UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

9700 BIOLOGY

9700/31 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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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)
underline	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
ACE	Analysis, Conclusions and Evaluation (skills)
MMO	Manipulations, Measurement and Observation (skills)
PDO	Presentation of Data and Observations (skills)

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Expected Answers			Mark
1 a (i) Complete Fig. 1.1 to show how you will make <u>two</u> further concentrations of copper sulfate solution			[3]
MMO decisions 3	[1]	(labels under correct sequence of beakers) 0.0003 AND 0.00003; Additional guidance **Must have** • % once	
	[1]	(adds copper sulfate solution, C, to **both** beakers) 1 cm^3 of 0.003(%) or shown as arrow (from 0.003 beaker) **AND** 1 cm^3 (to next beaker); Additional guidance **Must have** • cm^3 once **ECF** • if MP1 incorrect	
	[1]	(adds (distilled) water/W, to **both** beakers) 9 cm^3 (W/water); Additional guidance **Must have** • cm^3 once **ECF for MP3** if MP1 and MP2 incorrect BUT **MUST** add previous concentration to third and fourth beakers	

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Expected Answers				Mark
(a) (ii) Prepare the space below and record your observations. ***Mark in <u>vertical line</u> in order*.**				[5]
PDO recording 2	[1]	table with all cells drawn	**AND** heading (top or left) percent(age) conc(entration);	
		Additional guidance	**Can have** • no outer boundary • % • solution or copper sulfate % or percentage copper sulfate solution **Do not give mark if** • % in cells of the headed column/row • other units e.g. mol dm^{-3}	
	[1]	(heading on **any one time column/row** including mean) <u>time</u> with s/sec(onds);		
		Additional guidance	**Do not give mark if** • units in cells of the headed column/row • min(utes) • additional columns/rows for volumes of water/copper sulfate • t or T	

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		Expected Answers	Mark
MMO collection 3	[1]	records whole seconds (numbers), less than 181, for W / 0 / control **AND** 4 concentrations;	
		Additional guidance **Must have** • whole seconds only • no value over 180	
	[1]	(in concentration column) W / 0 / control and then lowest concentration of copper sulfate to highest concentration (**minimum of two concentrations**, lowest concentration and then next highest concentration);	
	[1]	lowest concentration of copper sulfate recorded is shorter time than next (higher) concentration; (mark **first** column/row of recorded time taken)	
		Additional guidance **Can have** • minimum of two recorded	

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Expected Answers			Mark
(a) (iii) Explain how your results provide evidence for the support or the rejection of this hypothesis.			[2]
ACE conclusion **max 2**	**max 2**	**1.** clear statement on hypothesis, support / true(hypothesis) OR reject / false(hypothesis);	
		2. correct statement about concentration lower than 0.03% with respect to time e.g. quote concentration and time;	
		3. correct statement about water e.g. no inhibition;	

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Expected Answers			Mark
(a) (iv) Identify <u>one</u> significant source of error in your investigation **<u>MARK</u> the first <u>TWO</u> different ideas for one correct answer.** ***Mark with tick where meet the marking point and cross if idea incorrect up to two.***			[1]
		Mark as incorrect ideas • temperature • evaporation • any errors which affect all test-tubes equally • pH	
ACE interpretation **max 1**	Cause of error		WITH idea of error
	max 1	**1.** (dependent) colour change end-point timing	difficult to judge see or identify determine is subjective may be different too quick;
		2. time intervals	(15 seconds) too long (a time interval);
		3. (standardised) air bubble in syringe	measuring not accurate;
	Additional guidance		**Do not give mark if (count as an idea)** • human reaction time • just have cause and no error • give improvement or correction of error e.g. 'should have timed each one separately' • contamination

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Expected Answers			Mark
(a) (v)	**Describe <u>three</u> other modifications to this investigation would improve the confidence in your results.** **Do not allow colorimeter.** **<u>MARK</u> the first FOUR different ideas for any THREE correct answers.** ***Mark with a tick where meet marking point and cross if idea but not correct up to 4.***		[3]
ACE improvements **max 3**	**max 3**	(dependent variable) **1.** replicate; **2.** more / closer / shorter time intervals (gaps); (**MUST BE** less than 15 seconds, but not less than 5 seconds) **3.** use of Benedict's solution **AND** timing to first colour change / clinistix;	
		Additional guidance **Can have** • repeat or more trials or more readings **Ignore** • mean	
		(standardised variables) **4.** add a buffer; **5.** idea of more accurate instruments e.g. use of graduated pipette or syringe with smaller divisions (1 cm^3) e.g. measuring cylinder;	
		Additional guidance **Ignore** (for MP5) • use burette	
		6. (independent variable) more / wide / narrow(er) / different / high(er) / low(er) / more concentrations / dilutions / solutions;	
		Additional guidance **Do not give mark if** • ref. to separate syringes • use larger volumes • put covers or lids on	

