

MARK SCHEME for the May/June 2011 question paper
for the guidance of teachers

9700 BIOLOGY

9700/32

Paper 32 (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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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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)
<u>underline</u>	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
BOD	Benefit of Doubt given
ACE	Analysis, Conclusions and Evaluation (skills)
PDO	Presentation of Data and Observations (skills)
MMO	Manipulations, Measurement and Observation (skills)

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1 (a) (i) Complete Fig. 1.1 to show how you will make a <i>serial</i> dilution to reduce the concentration by <i>half</i> between each concentration.		[3]
MMO decisions 1	[1] (labels under correct sequence of beakers)	1(.0) AND 0.5 AND 0.2(5);
	Additional guidance Must have	• % once
MMO decisions 2	[1] (uses serial dilution) (adds previous concentration of G to each of three beakers and same volume)	
	volume of <u>2</u> (%) or shown by arrow with volume	AND the <u>same</u> volume transferred from first beaker to second and from second beaker to third beaker);
	Additional guidance Must have	• cm ³ once
MMO decisions 2	[1] (adds of (distilled) water/W to each of three beakers)	10 cm ³ ;
	Additional guidance Must have	• cm ³ once

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(ii) Complete Table 1.1 to show the volumes of solutions you intend to use in your investigation.			[2]								
MMO decisions 2	[1]	<table border="1"> <thead> <tr> <th>solution</th> <th>volume / cm³</th> </tr> </thead> <tbody> <tr> <td>G and S1 and S2</td> <td> all same volume; Additional guidance Must have <ul style="list-style-type: none"> • volume 2 cm³ or more AND 15 cm³ or less • whole number Do not give mark for <ul style="list-style-type: none"> • drops </td> </tr> <tr> <td>Benedict's</td> <td> (whole number) same as G and S1 and S2 OR more than G and S1 and S2 OR same or more than the largest volume from G/S1/S2; </td> </tr> <tr> <td></td> <td> Additional guidance Do not give mark if <ul style="list-style-type: none"> • for a combined volume of solution plus Benedict's of 21 or more cm³ • if any value missing for G/S1/S2 </td> </tr> </tbody> </table>	solution	volume / cm ³	G and S1 and S2	all same volume; Additional guidance Must have <ul style="list-style-type: none"> • volume 2 cm³ or more AND 15 cm³ or less • whole number Do not give mark for <ul style="list-style-type: none"> • drops 	Benedict's	(whole number) same as G and S1 and S2 OR more than G and S1 and S2 OR same or more than the largest volume from G/S1/S2;		Additional guidance Do not give mark if <ul style="list-style-type: none"> • for a combined volume of solution plus Benedict's of 21 or more cm³ • if any value missing for G/S1/S2 	
		solution	volume / cm ³								
	G and S1 and S2	all same volume; Additional guidance Must have <ul style="list-style-type: none"> • volume 2 cm³ or more AND 15 cm³ or less • whole number Do not give mark for <ul style="list-style-type: none"> • drops 									
	Benedict's	(whole number) same as G and S1 and S2 OR more than G and S1 and S2 OR same or more than the largest volume from G/S1/S2;									
	Additional guidance Do not give mark if <ul style="list-style-type: none"> • for a combined volume of solution plus Benedict's of 21 or more cm³ • if any value missing for G/S1/S2 										
[1]											

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(b) (i) State one variable, other than volume, which needs to be kept the same in this investigation. Describe <i>how you</i> will keep this variable the same. [1]			
ACE improvement 1	[1]	Do not give credit if answer gives a choice.	
		<u>temperature</u>	AND (idea of how kept the water-bath the same) heat or described Or add hot or cold water
			AND boil Or to temperature 80(°C) to 100 Or checking or monitoring with thermometer BOD temperature probe/gauge;
		Additional guidance Do not give mark if <ul style="list-style-type: none"> • ref to thermostatically controlled or electronic etc. how will you • heating with thermometer • temperatures below 80 	

