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**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**GCE Advanced Subsidiary Level and GCE Advanced Level**

# MARK SCHEME for the October/November 2012 series

## 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.

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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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| | | |
|---|---|---|
| **1 (a) (i)** | | [1] |
| MMO decision 1 | | volume 20 up to and including 30 ($cm^3$); |
| **(ii)** | | [3] |
| MMO decision 3 | mp1 | (labels under correct sequence of beakers) (0).5 **AND** (0).25 **AND** (0).125 **AND** (0).0625; |
| | | Do not give mark if incorrect units e.g. mol $dm^{-3}$ |
| | mp2 | (solution G) $cm^3$ or ml(s) shown at least once **AND** shows transfer of 10 ($cm^3$) of 0.5 (%) to next dilution or shown by arrow with 10 ($cm^3$) **AND** 10 ($cm^3$) transferred from third beaker to fourth beaker and from fourth beaker to fifth beaker; |
| | | Do not give mark if incorrect concentrations<br>contradiction on units e.g. cm and $cm^2$ |
| | mp3 | $cm^3$ or ml(s) shown at least once **AND** adds 10 ($cm^3$) of (distilled) water/ **W** to each of four beakers **AND** must add previous concentration to fourth and fifth beakers; |
| | | Do not give mark if contradiction on units e.g. cm and $cm^2$ |
| **(iii)** | | [4] |
| PDO recording 2 | mp1 | table with all cells drawn **AND** heading (percent(age) conc(entration) (of) glucose or **G** or [**G**] or [glucose]; |
| | | Do not give mark if % in cells of headed column<br>other units e.g. mol $dm^{-3}$<br>more than one row in one cell |
| | mp2 | (heading for any column/row including mean) **only** time (with) s or sec(onds); |
| | | Do not give mark if units in cells of this column/row<br>headings for volumes or method information or in cells e.g. volumes and concentrations in same cells |
| MMO collection 2 | mp3 | (mark first column/row or recorded results)<br>records at least four results as whole numbers only that is any whole number between 3 and 120 or records > or more than 120; |
| | | Do not give mark if '< or less than 120'<br>e.g. 0:45 or 50:45 |
| | mp4 | (mark **first** column/row of recorded time for recording correct pattern) records 1% is the shorter/lower value than lowest concentration; (if numbered test tubes/ solutions only check aii for concentration) |
| | | Must have units for time recorded somewhere e.g. seconds with tenths or min:sec<br>minimum two recorded time including 'more than 120' |

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| | | |
|---|---|---|
| **(iv)** | | [2] |
| MMO collection 1 | mp1 | shows 0.25% in the centre of the scale line **AND** 0.125% half way between 0.25% and 0.0625%; |
| ACE interpretation 1 | mp2 | (from their results) puts **S** in correct position on scale; |
| | | Must have at least one concentration label either side of **S** |
| | | Do not give mark if shows values in the wrong order from their results<br>no value for **S** in results |
| **(v)** | | [3] |
| / | mp 1 | (independent variable) Idea of more/ wider/higher/lower concentrations of **G**; |
| | mp 2 | (dependent variable)replicate or repeat experiment; |
| | | Ignore mean |
| | mp 3 | (dependent variable) use a white tile or glucose dipstick or measure mass of precipitate; |
| | mp 4 | (standardised variables) thermostatically (-controlled) water bath for Benedicts test; |
| | | Do not give mark if temperature controlled room/ air conditioning |
| | mp 5 | (standardised variable) leave the visking tubing in the water for a longer time; |
| **(b) (i)** | | [4] |
| PDO layout 4 | O | *x*-axis concentration of glucose solution (inside the visking tubing) or [glucose] / arbitrary units or au **AND** *y*-axis absorbance of light (by the coloured solution) (/) arbitrary units or au; |
| | S | scale as *x*-axis 5 to 2 cm labelled each 2 cm except origin and 30 minutes **AND** *y*-axis 0.5(00) to 2 cm labelled each 2 cm except origin and 1.900; |
| | P | correct plotting of • five points<br>• as small cross (use square on grid)) **o**r dot (in circle use grid) **or** cross in circle to within half a square; |
| | L | five plots with ruled lines exactly point to point or curve through set of 5 points **AND** (quality) smooth line less than 1 mm thick use grid; |

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| | | |
|---|---|---|
| **Additional guidance** | | |
| | O | |
| | S | **Must have** label of value of origin if zero not at origin |
| | | **ecf** if no labels for O but figures show orientation is correct then must have required scale<br><br>**ecf** if reverse O scale *x*-axis 0.5 to 2 cm and *y*-axis 10 to 2 cm. |
| | P | Do not give mark if **ANY** blobs or dots alone |
| | L | Can have ecf from incorrect P<br>extrapolation to zero<br><br>Do not give mark if any feathery line or gap in the line or dashed line<br>any irregular thickness<br>extrapolation above 30 au |
| **(ii)** | | [1] |
| ACE conclusion 1 | | (at 15 au) idea of faster diffusion or more diffusion or steeper diffusion gradient or (at 10 au) idea of slower diffusion or less diffusion or less steep concentration/diffusion gradient; |
| **(iii)** | | [1] |
| ACE conclusion 1 | | (between 25 and 30 au) diffusion can't go any faster/at highest rate or there is a limiting factor or example of limiting factor e.g. volume of water, surface area of visking tubing or temperature or idea that dye now opaque or dye has deepest intensity of colour (so no further increase in light absorption); |
| **(iv)** | | [1] |
| ACE interpretation 1 | | (smallest division 0.2 $cm^3$ ÷ 2) (0).1; |
| | | **[Total: 20]** |
| **2 (a) (i)** | | [1] |
| ACE conclusion 1 | | Stele or central xylem/vascular tissue; |

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| | | | |
|---|---|---|---|
| **(ii)** | | | [4] |
| PDO layout 1 | mp1 | Do not give mark if | drawn over the print of the question or any shading anywhere or any ruled or compass lines smaller than 60 mm across the widest dimension<br><br>less than three enclosed areas<br><br>the outer most enclosed area has: <u>any</u> line 1 mm or thicker (use grid)<br><u>any</u> feathery or dashed or gap in line<br><u>any</u> 'tails' or overlaps |
| MMO collection 2 | mp2 | no cells drawn **AND** drawn whole section; | |
| | mp3 | the xylem tissue is drawn as a irregular enclosed area inside one central enclosed area; | |
| MMO decision 1 | mp4 | labels <u>cortex</u> with label line touching either innermost line of the epidermis or ending inside the enclosed area between epidermis and stele; | |
| | | Do not give mark if | any label which is biologically incorrect e.g. from animal<br>any label within drawn area |
| **(iii)** | | **Ignore** additional lines/circle round drawing of specimen | [5] |
| PDO layout 1 | mp1 | Do not give mark if | drawn over the print of the question or <u>any</u> shading anywhere or <u>any</u> ruled or compass lines smaller than 40 mm across widest cell;<br><br>less than four cell outlines<br><br>any outermost lines have (even if more than 4): <u>any</u> line thicker 1 mm or thicker<br><u>any</u> feathery line dashed or gap in the line<br><u>any</u> 'tails' or overlaps |
| MMO collection 2 | mp2 | <u>only four</u> complete vessel outlines drawn **AND** each vessel outline must touch at least one other vessel outline at least one point to form one group; | |
| | | Do not give mark if | any ruled or compass lines |
| | mp3 | all cells drawn have cell walls drawn as double lines all the way round (inner line can touch but not cross/overlap the outer line) **AND** (between any 2 adjacent cells middle lamella drawn) 3 lines at least 4 mm across at widest point; | |
| | | Do not give mark if | drawn EM organelles e.g. mitochondria<br>7 or more cells |

