Course Report 2017

Subject	Biology
Level	Advanced Higher

The statistics used in this report have been compiled before the completion of any Post Results Services.

This report provides information on the performance of candidates which it is hoped will be useful to teachers, lecturers and assessors in their preparation of candidates for future assessment. It is intended to be constructive and informative and to promote better understanding. It would be helpful to read this report in conjunction with the published assessment documents and marking instructions.

Section 1: Comments on the Assessment

Summary of the course assessment

Component 1 — question paper

Whilst most candidates demonstrated ability at Advanced Higher level, markers commented on the wide range of marks achieved. A number of candidates performed very well, demonstrating sound knowledge across the curriculum as well as the ability to apply this knowledge at the right depth in novel contexts.

There were, however, some candidates who seemed to have a poor grasp of many areas of the curriculum. It seemed that in some cases candidates were not well enough prepared across the whole course to deal with the scale of the assessment. Although most candidates attempted all of the questions, there was a small number who attempted very little of the question paper. Markers frequently commented that candidates did very well in questions that required them to describe trends or give terms or definitions, but had much more difficulty with the more challenging questions which required them to apply knowledge and show greater understanding or reasoning.

Some markers commented that the literacy skills of some candidates impacted on their performance — candidates sometimes struggled to express themselves clearly and concisely. Failure to read questions thoroughly also appeared to be an issue in some instances. For example, in Question 8, some candidates responded without any mention of parasites and their hosts, despite the clear reference to parasites in the question. The legibility of handwriting remains an issue.

The assessment was designed to have the appropriate balance of demonstrating knowledge, applying knowledge and skills questions. All questions were answered correctly by some candidates, so all were accessible. Overall this component proved more challenging than predicted and this was taken into account when setting grade boundaries.

Component 2 — project

For the 2017 diet, there were two changes to the marking instructions for the project: a three-mark penalty for exceeding the specified maximum word count; and a change to the criteria for referencing. The word count penalty was applied to a very small proportion of candidates, indicating this information was successfully conveyed to, and followed by, the vast majority of candidates. Whilst most candidates seemed aware of the requirement to use either the Harvard or the Vancouver system of referencing, the quality of referencing was disappointingly poor (this is discussed in more detail later in this report).

Markers reported that a wide variety of topics had been investigated, with many candidates demonstrating considerable originality and creativity in the planning and execution of their investigation. Many made good use of pilot studies to refine or confirm procedures. The

range of marks achieved was very wide, with some candidates performing extremely well and producing reports that demonstrated they had a very good understanding of the investigative process that this component is designed to assess. Markers noted that candidates were able to score well without projects being overly complicated.

However, it is a concern that there were some very poorly-performing candidates who appeared to have had little engagement with either laboratory work or the completion of their report. Very few candidates submitted reports with an inappropriate structure and, although the vast majority appeared to be well-prepared and provided with the most up to date instructions for candidates, some markers noted concern that this did not appear to always be the case. It remains disappointing that, despite the support of the *Investigative Biology* unit, the marks gained in this component have not improved. It is hoped that, as centres continue to become more familiar with the criteria, attainment in this component will be raised.

Section 2: Comments on candidate performance

Areas in which candidates performed well

Component 1 — question paper

Section 1

Although the average mark for Section 1 was lower than in 2016, candidates still performed well in this section of the question paper. Questions 2, 14 and 20, assessing the application of knowledge, were done particularly well by candidates. More than three-quarters of candidates correctly answered Questions 4, 8, 11, 12 and 21, which required them to demonstrate knowledge. Questions 10 and 25, which assessed problem-solving skills, were also done particularly well.