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Expected Answers			Mark
(b) (i) Draw a circle around each of the anomalous results and complete the table.			[2]
MMO decision 1	[1]	circles the two anomalous results/ for 12.5 <u>80</u> AND for 3.5 <u>84</u>;	
		Additional guidance **Do not give if** • circled more than two numbers **Ignore** • the figure 93 if in place of 96 do not count as a 'circle' if circled	
ACE Interpretation 1	[1]	calculates mean correctly/<u>59</u>;	
		Additional guidance **ECF** allow • <u>64</u> (as candidate has used anomalous result to calculate mean) **Do not give if** • 64.2 (needs to round number down) • given two answers	

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Expected Answers			Mark
(b) (ii) Plot a graph of the data shown in Table 1.1.			[4]
PDO layout 4	[1]	*x*-axis copper sulfate/mol dm^{-3} $x10^{-3}$	**AND** *y*-axis absorbance/%;
		Additional guidance	**Must have** • units on *x*-axis **AND** *y*-axis
	[1]	scale as *x*-axis 5 to 2 cm **must** label each 2 cm	AND *y*-axis 20 to 2 cm ; ECF if no labels for O **must** label each 2 cm
		Additional guidance	**Do not give mark if** • awkward scale e.g. • scale not written on each 2cm **Ignore** 0 on either axis AND 100 on *y*-axis
	[1]	correct plotting of each point <u>to</u> within half a square i.e less than 1 mm from intersection i.e. plot has to be nearer than halfway from a line - up or down OR if meant to be between two lines then must not be on line above or below;	
		Additional guidance	**Can have** • small cross or dot in circle or cross in circle • ECF if *x*-axis not 0 if scale 20 to 2 cm. even **Do not give mark if** • awkward *y*-axis scale • blobs or dots alone • cross too large with any part of line touching 4 mm by 4 mm square – check with grid dot/blob size which is 2 mm across • Mark the plot for figure 93 as for other plots, do not penalise for using the number.

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Expected Answers				
	[1]	lines point to point	**AND** • ruled, clear sharp and • quality ruled lines thinner than half square; **Do not give mark if** • less than 5 plots • any feathery line • irregular thickness extrapolated to zero	

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Expected Answers			Mark
(b) (iii) Explain the effect of copper sulfate on the protein suspension.			[2]
ACE conclusion **max 2**	**max 2**	**1.** (protein) coagulates / clots as concentration of copper sulfate increases;	
		2. denatures;	
		3. detail on the effect of changing the protein structure; e.g. bonds broken / shape changed / altered / quaternary structure / tertiary structure	
		Additional guidance **Do not give mark if** • link to enzyme for any MP	
[Total: 22]			

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Expected Answers					Mark
2 (a) Draw a large plan diagram of the part of the leaf indicated by the shaded area in Fig. 2.1. Label the xylem and an air space. *Mark in <u>vertical line</u> in order.*					[5]
PDO layout 1	[1]	clear, sharp, unbroken lines	**AND** no shading	**AND** longer than *60 mm* across middle / bulge from top to bottom;	
		Additional guidance 'tail' or overlap or gap has to be more than 1 mm to be marked as an error	**Must have** • **3** or more hand-drawn lines (not ruled) **and** one or more enclosed areas **Do not give mark if** • drawn over the print of question • any line thicker than 1mm • any feathery or broken or overlap in lines • drawn only <u>one enclosed area</u> and drawn <u>any</u> 'tail' or gap in the outline **Can have** • **1** 'tail' or overlap or gap in the outline if drawn 2/3 enclosed areas		
MMO collection 3	[1]	no cells drawn	**AND** drawn part of leaf indicated by shaded area **AND** outline of bulge at each side turns parallel to top layer*;*		
		Additional guidance	**Can have** • up to **3** enclosed areas within vascular bundle or within area where vascular bundle is situated (as drawing large xylem vessels which would make them cells)		
	[1]	vascular bundle divided into at least **2** regions;			
	[1]	definite area around hinge region drawn (at base of fold);			

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Expected Answers				
MMO decision 1	[1]	label line to central area air space drawn as distinct area which goes outside central area	**AND** labelled xylem **AND** labelled air space;	
		Additional guidance **Do not give mark if** • any label which is biologically incorrect e.g. from incorrect organ or animal • label within drawn area		

