



# Mark Scheme (Results)

January 2016

Pearson Edexcel International  
Advanced Level  
in Biology (WBI06)  
Paper 01 - Practical Biology and  
Investigative Skills

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## General Marking Guidance

- This mark scheme provides a list of acceptable answers for this paper. Candidates will receive credit for all correct responses but will be penalised if they give more than one answer where only one is required (e.g. putting an additional cross in a set of boxes). If a candidate produces more written answers than the required number (two instead of one, three instead of two etc), only the first answers will be accepted. Free responses are marked for the effective communication of the correct answer rather than for quality of language but it is possible that, on some occasions, the quality of English or poor presentation can impede communication and loose candidate marks. It is sometimes possible for a candidate to produce a written response that does not feature in the mark scheme but which is nevertheless correct. If this were to occur, an examiner would, of course, give full credit to that answer.
- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Additional guidance	Mark
<b>1(a)</b>	<ol style="list-style-type: none"> <li>1. suitable stain named ;</li> <li>2. acid treatment of root tip ;</li> <li>3. maceration / suitable description ;</li> <li>4. correct use of slide and coverslip ;</li> <li>5. idea that (darkly) stained chromosomes can be seen when cells observed through a microscope ;</li> <li>6. idea that stage of mitosis can be determined by observing the position of the chromosomes ;</li> </ol>	<p>NOT root <b>hair(s)</b>: penalise once only, then award subsequent marking points</p> <ol style="list-style-type: none"> <li>1. E.g Toluidine blue or Orcein <b>IGNORE</b> methylene blue (for animal cells)</li> <li>3. <b>E.g.</b> separate cells / make a thin layer <b>IGNORE</b> squashed</li> <li>4. <b>NOT</b> another slide on top</li> <li>5. <b>IGNORE</b> observation with naked eye</li> <li>6. <b>ACCEPT</b> a description of the position of chromosomes during a named stage</li> </ol>	<b>(5)</b>