Section 2

Question 1 (a):	Over half of candidates correctly described the trend using the labels from the axis from the bar graph.
Question 2 (a)(i):	A large proportion of candidates were able to name the protein opsin.
Question 3 (a)(i):	Many candidates were aware hydrophobic signalling molecules passed across the cell membrane.
Question 4 (a)(i); (ii):	Most candidates named kinase and phosphatase enzymes.
Question 5 (a):	A good number of candidates gave appropriate reasons for counting latrines as a sampling method.
Question 5 (b):	Many candidates recognised the type of sampling being used was systematic.

Question 6 (b):	A good number of candidates were able to describe the effect of temperature on the sex ratio of reptile species.
Question 6 (c)(iii):	A large majority of candidates were able to carry out this genetic cross.
Question 7 (a):	Most candidates were able to give the term ethogram.
Question 7 (d):	Most candidates suggested a suitable improvement such as the use of camera traps.
Question 8:	This question was generally answered well, with some candidates demonstrating an excellent understanding of the Red Queen hypothesis. Points 4, 7, and 8 were scored particularly frequently.
Question 9 (d):	Many candidates were able to suggest a way in which males might demonstrate greater reproductive investment.
Question 10 (a); (e):	A large proportion of candidates were able to provide these definitions.
Question 10 (c):	A large proportion of candidates correctly described the correlation between vaccine uptake and measles cases.
Question 10 (d)(iii):	A good number of candidates identified how the events in Swansea confirmed causation.
Question 11A (i):	The average score for this part of the extended response was high, reflecting the fact candidates answering this option showed good knowledge of the role of amino acid R-groups in determining tertiary structure.
Question 11B (i):	Many candidates gave good descriptions of the role of the phospholipid bilayer as a selective barrier.

Component 2 — project

Markers reported that the majority of candidates had clearly invested appropriate time and effort in this component of the course.

1. Abstract

Most candidates provided an abstract under a separate heading as required. Appropriate aims and findings were given in the majority of cases. Where candidates failed to score this mark, it was often because aims and/or findings were too vague — for example the independent and/or dependent variable lacked appropriate directionality. A small number of candidates gave findings in the abstract that were inconsistent with what was described later in the report. A significant number of candidates continue to include hypotheses and/or tables of results in the abstract, which is not necessary.

2. Introduction

Most candidates included aims and hypotheses in the introduction, and most were appropriate. Although the quality was variable, the vast majority of candidates attempted to give an account of underlying biology.

3. Procedures

A very high proportion of candidates used procedures that were appropriate to their aims. Good descriptions of the procedures used were common, with the majority of candidates scoring at least one mark for this aspect. Very few candidates failed to describe procedures in the past tense and impersonal voice. Most candidates described the controls used, and the number of candidates including suitable justification in investigations where no control was appropriate increased.

Although some candidates failed to achieve some marks because they had inadequate descriptions, most were aware of the need to consider the adequacy of repeats and replication, with most achieving the mark for having an appropriate sample size. A number of candidates made reference to pilot studies that had an important bearing on the final design of the investigation. Most candidates scored at least one mark for carrying out work that demonstrated a suitable level of complexity and accuracy.

4. Results

Some candidates scored very well in this section. The vast majority presented results that were relevant to the aims of their investigation. Most presented all the raw data, with many opting to put large quantities of raw data into an appendix to improve the clarity of the results presentation. As in previous years, when this mark was not awarded, the inclusion of an inappropriate number of decimal places in average values (claiming a degree of accuracy not justified by the measurements) was often the problem.

A variety of appropriate presentation formats were used, with candidates making good use of graphs and charts. There seemed to be an improvement in the quality of computer-generated graphs, although candidates still need to be careful to ensure that scales etc are appropriate for the presentation of scientific data if they choose to create graphs in this way.

A good number of candidates gave statements of trends following each table/graph. Where statements were attempted, but no mark was awarded, it was usually because the descriptions were inferential rather than the simpler description of the trends required for this mark.

5. Discussion

This is the most demanding section of the report, and it was again the weakest. Even if they found other aspects of this section challenging, most candidates were able to draw conclusions that were relevant to the aims of their project. A significant number of candidates attempted statistical analysis, although only some exploited this analysis well in their evaluation of results.