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| | | |
|---|---|---|
| MMO decision 2 | mp4 | labels lumen with labelled line inside enclosed area within xylem cell;<br>Do not give mark if any label within drawn area |
| | mp5 | correct annotation with a label line description of cell wall e.g. stained red, thick or (lumen) empty/ no cell contents/hollow/large/wide; |
| **(b) (i)** | | [3] |
| MMO decision 1 | mp1 | (answer to step 2) 0.01(0) (mm) OR expressed in standard from $1 \times 10^{-2}$; |
| PDO display 1 | mp2 | (either box in step 2) 1000 or $10^3$ **AND** answer from step 1 in other box;<br>**ecf** any answer to step 1 |
| ACE interpretation 1 | mp3 | μm **AND** answer from step 1 × 1000;<br>**Ignore** mp2 |
| **(b) (ii)** | | [max 2] |
| MMO collection 1 | mp1 | measures correctly in eyepiece graticule units 23, 24, 25, 26, 27 (epg units);<br>Do not give mark if μm or mm or cm or m |
| PDO display 1 | mp2 | (shows multiplication by answer from bi) any value multiplied by answer from step 2;<br>Do not give mark if division shown |
| PDO recording 2 | mp3 | organise as a table with only **three** columns or rows separated by lines (no cells needed)<br>**Ignore** number column **AND** headings in any order only **J1/**slide and **Fig. 2.3** **AND** third column contains features; |
| **(c)** | | [5] |
| | mp1<br>mp2 | features J1 Fig.2.3 (either way round and other column to left, right or in middle)<br>only differences (at least two) recorded; |
| | | Can have with no table<br>even if incorrect |
| | | Do not give mark if any similarities<br>any functions |

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ACE interpretation MAX 3

| | | | | | |
|---|---|---|---|---|---|
| Max 1 | mp3 | **feature** | **J1** | **Fig.2.3** |
| | | shape vascular bundles or tissues e.g. xylem | cross shape or not in a ring or irregular | ring/circular or regular; |
| | | vascular tissue/xylem position | in centre or inner or near endodermis/ pericycle<br>or<br>phloem tissue surrounds xylem | near edge/epidermis<br><br>or<br>phloem tissue outside xylem; |
| | | quantity of xylem/vascular tissue | few(er)/less | more; |
| | | cambium | absent | present; |
| Max 2 | mp4 | pith or middle or centre | none/absent /no | has/present; |
| | mp5 | endodermis or pericycle or stele | yes or present or has | no or absent or has not; |
| | mp6 | cortex | large(r)/wid(er)/thick(er)<br><br>or<br>more air spaces (between cells)<br>or<br>cells irregular shapes | small(er)/narrow(er)/thin (ner)<br>or<br>few(er) air spaces (between cells)<br>or<br>cells regular shape/circular/oval; |
| | mp7 | epidermis | thick(er) or wid(er) or larg(er)<br>or irregular shaped cells | thin(ner) or narrow(er)<br><br>or regular shaped cells; |
| | mp8 | collenchyma | absent | present; |

**[Total: 20]**

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**1 (a) (i)** [1]

MMO decision 1

size or diameter or length or width or surface area (bod) or volume (bod)
or colour
or whole
or same shape;

**Do not give mark if**
- any other variable than seeds

**Ignore**
- number
- mass

same type or species or age

**(ii)** [1]

MMO decision 1

(any one temperature)
°or degree(s) C **AND** any whole number 80 to and including 100 ;

**(iii)** [3]

MMO decisions 3

mp1 (0).3 **AND** (0).2 **AND** (0).1;

**Not required are**
- units
- zero

**Do not give mark if**
- incorrect units e.g. mol $dm^{-3}$

mp2 $cm^3$ or ml(s) shown at least once for R **AND** (0.3)7.5 and (0.2) 5 and (0.1)2.5;

**Do not give mark if**
- on on units e.g. cm or $cm^2$

mp3 values of (R and W) for ALL tubes must add up to 10 (minimum two tubes);

**(iv)** [1]

MMO decision 1

$cm^3$ or ml(s) once **AND**(volume of R) **2** **AND** (one volume of Benedict's)
any one whole number 2 to 10

that is 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10;

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<table>
<tr><td colspan="4">(v) [4]</td></tr>
<tr><td rowspan="4">PDO recording 2</td><td>mp1</td><td>table with all cells drawn</td><td>AND heading<br>(top row or column to left of recorded data)<br>percent(age) or % conc(entration) (of )R or reducing sugars ;</td></tr>
<tr><td colspan="3">Do not give mark if<br>• % in cells of headed column<br>• other units e.g. mol $dm^{-3}$<br>• more than one row in one cell for multiple trials</td></tr>
<tr><td rowspan="2">mp2</td><td colspan="2">(heading for any column/row including mean)<br>only time (with) s or sec(onds);</td></tr>
<tr><td colspan="2">Do not give mark if<br>• units in cells of this column/row<br>• min(utes)<br>• headings for volumes or method information or in cells e.g. volumes and concentrations in same cell</td></tr>
<tr><td rowspan="4">MMO collection 2</td><td rowspan="2">mp3</td><td colspan="2">(mark first column/row of recorded results)<br>records at least three results with whole numbers only<br>that is any whole number less than 180 or records ‘ > or more than 180’;</td></tr>
<tr><td>Must have<br>• whole numbers between 3 and 180 or ’ > or more than 180’</td><td>Do not give mark if<br>• ‘< or less than 180’<br>• e.g. 0:45 or 50:45</td></tr>
<tr><td rowspan="2">mp4</td><td colspan="2">(mark first column/row of recorded time for recording correct pattern)<br>recorded time for<br>0.4% is the shorter/lower value than lowest concentration;</td></tr>
<tr><td>Must have<br>• units for time recorded somewhere e.g. seconds with tenths or min:sec<br>• minimum two recorded times including ‘more than 180’</td><td>Do not give mark if<br>• no units for time anywhere</td></tr>
</table>

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<table>
<tr><td colspan="4">(vi) [1]<br>Do not give mark if no results for R or results all more than 180 or S.</td></tr>
<tr><td rowspan="2">ACE interpretation 1</td><td rowspan="2"></td><td><u>correct estimate</u> with their <u>time</u> results</td><td>AND uses only one of following values<br>• one value of 0.1, 0.2 , 0.3 ,0.4<br>• between 0.1 and 0.2<br>• between 0.2 and 0.3<br>• between 0.3 and 0.4<br>• less than 0.1<br>• more than 0.4<br>• or their own concentrations;</td></tr>
<tr><td colspan="2">Do not give mark if<br>• calculate or estimate between two of their concentration values<br>• description or colour only in results</td></tr>
<tr><td colspan="4">(vii) [2]<br>Do not give mp 1 if no result for seeds ecf for mp 2</td></tr>
<tr><td rowspan="3">ACE conclusion 2</td><td rowspan="2">mp1</td><td colspan="2">(should be) yes if result is positive for reducing sugar;</td></tr>
<tr><td colspan="2">Can have<br>• no if their result for S is negative for reducing sugar</td></tr>
<tr><td>mp2</td><td>positive result<br>described for seed sample either time or colour change</td><td>AND<br>so <u>reducing sugars</u><br>OR<br>sucrose broken down;</td></tr>
<tr><td></td><td></td><td>OR<br>negative result<br>no colour change or stayed blue</td><td>AND<br>so no <u>reducing sugars</u><br>OR<br>sucrose not broken down;</td></tr>
</table>

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**(b)** [3]

| | | | |
|---|---|---|---|
| | | MUST mention seeds (in solution/sucrose) in correct context to access marks.<br>**Do not give mark if**<br>• change more than one variable | |
| ACE improvements 3 | mp1 | (independent)<br>5 or more temperatures or described<br>OR<br>gives examples of 5 or more (units NOT required); | |
| | | | **Do not give mark if**<br>• change more than one variable<br>• in context of Benedict's test |
| | mp2 | (how to keep temperature standardised in context of different temperatures only)<br>use thermostat(ically-controlled) water-bath; | |
| | | | **Do not give mark if**<br>• ref. to temperature controlled room e.g. air conditioned or thermostat controlled room |
| | mp3 | (standardisation of variables only in context of changing temperature)<br>same number or example of number or mass or example of mass of seeds<br>**Ignore** amount<br>OR<br>same volume or example of volume with units of sucrose<br>OR<br>concentration or example of concentration of sucrose solution<br>OR<br>(seeds NOT Benedict's) same time in water-bath; | |
| | | | Do not give mark if<br>• not idea that changing temperature |

