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

9700/33 Paper 31 (Advanced Practical Skills 1), maximum raw mark 40

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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
AVP	Alternative version possible
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 *serial* dilution to reduce the concentration by *half* between each concentration. [3]

MMO decisions 1

[1]

(labels under correct sequence of beakers either left to right or right to left-)
2.5 AND 1.2(5) AND 0.6(25);

Additional guidance **Must have**
- % once
- concentrations to at least 1 decimal place

MMO decisions 2

[1]

(uses serial dilution to complete three unlabelled)
(adds previous concentration of E to **each** of three beakers and same volume)

5(%) with volume or shown by arrow from (5%) with volume	**AND** the same volume transferred from first beaker to second and from second beaker to third beaker);

Additional guidance **Must have**
- cm^3 once

ecf
- if mp1 incorrect

[1]

(adds (distilled) water / W to **each** of three beakers)
10 cm^3 (W / water);

Additional guidance **Must have**
- cm^3 once

ecf
- if mp1 incorrect
- if mp2 incorrect BUT **MUST** add previous concentration to second and third beakers

(ii) Describe how you will set up this control using the apparatus provided. [1]

ACE improvement 1

[1]

(may answer in terms of setting up test-tubes)
boil enzyme
Or replace enzyme / E with water / W
Or use water / W instead of enzyme / E
Or use urea / U and water / W
(Ignore equal volume or 2 cm^3 of each)

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(iii) Prepare the space below and record your results.			**[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 enzyme % or percentage solution or percentage enzyme **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) time with s or 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 enzyme or urea • t or T
MMO collection 3	[1]	(in concentration column) **lowest** concentration of E first to highest concentration minimum of three;	
		Additional guidance	**Ignore** • control or 0% or W before or after or not present **but** not in middle **Can have** • ecf **any** lowest recorded concentration
	[1]	records whole seconds (numbers) less than 601 for 5 concentrations **and** control (6); (mark **first** column/row of recorded time taken)	
		Additional guidance	**Must have** • whole seconds only • no value over 600
	[1]	highest concentration recorded is shorter time than next concentration; (mark **first** column/row of recorded time taken)	

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(iv) Calculate the rate of reaction for the 10% E concentration. **[1]**

ACE interpretation 1

[1]

(from results or mean)
correct answer (1 divided by the result for 10%) with units s^{-1};

Additional guidance

Can have
- $sec(onds)^{-1}$

Do not give mark if
- no result for 10%.
- more than 3 significant figures.

E.g. 0.00345 ✓ (3 sig. figs) **NOT** 0.003456 X (4 sig. figs)

(v) Identify *one* significant sources of error in your investigation. **[1]**

ACE interpretation max 1

max 1

Mark as incorrect ideas
temperature
pH
evaporation
any errors which affect all test-tubes equally

	Cause of error	WITH idea of error
1.	(dependent) colour change / red to blue / end-point litmus colour	difficult to judge see or identify determine is subjective may be different too quick;
2.	timing reaction starts	not same or describes only starts when added to all test-tubes or delayed or not added at same time too quick or describes more concentrated goes quickly or after reaction starts before timing;
3.	(standardised) litmus paper enzyme	 sticks to sides/bottom not dissolved;

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			Additional guidance	**Do not give mark if (count as an idea)** • human reaction time • just have cause and no idea of error • give improvement or correction of error e.g. should have timed each one separately • contamination
(vi) Suggest how you would make *two* improvements to this investigation.				**[2]**
ACE improvements max 2	max 2	**1.**	(dependent) use pH meter use datalogger **and** pH sensor liquid litmus or indicator **and** colorimeter;	
			Additional guidance	**Do not give mark if (count as an idea)** • only colorimeter (litmus paper!) • only universal indicator • use of colour charts
		2.	stagger start or do individually or use more stop clocks or use help;	
		3.	replicate;	
			Additional guidance	**Can have** • repeat or more trials or more readings **Ignore** • mean
		4.	(standardised variables) dry test-tubes (dissolve enzyme with idea of how) leave for longer or use stirrer or warm;	
			Additional guidance	**Do not give mark if** • ref. to separate syringes • use larger volumes • put covers or lids on
		5.	(independent variable) more / wide / narrow(er) / different / high(er) / low(er) / examples range of concentrations / dilutions / solutions;	
			Additional guidance	**Do not give mark if** • use burette or graduated pipette or smaller syringe or with smaller divisions

