Course report 2022

Subject	Biology
Level	Advanced 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 appeals.

Grade boundary and statistical information

Statistical information: update on courses

Number of resulted entries in 2022	3165

Statistical information: performance of candidates

Distribution of course awards including grade boundaries

A	Percentage	24.5	Cumulative percentage	24.5	Number of candidates	775	Minimum mark required	72
B	Percentage	25.5	Cumulative percentage	50.0	Number of candidates	805	Minimum mark required	58
C	Percentage	25.3	Cumulative percentage	75.3	Number of candidates	800	Minimum mark required	44
D	Percentage	16.4	Cumulative percentage	91.7	Number of candidates	520	Minimum mark required	30
No award	Percentage	8.3	Cumulative percentage	N/A	Number of candidates	265	Minimum mark required	N/A

You can read the general commentary on grade boundaries in appendix 1 of this report.

In this report:

- ‘most’ means greater than 70%
- ‘many’ means 50% to 69%
- ‘some’ means 25% to 49%
- ‘a few’ means less than 25%

You can find more statistical reports on the statistics page of SQA’s website.

Section 1: comments on the assessment

Question paper

This was the first exam since the revision of the Advanced Higher Biology course. This was the first Advanced Higher Biology question paper with a duration of three hours, and there was no evidence that candidates had difficulty completing the question paper in the time available.

The question paper was designed to have the appropriate balance of questions testing demonstrating knowledge and understanding, applying knowledge and understanding, and skills. Most candidates attempted most of or all the questions, so all questions were accessible. However, the overall number of unanswered questions was higher than in previous years.

Questions that were expected to be answered correctly by most or many candidates were balanced by those designed to be more challenging. Markers commented that the level of demand was fair and in line with previous assessments.

As in previous years, candidates achieved a very wide range of marks.

Candidates tended to perform best in questions that required them to demonstrate knowledge by giving terms or making simple statements. Performance in section 2 questions 5 and 14, which required extended responses, and for which advance notice of the topic areas had been provided through revision support, was also strong.

Candidates displayed competence in a wide range of problem-solving skills and coped particularly well with some calculations and identifying or stating trends and conclusions from data sets.

Some candidates were unable to express ideas clearly and accurately. The legibility of some candidates' handwriting was an issue for markers. Centres should encourage candidates to write as clearly as possible to ensure their handwriting is legible to markers.

Overall, the question paper proved more challenging than expected. Section 1 performed as expected, although Section 2 was more challenging than expected. This was taken into consideration when setting the grade boundaries.

Project

The requirement to complete the project was removed for session 2021–22.

Section 2: comments on candidate performance

Question paper

Section 1

Question 2	Most candidates were able to identify the function of structures involved in the synthesis and transport of proteins.
Question 3	Many candidates were able to apply their knowledge of phosphorylation to the information about enzymes involved in glycogen metabolism.
Question 4	Many candidates were able to identify a null hypothesis.
Question 5	Most candidates were able to process the data using the equation provided.
Question 7	Most candidates were able to order the sequence of events in response to an increase in the concentration of insulin in the bloodstream.
Question 8	Most candidates were able to identify molecules involved in the response of rod cells to light.
Question 9	Many candidates were able to use the information to calculate a respiratory quotient.
Question 10	Most candidates were able to identify the correct stage of mitosis from the diagram.
Question 11	Most candidates were able to identify the conclusions that were consistent with the graphical data.
Question 12	Many candidates were able to correctly classify a model organism.
Question 13	Many candidates were able to identify which of the descriptions of animal behaviour is anthropomorphic.
Question 15	Most candidates were able to apply their knowledge and understanding of the concepts of accuracy and precision to the data set.
Question 18	Many candidates were able to apply knowledge of resource partitioning to the information.
Question 20	Nearly all candidates were able to identify the characteristic of an r-selected species.

Section 2

Question 1	Many candidates found this data handling question challenging.
Question 1(d)(i)	Many candidates were able to identify the median values and calculate the percentage decrease.
Question 1(d)(ii)	Few candidates were able to correctly interpret the boxplots. It was very common for candidates to confuse the whiskers of the boxplots with error bars. Another common error was candidates making comparisons with the control instead of comparing between severe and mild infections. Other errors were confusing inter-quartile ranges with semi-inter-quartile ranges, not using data, and reading data points incorrectly.
Question 1(d)(iii)	Few candidates were able to explain how the data supported the hypothesis given. This question was intended to be challenging, but many candidates had poor understanding of the function of memory cells and did not make a link between memory cells and antibody production. This question had the greatest number of candidates making no attempt to provide a response.

