

**MARK SCHEME for the May/June 2011 question paper
for the guidance of teachers**

9700 BIOLOGY

9700/31

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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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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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| Expected Answers | | |
|--|-----|---|
| 1 a (i) Complete Fig. 1.1 to show how you will make <u>two</u> further concentrations of copper sulfate solution | | |
| | [3] | |
| MMO decisions 3 | [1] | (labels under correct sequence of beakers) 0.0003 AND 0.00003; |
| | | Additional guidance Must have • % once |
| | [1] | (adds copper sulfate solution, C, to both beakers) 1 cm ³ of 0.003(%) or shown as arrow (from 0.003 beaker) AND 1 cm ³ (to next beaker); |
| | | Additional guidance Must have • cm ³ once ECF • if MP1 incorrect |
| | [1] | (adds (distilled) water/W, to both beakers) 9 cm ³ (W/water); |
| | | Additional guidance Must have • cm ³ once ECF for MP3 if MP1 and MP2 incorrect BUT MUST add previous concentration to third and fourth beakers |

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| Expected Answers | | | Mark |
|--|-----|---|---|
| (a) (ii) Prepare the space below and record your observations. Mark in <u>vertical line</u> in order. | | | [5] |
| PDO recording 2 | [1] | table with all cells drawn | AND heading (top or left) percent(age) conc(entration); |
| | | Additional guidance | Can have <ul style="list-style-type: none"> • no outer boundary • % • solution or copper sulfate % or percentage copper sulfate solution Do not give mark if <ul style="list-style-type: none"> • % in cells of the headed column/row • other units e.g. mol dm⁻³ |
| | [1] | (heading on any one time column/row including mean) <u>time</u> with s/sec(onds); | |
| | | Additional guidance | Do not give mark if <ul style="list-style-type: none"> • units in cells of the headed column/row • min(utes) • additional columns/rows for volumes of water/copper sulfate • t or T |

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| | | Expected Answers | Mark |
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| MMO collection 3 | [1] | records whole seconds (numbers), less than 181, for W / 0 / control AND 4 concentrations; | |
| | | Additional guidance Must have <ul style="list-style-type: none"> • whole seconds only • no value over 180 | |
| | [1] | (in concentration column) W / 0 / control and then lowest concentration of copper sulfate to highest concentration (minimum of two concentrations , lowest concentration and then next highest concentration); | |
| | [1] | lowest concentration of copper sulfate recorded is shorter time than next (higher) concentration; (mark first column/row of recorded time taken) | |
| | Additional guidance Can have <ul style="list-style-type: none"> • minimum of two recorded | | |

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| Expected Answers | | Mark |
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| (a) (iii) Explain how your results provide evidence for the support or the rejection of this hypothesis. | | [2] |
| ACE conclusion max 2 | max 2 1. clear statement on hypothesis, <u>support</u> / true(hypothesis) OR <u>reject</u> / false(hypothesis); | |
| | 2. correct statement about concentration <u>lower than</u> 0.03% with respect to time e.g. quote concentration and time; | |
| | 3. correct statement about water e.g. no inhibition; | |

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| Expected Answers | | | Mark |
|--|--|---|--|
| <p>(a) (iv) Identify <u>one</u> significant source of error in your investigation</p> <p>MARK the first TWO different ideas for one correct answer. <i>Mark with tick where meet the marking point and cross if idea incorrect up to two.</i></p> | | | [1] |
| | <p>Mark as incorrect ideas</p> <ul style="list-style-type: none"> • temperature • evaporation • any errors which affect all test-tubes equally • pH | | |
| ACE interpretation max 1 | Cause of error | WITH idea of error | |
| | max 1 | <p>1. (dependent) colour change end-point</p> <p>timing</p> | <p>difficult to judge</p> <p>see or identify</p> <p>determine</p> <p>is subjective</p> <p>may be different</p> <p>too quick;</p> |
| | | 2. time intervals | (15 seconds) too long (a time interval); |
| | | 3. (standardised) air bubble in syringe | measuring not accurate; |
| | Additional guidance | <p>Do not give mark if (count as an idea)</p> <ul style="list-style-type: none"> • human reaction time • just have cause and no error • give improvement or correction of error e.g. 'should have timed each one separately' • contamination | |

