



2009 Biology

Advanced Higher – Investigation Report

Finalised Marking Instructions

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Category	Marks	Notes
<p>1 Presentation (3 marks)</p> <p>The Report has a logical structure appropriate to the Investigation and must include:</p> <p>(a) (i) an appropriate and informative title</p> <p>(ii) a contents page</p> <p>(iii) a brief summary stating the overall aim(s) and finding(s) of the Investigation</p> <p>(b) (i) references are cited in text with entries made in a standard way</p> <p>(ii) acknowledgements where appropriate.</p> <p>(c) The Report is clear and concise.</p>	<p>1</p> <p>1</p> <p>1</p>	<p>No half-marks</p> <p>eg not “Pollution and plants”; “Effect of garlic on lipase” is OK.</p> <p>Contents page is essential and there must be page numbers <i>listed here and present throughout the report</i>. Do not penalise occasional missing page numbers – eg on hand-drawn graphs.</p> <p>Summary must be clearly indicated <i>and must be separate from the Introduction</i>. Aims <u>and</u> findings must be present (even if not high quality).</p> <p>Minimum of three sources – texts, journals or websites. The last should indicate the date the site was visited and, where no author is available, the whole reference may be cited in the text. Strict marking for minimum three references/sources given in standard form. See Advanced Higher Biology Investigation Guidance for standard forms. Do not penalise if not alphabetical.</p> <p>Do not award if three different references are not cited in text in the format specified. <i>Acknowledgements/citations following lifted images will not count as references.</i></p> <p>Assistance given by external agencies, eg consultation with university/research staff or access to facilities should be acknowledged.</p> <p>The Report <i>structure</i> should be easy to follow and must include an introduction, procedures, results and discussion.</p> <p>Word limit of up to 2500 is for guidance only. Penalise excessive length only if repetitive/irrelevant.</p>

Category	Marks	Notes
<p>3 Procedures (6 marks)</p> <p>(a) The procedures are appropriate to the aim(s) of the Investigation.</p> <p>(b) The procedures are clearly described and in sufficient detail to allow the Investigation to be repeated.</p> <p>(c) The procedures are at an appropriate level of demand for Advanced Higher Biology in relation to:</p> <p>(i) controls and control of variables</p> <p>(ii) replicates and sample size</p> <p>(iii) complexity and accuracy</p> <ul style="list-style-type: none"> ● complexity of methods/inputs/outputs ● creativity and originality ● accuracy/modifications of protocols to improve accuracy or reliability 	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>2</p>	<p><i>In broad terms</i>, do the procedures allow the aims to be achieved?</p> <p>Omission of a small number of <u>minor</u> details should not be penalised. Safety issues should only be considered if they have a bearing on validity/reliability etc. Bulleted/numbered points only acceptable if statements are meaningful and coherent.</p> <p>Appropriate controls should be employed and relevant variables kept constant.</p> <p>Award replication mark if procedure/results indicate that at least two independent sets of results were produced.</p> <p>Has the candidate used a complex protocol or difficult techniques for this level of work? Has the candidate generated a novel way of using a simple procedure, or extended it? Credit can be given here for the development of appropriate methods that nevertheless turned out to be fruitless. Procedures/apparatus used need to be able to deliver an appropriate level of accuracy to test the aims.</p> <p>Do not give credit for simply <i>identifying procedures as inaccurate</i> or inadequate; modifications should have been considered.</p> <p>Similar or repetitive protocols by several candidates from a single centre will incur a penalty for lack of originality.</p>

