Course Report 2018

Subject	Biology
Level	Advanced Higher

This report provides information on the performance of candidates. Teachers, lecturers and assessors may find it useful when preparing candidates for future assessment. The report 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.

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

Section 1: comments on the assessment

Summary of the course assessment

Component 1 — question paper

The question paper was designed to have an appropriate balance of demonstrating knowledge, applying knowledge, and skills questions. Candidates were able to access all questions. Markers commented that the level of demand fair.

Overall, the question paper proved more challenging than expected and this was taken into account when setting grade boundaries.

Most candidates coped well with section 1. Many demonstrated the ability to recall and apply knowledge, and use a variety of problem-solving skills when responding to multiple-choice questions.

Markers commented on the wide range of scores candidates achieved in section 2. A number of candidates demonstrated good knowledge across the course and the ability to apply this knowledge at the appropriate depth in unfamiliar contexts.

However, some candidates had a poor understanding of many areas of the course. In some cases, candidates were ill prepared to deal with the assessment. Some candidates had a reasonably good knowledge of the content from the *Cells and Proteins* unit and the *Organisms and Evolution* unit, but had much less knowledge of the theory covered in the *Investigative Biology* unit. Candidates did very well in questions that required them to describe trends or give terms or definitions, but had difficulty with the more challenging questions, which required them to apply knowledge and show a greater degree of understanding or reasoning.

Markers commented that some candidates had difficulty expressing themselves clearly and concisely, sometimes failing to achieve marks as a result. Some candidates' handwriting was illegible.

Component 2 — project

There were no changes to the marking of the project report this year. An updated instructions for candidate's document, which aimed to give more detailed guidance about aspects of this task, was published for use this session.

Performance in the project was slightly better than in previous years. The word count penalty, introduced in 2017, was applied to even fewer candidates in 2018. Candidates chose a wide variety of topics for their projects. Many candidates demonstrated considerable originality and creativity while planning and carrying out their investigations.

This year, candidates achieved high marks for their projects without them being overly complicated. Fewer candidates ran into difficulty by having multiple aims they found difficult to address. The range of marks was again very wide, with most scoring well in the procedures and results sections of the report. The discussion section, where it is more

difficult to achieve marks, remains challenging for many candidates. Some candidates appeared to have relatively little experience of laboratory work.

Section 2: comments on candidate performance

Areas in which candidates performed well

Component 1 — question paper

Section 1

Candidates performed well in section 1 of the question paper. The average mark for section 1 was slightly higher than in 2017. Candidates answered questions 1, 2, 3, and 20, which assessed knowledge and understanding, particularly well. They also answered questions 13, 15, and 19, which assessed problem-solving skills, particularly well.

Section 2

Candidates performed well in the following questions:

Question 1(d)	Many candidates demonstrated knowledge about loss of insulin receptor sensitivity in type 2 diabetes, and a significant number related this to a failure to recruit GLUT 4 transporters.
Question 1(e)	Most candidates correctly described the trend shown in the graph. Most commonly, candidates did not achieve this mark because they did not refer to *concentration* in relation to caffeine.
Question 2(a)(i)(iii)	Most candidates provided the required terms.
Question 2(b)(i)	The majority of candidates identified malaria as the disease caused by *Plasmodium*.
Question 2(b)(ii)	Candidates did very well interpreting the information given and using it to suggest a mechanism for the action of the drug chloroquine. Most candidates achieved at least 1 mark, with many giving full answers describing both the build-up of the toxic haem and its effect on the parasite.
Question 3(a)(i)	A high proportion of candidates identified that points 1 and 6 represented the resting potential.
Question 3(a)(ii)	The majority of candidates correctly calculated the change in membrane potential. Some candidates omitted the units, which were required.
Question 3(a)(iii)	Although less than one fifth of candidates were able to state the direction of flow of K^+ ions, many identified the role of the K^+ channels in repolarisation.
Question 4(a)(i)	Despite some difficulties with spelling, most candidates knew quaternary structure.
Question 4(a)(ii)	Candidates demonstrated good knowledge of R-group structure, with most identifying that those in contact with a bilayer would be hydrophobic.

