# Course report 2019

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| Subject | Biology |
| Level | Higher |

This report provides information on candidates' performance. 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

This is the first year of the revised Higher Biology Course.

The question papers provided good coverage of the course.

Overall, the assessment was deemed to be fair with a good selection and balance of demonstrating and applying knowledge, understanding and skills questions. Feedback from markers and centres about the question papers was positive.

### Question paper 1

The multiple-choice paper performed as expected.

### Question paper 2

This question paper generally performed as expected. However, some questions proved more demanding than intended. This was taken into account when setting grade boundaries.

### Assignment

Candidates are required to carry out a practical experiment to generate data to use in the report stage of their assignment. The format of the assignment was changed this year, and candidate performance overall was lower than in previous years.

There was clear evidence that many candidates were well prepared.

# Section 2: comments on candidate performance

## Areas that candidates performed well in

Candidates performed well in questions requiring straight recall of the knowledge outlined in the course specification. They also performed well in skills questions, involving calculations, drawing a line graph, and selecting information from a graph.

Candidates performed well in questions with the more demanding skill of selecting information from a graph with two vertical axes. It is evident that centres are preparing candidates well for these types of questions.

### Question paper

#### Question paper 1

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| Question 4 | Most candidates could match banding patterns in gel electrophoresis. |
| Question 6 | Most candidates could identify a substitution mutation. |
| Question 7 | Most candidates could draw a conclusion from data in a number of bar graphs. |
| Question 9 | Most candidates could interpret a phylogenetic tree. |
| Question 10 | Most candidates could differentiate between anabolism and catabolism. |
| Question 13 | Most candidates could use information to identify a conformer. |
| Question 14 | Most candidates could identify the lag phase of microbial growth. |
| Question 16 | Most candidates could carry out a calculation using data from a semi-logarithmic graph. |
| Question 17 | Most candidates could identify aspects of a field trial. |
| Question 21 | Most candidates could identify an example of cross breeding. |
| Question 22 | Most candidates could identify animal behaviour indicating poor welfare. |
| Question 23 | Most candidates could identify examples of worker bee behaviour. |
| Question 24 | Most candidates could select examples of social defence. |

**Question paper 2**

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| Question 1(a) | Most candidates could identify a histone. |
| Question 1(c)(ii) | Most candidates could identify DNA ligase. |
| Question 1(d) | Most candidates could name either a plasmid or a circular chromosome in prokaryotes. |
| Question 2(a) | Most candidates could calculate a ratio. |
| Question 2(b) | Most candidates could name the components of a ribosome. |
| Question 2(d) | Most candidates could state a difference between DNA and RNA. |
| Question 3B | Most candidates could describe competitive inhibition of enzymes. |
| Question 6(b) | Most candidates could select information from a bar graph. |
| Question 6(c) | Most candidates could identify a feature of an investigation, which showed that replicates were used. |
| Question 7(a)(i) | Most candidates could select information from a table. |
| Question 7(a)(ii) | Most candidates could carry out a 'times greater' calculation. |
| Question 8(b)(i) | Most candidates could select information from a table. |
| Question 9(a) | Most candidates could name the location of glycolysis. |
| Question 9(c)(i) | Most candidates could describe the conditions required for fermentation. |
| Question 10(c)(i) | Most candidates could make a prediction using a line graph. |
| Question 11(a) | Most candidates could state an advantage of torpor. |
| Question 11(b) | Most candidates could suggest a measurement, which would show that an animal was in torpor. |
| Question 12(b) | Most candidates could draw and label a line graph to display two sets of data. |
| Question 13(a) | Most candidates could state how pesticides harm the environment. |
| Question 15(a)(i) | Most candidates could complete a calculation involving percentage. |

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| Question 16A | Most candidates could describe the effect of light energy on pigment molecules, describe photolysis, the use of hydrogen in carbon fixation, and the fate of G3P. |
| Question 16B | Most candidates could describe habitat fragmentation and habitat corridors. |

### Assignment

Candidates performed well in areas that had been assessed in the previous version of the assignment, such as the title, aim and drawing a graph. Candidates were less successful in new areas, such as producing a summary of the method and evaluating experimental method.

#### 1 Aim

Most candidates produced a clear aim with an independent and dependent variable clearly stated.

#### 2 Underlying biology

Most candidates gave expanded descriptions and explanations, which clearly demonstrated understanding of the biology relevant to the aim.

#### 3(b) Data collection

Most candidates included sufficient raw data across a suitable range, which showed that repeat measurements had been done.

#### 4 Graphical presentation

Most candidates produced an appropriate graph including suitable scales, labels and units, and accurately plotted data.

#### 8 Structure

Most candidates produced a clear and concise report with an informative title that flowed in a logical manner. Many used the headings from the candidate guide, which is good practice and ensures a logical flow.

## Areas that candidates found demanding

### Question paper

Some areas of the course proved difficult for candidates, including the use of yeast in recombinant DNA technology, the purpose of inbreeding in plant breeding programmes, describing a duplication mutation and why it is important in evolution, the importance of isolation barriers in speciation, the role of non-coding DNA, the role of ATP in glycolysis, and evidence that shows that a species has become invasive.

