

**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**  
GCE Advanced Subsidiary Level and GCE Advanced Level

**MARK SCHEME for the October/November 2011 question paper  
for the guidance of teachers**

**9700 BIOLOGY**

**9700/31**

Paper 3 (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.

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

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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Mark scheme abbreviations:

<b>;</b>	separates marking points
<b>/</b>	alternative answers for the same point
<b>R</b>	reject
<b>A</b>	accept (for answers correctly cued by the question, or by extra guidance)
<b>AW</b>	alternative wording (where responses vary more than usual)
<b><u>underline</u></b>	actual word given must be used by candidate (grammatical variants excepted)
<b>max</b>	indicates the maximum number of marks that can be given
<b>ora</b>	or reverse argument
<b>mp</b>	marking point (with relevant number)
<b>ecf</b>	error carried forward
<b>I</b>	ignore
<b>ACE</b>	Analysis, Conclusions and Evaluation (skills)
<b>MMO</b>	Manipulations, Measurement and Observation (skills)
<b>PDO</b>	Presentation of Data and Observations (skills)

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<b>1 (a)</b>	<b>[3]</b>
mp1	(labels under correct sequence of beakers) 0.025 <b>AND</b> 0.0125 <b>AND</b> 0.00625;
	Additional guidance <b>Must have</b> % once and concentrations to 3 or more decimal places <b>A</b> mixture of precision e.g. 0.025 with 0.012 or 0.013 with 0.006 or 0.0062 or 0.0063
mp2	<b>EITHER</b> (uses serial dilution) <u>10</u> cm <sup>3</sup> of 0.05(%) or shown by arrow with <u>10</u> cm <sup>3</sup> <b>AND</b> <u>10</u> cm <sup>3</sup> transferred from third beaker to fourth and from fourth beaker to fifth beaker;
	Additional guidance <b>Must have</b> cm <sup>3</sup> once in either and or % once when labelling or <b>ecf</b> if mp1 not given
mp3	(adds (distilled) water/ <b>W</b> to each of three beakers <b>BUT MUST</b> add previous concentration to fourth and fifth beakers) <u>10</u> cm <sup>3</sup> (into each beaker 3 <sup>rd</sup> /4 <sup>th</sup> /5 <sup>th</sup> ) of (d) <u>W</u> or <u>water</u> ;
	Additional guidance <b>Must have</b> cm <sup>3</sup> once <b>ecf</b> if mp1 not given and /or if mp2 not given
MMO decisions 3	

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<b>max 1</b>	<p><b>OR</b> (simple dilution for mp1 and mp3)</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">0.1% (S)</td> <td style="text-align: center;">2.5 AND</td> <td style="text-align: center;">AND</td> <td style="text-align: center;">1.25 AND</td> <td style="text-align: center;">AND</td> <td style="text-align: center;">0.625 AND</td> </tr> <tr> <td style="text-align: center;">W</td> <td style="text-align: center;">7.5</td> <td></td> <td style="text-align: center;">8.75</td> <td></td> <td style="text-align: center;">9.375</td> </tr> </table> <p style="text-align: center;">OR</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">0.1% (S)</td> <td style="text-align: center;">5.0 AND</td> <td style="text-align: center;">AND</td> <td style="text-align: center;">2.5 AND</td> <td style="text-align: center;">AND</td> <td style="text-align: center;">1.25 AND</td> </tr> <tr> <td style="text-align: center;">W</td> <td style="text-align: center;">15.0</td> <td></td> <td style="text-align: center;">17.5</td> <td></td> <td style="text-align: center;">18.75</td> </tr> </table> <p>Additional guidance <b>Must have</b> cm<sup>3</sup> once and 10 (%) for each beaker with % once or arrow from first beaker to each one  <b>ecf</b> if mp1 not given  <b>R</b> if</p> <ul style="list-style-type: none"> <li>• round volumes up or down</li> <li>• just <b>S</b></li> </ul>						0.1% (S)	2.5 AND	AND	1.25 AND	AND	0.625 AND	W	7.5		8.75		9.375	0.1% (S)	5.0 AND	AND	2.5 AND	AND	1.25 AND	W	15.0		17.5		18.75
0.1% (S)	2.5 AND	AND	1.25 AND	AND	0.625 AND																									
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	<b>(ii)</b>	<b>[5]</b>
PDO recording 2	[1]	table with all cells drawn <b>AND</b> heading (top or left) percent(age) conc(entratiion) ; Additional guidance <b>A</b> no outer boundary <b>A %</b> <b>R</b> if % in body of table <b>Ignore</b> test-tube/additional columns
	[1]	(heading below or to right) time sec(onds)/s; <b>R</b> T or t
MMO collection 2	[1]	Additional guidance <b>R</b> if units in body of table records times for at least four concentrations;
	[1]	Additional guidance <b>A</b> any times as long as with clear units. <b>Must have</b> cm <sup>3</sup> once <b>ecf</b> if mp1 not given for slip and/or if mp2 not given
MMO decision 1	[1]	any times as whole seconds (numbers) 'less than 601' ;
	[1]	Additional guidance <b>A</b> minimum of four recorded times including 'more than 600'. records correct pattern: highest concentration recorded is shorter time than next concentration;
		Additional guidance <b>A</b> any values, e.g. seconds with tenths or min:sec <b>A</b> minimum two recorded times including 'more than 600' once