Question 4(c)	Most candidates were able to link ligand binding to a change in the conformation of the receptor.
Question 4(d)	The majority of candidates used their knowledge of allosteric regulation to identify diazepam as a positive modulator.
Question 5(a)(b)	Many candidates demonstrated the correct knowledge about microtubules.
Question 5(d)	A very high proportion of candidates correctly stated the term cytokinesis.
Question 6(a)(i)	The majority of candidates used the information provided to state an acceptable hypothesis linking the product to a cure.
Question 6(c)(ii)	Many candidates were able to apply their knowledge from the *Investigative Biology* unit to state a null hypothesis.
Question 9(a)	Many candidates identified the disruption of successful genomes and the inability of half the population to produce offspring as disadvantages of sexual reproduction. Some candidates assumed all sexual reproduction would involve lots of parental investment in the offspring.
Question 10(a)	A good number of candidates were able to use the information provided to make the conversion between μm and nm.
Question 10(f)	Many candidates were able to use the information given, together with their knowledge of the challenges in the treatment and control of disease, to suggest a way of preventing or controlling EVD outbreaks. Candidates correctly related their suggestions to minimising transmission from wild animals to people, or from people to people.
Question 11	Markers commented that candidates tackled the extended writing better than in previous years. The vast majority of candidates made an attempt to give full answers for their chosen option. Responses were generally well laid out with parts (i) and (ii) of each option clearly identified. In option B, some candidates made good use of labelled diagrams to clarify what they had written. Option B was chosen slightly more often.
Question 11A(i)	Many candidates were able to distinguish between fundamental and realised niches on the basis of the absence or presence of interspecific competition. Some candidates referred to competition but did not specify that it was between species. Most attempted a definition of niche, although some used only knowledge gained at lower levels. Many candidates knew the terms *competitive exclusion* and *resource partitioning*, but did not give an adequate description of these processes so found points 4 and 5 more challenging.
Question 11A(ii)	Many candidates gave good descriptions of parasite niches. Most knew parasites benefitted by gaining resources, but some used ‘organism’ throughout their response instead of ‘host’. Point’s b, c, d and e were frequently awarded. A number of candidates knew the difference between definitive and intermediate hosts. Point f was awarded more frequently than point g because some candidates did not make a link between an intermediate host and completion of a

stage of the parasite's lifecycle. The term 'vector' was used frequently, but some candidates did not score point h because they did not make the link between vectors and *transmission*. Some candidates thought that all parasites rely upon vectors.

Question 11B(i) Many candidates demonstrated good knowledge of this part of the course. They gave good descriptions of how the activity of homologous chromosomes during meiosis leads to variable gametes. The majority of candidates who chose this option scored 4 marks or more in this section. Points 1, 2, 4, 7, and 8 were frequently awarded. Many candidates knew the term 'chiasmata', but they did not always describe them as points where chromatids from different chromosomes touch. Most candidates were aware crossing over takes place, but fewer were clear that the importance of this process is the exchange of alleles between homologous chromosomes giving new combinations of alleles. Many candidates knew the term independent assortment, and described the lining up of chromosomes irrespective of their parental origin, but fewer were awarded point 9 because they did not go on to describe the separation of chromosomes.

Question 11B(ii) Many candidates gained at least 1 mark for this part of their response. Point's b and d were awarded frequently. Many candidates referred to chromosomes at the equator in meiosis II, but did not make it clear they lined up singly.

Component 2 — project

The majority of candidates had clearly invested appropriate time and effort in planning and carrying out laboratory work at an appropriate level of demand for Advanced Higher. It was apparent that most had read the instructions for candidates and had tried to follow its guidance.

1 Abstract

Most candidates provided an abstract under a separate heading, as required. A very large number of candidates gave appropriate aims and findings. Where candidates did not gain this mark, it was often because aims and/or findings did not refer to the independent and/or the dependent variable directly. In some cases, the aims and findings lacked appropriate directionality. A small number of candidates gave findings in the abstract that were inconsistent with what was described later in the report.

2 Introduction

A very high proportion of candidates stated an acceptable aim and hypothesis in this section. Although the quality was variable, the majority of candidates attempted to give an account of the underlying biology at an appropriate level.

3 Procedures

Many candidates scored well in this section. A very high proportion of candidates used methods that were broadly appropriate to their aims. Most also gave a good description of

their procedures, with the vast majority of candidates scoring at least 1 of the 2 marks available. It was rare for candidates to lose a mark for not writing in the past tense and impersonal voice — most candidates were fully aware of this requirement. The majority of candidates identified appropriate controls, or explained why they were not required. Most candidates were aware of the need to consider repeats and replicates, with a very high proportion gaining the mark for adequate sample size. Most candidates gained at least 1 mark for carrying out work at a suitable level of complexity and accuracy. A high proportion carried out pilot studies, with many demonstrably having a bearing on the final procedures used.

