K1	Fig.2.2	<b>Ignore</b> <ul style="list-style-type: none"> <li>• tick and cross without a key</li> <li>• ref. to non-observable features</li> <li>• 3D shapes</li> </ul>
[1]		1	epidermis	hairs/trichomes <b>Ignore</b> 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 <b>Allow</b> 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;	



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<b>(c) (i) Plot a chart of the data shown in Table 2.1.</b>				<b>[4]</b>
<b>MAX 2 for O and S if line graph drawn</b>				
PDO layout 4	O [1]	x-axis content(s)	<b>AND</b> 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	<b>Reject</b> scale on y-axis any other than 20 to 2 cm. <b>AND</b> y-axis <u>20 to 2 cm</u> ;	
	P [1]	<b>Reject</b> 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 <b>Allow</b> 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.	<b>AND</b> quality – vertical lines no thicker than on grid, not feathery for the complete line; bars – • <u>ruled lines</u> <b>Reject</b> irregular thickness • labelled clearly with contents – any clear labels e.g. chemical formulae $\text{NH}_4$ , Ca, Mg, Na or mixture – underneath, must be directly below correct bar or inside bar or shaded with key.	<b>Reject</b> solid shading If line shading outside a bar

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<b>(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]</b>			
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]	<b>Reject</b> if no working <b>Allow</b> any answer less than 100 to no more than 3 significant figures 1 decimal place	<b>AND</b> percentage/%;
<b>(d) Suggest why there is <math>120 \mu\text{g cm}^{-3}</math> of sucrose in the phloem sieve tube elements. [2]</b>			
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;	
			<b>[Total: 22]</b>