**(c) (i)** [4]

If draw a chart then **max 1** for O

| | | | |
|---|---|---|---|
| PDO layout 4 | O | *x*-axis<br>pH(p.h. PH Ph) | **AND** *y*-axis<br>conc(entration of) reducing sugar(s) (/) mmol(e) $hr^{-1}$; |
| | S | scale on *x*-axis<br>1.0 to 2 cm with **4** at origin labelled each 2cm except 8 need not be labelled | **AND** *y*-axis<br>10 to 2 cm labelled each 2 cm;<br>except origin and 60 need not be labelled |
| | P | correct plotting of<br>• **five** points **Check** first four points for bark and last point for leaves; | |

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| | | | | |
|---|---|---|---|---|
| | L | plots joined with<br>ruled lines exactly point to point<br>or<br>curve through set of 5 points | **AND** (quality)<br>smooth line for bark less than 1 mm thick use grid | **AND**<br>**for each** line a label<br>leaves and bark or uses key; |

**Additional guidance:**

| | |
|---|---|
| O | |
| S | **Must have** label of value of origin if zero not at origin |
| P | plots (crosses or centre of dot) must be nearer than halfway line – up or down or either side<br><br>OR if meant to be within two lines then must not be on line above or below or either side |

| | | |
|---|---|---|
| | **Can have**<br><br>**ecf** if origin not zero but use scales as given<br>**ecf** if scale correct but not labelled every 2 cm<br>**ecf** if reverse axes and scale is<br>*x*-axis 20 to 2 cm and *y*-axis to 1 to 2 cm<br><br>**ecf** if scale of pH 2 to 2 cm on *x*-axis or *y*-axis | **Do not give mark if**<br>• any blobs or dots alone<br>• any cross or dot too large |
| L | | **Do not give mark if**<br>• any feathery or gap in line or dashed line<br>• any irregular thickness<br>• any extrapolation |

**(ii)** [1]

| | | | |
|---|---|---|---|
| ACE interpretation 1 | | (activity/concentration of reducing sugars) increases/rises to (pH) 5.3 | **AND** decreases to (pH) 7.8;<br>or rises by 2.5 |
| | | | |

**(iii)** [1]

| | | |
|---|---|---|
| ACE conclusion 1 | | In correct context<br><br>idea of (enzyme) denatured or denaturation; |

**[Total: 22]**

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**2 (a) (i)** [5]

| | | | | |
|---|---|---|---|---|
| PDO layout 1 | mp1 | **Do not give mark if**<br>drawn over the print of question<br>or<br>any shading anywhere<br>or<br>any ruled or compass lines<br>or<br>break in outline which does not have a line to seal open ends | **AND**<br>**Do not give mark if**<br>smaller than *60 mm* across widest point | **AND** (clear, sharp, unbroken lines);<br>**Do not give mark if**<br>• *less than 3 enclosed area*<br>***the outermost enclosed area has***<br>• any part of line 1mm or thicker (use grid)<br>• any feathery or dashed or gap in line<br>• *any 'tails' or overlaps* |
| MMO collection 3 | mp2 | no cells drawn **AND** *whole section drawn*; | | |
| | mp3 | *(epidermal layer and endodermis)*<br>both layers drawn as paired lines with a gap between the layers;<br><br>**Do not give mark if**<br>• regular enclosed areas e.g. ovals or circles between innermost paired lines | | |
| | mp4 | line separating pith from endodermis layer is continuous and wavy<br>OR<br>for epidermis three lines (two layers) for most of layer; | | |
| MMO decision 1 | mp5 | labels cortex with label line touching; | | |
| | | **Do not give mark if**<br>• any label which is biologically incorrect e.g. animal or cell structure<br>• any label written within drawn area | | |

**(ii)** [4]

| | | | | |
|---|---|---|---|---|
| PDO layout 1 | mp1 | **Do not give mark if**<br>drawn over the print of question<br>**or**<br>any shading anywhere<br>or<br>any ruled or compass lines | **AND**<br>**Do not give mark if**<br>smaller than 40 mm across widest cell; | **AND** (clear, sharp, unbroken lines)<br>outer boundary lines of any cells<br>**Do not give mark if**<br>• less than 5 cell outlines<br>any of outermost lines have<br>• any line 1 mm or thicker (use grid)<br>• any feathery or dashed or gap in line<br>• *any 'tails' or overlaps* |

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| | | | |
|---|---|---|---|
| MMO collection 2 | mp2 | only five complete cells drawn | **AND**<br>each cell must touch another cell at least at one point to form one group ; |
| | | | **Do not give mark if**<br>• any ruled or compass lines |
| | mp3 | at least one intercellular space at least 3 mm across at widest point<br>OR<br>at least three cells with rounded shape with no straight sharp corners in correct context; | |
| | | **Can have**<br>• drawn vacuoles/nucleus | **Do not give mark if**<br>or more cells<br>raw EM organelles e.g. mitochondria<br>raw incorrect cell structure e.g. sieve plates,<br>ll cells drawn separate |
| PDO recording 1 | mp4 | all cells with cell walls drawn as double lines all the way round (inner line can touch but not cross outer line-overlap)<br>**AND** (between any two adjacent cells middle lamella drawn)<br>so three lines less than 4 mm across at widest point; | |

**(b) (i)** [3]

| | | | |
|---|---|---|---|
| MMO decision 1 | mp1 | **Step 1**<br>**Ignore** first box<br>second box must be<br>whole number 3 to 92 | **AND**<br>EITHER<br>answer must be (0).00X(……)<br>where X is a number 1 to 9<br>OR<br>expressed in standard form e.g. x $10^{-3}$;<br>**Do not give mark if** fraction |
| PDO display 1 | mp2 | (either box in **Step 2**)<br>1000 or $10^3$ | **AND**<br>any answer from step 1 in other box; |
| | | **ecf** any answer to step 1 | |
| ACE interpretation 1 | mp3 | μm or mm **AND** answer from step 1 ×1000; | |
| | | | |

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| | | | | |
|---|---|---|---|---|
| **(ii)** | | | | [2] |
| MMO collection 1 | mp1 | measures correctly in eyepiece graticule units;<br>measures total length<br>57 or 58 or 59 or 60 or 61 or 62 (epg units) | | |
| | | **Do not give mark if**<br>• m or mm or cm or m or stage micrometer units<br>• hoice of measuring e.g. mm and epgu | | |
| PDO display 1 | mp2 | (shows multiplication by answer from **(b)(i)**)<br>any one value (multiplied by) X by answer from **(b)(i)** step 2; | | |
| | | **Can have**<br>• alternative signs • or * or value **(b)(i)**<br>**Do not give mark if**<br>• division shown | | |
| **(c)** | | | | [4] |
| PDO recording 1 | mp1 | organise as a table with only three columns or rows separated by lines (no cells needed)<br>**Ignore** number column | **AND** headings in any order only K1/slide and Fig 2.4 | **AND** third column/row contains list of tissues; |
| | | (features) K1/slide. Fig 2.4 (K1 or Fig 2.4 either way round and other column to left, right or in middle) ,<br>\| \| | | |

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ACE interpretations 3

max 1 / max 2

| | feature | K1 | Fig. 2.4 |
|---|---|---|---|
| mp2 | (vascular bundles or tissue shape) | absent or not visible/seen or cross shape or not in ring or irregular | present or visible/distinct or ring or regular; |
| | (position) | inner or inside or near endodermis/pericycle | outer or towards outside or near epidermis; |
| | (quantity of vascular tissue bundles/xylem/ phloem) | Idea of less or small(er) or few(er), narrow(er) | Idea of more or large(r) or wide(r); |
| | cambium | no(one) or absent or has not | yes or present or has; |
| mp3 | pith or middle or centre | any difference for central area either way round e.g. present vs absent or small(er) vs large(r) or not hollow vs hollow; | |
| mp4 | endodermis or pericycle or stele | yes or present or has | no(one) or absent or has not; |
| mp5 | cortex | large(r) or wider or more | small(er) or narrower; |
| mp6 | epidermis<br><br>thickened layer/ collenchyma/ sclerenchyma | thin(ner) or narrow(er) or one cell<br><br>no(one) or absent or has not | thick(er) or wide(r) or large(r) or more than one cell<br><br>has or present or yes; |
| mp7 | hairs (root) or (trichomes) | yes or present or has or many hairs or rough | no(one) or absent or has not or smooth; |