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(b) (i) Plot a chart of the data shown in Table 1.1. **[4]**

PDO layout 4

[1]

x-axis method

AND *y*-axis
nitrogen/N (/) millions ton(ne)s per year;

Additional guidance

Do not give mark if
- any units e.g. arbitrary units on *x*-axis

Must have
- units on *y*-axis

[1]

scale as *x*-axis
even widths to up to 2 cm

AND *y*-axis
20 to 2 cm and **must** label each 2 cm

AND
start at 0;

Additional guidance

Do not give mark if
- awkward scale e.g. 25 or 40 to 2 cm.
- Or bars drawn outside grid

[1]

correct plotting of each bar;

Additional guidance

ecf if *y*-axis not 0 if scale 20 to 2 cm.
Horizontal top line must be clear, sharp and ruled to show plot.

Do not give mark if
- awkward *y*-axis scale
- bars arranged differently from order of table
- horizontal lines too thick – 1 mm/half square or not clear

[1]

each bar separate and must be 5

AND bars –
- quality – ruled vertical lines
- and labelled clearly with method;

Additional guidance

Must have
- thinner than half square vertical lines to horizontal must meet exactly
- any clear labels e.g. I/A/D/N/F – underneath, **must be** directly below correct bar or inside bar

Do not give mark if
- solid shading or line shading outside a bar
- any feathery line
- irregular thickness OR not possible to see drawn line

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(ii) Calculate the percentage decrease from 1840–1850 to 1990–2000. **[2]**

PDO display 2

[1]

123 – 108

OR
108/123X100

Additional guidance **Must have**
- minus sign or minus

[1]

(123 – 108) or 15 must have (123 – 108) or decrease 15

or
(answer from any subtraction)
Can have 10^6 or (15) 000 000

divided by /123 **and** multiplied by X 100

AND answer rounded to whole number (12) or 3 sig. figs. i.e. one decimal place (12.2);

OR
100 – 87.8
Allow if can see 123 = 100% then mp2

AND answer rounded to whole number (12) or 3 sig. figs. i.e. one decimal place (12.2);

Additional guidance **Must have**
- answer from a subtraction,
- division and multiplication signs/wording

(iii) Suggest one reason for the difference in the natural fixation between 1840–1850 and 1990–2000. **[1]**

ACE conclusions 1

[1]

IDEA OF
less uncultivated land or more cultivated
OR more crops grown
OR (more) deforestation or loss of habitat or desertification
OR building or urbanisation
OR less leguminous plants or Rhizobium or organisms involved in N fixation
OR more fertilisers so eutrophication
AVP;

Additional guidance **Do not give mark if**
- more pollution unqualified

[Total: 20]

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2 (a) (i) Draw a large plan diagram of the part of the leaf indicated by the shaded area Fig. 2.1. Label the vascular bundle and the palisade layer. [5]

PDO layout 1	[1]	clear, sharp, unbroken lines	**AND** no shading	**AND** larger than *60 mm* across widest point top to bottom;
		Must have • three or more hand-drawn (not ruled) lines **and** one or more 'enclosed areas' **Do not give mark if** • drawn over the print of question • any feathery or broken or overlaps in lines • any 'tail' or overlap or gap in the outline of enclosed areas **Can have** • 1 'tail' or overlap or gap in the outline of 2/3 enclosed areas • only lines less than 1 mm		
MMO collection 2	[1]	no cells drawn	**AND** outline of bulge at each side turns parallel to top layer;	
	[1]	(upper epidermis and palisade layer above vascular bundle or bulge (if no vascular bundle)) drawn as three lines which continue into lamina;		
MMO decision 2	[1]	vascular bundle divided into at least **two** regions If **not** an enclosed area must be within bulge	**AND** epidermal layer at lowest point of bulge thinner than opposite epidermal layer;	
	[1]	correct label with label lines to vascular bundle(area inside bulge) and palisade layer (any area closer to opposite epidermal layer to vascular bundle);		
		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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	(ii) Make a high-power drawing of one epidermal cell with one attached, whole trichome (hair). Label epidermal cell and trichome. **[5]**			
PDO layout 1	[1]	clear, sharp, unbroken lines	**AND** no shading or stippling	**AND** trichome longer than *30* mm;
		Additional guidance	**Do not give mark if** • drawn over the print of question • any feathery or broken line in outline of enclosed areas • any feathery line or squiggle for trichome • 2 'tails' or overlaps or gaps if two lines for cell wall in epidermal cell • 0 'tails' or overlaps or gaps if one line for cell wall in epidermal cell **Can have** • only lines less than 1 mm	
MMO collection 2	[1]	only one epidermal cell drawn	**AND** one whole attached trichome drawn;	
	[1]	*(Trichome(s) wide enough to see clearly)* rounded or pointed end	**AND** only one cell in each trichome;	
PDO recording 1	[1]	cell walls drawn as double lines for whole of epidermal cell;		
MMO decision 1	[1]	correct label with label lines to epidermal cell and trichome;		
		Additional guidance	**Do not give mark if** • any label is biologically incorrect e.g. from incorrect organ or animal, chloroplast, stoma(ata) or e.g. Golgi or mitochondria • label within drawn area	