4 Results

Almost all candidates presented results that were relevant to their aims. The vast majority included raw data in their report, with many making good use of an appendix to present large quantities of raw data. The number of candidates presenting average values with an excessive number of decimal places has decreased, suggesting most candidates are now aware of the importance of not claiming a greater degree of accuracy in processed data. Candidates demonstrated the ability to choose suitable formats to present their data, with a good variety of charts and graphs being used appropriately. The majority of candidates gave statements of trends following each table/graph. Where candidates made statements, but did not gain a mark, it was usually because the descriptions were inferential rather than a simpler description of the trends.

5 Discussion

This is the most demanding section of the report and candidates' marks reflected this. Even if candidates found evaluating their work challenging, most were able to draw conclusions that were relevant to the stated aim(s).

6 Presentation

A very high proportion of candidates produced reports with an appropriate structure, including a contents page and page numbers. The majority of titles were acceptable, with most indicating the dependent and independent variables as well as the organism/context being investigated.

Areas which candidates found demanding

Component 1 — question paper

Section 1

Many candidates did not know the purpose of a randomised block design (question 14). They found the calculations in questions 5 and 8 particularly demanding.

Section 2

Candidates found the following questions more demanding:

Question 1(a)	Candidates found it challenging to link the 'levelling off' of the rate of transport to the binding of glucose to the transporter.

Question 1(b)	Candidates found the idea of K_M in the context of transport challenging. A significant number struggled to use information from the figure to support the given conclusion.
Question 1(c)(i)	As anticipated, a significant number of candidates found it challenging to obtain the correct V_{max} value. Many used the K_M value instead of the rate of transport. Although many candidates did gain at least 1 mark for either using the correct figures, or correctly processing incorrect figures, calculation and rounding errors were fairly common.
Question 1(c)(ii)	This was designed to be a challenging question and, as expected, few candidates were able to link the high K_M (low affinity) to glucose transport into the pancreatic cells only at high concentrations.
Question 1(f)	A significant number of candidates failed to read the scale of the graph in figure 3 correctly.
Question 2(a)(ii)	Many candidates struggled to link the information to the mandatory knowledge about the effect of pH on the affinity of haemoglobin for oxygen.
Question 3(b)	Although the question highlighted the need to consider stage 3 from the diagram, a significant number of candidates focused their response entirely on how tetrodotoxin might affect ligand-gated channels (stage 2).
Question 4(b)	Candidates showed poor knowledge of alternative splicing and its impact on protein production, so only a small number gained both marks for this question. They often seemed confused about terms such as intron, exon, primary transcript, mature transcript, and mRNA.
Question 5(c)(i)	Candidates were required to go beyond stating that the buffer alone could be compared to cells with antibody and show understanding that it was functioning as a negative control.
Question 5(c)(ii)	Many candidates simply restated some, or all, of the results rather than giving a conclusion based on the results.
Question 6(a)(ii)	Despite the information in the question, some candidates gave answers relating to the number of repeats/replicates. Candidates who stated that only conclusions about bone cancer could be made, missed the idea that no valid conclusions could be drawn from a study lacking appropriate controls, and control of confounding variables.
Question 6(b)	Some candidates did not understand this question was asking them to explain why the placebo effect would be unlikely to work with animals that do not understand the effect of the treatment being trialled.
Question 6(c)(i)	While most candidates seemed to be aware of the 3Rs of animal research, many failed to apply their knowledge to the specific trial being described. For example, despite being told the trial was being