(ii) Prepare the space below and record your results. Allow G as 4%. [4]						
PDO recording 2	[1]	<table border="1"> <tr> <td>table with all cells drawn</td> <td>AND heading (top or left) percent(age) conc(entration);</td> </tr> <tr> <td>Additional guidance</td> <td> Can have <ul style="list-style-type: none"> no outer boundary % Do not give mark if <ul style="list-style-type: none"> test-tube or beaker other units e.g. mol dm⁻³ </td> </tr> </table>	table with all cells drawn	AND heading (top or left) percent(age) conc(entration);	Additional guidance	Can have <ul style="list-style-type: none"> no outer boundary % Do not give mark if <ul style="list-style-type: none"> test-tube or beaker other units e.g. mol dm⁻³
	table with all cells drawn	AND heading (top or left) percent(age) conc(entration);				
Additional guidance	Can have <ul style="list-style-type: none"> no outer boundary % Do not give mark if <ul style="list-style-type: none"> test-tube or beaker other units e.g. mol dm⁻³ 					
[1]	<table border="1"> <tr> <td>(heading for any column/row including mean) <u>time</u> with s or sec(onds);</td> <td></td> </tr> <tr> <td>Additional guidance</td> <td> Do not give mark if <ul style="list-style-type: none"> units in cells of this column/row min(utes) additional columns/rows for method e.g. volumes of glucose or water or temp t or T </td> </tr> </table>	(heading for any column/row including mean) <u>time</u> with s or sec(onds);		Additional guidance	Do not give mark if <ul style="list-style-type: none"> units in cells of this column/row min(utes) additional columns/rows for method e.g. volumes of glucose or water or temp t or T 	
(heading for any column/row including mean) <u>time</u> with s or sec(onds);						
Additional guidance	Do not give mark if <ul style="list-style-type: none"> units in cells of this column/row min(utes) additional columns/rows for method e.g. volumes of glucose or water or temp t or T 					
MMO collection 2	[1]	<table border="1"> <tr> <td>records whole seconds (numbers) less than 301 for ANY 5 concentrations and S1 and S2 (7);</td> <td></td> </tr> <tr> <td>Additional guidance</td> <td> Must have <ul style="list-style-type: none"> whole seconds only no value over 300 </td> </tr> </table>	records whole seconds (numbers) less than 301 for ANY 5 concentrations and S1 and S2 (7);		Additional guidance	Must have <ul style="list-style-type: none"> whole seconds only no value over 300
	records whole seconds (numbers) less than 301 for ANY 5 concentrations and S1 and S2 (7);					
Additional guidance	Must have <ul style="list-style-type: none"> whole seconds only no value over 300 					
[1]	<table border="1"> <tr> <td>highest concentration recorded is shorter time than next concentration;</td> <td></td> </tr> <tr> <td>Additional guidance</td> <td> Can have <ul style="list-style-type: none"> minimum two recorded times </td> </tr> </table>	highest concentration recorded is shorter time than next concentration;		Additional guidance	Can have <ul style="list-style-type: none"> minimum two recorded times 	
highest concentration recorded is shorter time than next concentration;						
Additional guidance	Can have <ul style="list-style-type: none"> minimum two recorded times 					

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(c) (i) Estimate the concentration of glucose in solutions S1 and S2.		[1]
ACE conclusion 1	[1]	<p>correct estimate with their results for both S1 and S2</p> <p>AND percentage or % once;</p> <p>Additional guidance Do not give mark if</p> <ul style="list-style-type: none"> • calculate value between concentrations <p>Can have</p> <ul style="list-style-type: none"> • 'lower than' or quote lower value • 'higher than' or quote higher value • 'between ... and ...' Or e.g. 2–4%
(ii) State which solution, S1 or S2 is most likely to be from an untreated diabetic.		[1]
ACE conclusion 1	[1]	<p>(from (c)(i) – MUST have values for both S1 and S2) correct with their estimate from (c)(i) i.e. the highest concentration estimate;</p> <p>Additional guidance ECF if estimates the same value then can have 'S1 and S2' Or 'S1 or S2' Or 'both' Must have</p> <ul style="list-style-type: none"> • estimate in (c)(i) for both S1 and S2
		[Total: 12]