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<table>
<tr><td colspan="4">Expected Answers</td><td>Mark</td></tr>
<tr><td colspan="4">(b) Make a large drawing of <u>six</u> cells from the part of the leaf indicated by the shaded area in Fig. 2. 2.
The cells should be <u>two</u> adjacent (touching) cells from the epidermis and <u>two</u> adjacent cells from each of the next two layers. Label one epidermal cell.</td><td>[5]</td></tr>
<tr><td rowspan="2">PDO layout 1</td><td rowspan="2">[1]</td><td>clear, sharp, unbroken lines</td><td>AND
no shading or stippling</td><td>AND
longest dimension of any cell is 30 mm using grid;</td></tr>
<tr><td colspan="3">Must have
• 3 or more enclosed areas
Do not give mark if
• drawn over the print of question
• any line thicker than 1mm
• any feathery line
Can have
• 2 'tails' or overlap or gap in the <u>outline</u> of 6 enclosed areas
(assessing outer line)</td></tr>
<tr><td rowspan="3">MMO collection 2</td><td rowspan="2">[1]</td><td colspan="3">three pairs of <u>touching</u> cells only;</td></tr>
<tr><td>Additional guidance</td><td colspan="2">Do not give mark if
• other layers drawn</td></tr>
<tr><td>[1]</td><td colspan="3">the longest dimension (top to bottom) of one of the two middle cells is longer than the shortest dimension (top to bottom) of any of the other four cells (by at least 1 mm);</td></tr>
<tr><td>PDO recording 1</td><td>[1]</td><td colspan="3">cell walls drawn as double lines with middle lamella between any two cells;</td></tr>
</table>

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MMO decision 1	[1]	correct label with label line to <u>epidermal cell/cell from epidermis</u>;
		Additional guidance **Do not give mark** • for epidermis only • label within drawn area • for any label which is biologically incorrect e.g. organelles or from incorrect organ or animal

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Expected Answers				Mark
(c) The actual length of line Y is 785μm. Use this measurement to calculate the magnification of Fig. 2.3				[3]
MMO decision 1	[1]	measures line **Y** in mm; 22 22.5 23 23.5 24 mm		
		Additional guidance	**Can have** 2.2 2.25 2.3 2.35 2.4 cm **Must have** units somewhere only those values given	
PDO display 2	[1]	(uses mm and converts to μm by) shows <u>multiplied by</u> or <u>x</u> mm x 1000 OR x 10^3 OR (uses cm and converts to μm by) cm x 10000 x 10^4	**AND** <u>divided by</u> (785);	
		(converts (785) μm to mm or cm) shows <u>division by</u> or <u>1000</u> x 10^3 OR (converts (785) μm to mm or cm) shows <u>division by</u> or <u>10000</u> 10^4	**AND** <u>divides</u> Y <u>by</u> (0.785) OR **AND** <u>divides</u> Y <u>by</u> (0.0785);	

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		Additional guidance **Must have** multiplication and division signs/wording OR division and division signs/wording **Can have** ***** or **.** for 'multiplied by' even if no units mm or cm **ECF** using incorrect figure if MP1 wrong **Do not give mark if** uses metres anywhere
	[1]	rounds to whole number;
		Additional guidance for MP3 **ECF** from MP1 but needs to have MP2 correct

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Expected Answers						Additional guidance
(d) Prepare the space below so that it is suitable for you to record the observable differences between the specimens on J1 and that in Fig. 2.3.						[5]
PDO recording 1	[1]	organise as a table / ruled boxes	**AND** headed J1 and Fig 2.3	**AND** first difference opposite each other;		J1 Fig 2.3 Fig 2.3 J1
MMO decision 1	[1]	at least one difference and no similarities;				
ACE interpretation **max 3**	**max 3**		feature	J1	Fig. 2.3	
		1.	(mid-rib) shape	V-shaped / sharp / narrow / pointed / concave	bump / rise / rounded / circular / wide; (do not accept V-shaped)	
		2.	vascular bundle xylem / phloem position	small / nearer lower epidermis in one area	large / wide across midrib nearer upper epidermis;	

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		3.	vascular bundle sheath amount of xylem / phloem	present less	absent; more;
		4.	stomata / guard cells	present / many	absent / less / none / cannot see;
		5.	collenchyma	present	few cells / none;
		6.	upper epidermis	thick epidermis / large cells	thin epidermis / small cells;
		7.	hinge cells / rectangular cells	present	absent;
		8.	number of air spaces / lacunae / packing size of air spaces	many (cells) densely packed large	few / none (cells) loosely packed small;

Additional guidance

If reverse headings then
Do not give mark for PDO recording mark
– show the swapping over of headings on their table then **give marks** as if for the swapped headings.

If no organisation then
give mark only if in same sentence or following sentences

Ignore
- tick and cross without a key
- refs. to size
- 3-D descriptions such as spherical
- colours/staining

Can have
- differences even if not opposite each other.
- differences on one side if e.g. use more or –er

Total 18

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