**[Total: 18]**

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**CAMBRIDGE INTERNATIONAL EXAMINATIONS**

**GCE Advanced Subsidiary Level and GCE Advanced Level**

# MARK SCHEME for the October/November 2012 series

## 9700 BIOLOGY

**9700/34** Paper 3 (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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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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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| | | |
|---|---|---|
| **1 (a) (i)** | | [3] |
| MMO decisions 3 | mp 1 | (0).8 **AND** (0).6 **AND** (0).4 **AND** (0).2; |
| | mp 2 | (for correct concentration)<br>**Ignore** 1 %<br>$cm^3$ or mls shown at least once **AND** at least three correct volumes of E with 0.2 % difference between concentrations;<br>No ecf if incorrect concentrations. |
| | mp 3 | values for at least **three E** and **W** add up to 5; |
| **(ii)** | | [max 1] |
| MMO decisions max 1 | | Idea of<br>• replace enzyme with water<br>• W/water either as beaker or added to test-tube<br>• W/water and S/milk;<br>**Do not give mark for** more than one idea |
| **(iii)** | | [5] |
| PDO recording 2 | mp 1 | table with all cells drawn **AND** heading<br>(top row or column to left of recorded data)<br>percent(age) or % conc(entration) of E or enzyme;<br>**Can have**<br>• no outer boundary<br>**Ignore**<br>• test-tube/additional columns<br>• notes outside area<br>**Do not give mark if**<br>• % in cells of headed column<br>• other units e.g. mol $dm^{-3}$<br>• no percentage or %<br>• two rows in one cell for multiple trials |
| | mp 2 | (heading for any column/row including mean)<br>only time (with) s or sec(onds);<br>• if have columns/rows for test-tubes or observations e.g. colour<br>• any notes outside area<br>**Ignore**<br>• heading for test-tubes<br>• t or T<br>**Do not give mark if**<br>• units in cells of this column/row<br>• e.g. 45' (units)<br>• min(utes)<br>• headings for volumes or method information or in cells<br>• e.g. volumes and concentrations in same cells |
| MMO colle | mp 3 | (mark first column/row of recorded time)<br>records whole numbers only for ANY four (concentrations including control/0)<br>that is any whole number between 3 and 240 or records > or more than 240; |

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| | | |
|---|---|---|
| | | **Do not give mark if**<br>• < or less than 240<br>• e.g. 0:45 or 50:45 |
| | mp 4 | (mark first column/row of recorded time for recording correct pattern)<br>recorded time for <u>1%</u> is shorter time/lower value than lowest concentration;<br>**Ignore** control/0 |
| | | **Must have**<br>• units for time recorded somewhere e.g. seconds with tenths or min:sec |
| MMO decision 1 | mp 5 | records control or 0<br><u>'> or more than 240' (seconds/s)</u> |

**(iv)** [1]

| | | |
|---|---|---|
| ACE interpretation 1 | cause of error | WITH idea of error |
| | end-point or when goes clear<br>OR<br><u>time in water-bath</u><br>OR <u>temp</u> | judging or observing<br>seeing or figuring out<br>or varies<br>or subjective<br><br>different or varies or not the same or drops or changes; |

**(v)** [3]

| | | |
|---|---|---|
| ACE improvements 3 | mp 1 | (independent)<br>at least 3 pHs or at least 3 examples or low pH and high pH and neutral/pH7;<br>OR<br>Idea of keep enzyme conc same/use E **AND** range of/different pHs; |
| | | **Do not give mark if**<br>• change more than one variable |
| | mp 2 | (method to change pH)<br>(for all pHs) use <u>buffers</u>; |
| | mp 3 | (dependent) rate from data<br><u>divide 1 by time</u><br>or<br><u>divide 1000 by time</u><br>or<br>plot graph of <u>pH against time</u>; |

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**(b) (i)** [4]

| | | |
|---|---|---|
| PDO layout 4 | O | *x*-axis<br>time (/) min(utes)<br>**AND** *y*-axis<br>area of gelatine(/) $mm^2$; |
| | S | scale on *x*-axis<br>20 to 2 cm labelled each 2 cm except origin and 100<br>**AND** *y*-axis<br>50 to 2 cm labelled each 2 cm except origin and 200; |
| | P | correct plotting of<br>• points<br>**Ignore** plots at 200<br>• as small cross (use square on grid) **o**r dot (in circle use grid) **or** cross in circle to within half a square; |
| | L | plots joined with ruled lines exactly point to point<br>**AND** (quality) smooth line less than 1 mm thick<br>**AND** (for each line) a label with correct pH or key; |

**Additional guidance:**

| | | |
|---|---|---|
| O | **Ignore** abbreviations e.g. t/T or A/a | |
| S | **ecf** if no labels for O or if reverse O then scale must use more than half grid for both *x* and *y* axes<br><br>**Must have**<br>• label of value of origin if zero not at origin | **Do not give mark if**<br>• awkward scale e.g. to each 2 cm |

| Time /mins | Area/$mm^2$ |
|---|---|
| 15 | 40 |
| 18 | 80 |
| 25 | |
| 30 | |
| 40 | |

| | | |
|---|---|---|
| P | **Can have**<br>**ecf** if *x*-axis not 0 if scale 20 to 2 cm even<br><br>**Do not give mark if**<br>• awkward scale<br>• any blobs or dots alone<br>• any cross too large | |
| L | **Can have**<br>• **ecf** from incorrect **P** | **Do not give mark if**<br>• any feathery line<br>• any irregular thickness<br>• any extrapolation either end |

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| | | |
|---|---|---|
| | **(ii)** **Ignore** ref to enzyme activity<br>**Do not give mark if** wrong context | [2] |
| ACE interpretation 2 | mp 1 | Idea of<br>as/with increasing/longer <u>time</u> <u>area/gelatine /protein</u> decreases more in pH4 than pH6.4<br>OR<br>pH 4.0 more area/gelatine /protein hydrolysed/broken down in same time/faster<br>OR<br>area/gelatine /protein decreases quicker/more<br>**ora**<br>pH 6.4 less area/gelatine /protein hydrolysed/broken down in same time/slower/it<br>OR<br>area/gelatine /protein decreases slower/less; |
| | mp 2 | (pH 4) goes to zero or all area/gelatine/protein hydrolysed/broken down<br>or no area/gelatine/protein left<br>OR<br>(pH 6.4) area/gelatine/protein goes to half or 100 ($mm^2$);<br>OR<br>Ref to other quoted figures so<br>pH 4 with time and area **AND** pH 6.4 with ref to same time and area<br>**Ignore** units |
| | **(iii)** | [3] |
| ACE conclusions 3 | mp 1 | (pH 4) nearer/almost or at <u>optimum</u>; |
| | mp 2 | (pH 4/acidic/lower pH)<br>enzyme/it is more active or the activity higher/faster or works best/digests more<br>or more (ESCs) or more (substrate binds to enzyme/active sites)<br>**ora**<br>(pH 6.4 or alkali or higher pH)<br>enzyme/ it is less active or the activity lower/slower<br>or few (ESCs) or few (er) (substrate molecules bind to active sites)<br>OR<br>pH 4.0 is fast and pH 6 is slow; |
| | mp 3 | correct ref. to for either pH<br>enzyme substrate complexes or ESCs<br>idea that substrate (molecules) bind go into <u>active sites</u>;<br>**Ignore** collision(s)/effective collisions<br>OR<br>(pH 6.4) idea of enzyme denatured<br>Idea of enzyme shape/structure/molecule altered or bonds disturbed |
| | | **[Total: 22]** |