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| Expected Answers | | Mark |
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| <p>(a) (v) Describe three other modifications to this investigation would improve the confidence in your results. Do not allow colorimeter. MARK the first FOUR different ideas for any THREE correct answers. <i>Mark with a tick where meet marking point and cross if idea but not correct up to 4.</i></p> | | [3] |
| ACE improvements max 3 | <p>max 3 (dependent variable)</p> <ol style="list-style-type: none"> replicate; more / closer / shorter time intervals (gaps); (MUST BE less than 15 seconds, but not less than 5 seconds) use of Benedict's solution AND timing to first colour change / clinistix; | |
| | <p>Additional guidance Can have</p> <ul style="list-style-type: none"> repeat or more trials or more readings <p>Ignore</p> <ul style="list-style-type: none"> mean | |
| | <p>(standardised variables)</p> <ol style="list-style-type: none"> add a buffer; idea of more accurate instruments e.g. use of graduated pipette or syringe with smaller divisions (1 cm³) e.g. measuring cylinder; | |
| | <p>Additional guidance Ignore (for MP5)</p> <ul style="list-style-type: none"> use burette | |
| | <p>6. (independent variable) more / wide / narrow(er) / different / high(er) / low(er) / more concentrations / dilutions / solutions;</p> | |
| | <p>Additional guidance Do not give mark if</p> <ul style="list-style-type: none"> ref. to separate syringes use larger volumes put covers or lids on | |

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| Expected Answers | | Mark |
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| (b) (i) Draw a circle around each of the anomalous results and complete the table. | | [2] |
| MMO decision 1 | [1] circles the two anomalous results/ for 12.5 <u>80</u> AND for 3.5 <u>84</u> ; | |
| | <p>Additional guidance Do not give if</p> <ul style="list-style-type: none"> circled more than two numbers <p>Ignore</p> <ul style="list-style-type: none"> the figure 93 if in place of 96 do not count as a 'circle' if circled | |
| ACE Interpretation 1 | [1] calculates mean correctly/ <u>59</u> ; | |
| | <p>Additional guidance ECF allow</p> <ul style="list-style-type: none"> <u>64</u> (as candidate has used anomalous result to calculate mean) <p>Do not give if</p> <ul style="list-style-type: none"> 64.2 (needs to round number down) given two answers | |

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| Expected Answers | | | Mark |
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| (b) (ii) Plot a graph of the data shown in Table 1.1. | | | [4] |
| PDO layout 4 | [1] | x-axis copper sulfate/mol dm ⁻³ x10 ⁻³ | AND y-axis absorbance/%; |
| | | Additional guidance | Must have <ul style="list-style-type: none"> units on x-axis AND y-axis |
| | [1] | scale as x-axis 5 to 2 cm must label each 2 cm | AND y-axis 20 to 2 cm ; ECF if no labels for 0 must label each 2 cm |
| | | Additional guidance | Do not give mark if <ul style="list-style-type: none"> awkward scale e.g. scale not written on each 2cm Ignore 0 on either axis AND 100 on y-axis |
| | [1] | correct plotting of each point <u>to</u> within half a square i.e less than 1 mm from intersection i.e. plot has to be nearer than halfway from a line - up or down OR if meant to be between two lines then must not be on line above or below; | |
| | | Additional guidance | Can have <ul style="list-style-type: none"> small cross or dot in circle or cross in circle ECF if x-axis not 0 if scale 20 to 2 cm. even Do not give mark if <ul style="list-style-type: none"> awkward y-axis scale blobs or dots alone cross too large with any part of line touching 4 mm by 4 mm square – check with grid dot/blob size which is 2 mm across Mark the plot for figure 93 as for other plots, do not penalise for using the number. |