	conducted to test the effect of the drug on cats, some suggested replacing the cats with other species or cell cultures.
Question 7	Responses to this question were very variable. Some candidates seemed to be aware of random, systematic, and stratified sampling, but failed to give adequate descriptions. A minority of candidates focused their response entirely on describing sampling techniques, such as the use of quadrats. While it was possible for candidates to be awarded marks in the context of examples like this, they had to show an appreciation of how representative samples are obtained, irrespective of the technique being used.
Question 8	Candidates found it challenging to apply their knowledge of evolution to the given context. Many gave answers that relied entirely on understanding gained from previous levels, which were overly simplistic.
Question 8(a)	Many candidates gave very basic answers that did not compare the relative survival of longer versus shorter-necked giraffes. Poor understanding of the concept of fitness was also evident in many answers, indicating this continues to be an area of the mandatory knowledge that candidates find difficult.
Question 8(b)	Only a relatively small number of candidates realised that fewer trees would mean competition for the remaining trees would increase.
Question 8(c)(i)	Candidates continue to struggle with the concept of sexual selection. Despite being given information about male-male rivalry, a large number of candidates focused their response on the idea of female choice.
Question 8(c)(ii)	Candidates sometimes failed to express their ideas clearly, often just giving a description of sexual dimorphism in general, rather than relating this knowledge to the specific context of the question.
Question 9(b)	It was evident that many candidates were aware of the Red Queen hypothesis but found it difficult to apply their knowledge. A significant number of candidates simply stated the hypothesis without any attempt to relate it to the snails and their parasitic worms. A surprising number did not mention that sexual reproduction increases variation.
Question 9(c)	Only a small proportion of candidates made the link to parasite density.
Question 10(b)	A number of candidates gave responses that did not appear to be related to the information given in the flow chart, which showed that reverse transcriptase was not being used by the Ebola virus.
Question 10(c)	A significant number of candidates still seem unclear that caspases are protease enzymes.
Question 10(d)	This was intended to be a demanding question, and many candidates found it difficult to express themselves clearly and concisely. Some simply repeated the information given and stated that a high rate of mutation would make developing a vaccine difficult, without explaining

why. A significant number appeared to think that vaccines work directly on viruses, with some even referring to the vaccine as a drug.

Question 10(e) Despite the instruction given, some candidates did not make it clear whether or not they agreed or disagreed with the suggestion.

Component 2 — project

2 Introduction

Many markers commented that candidates again struggled to present relevant underlying biology at an appropriate depth. It was fairly common to see large chunks of disjointed syllabus information, often not clearly linked to the project aims. For example, candidates undertaking investigations involving enzymes sometimes provided large quantities of general information about protein structure but little, or no, information about the specific enzyme being studied.

A number of candidates gave accounts of familiar topics that contained errors or omissions. Overall, many of the accounts of underlying biology lacked sufficient breadth and depth to support an appropriate level of analysis and interpretation of results later in the report. As a result of these issues, few candidates gained more than 2 of the 4 marks available for underlying biology.

3 Procedures

Most candidates gained at least 1 mark for the description of procedures, few scored both marks. This was because candidates did not include all the information needed to repeat the work. Although most candidates seemed to be aware of the need to control the key confounding variables, many either failed to do so or gave unclear descriptions of how this was done.

It was fairly common for candidates to acknowledge, and attempt to justify, a failure to control, or monitor, key confounding variables. While more candidates are now aware of the need for repeats and independent replicates, just over half of candidates did not gain the mark for independent replication. Some candidates did not refer to independent replication at all, others did not explain how independent replication was achieved.

4 Results

Most candidates chose appropriate formats to present their data, but less than half achieved the mark for the quality of presentation. This was similar to last year, and was largely the result of errors with scales, labels, and table headings.

The criteria for gaining this mark are similar to those at lower levels. Most Advanced Higher candidates should be capable of achieving this mark. A number of candidates failed to summarise data adequately because they did not present overall averages.

5 Discussion

Candidates found almost all parts of this section of the report very challenging. Only a small proportion of candidates gave valid conclusions. Some candidates gave conclusions that

were not supported by the data presented. Other candidates had issues with the control of confounding variables, the absence of appropriate controls, and inadequate repeats or replicates.

A small proportion of candidates gained both marks for the evaluation of procedures. Many candidates did not achieve either of the marks available for this section.

Many candidates produced rather low-level discussions that failed to focus on the most significant factors affecting validity and reliability. Candidates often mentioned controls, but few explained their importance. Discussion of reliability was commonly restricted to simple statements about repeats and replicates. Candidates often failed to explain how they decided their experiments were reliable.

As in previous years, many candidates focused exclusively on negative aspects of their investigation. Candidates should also 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 in the planning stage of the investigation. Many candidates included a discussion of pilot studies, but they often failed to explain how they had affected the final experimental design.

Only half of all candidates were awarded marks for the evaluation of results, with a very small proportion gaining more than 1 of the 3 marks available. While some investigations were too simplistic to offer much scope for the discussion, many candidates did not seem to have a good knowledge of what was required in this section. Candidates rarely discussed the variation in results between repeats and replicates.

A large number of candidates attempted to use statistical analysis, but some candidates seemed to have a poor understanding of the statistical tests they were using. This sometimes resulted in them dismissing what appeared to be perfectly good trends on the basis of flawed statistical analysis.

Few candidates attempted to relate their findings to relevant biology and this was, at least in part, because they failed to include important relevant information in the underlying biology section.