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| | | |
|---|---|---|
| **2 (a) (i)** | **Ignore** additional lines/circle round drawing of specimen [5] | |
| PDO layout 1 | mp 1 | quality of plan diagram;<br><br>**Do not give mark if**<br>• drawn over the print of question or <u>any</u> shading or <u>any</u> ruled lines<br><br>• smaller than 50 mm across widest point of midrib – 5 squares on grid **AND** (clear, sharp, unbroken lines)<br><br>• stomata/breaks open-ended<br>• less than four enclosed areas<br>any of the line of enclosed area under outermost enclosed outline has<br>• <u>any</u> line 1 mm or thicker<br>• <u>any</u> feathery or broken/dashed line or gaps<br>• <u>any</u> 'tails' or overlaps |
| MMO collection 3 | mp 2 | no cells drawn **AND** complete leaf drawn; |
| | mp 3 | at least five lines counted across leaf as line through middle of central region across (upper to lower epidermis);<br>**Ignore** lines for vascular bundle |
| | mp 4 | central region drawn with at least 3 enclosed areas in shape which is not a symmetrical oval top to bottom; |
| MMO decision 1 | mp 5 | labels <u>xylem</u> with line touching line around enclosed area or ending inside enclosed area in vascular bundle with at least two regions; |
| | | **Ignore**<br>• any labels identifying tissues associated with plant<br>**Do not give mark if**<br>• any label which is biologically incorrect e.g. from animal<br>• any label written within drawn area |

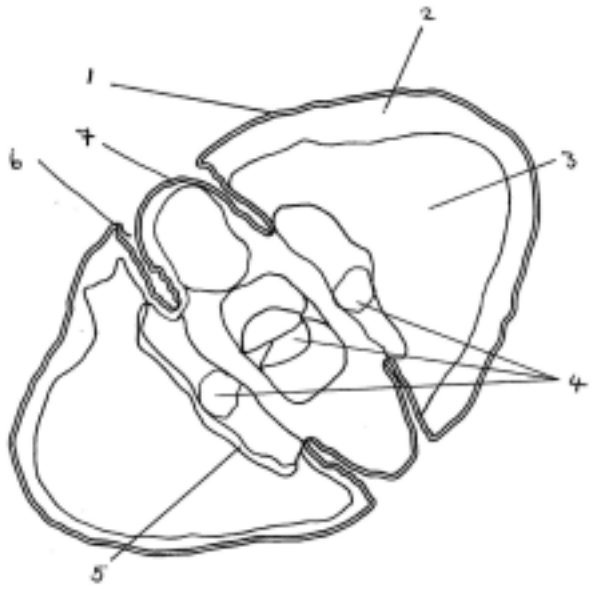
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| | | |
|---|---|---|
| **(ii)** | | [5] |
| PDO layout 1 | mp 1 | quality of drawing;<br><br>**Do not give mark if**<br>• drawn over the print of question or <u>any</u> shading or <u>any</u> ruled lines<br><br>• smaller than 50 mm across widest cell **AND** (clear, sharp, unbroken lines)<br><br>• less than 3 cell outlines<br>any of outermost lines have (even if more than 3)<br>• <u>any</u> line 1mm or thicker<br>• <u>any</u> feathery or broken/dashed line or gaps<br>• <u>any</u> 'tails' or overlaps |
| MMO collection 2 | mp 2 | only three complete cells drawn **AND** cells must touch another cell at least at one point to form one group; |
| | mp 3 | at least one cell has at least four internal enclosed areas drawn; |
| | | **Do not give mark if**<br>• additional organelles e.g. mitochondria, etc<br>• lines/dots drawn within chloroplast enclosed areas |
| PDO recording 1 | mp 4 | cell walls drawn as double lines with middle lamella between two complete adjacent cells; |
| MMO decision 1 | mp 5 | at least two cells must contain at least five small randomly scattered enclosed areas and labels <u>only one</u> chloroplast in any one cell with label line touching outermost line of chloroplast or into middle of chloroplast; |
| | | **Do not give mark if**<br>• small enclosed areas form single line around most of boundary of any two cell<br>• any label other than chloroplast<br>• any label within drawn lines |

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| | | |
|---|---|---|
| **(b)** | | [3] |
| MMO collection 1 | mp 1 | shows unit as <u>mm</u> on measurements for **both** (**Y** and **Z**) or larger and smaller values **AND** measures **Y** and **Z** lines correctly;<br>***Y*** *allow one of:*<br>*120(.00) or 120.5(0) or 121(.00) or 121.5(0) or 122(.00) or 122.5(0) or 123.(00)*<br>***Z*** *allow one of:*<br>*75(.00) or 75.5(0) or 76(.00) or 76.5(0) or 77(.00)* |
| PDO display 2 | mp 2 | shows any value of **Y** divided by any value of **Z**<br>OR<br>shows multiplication of both **Y** and **Z** by same number to give whole numbers; |
| | | **Do not give mark if**<br>• use <u>different</u> units for **Y** and **Z**<br>• conversions to metres<br>• conversions to μm |
| | mp 3 | as larger whole number **<u>:</u>** or <u>to</u> smaller whole number to <u>lowest common denominator</u>; |
| | | **Do not give mark if**<br>• no measurements or working<br>• if units |

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| | | |
|---|---|---|
| **(c) (i)** | | [2] |
| **(ii)** | | [3] |
| PDO recording 1 | mp 1 | (plan <u>no cells</u>)<br>has at least one line following outline in at least one 'wing'<br>**AND**<br>central region contains at least three enclosed areas; |
| MMO decision 1 | mp 2 | label lines and labels **P**, **Q** and **R** to three different features; |
| | |  |

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ACE interpretation max 3

Award marks from **only one column** for each mark point. [max 3]

| Labelled region | Fig 2.1 | M1 |
|---|---|---|
| mp 1<br>[2 marks]<br>overall shape<br>number of tissues/regions | has 'wings' or divided into two or irregular/ symmetrical/oval/AW;<br>more; | oval or more round or straight or regular/asymmetrical/triangular;<br>few; |
| mp 2<br>[1 mark]<br>**Do not give mark if** membrane | thin(ner) layer or one cell thick or less/fewer cells or loosely packed cells<br>or no thickened layer/cells<br>or cells not as round/AW<br>or rough or hair(s) or trichomes; | thick(er) layer or more cells or more compact/closely-packed<br>or cells rounder shape<br><br>or smooth or no hairs/trichomes; |
| mp 3 + 4<br>[max 2 marks]<br>**Ignore** general shape of cells | Idea of thick layer;<br>darker stained /contain more staining;<br>OR longer /thinner/oval or more/closely packed cells<br>OR (palisade cells/layer) missing/absent at **5**; | Idea of thin layer;<br>less stained;<br>round(er) cells or few/loosely packed cells; |
| mp 5<br>[1 mark]<br>**Do not give mark if** vacuole/s | more (air/intercellular) spaces or fewer cells<br>more (spongy mesophyll) cells or larger area; | less spaces or more cells<br><br>few (spongy mesophyll) cells/small area; |
| mp 6 + 7<br>[max 2 marks]<br>**Do not give mark if** vessel | two/divided/four/more areas<br>more xylem/cells (vessels)<br>more xylem to phloem ;<br>OR xylem inside phloem/xylem in centre phloem outside;<br>OR cross-shape /butterfly shape;<br>OR labels cells around it as present; | one/single/<br>less;<br><br>phloem one side only or not around xylem;<br>round or oval shape;<br>no /few cells ; |
| mp 7 + 8<br>[max 2 marks] | cross shape/butterfly shape;<br>bundle sheath present or absent or layer or cells present/absent; | round or oval or absent;<br>bundle sheath present/absent or layer/cells present/absent; |
| mp 9<br>[1 mark] | indent or gap or curled or sunken stoma(ta) or present; | straight or no indent or no gap or not curled or absent; |
| mp 10<br>[1 mark] | fold or ridge or lobe or present; | no fold or no wings or absent; |

**[Total: 18]**

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**GCE Advanced Subsidiary Level and GCE Advanced Level**

