

**UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS**  
**GCE Advanced Subsidiary Level and GCE Advanced Level**

**MARK SCHEME for the May/June 2010 question paper**  
**for the guidance of teachers**

**9700 BIOLOGY**

**9700/33**

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

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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| Question                                                                                                                                                | Expected Answers                                                                              | Additional Guidance                                                                                                                 | Marks |
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| 1 (a) Draw on Fig. 1.1 a line to show the level of water in the large test-tube.                                                                        |                                                                                               |                                                                                                                                     |       |
| MMO decision 1                                                                                                                                          | line drawn above or at the same level as the line showing the contents in the Visking tubing; |                                                                                                                                     | [1]   |
| (b) State the volume of Benedict's solution and the volume of the solutions and the sample.                                                             |                                                                                               |                                                                                                                                     |       |
| MMO decision 1                                                                                                                                          | (volume of Benedict's) equal to or greater than (volume of each solution <b>and</b> sample)   | (volume of each solution <b>and</b> sample) equal;                                                                                  | [1]   |
| (c) State ONE variable, other than volume, which needs to be kept constant when you do the TESTS and describe how you will keep this variable constant. |                                                                                               | Reject any other values e.g. 2.5 cm <sup>3</sup>                                                                                    | [1]   |
| MMO decisions 2                                                                                                                                         | <u>temperature:</u>                                                                           | Reject if in context of Visking tubing set up or experiment e.g. keep at room temperature<br>Reject if more than one variable given | [1]   |
|                                                                                                                                                         | use of water-bath                                                                             | <b>AND</b> between 80°C and 100°C or boiling;                                                                                       | [1]   |

|               |                                       |                 |              |
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| Question                                                  | Expected Answers                                                                              |                                                                                                                  | Additional Guidance                                                                                                                                                                                                                                                                                                                                    | Marks |
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| (d) (i) Prepare the space below and record your results.  |                                                                                               |                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                        |       |
| PDO recording 2                                           | 1. table with all cells drawn<br><b>No outer boundary needed</b>                              | (heading to left/ top)<br><b>AND</b> a <u>heading</u> to describe (sample, or solution or test-tube or glucose); |                                                                                                                                                                                                                                                                                                                                                        | [1]   |
|                                                           | 2. (heading)<br><u>time (/) s</u> or sec(onds) or min(utes);                                  |                                                                                                                  | <b>Reject</b> if units in table                                                                                                                                                                                                                                                                                                                        | [1]   |
| MMO collection 2                                          | 3. time for 0.3%/ <b>S3</b> quicker than 0.2%/ <b>S2</b> ;                                    |                                                                                                                  | Must be clear units<br><b>Reject</b> 1.24                                                                                                                                                                                                                                                                                                              | [1]   |
|                                                           | 4. figures for 0.2%/ <b>S2</b> quicker than 0.1%/ <b>S1</b> ;                                 |                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                        | [1]   |
| (ii) Estimate the concentration of glucose in the sample. |                                                                                               |                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                        |       |
| ACE interpretation 1                                      | correct estimate from <b>their</b> results<br><b>Reject</b> if sample not recorded in results | <b>AND</b> percentage/%;                                                                                         | <ul style="list-style-type: none"><li>• is 0.1% or 0.2% or 0.3%</li><li>• <b>between</b> 0.1% and 0.2%</li><li>• <b>0.15%</b></li><li>• <b>between</b> 0.2% and 0.3%</li><li>• <b>0.25%</b></li><li>• <b>greater/more than</b> 0.3%</li><li>• <b>less than</b> 0.1%</li></ul> <b>Reject</b> any other values<br><b>Ignore</b> use of <b>S1, S2, S3</b> | [1]   |