**Question paper 1**

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| Question 2: | Most candidates had difficulty relating anticodon base sequences to DNA |
| Question 3: | Most candidates had difficulty carrying out a calculation from a graph of temperatures used in PCR. |
| Question 8: | Many candidates had difficulty identifying a graph that shows stabilising selection. |
| Question 12: | Many candidates had difficulty stating that effectors for thermoregulation are in the skin. |
| Question 15: | Most candidates had difficulty stating that yeast could be used in recombinant DNA technology to ensure that the synthesised protein was folder properly. |
| Question 19: | Most candidates had difficulty explaining that inbreeding is carried out to reduce the frequency of heterozygotes. |
| Question 25: | Many candidates had difficulty identifying the two components of species diversity. |

**Question paper 2**

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| Question 1(b): | Most candidates had difficulty explaining why primers are needed for DNA replication. |
| Question 1(c)(i): | Most candidates had difficulty explaining why only the leading strand can be replicated continuously. |
| Question 2(c): | Most candidates had difficulty explaining how a mutation in the DNA sequence coding for rRNA could affect protein synthesis. |
| Question 3A: | Most candidates had difficulty stating that energy from electrons is used to pump hydrogen ions across the inner mitochondrial membrane. |
| Question 3B: | Most candidates had difficulty describing feedback inhibition. |
| Question 4(b): | Most candidates had difficulty explaining how a duplication mutation occurs and its importance in evolution. |
| Question 5(a): | Most candidates had difficulty explaining the role of isolation barriers in speciation. |
| Question 7(c): | Most candidates had difficulty giving a role of non-coding DNA. |

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| Question 7(d): | Most candidates had difficulty describing alternative RNA splicing. |
| Question 9(b)(i): | Most candidates had difficulty describing the role of ATP in glycolysis. |
| Question 9(c)(ii): | Most candidates had difficulty explaining why pyruvate must be converted to lactate during fermentation in animal cells, in order for glycolysis to continue<br>. |
| Question 11(d) | Many candidates had difficulty explaining how the design of an experiment ensures reliable results. |
| Question 12(c) | Most candidates had difficulty drawing a conclusion relating to the aim of an investigation. |
| Question 13(c)(i) | Most candidates had difficulty describing evidence that would suggest a species had become invasive. |
| Question 14(a)(ii) | Many candidates had difficulty describing a parasite. |
| Question 15(d) | Many candidates had difficulty stating advantages to primates of forming alliances and appeasement behaviour. |

## Assignment

### 1 Aim

Although most candidates produced a clear aim with an independent and dependent variable clearly stated, some had difficulty with this. For example, they stated ‘Investigating the effect of lead on enzymes’ rather than ‘Investigating the effect of lead concentration on enzyme activity’.

### 2 Underlying biology

Many candidates included extensive accounts of underlying biology that was not relevant to their aim. Marks are not awarded for irrelevant information.

### 3 Data collection and handling

#### 3(a) Brief summary

Most candidates had difficulty providing a brief summary of the method for their experiment. These often had too much detail of concentrations, volumes, or did not name the chemicals and equipment used to measure the dependent variable.

#### 3(c) Table

Many candidates had difficulty producing a table including averages. Errors included incorrect or no units provided and the heading ‘average’ without stating what was being averaged.

### 3(d) Data from an internet/literature source

Many candidates had difficulty selecting a relevant piece of data, particularly where they had a specific aim that named a specific enzyme. The selected internet/literature source should be for the same enzyme.

### 3(e) Citation and reference

Many candidates had difficulty citing and referencing the internet/literature source. Errors included giving the full reference alongside the data and at the end of the report, and not giving the date that a website was accessed.

## 5 Analysis

Most candidates had difficulty giving a valid comparison of the experimental data and the internet/literature source. Errors included failing to select an internet/literature source with the same range of values of the independent variable as the experiment. The range of values of the independent variable over which the two sources were compared was often not stated.

Most candidates had difficulty putting a correct calculation in context by stating what it showed in relation to the aim of the investigation.

## 6 Conclusion

Most candidates had difficulty drawing a valid conclusion that related the results from both sources to the aim of the investigation. Conclusions often restated results or were only related to one source. Some conclusions did not identify where a trend changed and levelled off.

## 7 Evaluation

Most candidates had difficulty providing justification for their evaluative statements. Statements about reliability should relate to atypical results in the data. The terms valid, reliable and accurate were often incorrectly used.

Many candidates commented on the reliability and robustness of the source from the internet/literature, which is no longer awarded marks.

## 8 Structure

Some candidates had difficulty providing an informative title and gave one that was too vague.

# Section 3: preparing candidates for future assessment

The *Higher Biology Course Specification* explains the overall structure of the course, including its purpose and aims as well as information on the skills, knowledge and understanding required. Course support notes are provided as an appendix to the document. Both the key areas **and** the depth of knowledge **can be assessed in the question paper**.

The *Higher Biology Assignment Assessment Task* explains the requirements for the assignment. This document provides guidance by including instructions for teachers and lecturers, as well as instructions for candidates.