# MARK SCHEME for the October/November 2012 series

## 9700 BIOLOGY

**9700/35** Paper 3 (Advanced Practical Skills 1), maximum raw mark 40

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Mark scheme abbreviations:

| | |
|---|---|
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| **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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| | | |
|---|---|---|
| **1 (a) (i)** | | [3] |
| MMO decision 3 | mp 1 | (labels for concentration under correct sequence of beakers)<br>(0).3 **AND** (0).03; |
| | mp 2 | (for dilution of C) $cm^3$ or ml(s) shown **AND** shows transfer of 1 ($cm^3$) of 0.3 (%) to next dilution or shown by arrow; |
| | | **Do not give mark** if incorrect concentrations |
| | mp 3 | (for water)<br>adds 9 $cm^3$ of (distilled) water /**W** to each of the two beakers **AND** must add previous concentration to third beaker; |
| **(ii)** | | [5] |
| PDO recording 2 | mp 1 | table with all cells drawn **AND** heading (top row or column to left of recorded data) percent(age) or % conc(entration) of C or copper sulfate or [ C ] **OR** only time (with) s or sec(onds); |
| | | Can have: • no outer boundary<br>**Ignore**: • test-tube /additional columns • notes outside area • t or T<br>**Do not give mark if**: • % in cells of headed column • other units e.g. mol $dm^{-3}$ • no percentage or % • units in cells of this column/row e.g. 45' (units) • min(utes) • more than one row in one cell for multiple trials |
| | mp 2 | (heading for any column/row including mean) temp(erature) (/) °C; |
| | | **Ignore**: • if have columns/rows for test-tubes or observations e.g. effervescence • any notes outside area • heading for test-tubes/heading for time • t or T<br>**Do not give mark if**: • headings for volumes or method information or in cells e.g. volumes and concentrations in same cell |

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| | | |
|---|---|---|
| MMO collection 3 | mp 3 | (mark first column / row) records at least four results as whole numbers or to half a degree only for 30 seconds that is any whole number or 0.5 °C, which is less than 35 and more than 15; |
| | mp 4 | (mark first column / row of recorded temperature for recording correct pattern) for **W/** water / 0, temperature at 210 seconds higher than temperature at 30 seconds; |
| | | **Must have** units for temperature recorded somewhere, e.g. °C |
| | mp 5 | in column / row for concentration/solution the order is **W** and then from their lowest concentrations to **3%**;<br>(water to left for row or top if column) |
| **(iii)** | | [1] |
| ACE conclusion 1 | | **Must have** results for water, 0.03% and 3% **AND** results for lowest temperature recorded e.g. initial temperature / 30 seconds **AND** results for 210 seconds; |
| | | (if change in temperature from 0 to 210 seconds for 3% is **LESS** compared to water/0.03%)<br><br>inhibition/ (reaction) slows down/less active/fewer ESCs/describes blocking active sites/denatured |
| | | (if change in temperature from 0 to 210 seconds for 3% is **MORE** compared to water/0.03%)<br><br>more active/reaction speeds up/more active/ more ESCs/ cofactor |
| | | (if change in temperature from 0 to 210 seconds for 3% is **SAME** compared to water/0.03%)<br><br>(allow 0.5°C difference)<br><br>no effect |

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| | | | |
|---|---|---|---|
| **(iv)** | | | [max 2] |
| ACE interpretation max 2 | | cause of error | WITH idea of error |
| | mp 1 | starting / initial temperature | not same / different / changes; |
| | mp 2 | thermometer position | not same / different / changes; |
| | mp 3 | mixing (of **W**, **H** and **Y** and/or **C**, **H** and **Y**) | not same for each test-tube / different / changes; |
| | mp 4 | concentration of hydrogen peroxide / substrate | changes / decreases; |
| **(v)** | | | [max 3] |
| ACE improvements max 3 | mp 1 | use thermostatically (controlled) water bath; | |
| | | **Do not give if** temperature controlled room / air conditioning | |
| | mp 2 | (dependent variable) use data logger with temperature sensor / digital thermometer / thermometer with narrower calibration; | |
| | mp 3 | use magnetic stirrer / mechanical stirrer (to standardise stirring); | |
| | mp 4 | (standardised variables) cover or use 'fresh' / from bottle hydrogen peroxide; | |
| | mp 5 | (independent variable) more / wider / narrower range of concentrations (of **C)**; | |
| | mp 6 | (dependent variable) record for longer OR for <u>longer intervals</u> OR repeats / replicate experiment / multiple tests; | |
| | mp 7 | insulate test-tubes / describes method; | |
| **(vi)** | | | [1] |
| MMO decision 1 | | *Idea of* | • replace **C** / copper sulfate with water<br>• **W**/water and **Y** / yeast suspension and **H** / hydrogen peroxide<br>• replace **Y** / yeast suspension with water/beads; |
| | | **Do not give** | • just remove **C** / copper sulfate<br>• boil enzyme / **Y** |

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| | | |
|---|---|---|
| **(vii)** | | [1] |
| ACE interpretation 1 | | half of smallest division (whatever stated as smallest division);<br>**Do not give** for any figure less than (0).25 |

| | | | |
|---|---|---|---|
| **(b) (i)** | | | [4] |
| PDO layout 4 | O | *x*-axis conc(entration) of catalase (/) arbitrary units / (au) **AND** *y*-axis absorbance of light (by the coloured solution) (/) arbitrary units (au); | |
| | S | scale as *x*-axis 20 to 2 cm labelled each 2 cm except origin and 100 need not be labelled **AND** *y*-axis 0.2(0) to 2 cm labelled each 2 cm except origin and 1.4(0) need not be labelled; | |
| | P | correct plotting of | • five points<br>• as small cross (use square on grid) **o**r dot (in circle, use grid) **or** cross in circle to within half a square; |
| | L | **Five** plots joined with ruled lines exactly point to point **AND** (quality) smooth line less than 1 mm thick (use grid); | |
| **Additional guidance:** | | | |
| O | | | |
| S | **Must have** label of value of origin if zero not at origin<br><br>**ecf** if no labels for O but numbers show orientation is correct then must have scale as normal.<br><br>If reverse orientation then only<br>*x*-axis 0.4 to 2 cm<br>*y*-axis 20 to 2 cm | | |
| P | Can have | | • **ecf** if *x*- and *y*-axis reversed if<br>*x*-axis 0.4 to 2 cm<br>*y*-axis 20 to 2 cm |
| | **Do not give if** | | • any blobs or dots<br>• any cross too large with any part of cross outside square on grid or dot larger than circle on grid |

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| | | |
|---|---|---|
| L | Can have<br><br>**Do not give if** | • ecf from incorrect **P**<br><br>• any feathery or gap in line<br>• any irregular thickness<br>• any extrapolation either end |
| | **(ii)** | [2] |
| ACE conclusions 2 | mp 1 | more enzyme-substrate-complexes / ESCs / more active sites binding to hydrogen peroxide / substrate; |
| | mp 2 | less hydrogen peroxide / substrate available / all gone / none left / hydrogen peroxide limiting factor; |
| | | **[Total: 22]** |
| **2** | **(a)** | [max 5] |
| PDO layout 1 | mp 1 | quality of plan diagram;<br><br>**Do not give if**<br>• drawn over the print of question or <u>any</u> shading or wiggly lines anywhere or <u>any</u> ruled or compass lines<br>• complete section<br>• drawn both walls<br>• thickness of wall smaller than 60 mm across widest point **AND** (clear, sharp, unbroken lines) ;<br>• less than **5** hand drawn lines<br><br>the outermost line and innermost line<br>• <u>any</u> part of the line 1mm or thicker<br>• <u>any</u> feathery or dashed or gap in line<br>• <u>any</u> 'tails' or overlaps |
| MMO collection 2 | mp 2 | no cells drawn **AND** only sector of wall drawn; |
| | | **Do not give if**<br>• two walls (not sector drawn)<br>• complete sector |
| | mp 3 | drawn 5 layers (6 lines); |

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MMO decision 2

mp 4: labels lumen with label line into the space below innermost line;

**Ignore**
- any labels identifying tissues associated with animal

**Do not give if**
- label is written between the innermost and outermost lines
- any label which is biologically incorrect e.g. plant
- any label written between the innermost and outermost lines

mp 5: correct annotation with at least one label line;

| inner wall | outer wall |
|---|---|
| folded<br>rough<br>irregular | not folded<br>smooth<br>regular |
| tightly packed cells | loosely packed cells |
| many nuclei | fewer nuclei/no nuclei |
| no cells | cells present |
| difference in density/colour of staining | |