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| Question                                                                                                                                            | Expected Answers                                                                                                                                                                                                                                                                                                                                                                                         | Additional Guidance                                                                                | Marks |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------|
| (iii) Suggest how you might modify this investigation to find the effect of temperature on the rate of diffusion of glucose through Visking tubing. |                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                    |       |
| ACE improvements 2                                                                                                                                  | states 5 or more temperatures<br>OR<br>gives examples of 5 or more 1°C to 100°C;                                                                                                                                                                                                                                                                                                                         |                                                                                                    | [1]   |
|                                                                                                                                                     | (in context of readings) repeats or more than once or replicates <b>AND</b> mean or average<br>OR<br>take samples at same time interval or example of time with units<br>OR<br>same volumes or example of volume with units of samples removed<br>OR<br>rate calculated from time taken to change colour<br>OR<br>same concentration or volume of glucose or example of concentration or volume + units; | <b>Reject</b> if change another variable e.g. concentration of glucose<br><br><b>Reject</b> amount | [1]   |

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| Question                                               | Expected Answers | Additional Guidance                                                                                     | Marks                                                                                                                                                                                                                                                                                                       |     |
|--------------------------------------------------------|------------------|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| (e) (i) Plot a graph to show the results in Table 1.1. |                  |                                                                                                         |                                                                                                                                                                                                                                                                                                             |     |
| PDO layout 4                                           | <b>O</b>         | x-axis<br>time (/) min(ute)s                                                                            | y-axis<br><b>AND</b> distance (diffused from well by coloured solution /) <u>mm</u> ;                                                                                                                                                                                                                       | [1] |
|                                                        | <b>S</b>         | scale as 20 min to 2 cm<br>ECF if no labels on axes for O<br>Allow 5/10 at origin but must label origin | <b>AND</b> 5 mm to 2 cm;<br>Allow 5/10 as long as scale 5 mm to 2 cm but must label origin                                                                                                                                                                                                                  | [1] |
|                                                        | <b>P</b>         | correct plotting using crosses or dots in circle only;                                                  | Intersection of cross must be clear to show plot                                                                                                                                                                                                                                                            | [1] |
|                                                        | <b>L</b>         | line joined point to point or smooth curve;                                                             | Quality – no thicker than on grid, not feathery for the complete line<br>Joining plots – <ul style="list-style-type: none"><li>• <u>Ruled lines plot to plot</u></li><li>• <u>Curve through all plots</u></li></ul> Extrapolation <ul style="list-style-type: none"><li>• Not beyond x- or y-axis</li></ul> | [1] |
|                                                        | 0                | 0                                                                                                       |                                                                                                                                                                                                                                                                                                             |     |
|                                                        | 15               | 14                                                                                                      |                                                                                                                                                                                                                                                                                                             |     |
| 30                                                     | 22               |                                                                                                         |                                                                                                                                                                                                                                                                                                             |     |
| 45                                                     | 26               |                                                                                                         |                                                                                                                                                                                                                                                                                                             |     |
| 60                                                     | 28               |                                                                                                         |                                                                                                                                                                                                                                                                                                             |     |
| 75                                                     | 29               |                                                                                                         |                                                                                                                                                                                                                                                                                                             |     |

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| Question                                                                                                                      | Expected Answers                                                                                                                                                                                                                               | Additional Guidance                                 | Marks |
|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|-------|
| <b>(ii) Use the graph to calculate the rate of diffusion of the solution between 10 mins and 20 mins. Show on your graph.</b> |                                                                                                                                                                                                                                                |                                                     |       |
| MMO collection 1                                                                                                              | 1. shows on graph at least one reading(s) <u>between or at 10 and 20 minutes</u> ;                                                                                                                                                             |                                                     | [1]   |
| PDO display 1                                                                                                                 | 2. shows <b>distance divided by time</b> (has to be clear) any number between 4 and 20 divided by or / or ÷ <u>whole</u> number (between 4 and 20) or shows subtraction of numbers;                                                            | <b>Reject</b> if not clear distance divided by time | [1]   |
| ACE interpretation 1                                                                                                          | 3. correct answer<br><b>AND</b><br>mm min <sup>-1</sup><br>or mm per min<br>or mm/min;                                                                                                                                                         |                                                     | [1]   |
| PDO display 1                                                                                                                 | 4. any figure rounded to maximum of four significant figures;                                                                                                                                                                                  |                                                     | [1]   |
| <b>(iii) Describe and explain the trend in the rate of diffusion shown in the graph you have drawn in (e) (i).</b>            |                                                                                                                                                                                                                                                |                                                     |       |
| ACE conclusion 2                                                                                                              | (description)<br>rate or distance decreases or slows or levels off;                                                                                                                                                                            |                                                     | [1]   |
|                                                                                                                               | (in correct context of diffusion ref. to)<br>Idea of concentration or diffusion <u>gradient</u> ; getting less<br>OR<br>Idea of (high at beginning) concentration or diffusion <u>gradient</u> high<br>OR<br>Idea of (at end) evenly coloured; |                                                     | [1]   |