	<b>(iii)</b>	<b>[1]</b>
ACE improvement 1		Mark first variable.
	[1]	temperature <b>AND</b> thermostatically controlled water-bath /AW; Additional guidance <b>R</b> pH <b>A</b> digital or electronic <b>A</b> description of use of heating and cooling with Bunsen or hot and cold water

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(iv)		[max 2]
	Mark the first three ideas for two correct.	
ACF improvement 2 max 2	max 2	
	mp1 (independent variable) more / different / vary / wider range concentrations / solutions;	
	mp2 two examples of different concentrations;	
	Additional guidance <b>A</b> mp1 and 2 if list at least two more concentrations between correct values or examples of smaller intervals or implies all differences e.g. 0.5% <b>R</b> 'serial dilution'	
	mp3 use a colorimeter or use a pH meter or indicator paper or use a colour standard;	
	mp4 (dependent variable) (repeat/replicate) more than once / many / more times / twice / thrice;	
	Additional guidance <b>A</b> doing repeats / replicates / repetitions	

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(b) (i)		[4]
PDO layout 4	O	x-axis concentration of inhibitor/ $\mu\text{g cm}^{-3}$ <b>AND</b> y-axis inhibition area/ $\text{mm}^2$ Additional guidance <b>Must have</b> units on x-axis <b>AND</b> y-axis
	S	scale as x-axis <u>20 to 2 cm</u> <b>AND</b> y-axis <u>20 to 2 cm</u> ;
	P	correct plotting of each point to <u>within</u> half a square; Additional guidance <b>ecf</b> if no labels for O if reverse O then scale must use more than half grid for both x and y and do not have an awkward scale <b>A</b> no 0 label at origin and no end label
	L	<u>ruled</u> lines point to point or curve through all points <b>AND</b> quality clear sharp; <b>R</b> if <ul style="list-style-type: none"> <li>• less than 5 plots</li> <li>• line 1mm or thicker</li> <li>• any feathery line</li> <li>• irregular thickness</li> <li>• any extrapolation</li> </ul>
		Additional guidance <b>A ecf</b> from incorrect P

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<b>(ii)</b>		<b>[1]</b>
ACE interpretation 1	[1] reading is shown at <u>100</u> <b>AND</b> correct concentration of inhibitor;	

<b>(iii)</b>		<b>[2]</b>
ACE interpretation 2	[1] as <u>concentration</u> increases the <u>inhibition</u> (area) increases;	
	Additional guidance <b>Ignore</b> (inversely/directly) proportional	
	[1] inhibition slows down;	
	Additional guidance <b>A</b> levelling off or plateau or decreasing rate <b>R</b> stops going up/increasing	

<b>(iv)</b>		<b>[2]</b>
ACE conclusion 2	[1] ( <i>rate of</i> ) hydrolysis or <i>breakdown</i> or <i>digestion</i> would <i>slow down</i> ;	
	Additional guidance <b>A</b> (enzyme) bonds broken or denatures	
	[1] <i>Idea of (at higher concentrations) more active sites inhibited / describe or shape of active site/enzyme changed or fewer ES complexes (formed);</i>	
		<b>[Total: 20]</b>

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<b>2 (a) (i)</b>	<b>[5]</b>
PDO layout 1	[1] <p><b>no shading AND longer than 60 mm in any direction AND</b> (clear, sharp, unbroken lines)  <b>Must have</b> four or more hand drawn lines and/or enclosed areas  <b>R if</b></p> <ul style="list-style-type: none"> <li>• drawn over the print of question</li> <li>• any line 1mm or thicker</li> <li>• any feathery line</li> <li>• three 'tails' or overlaps or gaps</li> <li>• <b>any</b> ruled or dashed line</li> </ul>
MMO collection 2	[1] <p>no cells drawn <b>AND</b> whole quarter drawn <b>AND</b> at least one enclosed area;</p>
PDO recording 1	[1] <p>(epidermis) drawn with two lines closer than 4 mm at widest point <b>AND</b> four and nine complete air spaces;  shows two / three distinct regions from centre;</p>
MMO decision 1	[1] <p>correct label with one label line to epidermis;  Additional guidance <b>R if</b></p> <ul style="list-style-type: none"> <li>• any label which is biologically incorrect e.g. from incorrect organ e.g. spongy mesophyll or animal e.g. epithelium or cell structures</li> <li>• any label within drawn area</li> </ul>

