



Advanced Higher Biology Teacher/Lecturer Investigation Guidance (for use from session 2008-2009)

General Information

The investigation seeks to develop the candidate's investigative skills and to provide opportunities for self-motivation, independent learning and the planning and designing of appropriate experiments. It also provides the candidate with an opportunity to write in a scientific manner. The report produced should show the significance of the findings of the investigation through critical and scientific analysis of the results, demonstrating knowledge and understanding of the biological basis of the investigation.

The investigation is assessed internally through the Unit assessment and externally through the Course assessment.

The length of the investigation Unit is 20 hours; this includes the planning stage of the investigation and the experimental work. After completion of the Unit, the report for the Course assessment is likely to take a further 5-10 hours.

Choice of an investigation topic

A number of points to consider:

- (a) Topics for investigation do not require prior approval by the Scottish Qualifications Authority.
- (b) The investigation must consist of a biology topic commensurate with the demands of Advanced Higher Biology. Candidates must not submit the same investigation for more than one of Advanced Higher Biology, Advanced Higher Chemistry and Advanced Higher Physics.
- (c) Group work and joint investigations are not permitted.
- (d) While the topic for investigation may be outwith the biology covered in the other Units of the Advanced Higher Biology Course, care must be taken to ensure that the investigation is not purely a technical exercise in, for example, statistics or computing.
- (e) The investigation must involve planning, collection and analysis of information through experimental work carried out by the candidate.
- (f) While not wishing to stifle enthusiasm, the teacher/lecturer must sound a note of realism and discourage candidates from embarking on over-ambitious plans. Focused investigations completed in the time available are likely to be the most successful. Candidates with well-controlled investigations employing a limited number of input variables are likely to score higher marks than those with over-complex investigations from which valid conclusions cannot be drawn.

- (g) Time constraints, laboratory facilities, availability of equipment and costs are all factors that need to be considered when candidates choose investigation topics.
- (h) In consultation with the teacher/lecturer, candidates should try to select topics that genuinely interest them.

The teacher/lecturer should encourage candidates to consult a wide variety of up to date sources in selecting topics for investigation. The sources could include:

- ◆ textbooks of a suitable level of demand
 - ◆ journals and periodicals, eg School Science Review, New Scientist, Scientific American
 - ◆ medical or government reports
 - ◆ newspapers
 - ◆ internet websites
- (i) Teachers/lecturers must ensure that the investigation is the candidate's own work and that any help received is acknowledged and is not excessive. Each candidate must sign the flyleaf accompanying the investigation report as a declaration that the report and the data in it have been produced by the candidate.
- (j) Teachers/lecturers should encourage the candidate to be creative and innovative; the investigation does not require to be a piece of original research but should be new to the candidate.

It is likely that the supervising teacher/lecturer will want to ensure an early focus on choosing a topic and give clear direction as to the suitability of the topic chosen. While candidates will be involved in initial reading and research, it is important that this aspect of the investigation does not absorb too much time. Early discussion with candidates is essential to establish feasible timescales and deadlines. A timetable such as the one below may be a useful way to ensure that all stages of the investigation are well-managed.

<i>Phase</i>	<i>Tasks</i>	<i>Deadline</i>	<i>Completed</i>
Planning	Selection of investigation topic that interests candidate. Discussion of ideas involved.		
	Research of biological background to chosen topic (books, journals, websites, etc).		
	Develop outline plan for the investigation.		
	Record aims, hypotheses and questions.		
	Outline experimental methods and procedures.		
Collecting data	Complete the experimental work in the time allocated. Allow time for replication.		
Producing report	Hand in first draft		
	Hand in final draft		

Unit Assessment

The investigation Unit has two Outcomes and all Performance Criteria must be met to pass the Unit assessment.

Outcome 1: Develop a plan for an investigation.

- PC (a) A record is maintained in a regular manner.
- PC (b) The aims of the investigation are clearly stated.
- PC (c) Hypotheses or questions relevant to the aims of the investigation are formulated.
- PC (d) Experimental, observational and sampling procedures, techniques and apparatus devised are appropriate for the investigation.
- PC (e) The need for controls and replicate treatments or survey samples is considered.
- PC (f) Relevant problems associated with the use of living materials or natural habitats are considered.

Outcome 2: Collect and analyse information obtained from the investigation.

- PC (a) The collection of experimental information is carried out with due accuracy.
- PC (b) Relevant measurements and observations are recorded in an appropriate format.
- PC (b) Recorded experimental information is analysed and presented in an appropriate format.

Evidence for Outcomes 1 and 2 requires the candidate to submit a laboratory record of the planning stage and the collection and analysis of the information obtained from the investigation.

For both Outcomes it is appropriate to support candidates continuously in meeting the Performance Criteria. Such support is to be encouraged as part of the ongoing learning and teaching process.

Centres must retain evidence that the Performance Criteria have been achieved. The laboratory record is the main source of evidence and should be dated and signed by staff to indicate where Performance Criteria have been met.

The laboratory record should be brought to every laboratory session and should contain a complete record of the work undertaken.

The laboratory record must include:

- ◆ discussions with teachers and other scientists
- ◆ background research
- ◆ references
- ◆ details of procedures
- ◆ results presented in appropriate forms, eg tables, graphs
- ◆ analysis of results
- ◆ conclusions/findings
- ◆ next steps
- ◆ modifications

Centres may be selected for verification of the 'Biology Investigation' Unit and would be required to make available the candidates' laboratory records to SQA. Centres should therefore retain the laboratory record for this purpose.