2 (a) Plot a graph of the data shown in Table 2.1.		[4]	
PDO layout 4	[1]	<p>x-axis <u>distance</u> (along tube (l) <u>cm</u></p> <p>AND y-axis <u>diameter</u> (of tube (l) <u>mm</u>;</p> <p>Additional guidance Must have</p> <ul style="list-style-type: none"> units on x-axis and y-axis 	
	[1]	<p>scale as x-axis 5.0 to 2 cm Must label each 2 cm</p> <p>AND y-axis 1.0 to 2 cm; Must label each 2 cm</p> <p>Additional guidance Do not give mark if</p> <ul style="list-style-type: none"> awkward scale scale not written on each 2 cm 	
	[1]	<p>correct plotting of each point;</p> <p>Additional guidance Can have</p> <ul style="list-style-type: none"> small cross or dot in circle or cross in circle ECF if x-axis not 0 if scale 20 to 2 cm. <p>Do not give mark if</p> <ul style="list-style-type: none"> awkward y-axis scale blobs or dots alone cross too large with any part of line touching 4 mm by 4 mm square – 	
	[1]	<p>lines point to point or line of best fit</p> <p>AND</p> <ul style="list-style-type: none"> ruled, clear sharp – quality – ruled lines thinner than half square; <p>Additional guidance Can have</p> <ul style="list-style-type: none"> extrapolation to edges of grid if line of best fit <p>Do not give mark if</p> <ul style="list-style-type: none"> less than 5 plots any feathery line irregular thickness extrapolated when point to point line (not line of best fit) 	

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(b) (i) Calculate the actual diameter of the tube shown by line x in fig. 2.1		[4]
MMO collection 1	[1]	measures line X correctly in mm; <i>95 or 95.5 or 96 or 96.5 or 97 mm</i>
		Additional guidance Must have <ul style="list-style-type: none"> • units
PDO display 2	[1]	shows measurement divided by <u>22</u> ;
		Additional guidance Can show <ul style="list-style-type: none"> • alternative division signs • incorrect measurement
	[1]	rounds any answer of division by <u>22</u> to two or three significant figures;
		Additional guidance Do not give if <ul style="list-style-type: none"> • in metres
ACE interpretation 1	[1]	correct answer one of following only <u>in mm</u> ; 4.32 or 4.34 or 4.36 or 4.39 or 4.41 or 4.3 or 4.4 mm.
		Additional guidance Do not give mark if 0.43/0.44 cm or micrometres
(ii) Use the actual diameter of the tube calculated in (b)(i) and your graph in (a)(i) to estimate the distance along length of the tube.		[1]
ACE interpretation 1	[1]	correct answer using their answer from (b)(i) and graph and <u>cm</u> ;

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(iii) Describe how you would find the mean diameter of the tube shown in Fig. 2.1.		[2]		
ACE improvements 2	[1]	<p>assume in context of the tube –</p> <p>Do not give mark if</p> <ul style="list-style-type: none"> • Idea of different tubes • Just 'take readings' 		
		<table border="1" style="width: 100%;"> <tr> <td style="width: 35%;"> Idea of more or e.g. 2 or higher take/find measure make readings/measurements of OR Uses/adds </td> <td style="width: 65%;"> diameters (from graph) measurements 5 actual figures from data or 5 points from graph – Or all diameters or values-or readings </td> </tr> </table>	Idea of more or e.g. 2 or higher take/find measure make readings/measurements of OR Uses/adds	diameters (from graph) measurements 5 actual figures from data or 5 points from graph – Or all diameters or values-or readings
	Idea of more or e.g. 2 or higher take/find measure make readings/measurements of OR Uses/adds	diameters (from graph) measurements 5 actual figures from data or 5 points from graph – Or all diameters or values-or readings		
[1]	<p>add/sigma/sum of (measurements can be from graph)</p> <p>and divide by the number of measurements (ecf)</p> <p>OR alternative description;</p>			

(iv) Prepare the space below so that it is suitable for you to record the observable differences between the specimens in Fig. 2.1 and in Fig. 2.2. [5]