6. Presentation

A large majority of candidates produced project reports that were appropriately structured and included a contents page and page numbers. The vast majority were within the word limit. The majority of titles were acceptable, with most indicating the dependent and independent variable as well as the organism/context being investigated.

Areas which candidates found demanding

Component 1 — question paper

Section 1

Slightly more than one third of candidates could identify positive and negative controls in Question 7. Many candidates calculated the index incorrectly in Question 16 because they used the number of organisms rather than the number of taxa as indicated in the formula.

Section 2

Across the whole of Section 2 marks were frequently lost because candidates did not relate the biology they should know to the contexts. Candidates also often struggled with the interpretation of previously-unseen data. There were many common errors of understanding, which are detailed below.

Question 1:	This proved challenging for many candidates who seemed to find interpretation of the data difficult.
Question 1(b):	Many candidates thought caspases are DNAases.
Question 1 (c)(i):	Although many candidates described the effect on apoptosis of adding caspase 9 inhibitor to the extract, most didn't realise the importance of ci8 having no effect.
Question 1 (c)(ii):	Only a small number of candidates referred to the decrease being relative to the control.
Question 1 (d)(i):	Markers expressed disappointment that fewer candidates than expected at this this level were able to calculate the percentage increase. Candidates often went wrong by expressing this as a percentage decrease, suggesting they had not read the question carefully enough.
Question 2 (a)(ii):	Some candidates simply described information from the graph with no attempt to explain the observation.
Question 2 (b):	Many candidates seemed to have a weak grasp of the syllabus here and made no reference to the high degree of amplification in rods.
Question 2 (c):	Although most candidates seemed to know the wavelength range was UV, a significant number missed a relatively straightforward mark by not reading the question carefully and trying to quote wavelengths.
Question 3 (a)(i):	Many candidates seemed unaware of the role of steroid hormone receptors in the control of transcription.

Question 3 (a)(ii):	Candidates frequently responded by more or less restating the question rather than attempting to suggest a way in which the different effects in different tissues might come about.
Question 3 (b):	Although this question was answered reasonably well, several candidates simply quoted values and made no reference to the magnitude of the rise in levels which the stem indicated was critical. A significant number gave either no units or incorrect units.
Question 4 (a)(iii):	Only a small number of candidates were able to reason that the system had to be able to respond again.
Question 4 (b)(i); (ii):	For both parts of this question candidates were getting confused with other techniques they had heard of. In part (i) some described isoelectric point, and in part (ii) they gave descriptions of affinity chromatography. A number of candidates did not seem to be aware that antibodies have to be labelled in some way to allow their subsequent detection.
Question 5 (c)(i); (ii); (d):	Many candidates did not seem to have a good understanding of the concepts of reliability and validity — responses to these questions were sometimes mixed up. In part (d) it was not uncommon for candidates to try to answer with no reference to the information provided.
Question 6:	This was highlighted by many markers as an area where candidates seemed to have struggled to move their understanding beyond what they had learned from lower levels. It was reported that parts (a) and (c) revealed significant variation in knowledge and understanding between more and less well prepared candidates.
Question 6 (a):	A significant number simply stated that males are XY whilst females are XX.
Question 6 (c)(i):	Many did not state the idea that males always express the alleles on their single X chromosome, and instead discussed the masking of recessive alleles by dominant alleles in females.
Question 6 (c)(ii):	Fewer candidates than expected appeared to be aware of the concept of X-chromosome inactivation and, of those that were, many were unaware of the effect this has on carrier females.
Question 7 (b):	Many candidates did not know what a time budget is and gave very vague, simplistic answers about drawing pie charts. Few appeared to notice the reference to ‘the data’ in the question, and it was therefore rare to see candidates refer to the start times mentioned in the stem.
Question 7 (c):	It was anticipated that this question would be challenging, with a number of candidates only managing to define anthropomorphism rather than explain why it should be avoided in behavioural studies.