Category	Marks	Notes
<p>4 Results (5 marks)</p> <p>(a) (i) The results are relevant to the aims of the Investigation.</p> <p>(ii) Readings (raw data) are recorded and are within the limits of accuracy of measurement.</p> <p>(b) Raw and processed results are presented in a clear and concise manner with appropriate use of tables, graphs, diagrams and calculations.</p> <p>(c) A statement of results from tables and/or graphs is included.</p> <p>(d) In descriptive components of the work, observations are detailed, suitably recorded and, where appropriate, quantitative.</p>	<p>1</p> <p>1</p> <p>2</p> <p>1</p>	<p>Extensive raw data may be recorded in an appendix. Penalise if no raw data are presented to enable checking of processed results.</p> <p>Penalise average results with an excessive number of decimal places or a claimed degree of accuracy greater than that of the raw data.</p> <p>Are tabulation and graphical presentation appropriate? Consider:</p> <p>(i) if the graphs and tables chosen are appropriate for linking the data and the aims</p> <p>(ii) if the quality of presentation is adequate, including headings/units/scales/labels/clarity. Computer generated graphs should be appropriate to the aims and <u>have suitable scales</u>.</p> <p>Data presented should summarise the overall results. Where raw data are presented in an appendix, any graph of processed data should be <u>supported by an appropriate table</u> in the body of the report. Do not penalise trivial errors in large amounts of data.</p> <p>Descriptions are given of trends and patterns in results tables or graphs.</p> <p>Description may be credited even if in different section; eg discussion/conclusions. This is the only permitted opportunity for transferability.</p> <p>Award up to three marks as an alternative to (b) and (c) in qualitative-type investigations.</p>

Category	Marks	Notes
<p>5 Discussion (7 marks)</p> <p>(a) (i) The overall conclusions relate to the aim(s) of the Investigation.</p> <p>(ii) The overall conclusions are valid for the results obtained.</p> <p>(b) The evaluation of the procedures addresses such points as:</p> <ul style="list-style-type: none"> • accuracy of measurement • adequate replication • adequate sampling • adequate controls • sources of error in relation to measurements • the ways in which problems encountered in the Investigation were dealt with • the ways in which procedures have been modified to improve the Investigation. <p>(c) The evaluation of the results addresses such points as:</p> <ul style="list-style-type: none"> • analysis and interpretation of the results • account taken of the errors described (replicates) • consideration of the effect of error on the outcome (replicates) • suggestions for further work • significance of the findings discussed in a critical and scientific manner • appropriate depth of biological knowledge and understanding demonstrated. 	<p>1</p> <p>1</p> <p>2</p> <p>2</p> <p>1</p>	<p>Comments/inferences on perceived trends in mean results would be appropriate here. If 4 (c) has already been awarded, additional credit cannot be gained here by repetition; the candidate's comments/inferences should relate to the aims or address the work as a whole.</p> <p>If an essential variable has not been controlled then conclusions will not be valid. This mark is not awarded where candidates fail to appreciate the significance of an uncontrolled variable or where variation in replicate results clearly casts doubt.</p> <p>The inclusion of replicates and controls is a pre-requisite at the planning stage in the Lab notebook/Daybook so the absence of these in Procedures is a major omission. Candidates cannot achieve marks here simply by noticing that replicates or controls were omitted and by going on to discuss their use as examples of improvements.</p> <p>Award two marks for evaluations that consider the aspects of experiment design that have most bearing on validity of conclusions. It is appropriate to emphasise positive aspects of the Investigation design as well as negative ones.</p> <p>Award only one mark if a major aspect of the procedures that compromises validity has not been considered, eg the inadequacy of replicates, controls, sample size.</p> <p>Work lacking complexity/demand is unlikely to score in this section where treatments do not offer much scope for meaningful evaluation.</p> <p>Discussion here is expected to be critical/analytical. Variation in results obtained from replicates and the degree of accuracy of results should be discussed. Candidates need to show awareness of the role of replicates in judging the reliability of mean values and apparent trends. Credit can be given for attempts to carry out statistical evaluation.</p> <p>In discussing the Investigation outcomes, candidates should make effective use of their biological knowledge, drawing particularly on the background they presented in the Introduction section. Credit should be given for discussion which attempts a critical evaluation of the Investigation as a whole.</p>

[END OF MARKING INSTRUCTIONS]