Question 2(a)	Most candidates were able to state the importance of aseptic technique when culturing micro-organisms.
Question 2(c)(ii)	Few candidates were able to give another way of determining a viable bacterial cell count. Many candidates suggested techniques that would require the use of a vital stain.
Question 2(c)(iii)	Few candidates used the information to give a response linked to the context of the question (membrane disruption in bacterial cells).
Question 3(a)	Most candidates correctly stated the main force stabilising secondary structure within polypeptides.
Question 3(d)(ii)	Few candidates were able to use the information and apply their knowledge to explain the importance of an increase in the concentration of 2,3-DPG. Some candidates simply repeated their response to 3(d)(i) and did not consider the effect of an increase above the 'normal' level.
Question 4(b)	Most candidates knew the type of channels that open and close in response to changes in ion concentration.
Question 4(c)(i)	Few candidates were able to give the meaning of the term 'electrochemical gradient'. Some referred to the electrical gradient but not the concentration gradient.
Question 4(c)(ii)	Few candidates were able to apply their knowledge and understanding of concentration and ion gradients to explain the movement of the potassium ions in guard cells.
Question 5	Most candidates achieved high marks in this question, with many achieving full marks. All the marking points were accessed frequently but point 3 was sometimes not achieved because candidates missed the idea of receptors being specific. A few candidates confused hormone receptor complexes and hormone response elements. Performance in this question indicated candidates had made good use of the information provided in the revision support.
Question 6(a)	Although some candidates achieved 2 or 3 marks, many candidates showed poor knowledge and understanding of the mechanism by which neurotransmitters initiate an action potential.
Question 6(b)(i)	Most candidates were able to describe the relationship shown in the graph.
Question 6(b)(ii)	Few candidates were able to apply their knowledge and understanding to explain how the ligand could affect the function of the channel described in the question.
Question 7(b)(i)	Many candidates were able to give an outcome of p53 activation.
Question 7(b)(ii)	Few candidates were able to apply their knowledge and understanding of the function of retinoblastoma protein to explain why inhibition of retinoblastoma would disrupt the normal control of cell division.
Question 7(c)(i)	Most candidates were able to describe the effect shown in the graph.
Question 8	Many candidates found this experimental question challenging.
Question 8(c)	Few candidates were able to describe the purpose of a standard curve in the investigation described.
Question 8(d)	Although many candidates knew that centrifugation separated substances based on density, few could apply this knowledge to the experimental context described.

Question 8(e)	Few candidates could describe how to prepare an extract to ensure the concentration was controlled. Some candidates referred to the mass of the banana pieces, but few candidates also considered the volume of water. Many described a serial dilution, which did not address the issue of controlling the concentration of the initial solution.
Question 8(f)	Most candidates could not describe a feature of an independent replicate.
Question 8(g)	Few candidates could suggest a reason why results from the experiment described could be invalid.
Question 9	Few candidates performed well in this question.
Question 9(a)(i)	Few candidates could state a method used to identify organisms in a sample during fieldwork. A common error was to give techniques for sampling or marking organisms.
Question 9(a)(ii)	Few candidates knew what was meant by the term morphology.
Question 9(b)(i)	Few candidates could give an example of heritable evidence used to construct a phylogenetic tree. A common error was to describe the purpose of a phylogenetic tree, despite this information being provided in the stem of the question.
Question 10(a)	Most candidates were not able to state the meaning of the term 'parthenogenesis'. Some candidates gave too generalised a description of asexual reproduction, or confused parthenogenesis with hermaphroditism.
Question 10(c)(i)	Although many candidates correctly predicted the effect on crop production, only some gave a justification relating to the information provided.
Question 10(c)(i)	Few candidates were able to apply their knowledge and understanding to suggest a benefit of sexual reproduction in the context described.
Question 11(a)	Most candidates were able to use the information to present treatments as a Latin square.
Question 11(c)(i)	Many candidates were able to suggest an appropriate confounding variable. Some candidates did not achieve this mark because the variable they suggested was mentioned in the information given.
Question 11(c)(ii)	Although some candidates gave a correct conclusion, it was quite common for candidates to ignore the importance of the error bars.
Question 11(d)	Although some candidates described possible ways of setting up a similar experiment in a laboratory, few candidates included any reference to comparing numbers on the different surfaces.
Question 12(b)	Most candidates were able to correctly select information from the figure.
Question 12(c)	Most candidates were unable to apply their knowledge and understanding to suggest how a new ecological niche could be created for the species described. A common error was for candidates to simply provide a definition of an ecological niche.
Question 12(d)	Most candidates achieved 2 or 3 marks for describing the mark and recapture technique.
Question 13(a)(i)	Few candidates were able to use the Hardy-Weinberg principle to calculate a genotype frequency. Some candidates wrote the equations correctly but did not apply the values. It was common for candidates to