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| Question                                                        | Expected Answers                                    | Additional Guidance | Marks |
|-----------------------------------------------------------------|-----------------------------------------------------|---------------------|-------|
| (f) State the uncertainty of the measurements using this ruler. |                                                     |                     |       |
| ACE interpretation 1                                            | $\pm 0.5 \text{ mm}$<br>OR<br>$\pm 0.05 \text{ cm}$ |                     | [1]   |
| Total                                                           |                                                     |                     | [22]  |

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| Question                                                                                                                                                                                  | Expected Answers                                                                                                                                                                                                                                                                                                     | Additional Guidance                                                                                     | Marks |
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| <b>2 (a) (i) Make a large, labelled drawings of two different types of cell from Fig. 2.1 and one cell from Fig. 2.2. Indicate on the photomicrographs the cells that you have drawn.</b> |                                                                                                                                                                                                                                                                                                                      |                                                                                                         |       |
| MMO collection 1                                                                                                                                                                          | 1. (only cells marked on Figs. and drawn)<br>on Fig. 2.1<br><b>white blood cell</b>                                                                                                                                                                                                                                  | on Fig. 2.2<br><b>AND</b> any one complete red blood cell;                                              | [1]   |
|                                                                                                                                                                                           | <b>AND</b> any one complete red blood cell                                                                                                                                                                                                                                                                           | <b>AND</b> any one complete red blood cell;                                                             |       |
| PDO layout 1                                                                                                                                                                              | 2. clear, sharp, (not thicker than grid line for whole line) unbroken lines<br><b>Allow</b> 1 error in three cells<br>0 error for two or one cell                                                                                                                                                                    | <b>AND</b> no shading<br><b>AND</b> smallest cell drawn larger than 2 cm (+/- 1mm) at widest point;     | [1]   |
| MMO decision 2                                                                                                                                                                            | 3. (wbc from Fig. 2.1) (nucleus position) nearer to one side                                                                                                                                                                                                                                                         | (nucleus size)<br><b>AND</b> (+ or – 1 mm) nucleus fills between 50 and 75 % of whole cell;             | [1]   |
|                                                                                                                                                                                           | 4. <b>Reject</b> if any label is biologically incorrect e.g. cell wall any ref. to plants e.g. cell wall or named plant cell or named animal cell other than blood cells.<br><b>Ignore</b> nucleolus and named blood cells<br>One correct label with label line from nucleus nucleoplasm cytoplasm cell membrane/AW; | <b>Reject</b> if any additional organelles drawn in any cell<br><b>Reject</b> if any writing on drawing | [1]   |



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| Question                                                                                                                | Expected Answers                                                                                                                                                                                                                                                         | Additional Guidance                                 | Marks |
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| (ii) Prepare the space below so that it is suitable for you to compare and contrast the cells in Fig. 2.1 and Fig. 2.2. |                                                                                                                                                                                                                                                                          |                                                     |       |
| PDO<br>recording 2                                                                                                      | (organise)<br>table/<br>venn diagram/<br>ruled connected<br>boxes                                                                                                                                                                                                        | <div> <div>Fig 2.1</div> <div>Fig. 2.2</div> </div> | [1]   |
|                                                                                                                         | (heading for differences)<br>Fig. 2.1 and Fig. 2.2, labelled cells from <b>(a) (i)</b> , named cells linked to figs.                                                                                                                                                     |                                                     |       |
| ACE<br>interpretation 3                                                                                                 | heading similarities;                                                                                                                                                                                                                                                    |                                                     | [1]   |
|                                                                                                                         | Mark with identification from <b>(i)</b> drawings even if incorrectly named cells<br>Mark for any similarities or differences max 3<br>Must be clear which <b>cells</b> are being compared or contrasted<br>Ticks and crosses requires a key<br>(continued on next page) |                                                     |       |