Question Number	Answer	Additional guidance	Mark
<b>1(b)(i)</b>	<ol style="list-style-type: none"> <li>1. { age / size } of plant ;</li> <li>2. tissue taken from { tip of a growing root / same part of the plant / eq } ;</li> <li>3. { soil type / growth medium } of plants ;</li> <li>4. other named environmental condition for plant growth ;</li> </ol>	<p><b>Variables must relate to the plant or its tissue.</b> <b>IGNORE</b> refs to staining or observation procedure. <b>IGNORE</b> species / family of plant.</p> <p>Some context is expected: <b>IGNORE</b> eg. 'temperature' or 'pH' alone.</p>	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>1(b)(ii)</b>	<p>Mark with reference to the variable selected – even if different from part (i).</p> <ol style="list-style-type: none"> <li>reasonable suggestion as to the effects of the variable on mitosis, e.g. fewer cells in mitosis in an older plant / poor soil / drought / etc ;</li> <li>biological reason, e.g. lack of phosphate for DNA replication, lack of glucose due to limited photosynthesis, cells have become specialised so are no longer dividing, etc</li> </ol>	<p>These marks <b>can</b> be awarded even if the variable was not mark-worthy in part (i), eg. species of plant</p> <ol style="list-style-type: none"> <li>Suggestion must be directional.</li> <li>Credit any reasonable biological logic. <b>IGNORE</b> ref to chromosome number</li> </ol>	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>1(c)</b>	1. idea of finding the total number of cells visible ; 2. idea of calculating { % / proportion } at each stage ; 3. idea that the relative numbers of cells at each stage represents the relative duration of each stage ;	1. and 2. <b>ACCEPT</b> example of calculation, e.g. number of cells in prophase ÷ total number of cells (x 100 for percentage)	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>1(d)</b>	1. idea that { more chromosomes / larger quantity of DNA / eq } may take more time to condense ; 2. spindle may take more time to form because more spindle fibres are needed ; 3. idea that manoeuvring more chromosomes (towards the equator) may take more time ; 4. other logical suggestion as to why correct events of prophase might take more time with more chromosomes ;	1. <b>IGNORE replication</b> of DNA – does not occur in prophase 2. <b>IGNORE</b> ref to pairing or splitting of chromosomes 3. (This is sometimes called prometaphase, but candidates are not expected to distinguish between prophase and prometaphase.) 4. E.g more chromosomes take longer to attach to spindle fibres	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>2(a)</b>	1. there is no <u>significant correlation</u> ;  2. between brain mass and percentage decrease in time taken to {find food / navigate maze / eq} ;	2. <b>IGNORE</b> brain <b>size</b> / eq <b>ACCEPT</b> brain mass and ability to learn	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark																		
2(b)	<div>1. correctly calculated means ;</div> <div>2. table correctly filled using appropriate format of rows and columns, including data for brain mass and percentage decrease in time;</div> <div>3. clear headings including units for data presented ;</div>	<div>IGNORE raw data in table</div> <div>1. NOT with additional decimal places</div> <div>Example table: (Mammal column <b>not</b> essential)</div> <table><tr><th>mammal</th><th>brain mass / g</th><th>mean percentage decrease in time (to find food) (%)</th></tr><tr><td>cavy</td><td>3.8</td><td>12</td></tr><tr><td>hamster</td><td>0.9</td><td>30</td></tr><tr><td>gerbil</td><td>1.4</td><td>34</td></tr><tr><td>mouse</td><td>0.4</td><td>44</td></tr><tr><td>rat</td><td>2.1</td><td>50</td></tr></table> <div>3. NOT if units repeated in data cells. % symbol <b>not</b> required if 'percent(age)' written</div>	mammal	brain mass / g	mean percentage decrease in time (to find food) (%)	cavy	3.8	12	hamster	0.9	30	gerbil	1.4	34	mouse	0.4	44	rat	2.1	50	(3)
mammal	brain mass / g	mean percentage decrease in time (to find food) (%)																			
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Question Number	Answer	Additional guidance	Mark																		
2(c)	<p>A axes correct way round with linear scales, suitable labels and units ;</p> <p>P means plotted accurately as <b>scatter graph</b> ;</p> <p>B range bars included at each point and fit within the grid ;</p>	<p>A: must be large enough for all means to fit on the grid</p> <p>P: ALLOW ECF from means in 2(b) IGNORE joined points, line of best fit</p> <p>Correct data in plotting order, for reference:</p> <table><tr><th>brain mass</th><th>mean</th><th>range</th></tr><tr><td>0.4</td><td>44</td><td>35 - 51</td></tr><tr><td>0.9</td><td>30</td><td>23 - 37</td></tr><tr><td>1.4</td><td>34</td><td>27 - 42</td></tr><tr><td>2.1</td><td>50</td><td>37 - 61</td></tr><tr><td>3.8</td><td>12</td><td>7 - 18</td></tr></table>	brain mass	mean	range	0.4	44	35 - 51	0.9	30	23 - 37	1.4	34	27 - 42	2.1	50	37 - 61	3.8	12	7 - 18	(3)
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Question Number	Answer	Additional guidance	Mark
2(d)	<ol style="list-style-type: none"> <li>idea that graph shows {no / little} correlation ;</li> <li>0.805 identified ;</li> <li>the {calculated value / eq} is less than {0.805 / the value at {5% / 0.05 / 95% / 0.95} {confidence / significance} level} / eq ;</li> <li>the null hypothesis is {accepted / not rejected} ;</li> <li>there is <b>not</b> a <b>significant</b> correlation between brain mass and percentage decrease in time (to find food) ;</li> </ol>	<ol style="list-style-type: none"> <li><b>ACCEPT</b> graph may show a negative correlation</li> <li></li> <li>0.403 is lower than 0.805 = Mps 2 &amp; 3 NOT if incorrect value used</li> <li></li> <li><b>ACCEPT</b> no significant correlation between brain mass and ability to {learn / navigate through a maze / eq }</li> </ol>	(4)

Question Number	Answer	Additional guidance	Mark
2(e)	<ol style="list-style-type: none"> <li>idea that a <b>named</b> factor has not been taken into consideration in the sample ;</li> <li>idea that characteristics of different { mammals / species } affect speed of finding food ;</li> <li>idea that brain mass may be linked to overall body mass (which is not mentioned / not controlled) ;</li> <li>idea that actual brain mass of mammals not measured / mammals may not have typical brain mass ;</li> <li>small sample size / only three individuals of each type / eq ;</li> <li>idea that results from mammals cannot be extended to other animals ;</li> </ol>	<ol style="list-style-type: none"> <li>e.g. gender, age, size</li> <li>e.g. eyesight, sense of smell, normal habitat or foraging behaviour</li> <li>6. <b>IGNORE</b> ref to lab conditions not reflecting real life conditions <b>ACCEPT</b> only mammals tested</li> </ol>	<b>(3)</b>

Question Number	Answer	Additional guidance	Mark
3(a)	<ul style="list-style-type: none"><li>1. safety risk linked to { perforin / inhibitors / plant tissue } ;</li><li>2. safety risk linked to equipment ;</li><li>3. idea that there are no (significant) ethical issues ;</li></ul>	<ul style="list-style-type: none"><li>1. <b>ACCEPT</b> allergen, irritant, damage to human cell membranes</li><li>2. <b>ACCEPT</b> use of sharp blade when preparing plant tissue</li></ul>	(2)