**(b) (i)** [3]

MMO decision 1

mp 1: (Step 1) answer ( = .. mm) must be 0.004 (0) OR expressed in standard form $4 \times 10^{-3}$;

PDO display 1

mp 2: (either box in step 2) 1000 OR $10^3$ **AND** answer from step 1 in other box;

**ecf** any answer to step 1

ACE interpretation 1

mp 3: μm **AND** answer from step 1 x 1000;

freestanding mark in isolation from answers to boxes in step 2

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| | | |
|---|---|---|
| **(ii)** | | [2] |
| MMO collection 1 | mp 1 | measures correctly in eyepiece graticule units <u>51 to 65</u> (epg units);<br>**Do not give if** • μm or mm or cm or m |
| PDO display 1 | mp 2 | shows multiplication by answer from **(b) (i)**<br>any one value (multiplied by) <u>x</u> by <u>answer from **(b) (i)** step 2;</u><br>Can have<br>• alternative signs . or *<br>**Do not give if**<br>• if any division shown |
| **(c)** | | [4] |
| PDO layout 1 | mp 1 | quality of drawing;<br>**Do not give if**<br>• drawn over the print of question or <u>any</u> shading anywhere or<u>any</u> ruled or compass lines smaller than 50 mm across widest cell less than 4 cell outlines<br>• any of outermost lines have<br>• <u>any</u> line 1 mm or thicker (use grid)<br>• <u>any</u> feathery or dashed line or gap in line<br>• <u>any</u> 'tails' or overlaps |
| MMO collection 2 | mp 2 | <u>only</u> <u>four</u> complete cells drawn **AND** cell 1 must touch cells 2 and 3;<br>**Do not give if** • any ruled or compass lines |
| | mp 3 | at least two nuclei with both drawn either in contact with a single line (either side of a line) or within two lines;<br>**Do not give if** • drawn EM organelles e.g. mitochondria<br>• all cells drawn separately |
| MMO decision 1 | mp 4 | labels <u>only one</u> nucleus with ruled label line touching either outer line of enclosed area or ending inside enclosed area*;*<br>**Do not give if** • any label other than nucleus, **ignore** label lines and **P**<br>• any label within drawn area |

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**(d)** [4]

**PDO recording 2**

**mp 1**

organise as a table with only three columns or rows separated by lines (no cells needed) **Ignore** number column **AND** headings in any order only **L1 / slide** and **Fig. 2.6 AND** third column/row contains list of features;

(features) L1 Fig. 2.6 (L1 or Fig. 2.6 either way round and other column to left, right or in middle

**mp 2**

only differences (all recorded);

**Do not give if**
- any similarities recorded
- any functions
- any EM features

**ACE interpretation max 2**

**max 2**

**Do not give if** any ref. to membranes/vacuoles/tunica

| | feature | L1/slide | Fig. 2.6 |
|---|---|---|---|
| 1 | (number of folds / folding) (inner layer / surface) | highly folded / more / many | less folded / less/few(er); |
| 2 | (size of folds / innermost layer) | large(r) / thick(er) | small(er)/ thin(ner) |
| | (shape of folds / lumen) | rough / less smooth / irregular/ wavy | more smooth / regular/rectangular |
| 3 | contents of lumen | has/present | none |
| 4 | cartilage (‘middle tissue’) | no (one) / absent/has not continuous | yes / present/has discontinuous / has break; |
| 5 | number of layers | either way; | |
| 6 | nuclei | more | less |

**[Total 18]**

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**GCE Advanced Subsidiary Level and GCE Advanced Level**

# MARK SCHEME for the October/November 2012 series

## 9700 BIOLOGY

**9700/36** Paper 3 (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.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the October/November 2012 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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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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| | | | |
|---|---|---|---|
| **1 (a) (i)** | | | [3] |
| MMO decisions 3 | [1] | cuts two blocks which are different from 10 × 10 × 5 mm (400 $mm^2$) | **AND** dimensions OR surface area of blocks 2 and 3 are **smaller** than block 1; |
| | [2] | each surface area column correctly completed;; | |
| **(ii)** | | | [5] |
| PDO recording 2 | mp 1 | table with all cells drawn | **AND** heading<br>(top row or column to left of recorded data)<br>surface area (/) $mm^2$; |
| | | **Can have**<br>• no outer boundary<br>**Ignore**<br>• block/additional columns (results for **U**)<br>• notes outside the area | **Do not give mark if**<br>• units $mm^2$ in cells of headed column<br>• other units e.g. $cm^2$<br>• no heading for surface area or $cm^2$<br>• SA<br>• two rows in one cell |
| | mp 2 | (heading for any column/row including mean)<br>only time (with) s or sec(onds); e.g. time and observation in same heading | |
| | | **Ignore**<br>• if have columns/rows for blocks or observations e.g. colour<br>• any notes outside area<br>• headings for blocks<br>• t or T | **Do not give mark if**<br>• volume<br>• units in cells of this column/row/other notation e.g. 35**'**<br>• min(utes)<br>• ref. to width/length/depth or method information or in cells e.g. width, length, depth and surface area in the one cell<br>• ref. to **U**<br>• ref. to temperature |
| MMO collection 2 | mp 3 | (mark **first** column/row of recorded time) records whole numbers only for ANY three (surface areas/blocks) that is any whole number less than 360 or records > or 'more than 360'; | |
| | | **Must have**<br>• whole numbers between 3 and 360/'more than 360' | **Do not give mark if**<br>• 'less than 360'<br>• time recorded as 0**:**51 |
| | mp 4 | replicates for all three surface areas (six times); | |

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| | | |
|---|---|---|
| MMO decision 1 | mp 5 | calculates mean OR rate for all surface areas; |

**(iii)** [2]

| | | | |
|---|---|---|---|
| ACE interpretation max 2 | | **cause of error** | **WITH idea of error** |
| | mp 1 | loss of colour/or describe | judge<br>observe<br>see<br>identify<br>determine<br>subjective<br>different/varies/not same; |
| | mp 2 | handling<br>e.g. using the mounted needle | gave 'hole' describes damage/<br>increases or changes surface area; |
| | mp 3 | temperature | different/varies/not same<br>drops/decreases/changes; |
| | mp 4 | blue colour/staining of blocks or orientation in test-tube/ block touches the sides of the test tube | not dark enough/uneven or blotchy/<br>decreases/changes the surface area; |
| | mp 5 | cutting the blocks | difficult to get correct size/accurate; |

**(iv)** [3]

| | | |
|---|---|---|
| ACE improvements max 3 | mp 1 | idea of using more or different or wider/narrower range of surface areas/sizes or examples<br><br>OR<br><br>repeats/replicates//more readings; |
| | mp 2 | (method to keep surface area constant)<br>use 'cutter'/use a machine<br>use sharper (scalpel)<br>use Vernier calliper<br>use moulds; |

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| | | | |
|---|---|---|---|
| | mp 3 | *(*standardised variables)<br>(how water temperature is maintained)<br>temperature maintained in thermostatically(-controlled) water-bath<br>or<br>described using heating<br>or<br>different/'fresh' water at desired temperature; | |
| | | **Can have**<br>thermostatic/electr(on)ic/incubator | |
| | mp 4 | staining for longer/shorter/use darker/lighter stain; | |
| | mp 5 | use a flat/shallow container/beaker and make sure blocks same way up; | |
| | mp 6 | use spoon/forceps to prevent damage to block; | |
| **(b) (i)** If draw chart then max 1 for O. [4] | | | |
| PDO layout 4 | O | *x*-axis<br>time (/) s(econds)<br><br>**AND** *y*-axis<br><br>speed of (the) bubble (/) cm $s^{-1}$ or cm/s or cm per second; | (**R** cm/$s^{-1}$) |
| | S | scale on *x*-axis<br><br>5 to 2cm labelled each 2 cm except origin and 30<br><br>**AND** *y*-axis<br><br>2 to 2 cm labelled each 2 cm except origin and 8; | **ecf** if no labels for O or if reverse O then scale must use more than half grid for both *x* and *y*<br><br>Allow speed of bubble 1 to 2 cm (3 at origin) AND time 10 to 2 cm ONLY<br><br>**Ignore** symbol for break in *y*-axis<br><br>**Must have**<br>• label of value of origin if zero not at origin<br><br>**Do not give mark if**<br>• awkward scale |
| | P | correct plotting of<br>• **5** points<br>• as small cross (lines less than 4 mm each) **o**r dot (in circle) **or** cross in circle to within half a square<br><br>**Can have**<br>• **ecf** if *x*-axis not 0 if scale 5 to 2cm even | **Do not give mark if**<br>• the plot for the reading-off point is the same as for the five plotting points<br>• awkward scale.<br>• **ANY** blobs or dots alone<br>• **ANY** cross too large |