	give frequencies greater than one. There was a notable number of no responses for this question.
Question 13(c)	Most candidates knew the meaning of the term ‘definitive host’.
Question 14	Option A was more popular than option B. The mean marks for the two options were very similar, with option B scoring fractionally higher.
Question 14A(i)	Most candidates scored 2 or 3 marks and gave good descriptions of mating systems. Some candidates did not achieve point 2 because they missed the idea of both partners mating exclusively. The idea of exclusivity in polygyny was also sometimes missed. Point 6 was rarely awarded because most candidates were able to describe at least one of the mating systems.
Question 14A(ii)	Most candidates scored 4 or more marks. Although all marking points were accessed, and many candidates gave good accounts, point (a) was awarded less frequently. Although many candidates referred to honest signals in their responses, some missed the importance of the link between honest signals and genetic quality and, therefore, did not achieve point (g). A few candidates thought a lek is the display itself rather than the site of the display.
Question 14B(i)	Most candidates achieved at least 2 marks, with many achieving 3 or 4 marks. Many candidates gave good accounts of natural selection, and all marking points were accessed. Some candidates missed the comparative aspect of point 6. Candidates should understand that favourable alleles provide a selective advantage but do not guarantee an organism’s survival.
Question 14B(ii)	Many candidates achieved 4 or more marks. Many candidates gave good accounts of genetic drift, and all marking points were accessed.

Section 3: preparing candidates for future assessment

Question paper

Although candidates generally perform well when asked to give terms or short definitions, they had difficulty providing more detailed descriptions. The course support notes (appendix 1 of the course specification) provide detail on the depth of knowledge required for each key area of the course. Both the key areas and the depth of knowledge can be assessed in the question paper, so candidates preparing for future assessments should work towards having a sound knowledge and understanding of this biology.

Candidates had difficulty demonstrating and applying knowledge and understanding relating to investigative biology. Questions relating to investigative biology appear throughout the paper, but as specified in the question paper brief, the paper will contain one large experimental design question, for which candidates will need a secure knowledge and understanding of this area of the course. Although there is no requirement to complete the project for session 2022–23, centres should give candidates opportunities to undertake practical work where this is feasible and safe. This would improve candidates' understanding of investigative biology and help them to prepare for the question paper.

Candidates should be able to apply knowledge and understanding to unfamiliar contexts. When directed to relate an answer to specific data or a particular context, they must avoid giving responses that are too generalised. Centres should encourage candidates to read questions carefully and identify key information to focus on the question being asked. Candidates should pay close attention to information in question stems. This information is included to support candidates. Candidates cannot gain marks for repeating this information. Centres should give candidates opportunities to practise a variety of question types so that they become familiar with the standard required at Advanced Higher.

Candidates should be able to use the Hardy-Weinberg principle to determine allele, genotype, and phenotype frequencies. Centres should give candidates opportunities to practise using the Hardy-Weinberg principle to solve problems similar to the question in this year's exam.

Candidates should be able to interpret data from a range of sources, including box plots. They should be aware that the whiskers on a box plot show the range and be able to identify the median, lower quartile, upper quartile, and inter-quartile range. Candidates do not need to use the semi-inter-quartile range. Box plots are widely used in biological publications because they are a useful way of illustrating variation in a data set, and helpful when comparing data sets. Candidates should be prepared for box plots to be assessed again in future.

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

Appendix 1: general commentary on grade boundaries

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

For most National Courses, SQA aims to set examinations and other external assessments and create marking instructions that allow:

- a competent candidate to score a minimum of 50% of the available marks (the notional grade C boundary)
- a well-prepared, very competent candidate to score at least 70% of the available marks (the notional grade 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 for each course to bring together all the information available (statistical and qualitative) and to make final decisions on grade boundaries based on this information. Members of SQA's Executive Management Team normally chair these meetings.

Principal assessors utilise their subject expertise to evaluate the performance of the assessment and propose suitable grade boundaries based on the full range of evidence. SQA can adjust the grade boundaries as a result of the discussion at these meetings. This allows the pass rate to be unaffected in circumstances where there is evidence that the question paper or other assessment has been more, or less, difficult than usual.

- The grade boundaries can be adjusted downwards if there is evidence that the question paper or other assessment has been more difficult than usual.
- The grade boundaries can be adjusted upwards if there is evidence that the question paper or other assessment has been less difficult than usual.
- Where levels of difficulty 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 on year. This is because the specific questions, and the mix of questions, are different and this has an impact on candidate performance.

This year, a package of support measures including assessment modifications and revision support, was introduced to support candidates as they returned to formal national exams and other forms of external assessment. This was designed to address the ongoing disruption to learning and teaching that young people have experienced as a result of the COVID-19 pandemic. In addition, SQA adopted a more generous approach to grading for National 5, