SCOTTISH QUALIFICATIONS AUTHORITY

2006 Biology

Advanced Higher – Investigation Report

Finalised Marking Instructions

Category	Marks	Notes
1 Presentation (3 marks)		**No half-marks**
The Report has a logical structure appropriate to the Investigation and must include:		
(a) (i) an appropriate and informative title	1	e.g. **not** "Pollution and plants"; " Effect of garlic on lipase" is OK.
(ii) a contents page		Contents page is essential and there must be page numbers **here and throughout the report**. Do not penalise occasional missing page numbers – eg on hand-drawn graphs.
(iii) a brief summary stating the overall aim(s) and finding(s) of the Investigation.		Summary must be clearly indicated <u>under a separate heading</u> and **not** be part of the Introduction. Aims <u>and</u> findings must be present (even if not high quality).
(b) (i) references are cited in text with entries made in a standard way	1	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 AHB Investigation Guidance for standard forms. Do not penalise if not alphabetical. Do not award if three different references are not cited in text in the format specified.
(ii) acknowledgements where appropriate.		Assistance given by external agencies, eg consultation with University/research staff or access to facilities should be acknowledged.
(c) The Report is clear and concise.	1	The Report structure should be easy to follow and must include an introduction, procedures, results and discussion. Word limit of up to 2500 is for guidance only. Penalise excessive length only if repetitive/irrelevant.

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2 Introduction (4 marks) This section must include:		
(a) a clear statement of the aim(s) of the Investigation <u>together with</u> relevant hypotheses or questions.	1	Aims and hypotheses/questions must be explicitly stated.
(b) an account of the underlying biology in which terms are used accurately and ideas are clearly explained.	3	The candidate should provide enough information in this section to allow an appropriate level of analysis, interpretation or discussion of results. There are three elements to judge: (i) biological terms/ideas are explained clearly and accurately. (ii) the background theory must be relevant; ie the information must clearly link to the aims. (iii) the biological importance is justified. The candidate must address issues that explain why the study is worth doing. Copying of lengthy sections of original text should not be rewarded.

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3 Procedures (6 marks)		
(a) The procedures are appropriate to the aim(s) of the Investigation.	1	*In broad terms* do the procedures allow the aims to be achieved?
(b) The procedures are clearly described and in sufficient detail to allow the Investigation to be repeated.	1	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.
(c) The procedures are at an appropriate level of demand for Advanced Higher Biology in relation to:		
(i) controls and control of variables	1	Appropriate controls should be employed and relevant variables kept constant
(ii) replicates and sample size	1	Award replication mark if procedure/results indicate that at least duplicates were produced.
(iii) complexity and accuracy ▪ complexity of methods/inputs/outputs ▪ creativity and originality ▪ accuracy ▪ modifications of protocols to improve accuracy or reliability	2	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. Do not give credit for simply identifying that procedures were inaccurate or inadequate; modifications should have been considered. Similar or repetitive protocols by several candidates from a single centre will incur a penalty for lack of originality.

Category	Marks	Notes
4 Results (5 marks)		
(a) (i) The results are relevant to the aims of the investigation.	1	
(ii) Readings (raw data) are recorded and are within the limits of accuracy of measurement.	1	Extensive raw data may be recorded in an appendix. Penalise if no raw data are presented to enable checking of processed results. Penalise average results with an excessive number of decimal places or a claimed degree of accuracy greater than that of the raw data.
(b) Raw and processed results are presented in a clear and concise manner with appropriate use of tables, graphs, diagrams and calculations.	2	Are tabulation and graphical presentation appropriate: consider (i) if the graphs and tables chosen are appropriate for linking the data and the Aims (ii) if the quality of presentation is adequate, including headings/units/scales/labels/clarity. Computer generated graphs should be appropriate to the aims and have suitable scales. Data presented should summarise the overall results. Where raw data are presented in an appendix, any graph of processed data should be supported by an appropriate table in the body of the report.
(c) A statement of results from tables and/or graphs is included.	1	Descriptions are given of trends and patterns in results tables or graphs. Description may be credited even if in different section; eg discussion/conclusions.
(d) In descriptive components of the work, observations are detailed, suitably recorded and, where appropriate, quantitative.		Award up to three marks as an alternative to (b) and (c) in qualitative-type investigations.

Category	Marks	Notes
5 Discussion (7 marks)		
(a) (i) The overall conclusions relate to the aim(s) of the Investigation.	1	If 4 (c) has already been awarded, additional credit cannot be gained here by repetition. Comments/inferences on perceived trends in mean results would be appropriate here. The candidate's comments/inferences should relate to the aims or address the work as a whole.
(ii) The overall conclusions are valid for the results obtained.	1	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.
(b) The evaluation of the **procedures** addresses such points as: • 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.	2	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. 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. 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.
(c) The evaluation of the **results** addresses such points as: ▪ analysis and interpretation of the results ▪ account taken of the errors described ▪ consideration of the effect of error on the outcome	2	Work lacking complexity/demand is unlikely to score in this section where treatments do not offer much scope for meaningful evaluation. 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. Where candidates have used statistical tests, they should get credit if they show insight into the role of the test used.
▪ suggestions for further work		No penalty if missing. To gain credit, the suggestions should be coherent, arise out of the study and be of an appropriate level of demand; not, for example, "do more samples, test more varieties ..."
▪ significance of the findings discussed in a critical and scientific manner ▪ appropriate depth of biological knowledge and understanding demonstrated	1	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**.

[END OF MARKING INSTRUCTIONS]