Question 9 (a):	Many candidates failed to describe the role of the control in the trial. Some described the application of antibiotics but did not refer to the expected outcome (males being produced again) if the hypothesis was supported.
Question 9 (b):	A number of candidates thought horizontal gene transfer was the transfer of genetic information by asexual reproduction.
Question 9 (c):	The novelty of this context proved challenging for many candidates. The idea of sex-role-reversal was often missed with candidates describing the lekking swarms from the more familiar male perspective. The idea of females being in competition because of the low number of males was only grasped by a few.
Question 10 (b):	Most failed to score in this question either because they missed the regularity of the pattern shown in the graph or their language skills did not allow them to express the pattern clearly enough.
Question 10 (d)(i):	A number of candidates seemed unfamiliar with the term ‘peer reviewed’.
Question 10 (d)(iii):	Many candidates simply restated that the number of children being vaccinated had fallen rather than consider the consequences of this.
Question 11A(ii):	Performance in this part was weak with many candidates failing to show understanding of how the positioning of R-groups in proteins influences their location within cells. Some gave irrelevant information about levels of protein structure rather than addressing the question. This is an area of the syllabus where candidates seem to struggle to understand the concepts, and this confusion was apparent in their responses.
Question 11B(ii):	Many candidates gave responses that relied too heavily only on knowledge gained at lower levels. Some failed to access relatively straightforward points such as diffusion through channels. A number of candidates focused only or mainly on the sodium-potassium pump, thus limiting their potential to score in this part of the question.

Component 2 — project

2. Introduction

Markers reported that candidates’ efforts to describe the relevant background biology were disappointing — less than one third of candidates scored 3 or 4 marks for underlying biology. In particular, it seemed more common this year to see introductions containing large chunks of syllabus information which were presented in a disjointed way and not clearly linked to a project’s aims. Evidence that candidates had read appropriately, to support an account that focused on underlying biology directly relevant to a project’s aims, was often lacking.

Accounts of underlying biology often lacked sufficient breadth and depth to support an appropriate level of analysis and interpretation of results later in the report. In some instances, familiar processes, such as photosynthesis, were described at a very basic level, often with significant errors or omissions.

Although many candidates attempted a justification, some of these were not clearly linked to the specific aims of their project.

3. Procedures

Although most candidates gave coherent descriptions of the procedures used, less than one third scored full marks for 3(b) because some details were omitted. Although many candidates seemed familiar with the term ‘confounding variable’, only approximately one third adequately controlled the key variables that could impact on validity.

Fewer than half of candidates achieved the mark for evidence of independent replication. Some candidates included a statement that independent replication was carried out, but failed to give any information as to how this was achieved.

It appeared more common this year for candidates to describe large amounts of procedural information in appendices. Candidates need to be aware that essential information relating to procedures should be within the appropriate section of the report.

4. Results

Whilst most candidates did choose appropriate formats for presenting their data, a significant number used bar graphs to plot data when the independent variable was quantitative. Fewer than half achieved the mark awarded for the quality of presentation. The criteria for gaining this mark largely depend upon skills acquired and assessed at lower levels, and failure to score was usually the result of carelessness with table headings, scales and labels.

Again, approximately one third of candidates failed to summarise their data appropriately — often the result of failing to average overall results and/or not presenting graphs that summarise all replicate data.

5. Discussion

Less than one fifth of candidates gave conclusions that were valid. Common reasons for failure to achieve this mark were: conclusions not supported by data; issues with the control of confounding variables; the absence of appropriate controls; or inadequate replication or sample size. The evaluation of procedures and results continues to prove challenging for candidates, with almost half not scoring any marks for evaluation of procedures and/or evaluation of results.

As was the case last year, the evaluation of procedures was often a rather low-level discussion of possible instrument errors.