PDO recording 2	[1]	organise as a table/Venn diagram/ruled boxes	AND headed Fig. 2.1 and Fig. 2.2	AND first difference opposite each other;	
		Additional guidance Fig. 2.1 Fig. 2.2 OR Fig. 2.2 Fig. 2.1			
	[1]	observable differences only; can be incorrect Do not give mark if any similarities or function differences or features in overlapping part of Venn diagram			
ACE interpretation max 3	max 3		feature	Fig. 2.1	Fig. 2.2
		1.	lumen shape or epithelial	less / few / four folds / thick cross(-shape) or drawn	more / five / six folds / thin star or drawn
		2.	lumen size	large(r)	small(er);
		3.	epithelial tissue	thick(er)	thin(er);
		4.	connective tissue	goes less into folds thick(er) or thin(ner)	goes more into folds thin(ner) or thick(er);
		5.	muscle tissue	more / thick or less / thin striated / skeletal / voluntary	less / thin or more / thick smooth / involuntary;
		6.	cells or nuclei	visible / present / seen	not visible / absent / not seen;
		7.	(Overall) shape Extra layer between connective tissue and muscle	squashed / no extra layer absent	round / extra 'arm' present / has / described
[Total: 16]					

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3 (a) (i) Draw a large plan diagram of the whole of the transverse section. Label the epidermis and xylem.				[5]
PDO layout 1	[1]	clear, sharp, unbroken lines	AND no shading	AND larger than 60 mm across widest point top to bottom;
		Additional guidance 'tail' or overlap or gap has to be more than 1 mm	Must have <ul style="list-style-type: none"> three or more enclosed areas Do not give mark if <ul style="list-style-type: none"> drawn over the print of question any line thicker – 1 mm or more any feathery line or broken in enclosed area 	
MMO collection 2	[1]	no cells drawn	AND complete section drawn;	
	[1]	draws outline with at least four larger bulges;	Additional guidance Can have <ul style="list-style-type: none"> different bulge attached or additional structure outside main outline 	
MMO decisions 2	[1]	inner region below bulges has at least three lines (two layers);	Additional guidance Do not give mark if <ul style="list-style-type: none"> vascular bundle(s) drawn 	
	[1]	correct label with label lines to epidermis (outer two lines or touches outermost line not into area past a single line) and xylem (any inner region outside centre and under bulges); blob tick	Additional guidance Do not give mark if <ul style="list-style-type: none"> any label which is biologically incorrect e.g. from incorrect organ or animal any label within drawn area except if showing ratio upper or lower Can have <ul style="list-style-type: none"> labels to additional bulges 	

(ii) Calculate the ratio of the total diameter of the stem to the diameter of the pith.			[1]
ACE interpretation 1	[1]	last answer as larger whole number to/: smaller whole number;	
		Additional guidance	<p>Must have</p> <ul style="list-style-type: none"> to smallest denominator <p>Can have</p> <ul style="list-style-type: none"> as a fraction to smallest denominator <p>Do not give mark if</p> <ul style="list-style-type: none"> any units/epg in answer if give more than one answer
(b) (i) State one observable feature of the epidermis that supports the conclusion that this is a stem from a plant growing in a dry habitat. Explain how this feature reduces water loss. Read whole answer for feature.			[1]
ACE conclusions 1	[1]	cuticle or stomata with no or BOD few or sunken epidermis with folded grooved fleshy	<p>AND</p> <p>reduces or prevents</p> <p>storage of water</p> <p>evaporation or water escaping or diffusing or transpiration;</p>
		Additional guidance	<p>Do not give mark if</p> <ul style="list-style-type: none"> features not linked to epidermis ref. to leaf <p>Ignore</p> <ul style="list-style-type: none"> ref. to surface area

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(ii) Make a large drawing of three adjacent cells from the central pith. Label the cell wall. [5]			
PDO layout 1	[1]	clear, sharp, unbroken lines	AND no shading
		Additional guidance	AND longer than 30 mm across widest point of largest cell;
MMO collection 3	[1]	only three cells drawn	AND as a group or as line;
	[1]	no gaps between two pairs of touching cell walls;	
		Additional guidance	Must have <ul style="list-style-type: none"> at least three enclosed areas Do not give mark if <ul style="list-style-type: none"> drawn over the print of question any thicker line – than 1 mm any feathery line
MMO decision 1	[1]	cell walls drawn as double lines with middle lamella between adjacent walls of any two cells;	
		Additional guidance	Do not give mark if <ul style="list-style-type: none"> any label is biologically incorrect e.g. from incorrect organ or animal or EM organelles or chloroplasts label within drawn area
[Total: 12]			