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| | | | |
|---|---|---|---|
| | L | **five** plots with<br>ruled lines exactly point to point<br><br>**AND** (quality)<br><br>smooth line less than 1 mm thick;<br><br>**Can have**<br>• **ecf** from incorrect **P** | **Do not give mark if**<br>• any feathery line<br>• any irregular thickness<br>• any extrapolation either end |
| | **(ii)** | | [2] |
| MMO collection 1 | mp 1 | shows on graph where reading taken off at 10 seconds; | |
| | | **Can have mark if**<br>• same as other plotted points<br>• one or two lines<br>• on graph with *x* and *y* axes incorrectly orientated | **Do not give mark if**<br>• shown two lines on graph (given choice of two lines anywhere on graph) |
| ACE interpretation1 | mp 2 | correct reading from graph accurate to value of half square | **AND**<br>(cm $s^{-1}$ or cm/s or cm per second);<br>(**Do not give** $cm/s^{-1}$) |
| | | **Can have mark if**<br>• line crosses at halfway between horizontal lines then **MUST** read half square value e.g. 0.1<br>• line crosses nearer right horizontal then can have only either half square value or value of right horizontal<br>• line crosses nearer left horizontal then can have only either value of left horizontal or half way value<br>• apply same idea if drawn on incorrect scale<br>• units incorrect on graph then allow **ecf** for units here | |

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| | | |
|---|---|---|
| **(iii)** | | [3] |
| ACE conclusions 3 | mp 1 | (between 12 and 17 seconds)<br><br>starch is being hydrolysed/broken down by the enzyme; |
| | mp 2 | (between 25 and 30 seconds)<br><br>hydrolysis (almost) ended/almost finished/no more starch or starch all hydrolysed/broken down<br>or limiting (factor) or nearly zero/hardly any left; |
| | mp 3 | (either 12-17 seconds or 25-30 seconds)<br><br>correct ref. to active sites used or ESCs (substrate binding);<br><br>**Do not give mark for**<br>• colliding<br>• effective collision |
| | | **[Total: 22]** |



| | | |
|---|---|---|
| **2 (a) (i)** | | [5] |
| PDO layout 1 | mp 1 | quality of plan diagram with clear, sharp, unbroken lines;<br><br>**Do not give mark if**<br><br>• drawn over the print of question<br>• <u>any</u> shading anywhere<br>• <u>any</u> ruled lines<br><br>• smaller than 60 mm across widest point (from outermost line to innermost line)<br><br>• if less than **three** hand drawn lines AND at least **one** enclosed area (best vascular bundle)<br>if any of the **three** outermost lines and any **one** outer line of enclosed area has<br>• <u>any</u> line 1mm or thicker<br>• <u>any</u> feathery line or broken/dashed line or gaps<br>• <u>any</u> 'tails' or overlaps |

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| | | | |
|---|---|---|---|
| MMO collection 2 | mp 2 | no cells drawn<br>**AND**<br>sector plus at least one vascular bundle drawn; | |
| | | **Ignore**<br>• outline being curved | |
| | mp 3 | the outermost line **AND** at least three inner lines comprising the 'epidermal layers'; | |
| MMO decision 2 | mp 4 | (vascular bundle) drawn with at least three enclosed areas **AND** tapering (inner phloem narrower than outer phloem, **NOT** symmetrically oval); | |
| | mp 5 | labels <u>phloem</u> with ruled line touching line around enclosed area or ending inside enclosed area in vascular bundle with at least **three** regions where middle region is the widest (either outer or inner region); | |
| | | **Ignore**<br>• any labels identifying tissues associated with plant | **Do not give mark if**<br>• any label which is biologically incorrect e.g. from animal<br>• any label within drawn area |
| | **(ii)** | | [4] |
| PDO layout 1 | mp 1 | quality of drawing with clear, sharp, unbroken lines;<br><br>**Do not give mark if**<br><br>• drawn over the print of question<br>• enclosed in an outline (VB)<br>• <u>any</u> shading anywhere<br>• <u>any</u> ruled lines<br><br>• if smaller than 50mm across widest cell<br><br>• if less than 3 cell outlines<br>either of the outermost lines of the **two** largest enclosed areas have<br>• <u>any</u> line 1mm or thicker (use grid)<br>• <u>any</u> feathery line or broken/dashed or gaps<br>• <u>any</u> 'tails' or overlaps | |
| MMO collection 2 | mp 2 | only two largest enclosed areas drawn **AND** at least two smaller vessels; | for the two largest enclosed areas **do not give mark if**<br>• any enclosed areas/cell structures<br>• regions of vascular bundles are drawn (see exemplar E in standardisation) |
| | mp 3 | for both largest enclosed areas the cell walls must have double lines; | |
| MMO decision 1 | mp 4 | labels <u>lumen</u> with ruled line inside enclosed area within xylem cell;<br><br>**Do not give mark if**<br>• any label (apart from xylem vessels and xylem cells) other than lumen<br>• any label within drawn lines | |

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| | | | |
|---|---|---|---|
| **(b) (i)** | | | [4] |
| MMO decision 1 | mp 1 | shows at least three large values<br><br>OR<br>shows at least three large values | **AND** the same number of smaller values all less than the large values<br>**AND**<br>draws and measures a line across at least five cells; |
| MMO collection 1 | mp 2 | for width and length shows at least once on raw data<br><br>OR<br>where added up units <u>mm</u> or <u>cm</u> | **AND**<br>either whole number mm or to 0.5 mm<br>OR<br>whole cm or to 0.05 cm; |
| PDO display 2 | mp 3 | shows either<br>for width AND length shows addition and division by number of measurements<br>OR<br>for width one measurement divided by the number of cells AND for length addition and division by number of measurements; | |
| | | **Do not give mark if**<br>• use different units for width and length<br>• conversion to metres<br>• conversion to μm | |
| | mp 4 | any number shown to <u>lowest common denominator</u><br>either as larger whole number: or <u>to</u> smaller whole number<br><br>OR<br><br>as a fraction, larger number over smaller number; | |
| | | **Do not give mark if**<br>• only give ratio with no working shown | |

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**(ii)** [5]

**PDO recording 2**

mp 1

organise as a table with only **three** columns or rows separated by lines (no cells needed)
**Ignore** number column

**AND** headings in any order only
cortex and xylem

**AND**
third column contains features;

features | cortex | xylem either way round and other column to left, right or in middle

mp 2

only observable differences (at least two) recorded;

**Do not give mark if**
- any similarities or function recorded
- living versus dead
- ref. to cell membrane
- ref. to end walls/pits/pores

**ACE interpretation max 3**

[max 3]

| mp | feature | cortex | xylem |
|---|---|---|---|
| 1 | nuclei | visible/present (**ignore** more nuclei) | not visible/absent; (**ignore** fewer nuclei) |
| 2 | ratio of length to width/ length width | low(er) shorter wider | high(er) longer narrower; |
| 3 | cell wall | thin | thick; |
| 4 | bands (of lignin)/ staining/colour | absent/brown/ different | present/red/different; |
| 5 | cell contents/ cytoplasm/ vacuole/lumen/hollow | present any difference | absent any difference; |
| 6 | number of cells/packing | more/closely packed | few(er)/loosely packed; |

**[Total: 18]**

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