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(iii) State two observable features of K1 which support the conclusion that this is a leaf from a plant growing in a dry habitat. Explain how these features reduce water loss. [2]

ACE conclusions max 2	max 2	1 mark for 2 features **mp1**	Then 1 mark (mp2 to 5) for one correct reason with the correct feature
		leaf curled/rolled	**mp 2** Idea of reduces evaporation/diffusion or traps moist(ure)/water or humidity increases;
		trichomes or hairs or hair-like	**mp 3** Idea of absorb or trap water/moist(ure) or prevent diffusion or evaporation;
		cuticle	**mp 4** Idea of prevents or reduces evaporation or described;
		stomata on lower epidermis/not on upper epidermis or sunken or few	**mp 5** Idea of prevents diffusion or reduces evaporation or described;
		Additional guidance	**Ignore** • refs. to water potential • reduces transpiration (rate);

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(b) (i) Use the magnification to calculate the *actual length* of line Y in μm.			**[3]**
MMO collection 1	[1]	measures line X correctly in mm; 87 87.5 88 88.5 89 mm	
		Additional guidance **Must have** • only those values given and units **Ignore** • use of metres	
MMO decision 1	[1]	EITHER (uses any measurement and converts to μm) (mm) measurement x1000 OR x 10^3 OR cm to μm (cm) X10 000 x 10^4 OR gives only answer e.g. 87,000 or 87,500 88,000 or 88 500 or 89,000	OR (uses any measurement and divides by 350) measurement mm / 350 e.g. 87 / 350 OR measurement cm / 350 e.g. 8.7 / 350 OR gives only answer e.g. 0.2485 or 0.02485
		Additional guidance **Do not give mark if** • use metres anywhere	
ACE interpretation 1	[1]	correct answer; any whole number **248** to **254** OR answer up to two decimal places between **248.56** and **254.30**	

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(ii) Prepare the space below so that it is suitable for you to record the observable similarities and differences between the specimens on K1 and that in Fig. 2.2. **[5]**

PDO recording1	[1]	organise as a table/Venn diagram/ruled boxes	**AND** headed K1 and Fig. 2.2	**AND** first difference opposite each other;
		Additional guidance	K1 | Fig. 2.2 OR Fig. 2.2 | K1	
MMO decision 1	[1]	attempted one similarity;		

ACE interpretation max 3 — max 3

[internal max 2 for similarities (S1–S2) and max 2 for differences (D1–D7)]

	feature	K1	Fig. 2.2
S1 S2	trichomes hairs present;	single cell; nucleus present;	epidermal cells/epidermis/epidermal layer;
D1	trichome postion	on surface/ not in pits/ not sunken	below surface/ in pits/dip/ sunken
D2	trichome packing	separate or few(er)	close together or more;
D3	trichome shape	straight	curled/bent;
D4	trichome nucleus	not seen absent	visible present
D5	cuticle	present or thin(ner)	none/absent or thick(er)
D6	cell packing	loosely/air spaces	tightly/no air spaces
D7	stomata	present or visible	absent or not visible or not seen

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		Additional guidance	**Ignore** • tick and cross without a key • refs. to size • 3-D descriptions such as spherical • colours/staining
			[Total: 20]

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