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| Question                          | Expected Answers               |                                     |                                                    |                        | Additional Guidance                                                                                                                                                                                                                                                                                                   | Marks   |
|-----------------------------------|--------------------------------|-------------------------------------|----------------------------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| feature                           | Fig. 2.1                       |                                     |                                                    |                        | Beware Fig 2.1 cells magnified 3+ more than Fig 2.2 so cells in Fig 2.1 smaller<br>Reject nucleus<br><br>Reject if just cells have nucleus present or absent<br><br>Reject 3D , rugby or disc or spherical or biconcave or arbitrary or random<br>Reject negatives e.g. not circular<br>Reject opposites e.g. regular | [max 3] |
| Only credit each number once.     | Fig. 2.2                       |                                     |                                                    |                        |                                                                                                                                                                                                                                                                                                                       |         |
| 1. size                           | rbc or label from (i)          | wbc or label from (ii)              | rbc or label                                       |                        |                                                                                                                                                                                                                                                                                                                       |         |
| cells;                            | (rbc) small(er)                | (wbc) larg(er)                      |                                                    |                        |                                                                                                                                                                                                                                                                                                                       |         |
|                                   | small(er)                      |                                     | larg(er)                                           |                        |                                                                                                                                                                                                                                                                                                                       |         |
| 2. types of cells;                | rbc or label                   | and wbc or label                    | and only rbc/label                                 |                        |                                                                                                                                                                                                                                                                                                                       |         |
|                                   |                                | wbc present                         | no wbc                                             |                        |                                                                                                                                                                                                                                                                                                                       |         |
| 3. number                         | two                            |                                     | one                                                |                        |                                                                                                                                                                                                                                                                                                                       |         |
|                                   | many or more cells/rbcs        |                                     | few(er) cells/rbcs                                 |                        |                                                                                                                                                                                                                                                                                                                       |         |
|                                   | many or more rbcs              | one or a<br>Reject few/small<br>no. |                                                    |                        |                                                                                                                                                                                                                                                                                                                       |         |
| OR degree of packing;             | dens(er)/more overlapping rbcs |                                     |                                                    |                        | less dense;                                                                                                                                                                                                                                                                                                           |         |
| 4. nucleus                        | absent Allow<br>cannot be seen | present                             |                                                    |                        |                                                                                                                                                                                                                                                                                                                       |         |
|                                   | absent Allow<br>cannot be seen |                                     |                                                    | present                |                                                                                                                                                                                                                                                                                                                       |         |
|                                   | (no key)                       | present                             | present                                            |                        |                                                                                                                                                                                                                                                                                                                       |         |
|                                   |                                | lobed or irregular                  | not lobed or oval or round<br>or regular or smooth |                        |                                                                                                                                                                                                                                                                                                                       |         |
| OR nucleus shape;                 |                                |                                     |                                                    |                        |                                                                                                                                                                                                                                                                                                                       |         |
| 5. cell shape;                    | circular or round              | irregular                           |                                                    |                        |                                                                                                                                                                                                                                                                                                                       |         |
|                                   | circular or round              |                                     | oval                                               |                        |                                                                                                                                                                                                                                                                                                                       |         |
|                                   |                                | irregular                           | oval                                               |                        |                                                                                                                                                                                                                                                                                                                       |         |
|                                   |                                |                                     | Allow few or some round<br>Reject round            |                        |                                                                                                                                                                                                                                                                                                                       |         |
|                                   |                                |                                     |                                                    |                        |                                                                                                                                                                                                                                                                                                                       |         |
| 6. cytoplasm;                     | not granular                   | granular                            |                                                    | not granular or normal |                                                                                                                                                                                                                                                                                                                       |         |
| 7. cytoplasm<br>OR cell membrane; | (no key) present               |                                     |                                                    |                        |                                                                                                                                                                                                                                                                                                                       |         |