Question Number	Answer	Additional guidance	Mark
3(b)	<ul style="list-style-type: none"><li>1. idea of practising proposed method to see if it will work ;</li><li>2. idea of finding appropriate { concentration / volume } of { perforin / inhibitor } ;</li><li>3. idea of finding appropriate { temperature / pH } for perforin activity ;</li><li>4. idea of determining appropriate { size / mass / volume } of tissue ;</li><li>5. idea of determining a named detail in the measurement of the dependent variable ;</li><li>6. idea of finding appropriate timescale for { perforin / inhibitor } to work ;</li></ul>	<ul style="list-style-type: none"><li>3. <b>IGNORE</b> finding conditions for inhibitor to work</li><li>5. <b>ACCEPT</b> appropriate wavelength setting for colorimeter</li></ul>	(3)

Question Number	Answer	Additional guidance	Mark
3(c)	<ol style="list-style-type: none"> <li>clear statement that the independent variable is the { presence of substances A-E / inhibitor used / eq } ;</li> <li>clear statement that the dependent variable is the { activity / eq } of perforin ;</li> <li>idea of preparing tissue before use (after cutting) ;</li> <li>correct experimental design: 5 separate tests involving substances A-E, perforin and tissue in a sensible order;</li> <li>use of control with perforin and tissue but no inhibitor ;</li> <li>idea of ensuring solution is well mixed (to disperse pigment) ;</li> <li>description of method of determining dependent variable ;</li> <li>identification of <b>two</b> relevant variables ;</li> <li>and 10. description of how two identified variables can be <b>controlled</b> ; ;</li> <li>clear reference to need for repeats (for each substance) ;</li> </ol>	<ol style="list-style-type: none"> <li><b>ACCEPT</b> { washing / soaking / rinsing / eq } tissue pieces</li> <li><b>NOT</b> perforin and tissue together before inhibitor added <b>NOT</b> with ethanol</li> <li><b>ACCEPT</b> shaking</li> <li><b>ACCEPT</b> e.g. use of colorimeter to obtain readings for { absorbance / transmittance }</li> </ol> <p>One mark for <b>2</b> variables</p> <p>One mark for <b>each</b> control method</p>	<p><b>(8)</b> <b>+2</b> <b>SPAG</b></p>

Level	Mark	Descriptor
<b>Level 1</b>	<b>0</b>	The account is very disorganised and is very difficult to follow. Scientific vocabulary is very limited with many spelling and grammatical errors.
<b>Level 2</b>	<b>1</b>	There is some disorganisation in the account which is not always in the correct sequence. Some relevant scientific vocabulary is used. The account is not always in continuous prose and there are grammatical errors and some important spelling mistakes.
<b>Level 3</b>	<b>2</b>	The account is well organised with no undue repetition and a correct sequence. There is good use of scientific vocabulary in the context of the investigation described. The account is written in continuous prose which is grammatically sound with no major spelling errors.

Question Number	Answer	Additional guidance	Mark
<b>3(d)</b>	1. clear table for raw data with headings and units ; 2. means calculated from repeat data ; 3. suitable bar chart sketched or described with correct axis labels ; 4. appropriate statistical test e.g. t-test or Mann-Whitney U test <b>used to compare inhibitor with control</b> ;	1. <b>ACCEPT</b> "intensity of colour / au" 2. <b>evidence</b> of at least 1 repeat needed 3. <b>ACCEPT</b> use of 1/transmittance on y axis <b>ACCEPT</b> appropriate plotting of the data in the <b>candidate's table, as an ECF.</b> 4. <b>Do not</b> award the mark unless it is clear that the test is used to compare relevant results.	<b>(4)</b>

Question Number	Answer	Additional guidance	Mark
3(e)	<p>1. idea that it is difficult to control (all) variables affecting { colour of the solution / activity of perforin / permeability of the membrane } ;</p> <p>2. idea of variation in tissue used, e.g. variation in tissue { pigment content / membrane composition / precise piece size / eq } ;</p> <p>3. idea of { membrane damage / escape of pigment } not due to perforin, e.g. damage to cells when cutting tissue pieces;</p> <p>4. reference to difficulty of measuring dependent variable, e.g. absorbance by cuvette, uneven distribution of pigment ;</p> <p>5. idea that only one type of perforin tested / perforins from different species may not be inhibited in the same way ;</p>	<p>2. <b>IGNORE</b> variables that could easily have been controlled eg. age, species</p> <p>4. <b>ACCEPT</b> idea of subjectivity if judging colour by eye</p> <p>5. <b>IGNORE</b> only tested on one tissue / ref to difference between membranes in different tissues</p>	<b>(3)</b>