**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

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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**<br>• if any units in body of table<br>• only t | | | |
| | | table with all cells drawn | **AND** heading (top or left) temperature °C; | | Must have units |
| | [1] | **Reject**<br>• if units in body of table<br>• if headings for volumes or stages<br>(heading)<br>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**<br>• 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; | | |

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

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

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

| | | | |
|---|---|---|---|
| ACE improvement 1 | [1] | boil enzyme; | |

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**(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<br>Or<br>use thermostatically controlled water bath<br>Or<br>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<br>ACE interpretation 1 | [1] | circles around <u>8.2, 4.9, 1.1;</u> | |
| | [1] | <u>8.8</u> **<u>Allow 8.7</u>** | |

| | 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 A 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 |

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**(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.<br>must use more than half grid in *x* and *y*. |
| | scale as 0.2 to 2 cm<br>Origin must be labelled as 6 or 6.02 | **AND** 2 to 2 cm; | |
| P [1] | **Reject**<br>plotting if scale is awkward<br>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;<br>error carried forward if scale or plotting incorrect<br><br>6.02 8.8 or 8.7 or ecf<br>6.22 6.8<br>6.40 4.4<br>6.64 1.0<br>6.70 0.6 | quality – not thick, not feathery for the complete line.<br>joining plots –<br>• ruled lines plot to plot<br>• line of best fit<br>• curve through all plots | |

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**(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)<br>structure of protein or substrate or enzyme or active site<br><br>or bonds | changed/altered/destroyed/no longer complementary<br><br>broken; | |
| | [1] | (in correct context of increase in pH and decrease activity)<br>so fewer enzyme-substrate complexes (ESCs) or less/no substrate can bind/combine/attach/fit into<br>OR<br>(in context of decrease in pH and increase in activity)<br>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)<br><br><u>denatured/denaturation</u>; | | |
| | | **[Total: 20]** | | |

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| 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**<br>if drawn over print of question | | | |
| | | **Reject**<br>• thick lines<br>• feathery lines<br>• one 'tail' or overlap or gap<br>clear, sharp, unbroken lines | **AND**<br>no shading | **AND** uses most of space provided; | |
| MMO collection 2 | [1] | **Reject**<br>if drawn two walls | | | |
| | | no cells drawn | **AND** three layers drawn<br>include any circles as only one layer; | | |
| | [1] | **Reject**<br>if only two layers drawn<br>innermost layer is wider than outermost layer at same point; | | | |
| MMO decisions 1 | [1] | **Reject**<br>• if any label is biologically incorrect e.g. regions belonging to other organs or plants.<br>• label within drawn area – e.g. between two walls<br>correct label with label line to or in lumen on inside; | | | |

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**(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 | |
|---|---|---|---|
| thickness [1]<br>**Reject** cell wall | thin)ner) | think(er); | |
| texture [1] | smooth | rough; | |
| cells/nuclei [1] | Not clear/densely packed/ visible | Clear/less densely packed/(air) spaces/lots | |
| Colours/staining of [1] | 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 |

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

| | | | |
|---|---|---|---|
| ACE improvement 1 | [1] | different dimensions/diameters<br><br>or use vernier callipers<br><br>or (eyepiece) graticule<br><br>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**<br>if drawn over print of question | | | |
| | | **Reject**<br>• thick lines<br>• feathery lines<br>• 2 'tails' or overlaps or gaps | **AND**<br>no shading | **AND**<br>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**; | | | |

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**(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]**

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