Centres must not send in the candidates' laboratory records to SQA with the investigation reports.

Course Assessment

For the Course assessment each candidate is required to write and submit a final investigation report.

A total of 25 marks, representing 20% of the total marks for the Course, are awarded for the investigation report. The report is entirely externally marked; no marks are awarded by the centre for Course assessment.

The investigation report will be marked using the following categories:

- 1 Presentation (3 marks)
- 2 Introduction (4 marks)
- 3 Procedures (6 marks)
- 4 Results (5 marks)
- 5 Discussion (7 marks)

The centre will be supplied with a flyleaf and a clear-faced bag for the submission of each candidate's report. The use of ring binders or other bulky folders must be avoided to ensure the report fits into the supplied stationery.

The deadline for submission of the investigation report in Advanced Higher Biology is likely to be late April. SQA Co-ordinators should be able to provide exact dates.

Producing the investigation report

The investigation report submitted to SQA must have a logical structure and must be clear, concise and easy to read.

The report should be around 2,000-2,500 words in length excluding the title page, contents page, tables, graphs, diagrams, calculations, references, acknowledgements and any appendices. It should be written in the past tense and the impersonal voice should be used.

The report must include the following sections:

- ◆ title page
- ◆ contents page
- ◆ abstract/summary
- ◆ introduction
- ◆ procedures
- ◆ results
- ◆ discussion
- ◆ list of references

Detailed advice on the contents of the investigation report is given in *Advanced Higher Biology Guidance for Candidates (2008)*. Information on the assessment criteria for each of the above assessment categories, together with the subdivision of marks available within these categories, is provided overleaf.

Advanced Higher Biology Investigation — summary of assessment scheme and mark allocation for the Course report

Assessment category and criteria	Mark	Check
<p>Presentation</p> <ul style="list-style-type: none"> ◆ appropriate and informative title ◆ contents page and page numbers ◆ brief summary/abstract stating aims and findings ◆ references cited in text and listed in standard form ◆ report is clear and concise (2,000 – 2,500 words) 	<p style="text-align: center;">1 1 1</p>	
<p>Introduction</p> <ul style="list-style-type: none"> ◆ clear statement of aims together with hypotheses/questions ◆ account of underlying biology relevant to aims ◆ biological terms/ideas are clear and at an appropriate depth ◆ biological importance is explained/justified 	<p style="text-align: center;">1 3</p>	
<p>Procedures</p> <ul style="list-style-type: none"> ◆ appropriate to aims ◆ clear description with enough detail to allow repetition ◆ include appropriate controls and adequate control of variables ◆ adequate replicates and sample size ◆ appropriate complexity of methods/inputs/outputs ◆ creativity and originality ◆ appropriate accuracy or modifications to improve accuracy 	<p style="text-align: center;">1 1 1 1 2</p>	
<p>Results</p> <ul style="list-style-type: none"> ◆ relevant to aims ◆ data recorded within limits of accuracy of measurement ◆ data presented summarise overall results ◆ adequate quality, including headings/units/scales/labels/clarity ◆ brief description of trends and patterns in tables or graphs 	<p style="text-align: center;">1 1 1 1 1</p>	
<p>Discussion</p> <ul style="list-style-type: none"> ◆ conclusions relate to aims ◆ conclusions are valid for results obtained <p>evaluation of procedures includes comment as appropriate on:</p> <ul style="list-style-type: none"> ◆ accuracy/sources of error in measurement ◆ adequacy of replication/sampling ◆ adequacy of controls ◆ solutions to problems and modifications to procedures <p>evaluation of results includes as appropriate:</p> <ul style="list-style-type: none"> ◆ analysis and interpretation of results ◆ account taken of error/variation in replicates ◆ meaningful suggestions for further work ◆ critical and scientific discussion of significance of findings ◆ appropriate depth of biological knowledge and understanding 	<p style="text-align: center;">1 1 2 3</p>	
Total marks	(25)	

Relevant documentation

The following documents are available from SQA:

Biology Advanced Higher Arrangements (2006) 6th edition. (SQA website)

Guidance on approaches to assessment of the investigation Unit is provided in the support notes in the Unit Specification (pp 82/3).

Biology Investigation D034 13/NAB001 (August 2002) (SQA secure website)

The instrument of assessment and guide to recording of evidence. Advice to candidates.

Advanced Higher Biology Candidate Investigation Guidance (2008) (SQA website)

This should be issued to all candidates. It contains advice regarding the conduct and timing of all stages of the investigation. It also contains support and detailed guidance relating to the contents of the investigation report.

Senior Verifier's reports for Advanced Higher Biology Investigation (SQA website)

These reports contain clear and consistent messages over several years concerning the role of the laboratory record (daybook) as the major source of evidence that Unit Performance Criteria have been achieved.

Principal Assessor's reports for Advanced Higher Biology (SQA website)

These reports highlight common deficiencies in candidates' submissions. Reports for 2004 and 2005 have an appendix with detailed advice that should allow, if followed, a high level of candidate attainment in the investigation.

Suggestions for Investigation (2005) (SQA secure website)

Support and advice regarding the selection and early planning of investigations.

Exemplification of Standards for Investigations (2004) (SQA - secure website)

This pack provides exemplification of the standards required for grades A and C in the Investigation Report.

Investigation Report Marking Scheme (2008) (SQA website)

Another opportunity to see how marks are won (and lost) in the investigation.