Many candidates focused exclusively on negative aspects of their investigation, with instances of contradicting information given in procedures that suggested procedures were

appropriate. Candidates should be aware that, where they have carefully planned and carried out an investigation to allow valid conclusions to be drawn, it is appropriate to highlight the positive aspects of their work in this section.

Candidates continue to identify flaws, such as a failure to control key confounding variables, which should be addressed at the planning stage of the investigation. Only a small number of candidates scored more than 1 mark for the evaluation of results. Markers suggested that an inability to access these marks may be due, at least in part, to candidates failing to have a good enough understanding of the concepts relating to their project to be able to comment meaningfully in this section.

Failure to relate findings to relevant biology (often a consequence of weak introductions) was very common. Few candidates managed to give an adequate discussion of the variation between repeat/replicate values, or any explanation of how this variation might have come about and how it impacts on the conclusions drawn. Although a large number of candidates used statistical analysis, some markers commented that candidates seemed unsure how to interpret this information or failed to discuss this in the evaluation.

6. Presentation

Some candidates put important information that should have been in the main body of the report into appendices.

Candidates sometimes referenced using a mixture of the Harvard and Vancouver systems. One referencing system should be selected and adhered to throughout the report. Those using Vancouver sometimes included only footnotes and thus failed to include the required listing of references at the end of the report.

Section 3: Advice for the preparation of future candidates

Component 1 — question paper

Many markers observed that, whilst the ability of most candidates to demonstrate knowledge by stating terms and giving definitions was generally good, many seemed less prepared to cope with more detailed descriptions or the application of knowledge in unfamiliar contexts. The latter are required by the Advanced Higher assessment, and candidates should be given opportunities to rehearse these and become familiar with the standard required at this level.

Markers also commented that candidates' performance in questions relating to the Investigative Biology unit again seemed less secure than the other two units. Centres and candidates need to be clear that mandatory knowledge from all three units will be assessed in the question paper. As well as the 2017 and 2016 papers, the Specimen Question Paper, and past papers for the discontinued Advanced Higher Biology Revised course, provide suitable practice for candidates to use as part of their preparation for the exam.

Candidates should be encouraged to read questions carefully, perhaps underlining key information to help ensure they are focusing on the question that is being asked. They should pay close attention to new information being given in question stems as the question progresses — it may be providing key information or setting up an idea slightly beyond what has already been provided.

Most candidates used the space available to show working, and this is to be encouraged as it makes it easier for them to check their work. Candidates should be reminded that units will usually be required in numerical answers.

Most candidates who needed to write outwith the support lines indicated clearly where the additional information could be found. This good practice should continue to be highlighted to candidates, as it makes it easy for markers to ensure all work is marked appropriately.

Candidates should be reminded that markers need to be able to read their work, and centres should provide appropriate support if they identify candidates who struggle to write legibly.

Component 2 — project

The purpose of the project component of the Advanced Higher Biology Course is to develop candidates' investigative skills and, as such, what is being assessed is their understanding of the investigative process. The wide variety of projects undertaken by candidates is welcome, and centres are encouraged to continue to provide these rich opportunities. Candidates should be encouraged to develop sound protocols with appropriate controls, procedures that allow key variables to be controlled, a reasonable sample size and independent replication.

Analysis of data generated from a well-planned and carefully-executed investigation will allow analysis of the data to show whether variability is due to error in lab practice, intrinsic variation in the biological samples studied, or the treatments that have been planned. Candidates need to be cautioned against trying to increase the complexity of their work by attempting to address a large number of aims, as the consequence of this is often that they end up with overwhelming amounts of data (often not well-connected) which they find difficult to present and interpret coherently. At the other extreme, some candidates carry out work that is so straightforward that the results generated offer little scope for discussion; this should also be avoided. The continued use of pilot studies to develop procedures, assess validity and refine techniques is to be encouraged.

