UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2010 question paper for the guidance of teachers

9700 BIOLOGY

9700/36 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.

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Question		Expected Answers			Additional guidance
1 (a) (i)		**Decide on the temperatures you plan to use in the range (between) 25°C to 45°C. Record the temperatures you have chosen in the space below.**			**[2]**
MMO decisions 2	[1]	at least 5 temperatures;			
	[1]	one temp. 25°C to 29°C	**AND** one temp 40°C to 45°C	**AND** any three with two even intervals 3 or more degrees;	
	(ii)	**Prepare the space below and record your results.**			**[4]**
PDO recording 2	[1]	**Reject** • if any units in body of table • only t			
		table with all cells drawn	**AND** heading (top or left) temperature °C;		Must have units
	[1]	**Reject** • if units in body of table • if headings for volumes or stages (heading) time with units;			
MMO collection 2	[1]	temperatures recorded highest to lowest	**AND** first set of times recorded in whole seconds;		
	[1]	time at the lowest temperature is greater than the next temperature;			**Allow** • only if 3 or more results
	(iii)	**From your results, state the temperature at which the activity of the enzyme is lowest.**			**[1]**
ACE interpretation 1	[1]	temperature with longest time	AND with units, °C;		

(iv) Identify *two* significant sources of error in this investigation. [2]

ACE interpretation max 2		cause of error	error	
	[1]	(dependent) stage 3 or end-point clots stick small clots coagulation milk drains back slowly	idea of seeing determining judging when;	
	[1]	(standardised variables) rotation or angle;	AND idea of not constant/different not same timing delayed;	
	[1]	shaking or mixing or E/enzyme starts to react;		
	[1]	E/enzyme temperature; (as milk)/AW		
	[1]	(independent variable) temperature or test-tube removed from water-bath	idea of not constant/not maintained decreasing cools down;	Max 2

(v) Describe a suitable control for this investigation. [1]
Reject if give two.

ACE improvement 1	[1]	boil enzyme;	

(vi) Suggest how you could make this investigation as reliable as possible. **[1]**

ACE improvements MAX 1

C control of any relevant variable [1]	equilibrate milk and enzyme to temp. separately then mix Or use thermostatically controlled water bath Or keep tube in water bath during rotation;		max 1
R1 improve method to get repeat data [1]	repeat	**AND** calculate or find mean/average;	

(b) (i) Three of the values in Table 1.1 are anomalous. Draw a circle around each of these values. **[1]**

(ii) Complete the Table 1.1 by calculating the missing value. **[1]**

MMO decisions 1
ACE interpretation 1

[1] circles around 8.2, 4.9, 1.1;

	activity of milk clotting enzyme / arbitrary units					
pH of milk	trial 1	trial 2	trial 3	trial 4	trial 5	mean
6.02	8.8	8.7	8.9	8.2	8.7	8.8 8.7
6.22	6.8	6.8	6.8	6.7	6.9	6.8
6.40	4.9	4.3	4.4	4.3	4.4	4.4
6.64	1.1	1.0	1.0	0.9	1.0	1.0
6.70	0.7	0.6	1.1	0.5	0.7	0.6

[1] 8.8 **Allow 8.7**

(iii) Plot a graph of the data shown in Table 1.1. **[4]**

PDO layout 4

O [1]	*x*-axis pH	**AND** *y*-axis activity (/) arbitrary units or au;	Must have units
S [1]	**Reject** if awkward scale		error carried forward if incorrect O then scale *x*-axis 2 to 2 cm and *y*-axis 0.2 to 2 cm. must use more than half grid in *x* and *y*.
	scale as 0.2 to 2 cm Origin must be labelled as 6 or 6.02	**AND** 2 to 2 cm;	
P [1]	**Reject** plotting if scale is awkward if only dots/blobs or blobs in circles	intersection of cross must be clear to show plot.	
	correct plotting using crosses/dots in circle only;		
L [1]	straight line through points; error carried forward if scale or plotting incorrect 6.02 8.8 or 8.7 or ecf 6.22 6.8 6.40 4.4 6.64 1.0 6.70 0.6	quality – not thick, not feathery for the complete line. joining plots – • ruled lines plot to plot • line of best fit • curve through all plots	

(iv) Explain the relationship between pH and the enzyme shown in the data. **[3]**

ACE conclusions 3

[1]	(in correct context of pH and effect on activity) structure of protein or substrate or enzyme or active site or bonds	changed/altered/destroyed/no longer complementary broken;
[1]	(in correct context of increase in pH and decrease activity) so fewer enzyme-substrate complexes (ESCs) or less/no substrate can bind/combine/attach/fit into OR (in context of decrease in pH and increase in activity) more ESCs or more substrate binds/attaches;	
[1]	(in correct context of effect of pH on enzyme i.e. when pH higher/nearer 7/less acidic/more alkaline) denatured/denaturation;	