6 Presentation

Few candidates provided the minimum of three references correctly cited in the text and listed at the end of the report in one of the standard referencing formats.

Common errors included:

- failing to provide a numbered list of references at the end of the report when using the Vancouver system
- providing only URLs for websites when other information, such as the organisation, was available
- listing references at the end but failing to cite them in the text

Section 3: advice for the preparation of future candidates

Component 1 — question paper

Many markers observed that, as in previous years, while most candidates demonstrated knowledge by stating terms and giving definitions, many were unable to provide more detailed descriptions or apply knowledge in unfamiliar contexts. Candidates need to be familiar with the standard required at this level. Candidates should take care to use vocabulary appropriate to Advanced Higher level. For example, the terms ‘species’ and ‘organisms’ are not equivalent.

Candidates need to read questions carefully, and identify key information, to help them understand the question requirements. They should pay close attention to the information given in question stems and be prepared to apply knowledge to novel contexts when required.

Most candidates used the space available to show working and this makes it easier for candidates to check their work. Units are usually required for numerical answers.

Most candidates who needed more writing space indicated clearly where they had continued their responses. Teachers and lecturers should continue to highlight this good practice to candidates, as it makes it easy for markers to ensure all work is marked appropriately.

Component 2 — project

Teachers and lecturers should continue to provide opportunities for candidates to complete creative and interesting projects. Candidates should refer to the most recent instructions for candidates throughout the entire process of planning, carrying out, and reporting.

Candidates could also use 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 are available on the SSERC website.

Although candidates may modify their aims as their investigations progress, they should formulate a clearly stated aim at a very early stage in the planning process. Teachers and lecturers should encourage candidates to apply knowledge from the *Investigative Biology* unit to help them develop good protocols with appropriate controls, procedures that allow key variables to be controlled, a reasonable sample size, and independent replication. Teachers and lecturers should also encourage candidates to use pilot studies to develop procedures, assess validity and refine techniques. Candidates’ descriptions of procedures should make clear the controls used, how they controlled confounding variables, the sample size used, and how independent replication was achieved.

When considering what to include in the account of underlying biology, candidates should ensure they have focused on information that is most relevant to the aim(s) of their investigation. Their account needs to have sufficient depth to support later discussion of their results. Although it is often perfectly appropriate for candidates to include information from

the Advanced Higher Biology course, they must be aware this is not essential and that their reading should extend beyond the scope of the mandatory knowledge for the course.

All candidates presented at this level should be capable of presenting results in tables, graphs and charts of an acceptable quality. They should consider what they have learnt from previous levels to ensure adequate quality of presentation.

Candidates using statistical analysis need to understand the tests they are using to avoid errors in interpretation. All candidates would benefit from an analysis of the variation between repeats and replicates. This would support discussion about whether variability is due to error in lab practice, intrinsic variation in the biological samples studied, or the treatments planned.

Candidates must present all references using one of the standard referencing formats (Harvard or Vancouver). They must follow the referencing guidance closely.

Markers raised concerns about the safety of some of the procedures candidates seemed to undertake. These included, but were not limited to, incubating micro-organisms (including potential pathogens) at 37˚C and inappropriately using toxic chemicals. Markers also raised ethical concerns about the use of living organisms (including human volunteers). The safety and well-being of the candidates carrying out Advanced Higher Biology investigations, or those participating as volunteers, is paramount. Staff supervising projects must be aware of the need to comply with all relevant safety and ethical regulations and codes of practice.

Grade boundary and statistical information:

Statistical information: update on courses

Number of resulted entries in 2017	2252

Number of resulted entries in 2018	2319

Statistical information: performance of candidates

Distribution of course awards including grade boundaries

Distribution of course awards	Percentage	Cumulative %	Number of candidates	Lowest mark
Maximum mark				
A	23.5%	23.5%	546	76
B	25.1%	48.7%	583	65
C	25.8%	74.5%	598	54
D	11.9%	86.4%	276	48
No award	13.6%	-	316	-

General commentary on grade boundaries

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.

SQA aims to set examinations and create marking instructions which 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.

Therefore, SQA holds a grade boundary meeting every year for each subject at each level to bring 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.

Grade boundaries from exam papers in the same subject at the same level tend to be marginally different year to year. This is because the particular questions, and the mix of questions, are different. This is also the case for exams set by centres. If SQA alters a boundary, this does not mean that centres should necessarily alter their boundary in the corresponding practise exam paper.