Whilst most reports are appropriately structured, candidates need to be aware that essential information relating to the description of their procedures must be in the procedures section within the main body of their report — it is not acceptable to place this information in appendices. They should also be aware that large amounts of text placed inappropriately in tables will contribute to the overall word count. Descriptions of procedures should make clear the controls that were used, how confounding variables were controlled, the sample size used, and how independent replication was achieved.

Candidates should be reminded that when presenting their data in tables, graphs and charts, they should consider what they have learned from previous levels to ensure the quality of

presentation is adequate. They should also be reminded of the need to adequately summarise their data.

It is essential that candidates have access to the instructions to candidates provided in the coursework assessment task. This has been updated to provide some additional guidance to candidates, including exemplification of both Harvard and Vancouver referencing systems. Centres should ensure candidates are provided with the most recent guide. Other publications that could be used by candidates to support them with this component are the guides produced by the Scottish Schools Education Research Centre (SSERC): *Advanced Higher Biology Project Investigations* and *Statistics for School Biology Experiments and Advanced Higher Biology Projects*. These can be downloaded from the SSERC website.

Many candidates now include statistical analysis of their data. Candidates will benefit more from including statistics if they have an understanding of their use in assessing variance, and consider which statistical tests would be most appropriate for a given project at the planning stage.

There was a large increase in the number of markers reporting concerns regarding safety. These included, but were not limited to, candidates incubating micro-organisms (including potential pathogens) at 37°C, and the use of acids or toxic chemicals at unnecessarily high concentrations. Ethical concerns arising from the use of living organisms (including human volunteers) were also raised. The safety and well-being of those carrying out, or participating as volunteers in, Advanced Higher Biology investigations is paramount, and staff supervising projects need to be aware of the need to comply with all relevant safety and ethical regulations and codes of practice.

Grade Boundary and Statistical information:
(Completed by SQA)

Statistical information: update on Courses

Number of resulted entries in 2016	2362

Number of resulted entries in 2017	2252

Statistical information: Performance of candidates

Distribution of Course awards including grade boundaries

Distribution of Course awards	%	Cum. %	Number of candidates	Lowest mark
Maximum Mark -				
A	18.6%	18.6%	418	72
B	27.5%	46.1%	620	61
C	27.7%	73.8%	624	50
D	13.1%	86.9%	296	44
No award	13.1%	-	294	-

General commentary on grade boundaries

- While SQA aims to set examinations and create marking instructions which will allow a competent candidate to score a minimum of 50% of the available marks (the notional C boundary) and a well prepared, very competent candidate to score at least 70% of the available marks (the notional A boundary), it is very challenging to get the standard on target every year, in every subject at every level.

- Each year, SQA therefore holds a grade boundary meeting for each subject at each level where it brings together all the information available (statistical and judgemental). The Principal Assessor and SQA Qualifications Manager meet with the relevant SQA Business Manager and Statistician to discuss the evidence and make decisions. The meetings are chaired by members of the management team at SQA.

- The grade boundaries can be adjusted downwards if there is evidence that the exam is more challenging than usual, allowing the pass rate to be unaffected by this circumstance.

- The grade boundaries can be adjusted upwards if there is evidence that the exam is less challenging than usual, allowing the pass rate to be unaffected by this circumstance.

- Where standards are comparable to previous years, similar grade boundaries are maintained.

- An exam paper at a particular level in a subject in one year tends to have a marginally different set of grade boundaries from exam papers in that subject at that level in other years. This is because the particular questions, and the mix of questions, are different. This is also the case for exams set in centres. If SQA has already altered a boundary in a particular year in, say, Higher Chemistry, this does not mean that centres should necessarily alter boundaries in their prelim exam in Higher Chemistry. The two are not that closely related, as they do not contain identical questions.

- SQA's main aim is to be fair to candidates across all subjects and all levels and maintain comparable standards across the years, even as arrangements evolve and change.