[Total: 20]

Question		Expected Answers			Additional guidance
2 (a) (i)		**Draw a large plan diagram showing the features of the wall of the organ. Label the position of the lumen.**			**[4]**
PDO layout 1	[1]	**Reject** if drawn over print of question			
		Reject • thick lines • feathery lines • one 'tail' or overlap or gap clear, sharp, unbroken lines	**AND** no shading	**AND** uses most of space provided;	
MMO collection 2	[1]	**Reject** if drawn two walls			
		no cells drawn	**AND** three layers drawn include any circles as only one layer;		
	[1]	**Reject** if only two layers drawn innermost layer is wider than outermost layer at same point;			
MMO decisions 1	[1]	**Reject** • if any label is biologically incorrect e.g. regions belonging to other organs or plants. • label within drawn area – e.g. between two walls correct label with label line to or in lumen on inside;			

(ii) Annotate (make notes with label lines) your diagram to show one difference between the outside layers and the inside layers. [1]

MMO decision max 1

Reject
- if written over lines of the diagram drawing.
- if written underneath, unless have labelled on diagram

Allow 'er' for one label

	outermost	innermost	
[1]	thickness **Reject** cell wall	thin)ner)	think(er);
[1]	texture	smooth	rough;
[1]	cells/nuclei	Not clear/densely packed/ visible	Clear/less densely packed/(air) spaces/lots
[1]	Colours/staining of	Pink/red/grey/lighter/more	Purple/darker/less;

max 1

(b) (i) Actual diameter of the nucleus in the cell labelled Y is 7.8 µm. Use this information to calculate the actual diameter of the largest nucleolus in cell Y. [4]

MMO collection 2	[1]	correct measurement of <u>one</u> nucleus, 11 to 15 mm;		**Reject** if no units
	[1]	correct measurement of <u>one</u> nucleolus, 2 to 4.5 mm;		**Reject** if no units
PDO display 2	[1]	(mean) adds three measurements	**AND** shows division by 3;	
	[1]	answer to no more than 2 significant figures, (1 decimal place) between 1.1 and 6.4;		**Reject** standard form

(ii) Suggest how you would make the measurement of each nucleolus more accurate. **[1]**

ACE improvement 1	[1]	different dimensions/diameters or use vernier callipers or (eyepiece) graticule or increase magnification or high power (of microscope) or enlarging or increase resolution;	

(iii) Make a large drawing of the cell labelled X with three complete cells touching cell X. **[5]**

PDO layout 1	[1]	**Reject** if drawn over print of question			
		Reject • thick lines • feathery lines • 2 'tails' or overlaps or gaps	**AND** no shading	**AND** uses most of space provided;	
		clear, sharp, unbroken lines			
MMO collection 2	[1]	only cell **X** and three correct complete touching cells;			
	[1]	nucleus with at least two distinct nucleoli (other than cell **X**);			
MMO decisions 2	[1]	chromosomes drawn as two areas (no details of chromosomes shown);			
	[1]	blue region/spindle around chromosomes drawn in cell **X**;			

(iv) Prepare the space below so that it suitable for you to compare the cells labelled X and Y. **[5]**

PDO recording 2

[1] organise as a table or Venn diagram or ruled connected boxes; headed (cell) X and (cell) Y; differences opposite each other;

[1] heading for similarities/similarity/compare (with contrast)/same;

X | Y

MMO decision 1

[1] has at least one correct similarity, cytoplasm or cell/plasma membrane or shape;

ACE interpretation max 2

Reject tick and cross without a key

	feature	(cell) X	(cell) Y
[1] 1	nucleus/nuclear membrane	absent/none/not clear	present/clear;
[1] 2	nucleoli	absent/none/	present/clear;
[1] 3	cytoplasm	less/not granular	more/granular;
[1] 4	spindle fibres	present/visible	absent/none/not visible;
[1] 5	chromosomes/chromatid(s)	present/visible	not visible;
[1] 6	cytoskeleton	absent/not clear	present/clear/visible;
[1] 7	cell size	small(er)	larg(er);
Similarities			

if no organisation then mark points only if in same sentence or following sentences.

Allow two ticks for both present i.e. for cytoplasm and shape.

Allow differences even if not opposite each other.

Allow difference on one side if e.g. use more or –er.

max 2

[Total: 20]