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| Expected Answers | | | |
|------------------|-----|----------------------|---|
| | [1] | lines point to point | <p>AND</p> <ul style="list-style-type: none">• ruled, clear sharp and• quality ruled lines thinner than half square; <p>Do not give mark if</p> <ul style="list-style-type: none">• less than 5 plots• any feathery line• irregular thickness extrapolated to zero |

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| Expected Answers | | Ma |
| (b) (iii) Explain the effect of copper sulfate on the protein suspension. | | [2] |
| ACE conclusion max 2 | max 2 | 1. (protein) coagulates / clots as concentration of copper sulfate increases; |
| | | 2. denatures; |
| | | 3. detail on the effect of changing the protein structure; e.g. bonds broken / shape changed / altered / quaternary structure / tertiary structure |
| | | Additional guidance Do not give mark if <ul style="list-style-type: none"> • link to enzyme for any MP |
| [Total: 22] | | |

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| Expected Answers | | | Mark |
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| 2 (a) Draw a large plan diagram of the part of the leaf indicated by the shaded area in Fig. 2.1. Label the xylem and an air space. Mark in vertical line in order. | | | [5] |
| PDO layout 1 | [1] | clear, sharp, unbroken lines AND no shading AND longer than 60 mm across middle / bulge from top to bottom; | |
| | | Additional guidance 'tail' or overlap or gap has to be more than 1 mm to be marked as an error Must have <ul style="list-style-type: none"> • 3 or more hand-drawn lines (not ruled) and one or more enclosed areas Do not give mark if <ul style="list-style-type: none"> • drawn over the print of question • any line thicker than 1mm • any feathery or broken or overlap in lines • drawn only <u>one enclosed area</u> and drawn <u>any</u> 'tail' or gap in the outline Can have <ul style="list-style-type: none"> • 1 'tail' or overlap or gap in the outline if drawn 2/3 enclosed areas | |
| MMO collection 3 | [1] | no cells drawn AND drawn part of leaf indicated by shaded area AND outline of bulge at each side turns parallel to top layer; | |
| | | Additional guidance Can have <ul style="list-style-type: none"> • up to 3 enclosed areas within vascular bundle or within area where vascular bundle is situated (as drawing large xylem vessels which would make them cells) | |
| | [1] | vascular bundle divided into at least 2 regions; | |
| | [1] | definite area around hinge region drawn (at base of fold); | |

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| | | Expected Answers | |
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| MMO decision 1 | [1] | label line to central area air space drawn as distinct area which goes outside central area | AND labelled xylem AND labelled air space; |
| | | Additional guidance Do not give mark if <ul style="list-style-type: none"> • any label which is biologically incorrect e.g. from incorrect organ or animal • label within drawn area | |

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| Expected Answers | | | Mark |
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| <p>(b) Make a large drawing of <u>six</u> cells from the part of the leaf indicated by the shaded area in Fig. 2. 2. The cells should be <u>two</u> adjacent (touching) cells from the epidermis and <u>two</u> adjacent cells from each of the next two layers. Label one epidermal cell.</p> | | | [5] |
| PDO layout 1 | [1] | <p>clear, sharp, unbroken lines</p> <p>AND no shading or stippling</p> <p>AND longest dimension of any cell is 30 mm using grid;</p> <p>Must have</p> <ul style="list-style-type: none"> • 3 or more enclosed areas <p>Do not give mark if</p> <ul style="list-style-type: none"> • drawn over the print of question • any line thicker than 1mm • any feathery line <p>Can have</p> <ul style="list-style-type: none"> • 2 'tails' or overlap or gap in the <u>outline</u> of 6 enclosed areas (assessing outer line) | |
| | MMO collection 2 | [1] | <p>three pairs of <u>touching</u> cells only;</p> <p>Additional guidance</p> <p>Do not give mark if</p> <ul style="list-style-type: none"> • other layers drawn |
| [1] | | <p>the longest dimension (top to bottom) of one of the two middle cells is longer than the shortest dimension (top to bottom) of any of the other four cells (by at least 1 mm);</p> | |
| PDO recording 1 | [1] | <p>cell walls drawn as double lines with middle lamella between any two cells;</p> | |