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		(ii)	[5]
PDO layout 1	[1]	no shading <b>AND</b> largest dimension of one cell larger more than 40 mm in any direction <b>AND</b> (clear, sharp, unbroken lines for outer cell line only); <b>Must have</b> three or more hand drawn enclosed areas <b>R if</b> <ul style="list-style-type: none"> <li>• drawn over the print of question</li> <li>• any line thicker 1 mm or thicker</li> <li>• any feathery or broken/dashed line</li> <li>• any 'tails' or overlaps or gaps if two lines for cell walls</li> <li>• any ruled lines</li> </ul>	
	[1]	drawn three cells touching and forming a single chain; Additional guidance <b>R if</b> any ruled lines	
	[1]	one cell tapers to join one adjacent cell <b>AND</b> this cell is the largest; Additional guidance <b>R if</b> any extra line (basal line) <b>R if</b> incorrect cell organelles such as golgi, mitochondria etc.	
	[1]	cells walls as double lines with middle lamella between each pair of adjacent walls; correct label with one label line to a cell wall;	
	[1]	Additional guidance <b>R if</b> any label other than cell wall <b>R</b> any label within drawn area	
MMO decision 1		(iii)	[1]
		Mark first feature.	
ACE conclusion 1	[1]	(air) spaces for floating/buoyancy/support/flexibility <b>OR</b> chains of cells for support/gas exchange/AW;	

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<b>(b) (i)</b>		<b>[4]</b>
MMO collection 1	[1] <u>five (measurements)</u> all between 10 and 40  Additional guidance <b>A</b> 1 to 4 <b>A</b> to 0.5 mm only and to 0.05 cm only	
MMO decision 1	[1] <i>(10 to 40) mm OR (1 to 4) cm;</i>	
PDO display 2	[1] shows <u>addition step</u> <b>AND</b> shows <u>division</u> by no. of measurements shown;	
	[1] shows <u>multiplication</u> by $1000/10^3$ for mm or $10000/10^4$ for cm <b>AND</b> shows <u>division</u> by <u>30</u> ;	
	Additional guidance <b>ecf</b> for incorrect measurements <b>R</b> any ref. to metres	

<b>(ii)</b>		<b>[5]</b>
PDO recording 1	[1] organise as a table/Venn diagram/ruled boxes <b>AND</b> headed <b>J1</b> and <b>Fig 2.2</b> <b>AND</b> first difference opposite each other;	
MMO decision 1	[1] only <b>one</b> observable similarity recorded <b>AND</b> only <b>two</b> differences;	

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max 3	ACE interpretation max 3	<b>feature</b>	<b>J1</b>	<b>Fig. 2.2</b>
		<b>Similarities</b>	spaces or vascular bundle(s) or chains of cells;	
		<i>central stele</i>	<i>present</i>	<i>absent;</i>
		<i>vascular bundle</i>	<i>centre</i>	<i>scattered or periphery;</i>
		<i>air space shape</i>	<i>triangular</i>	<i>circular/oval;</i>
		<i>arrangement</i>	<i>regular or symmetrical</i>	<i>irregular/random or not symmetrical;</i>
		<i>air space number</i>	<i>more</i>	<i>few;</i>
		<i>area</i>	<i>less of small(er)</i>	<i>more or large(r);</i>
		<i>projections into air space</i>	<i>none</i>	<i>spiky projections;</i>
max 3	Additional guidance <b>Ignore</b>	<i>each air space sizes</i>	<i>similar/same</i>	<i>different or vary or large and small;</i>
		<i>epidermis</i>	<i>thin</i>	<i>thick;</i>
		<i>cells</i>	<i>large(r) or more packed or more vary or different</i>	<i>smaller or loosely packed or few(er) same or less different;</i>
		<i>cell shape</i>		
		<b>Additional guidance</b>	<b>Ignore</b>	
		• tick and cross without a key		
		• diagrams		
		• refs. to size		
• 3-D descriptions such as spherical				
• colours / staining				
				<b>[Total: 20]</b>