Centres must ensure that they are using the most up-to-date versions of these documents, which are available on SQA's website.

## Question papers

The quality of candidates' answers in most cases was high. The reduction in course content and introduction of the 'depth of knowledge required' column to the course specification has clarified what can be assessed. As a result of these changes, candidates' attainment in the question papers has improved, which is encouraging.

It was clear that candidates were well prepared to answer questions that demonstrated knowledge and understanding of areas including phylogenetics, metabolism, enzyme inhibition, glycolysis, surviving adverse conditions, microbial growth curves, crop protection, animal welfare, and primate behaviour.

Skills questions involving most types of calculation, drawing line graphs and selecting information from graphs and tables were well answered. This indicates that centres are preparing candidates well by practising these types of questions.

It was evident that candidates in some centres were still being taught content that has now been removed from the course. Centres must use the current Higher Biology Course Specification when preparing candidates.

There were a number of areas where candidates' knowledge was insufficient. Many candidates had difficulty with questions requiring knowledge of DNA replication, rRNA, alternative RNA splicing, fermentation, feedback inhibition, inbreeding parasites, and invasive species. Centres should spend time preparing candidates to answer questions in these areas.

Questions requiring candidates to apply their knowledge to new situations still caused candidates difficulty. Candidates should prepare for these by practising with examples from past papers.

As in previous years, some candidates had difficulty answering questions that asked them to describe or explain, often confusing these command words. Examples of valid responses to command words are provided in the general marking principles within the marking instructions.

Many candidates continue to have difficulty answering experimental questions. They found it particularly difficult to identify features of an investigation that would ensure reliability, and to draw a conclusion relating to the aim. Candidates should be advised to identify the aim of the investigation in the stem of the question and to use the aim in drawing the conclusion, rather than restating results.

## Assignment

With the change to the assignment this year, including a mandatory experiment, attainment in this component was lower than in previous years. Teachers and lecturers are encouraged to use the exemplar materials on the Understanding Standards website to prepare candidates.

The following advice relates to the specific sections of the assignment.

### Aim

Candidates should make sure they provide an aim that has a clear independent and dependent variable.

### Underlying biology

Only underlying biology that is relevant to the aim should be included.

### Data collection and handling

The summary of the method should not include too much experimental detail of, for example, concentrations and volumes used, but should name any chemicals used and the equipment used to measure the dependent variable.

In some centres, all candidates appeared to have used the same values for the independent variable, for example the same concentrations. As a mark is awarded for selecting a suitable range of values, candidates should not all have the same values of the independent variable.

Candidates must state what they have calculated an average of clearly in their table headings.

Candidates should be careful to select data/information from an internet source that is relevant to the aim of their investigation and to cite and reference this rather than include the reference alongside the data/information. The citation entered alongside their chosen source could be: ‘Source 1’, ‘Ref 1’ or simply ‘1’. The full reference, linked to the citation, should be given at the end of the report.

### Analysis

When analysing data by comparing the experiment and data from internet/literature, candidates should be careful to compare the data over a common range of values of the independent variable. Where a calculation has been done, it should be outlined how this relates to the aim and for which values of the independent variable the calculation refers.

**Conclusion**

The conclusion must relate clearly to the aim of the assignment, rather than restating the results. The conclusion must be supported by all the data in the report.

**Evaluation**

In the evaluation, candidates should be directed to appropriately justify evaluative comments, such as stating why named variables should be controlled and stating how results would be affected if this was not done. There is no requirement for candidates to use the terms ‘valid’, ‘reliable’ and ‘accurate’. However, if these terms are used, they must be used correctly.

# Grade boundary and statistical information:

## Statistical information: update on courses

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| **Number of resulted entries in 2018** | 7305 |

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| **Number of resulted entries in 2019** | 7685 |

## Statistical information: performance of candidates

### Distribution of course awards including grade boundaries

| Distribution of course awards | Percentage | Cumulative % | Number of candidates | Lowest mark |
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| **Maximum mark** | | | | |
| **A** | 27.6% | 27.6% | 2124 | 105 |
| **B** | 22.4% | 50.0% | 1721 | 89 |
| **C** | 22.7% | 72.7% | 1743 | 73 |
| **D** | 17.3% | 90.1% | 1333 | 57 |
| **No award** | 9.9% | - | 764 | - |

## 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 that allow:

- a competent candidate to score a minimum of 50% of the available marks (the notional C boundary)
- 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 head of service and statistician to discuss the evidence and make decisions. Members of the SQA management team chair these meetings. SQA can adjust the grade boundaries as a result of the meetings. This allows the pass rate to be unaffected in circumstances where there is evidence that the question paper has been more, or less, challenging than usual.

- The grade boundaries can be adjusted downwards if there is evidence that the question paper is more challenging than usual.
- The grade boundaries can be adjusted upwards if there is evidence that the exam is less challenging than usual.
- Where standards are comparable to previous years, similar grade boundaries are maintained.

Grade boundaries from question 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 question papers set by centres. If SQA alters a boundary, this does not mean that centres should necessarily alter their boundary in the question papers that they set themselves.