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| MMO decision 1 | [1] | correct label with label line to <u>epidermal cell/cell from epidermis</u> ; |
| | | <p>Additional guidance Do not give mark</p> <ul style="list-style-type: none">• for epidermis only• label within drawn area• for any label which is biologically incorrect e.g. organelles or from incorrect organ or animal |

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| Expected Answers | | Mark |
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| (c) The actual length of line Y is 785µm. Use this measurement to calculate the magnification of Fig. 2.3 | | [3] |
| MMO decision 1 | [1] measures line Y in mm; 22 22.5 23 23.5 24 mm | |
| | Additional guidance Can have 2.2 2.25 2.3 2.35 2.4 cm Must have units somewhere only those values given | |
| PDO display 2 | [1] (uses mm and converts to µm by) shows <u>multiplied by</u> or <u>x</u> mm x 1000 OR x 10 ³ OR (uses cm and converts to µm by) cm x 10000 x 10 ⁴ | AND <u>divided by</u> (785); |
| | (converts (785) µm to mm or cm) shows <u>division by</u> or <u>1000</u> x 10 ³ OR (converts (785) µm to mm or cm) shows <u>division by</u> or <u>10000</u> 10 ⁴ | AND <u>divides Y by</u> (0.785) OR AND <u>divides Y by</u> (0.0785); |

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| | | <p>Additional guidance</p> <p>Must have multiplication and division signs/wording OR division and division signs/wording</p> <p>Can have * or . for 'multiplied by' even if no units mm or cm</p> <p>ECF using incorrect figure if MP1 wrong</p> <p>Do not give mark if uses metres anywhere</p> |
| [1] | rounds to whole number; | |
| | | <p>Additional guidance for MP3</p> <p>ECF from MP1 but needs to have MP2 correct</p> |

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| Expected Answers | | | | Additional guidance | |
|--|--------------|--|--|--|--|
| (d) Prepare the space below so that it is suitable for you to record the observable differences between the specimens on J1 and that in Fig. 2.3. | | | | | [5] |
| PDO recording 1 | [1] | organise as a table / ruled boxes | AND headed <u>J1</u> and <u>Fig 2.3</u> | AND first difference opposite each other; | <u>J1</u> <u>Fig 2.3</u> <u>Fig 2.3</u> <u>J1</u> |
| MMO decision 1 | [1] | at least one difference and no similarities; | | | |
| ACE interpretation max 3 | max 3 | feature | J1 | Fig. 2.3 | |
| | 1. | (mid-rib) shape | V-shaped / sharp / narrow / pointed / concave | bump / rise / rounded / circular / wide; (do not accept V-shaped) | |
| | 2. | vascular bundle xylem / phloem position | small / nearer lower epidermis in one area | large / wide across midrib nearer upper epidermis; | |

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| | 3. | vascular bundle sheath amount of xylem / phloem | present less | absent; more; |
| | 4. | stomata / guard cells | present / many | absent / less / none / cannot see; |
| | 5. | collenchyma | present | few cells / none; |
| | 6. | upper epidermis | thick epidermis / large cells | thin epidermis / small cells; |
| | 7. | hinge cells / rectangular cells | present | absent; |
| | 8. | number of air spaces / lacunae / packing size of air spaces | many (cells) densely packed large | few / none (cells) loosely packed small; |

Additional guidance

If reverse headings then
Do not give mark for PDO recording mark
– show the swapping over of headings on their table then **give marks** as if for the swapped headings.

If no organisation then
give mark only if in same sentence or following sentences

Ignore

tick and cross without a key
refs. to size
3-D descriptions such as spherical
colours/staining

Can have

differences even if not opposite each other.
differences on one side if e.g. use more or –er

Total 18