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| Question                                                                         | Expected Answers                                                                                                                                    | Additional Guidance                                                    | Marks                                            |     |
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| (iii) Calculate the actual diameter of the cell shown by the line X in Fig. 2.2. |                                                                                                                                                     |                                                                        |                                                  |     |
| MMO collection 2                                                                 | measures line X correctly in mm or cm;<br><br><b>Reject</b> m                                                                                       |                                                                        | [1]                                              |     |
|                                                                                  |                                                                                                                                                     | mm                                                                     | cm                                               |     |
|                                                                                  |                                                                                                                                                     | 26(.0)                                                                 | 2.6                                              |     |
|                                                                                  |                                                                                                                                                     | 26.5                                                                   | 2.65                                             |     |
|                                                                                  |                                                                                                                                                     | 27(.0)                                                                 | 2.7                                              |     |
|                                                                                  |                                                                                                                                                     | 27.5                                                                   | 2.75                                             |     |
|                                                                                  |                                                                                                                                                     | 28(.0)                                                                 | 2.8                                              |     |
|                                                                                  | shows<br>(their measurement divided by or / or ÷ 700)<br><br>AND × 1000 or 10 <sup>3</sup> (mm)<br>or 10000 or 10 <sup>4</sup> (cm) or × 10 × 1000; | <b>Reject</b> use or conversion to metres<br><b>Reject</b> if no units | [1]                                              |     |
|                                                                                  | (iv) Suggest how you would obtain a mean diameter for cells of this type.                                                                           |                                                                        |                                                  |     |
| ACE improvement 1                                                                | idea of make more measurements<br><b>Reject</b> calculate                                                                                           | <b>AND</b> add together                                                | <b>AND</b> divide by the number of measurements; | [1] |

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| Question                                                                                                                 | Expected Answers                                                                                                                                              | Additional Guidance                                                                           | Marks |
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| <b>(b) (i) Draw a large plan diagram of two different blood vessels shown in K1. Reject if one line for each vessel.</b> |                                                                                                                                                               |                                                                                               |       |
| PDO layout 1                                                                                                             | 1. clear, sharp, (unbroken lines) complete vessels only                                                                                                       | <b>AND</b> no shading                                                                         | [1]   |
|                                                                                                                          |                                                                                                                                                               | <b>AND</b> large;                                                                             |       |
| MMO collection 2                                                                                                         | 2. no cells                                                                                                                                                   | <b>AND</b> only two complete vessels drawn; Minimum of <b>three</b> lines between two vessels | [1]   |
|                                                                                                                          | 3. different vessels; (more than one) at least two complete vessels<br>OR<br>total size <b>or</b> shape;<br>Minimum of <b>three</b> lines between two vessels |                                                                                               | [1]   |
| MMO decision 2                                                                                                           | 4. at least one complete vessel drawn with two or more layers;<br>Minimum three lines                                                                         |                                                                                               | [1]   |
|                                                                                                                          | 5. one with wall thicker than other vessel wall;                                                                                                              | <b>Reject</b> if more than two vessels                                                        | [1]   |

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| Question                                                                     | Expected Answers                                                                                                   | Additional Guidance           | Marks       |
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| (ii) Suggest one way in which these blood vessels are adapted for transport. |                                                                                                                    |                               |             |
| ACE<br>conclusion 1                                                          | lumen/hollow<br>OR<br>smooth muscle OR tunica media<br>OR<br>elastic fibres/elastin OR collagen OR tunica externa; | Reject if more than one given | [1]         |
| <b>Total</b>                                                                 |                                                                                                                    |                               | <b>[18]</b> |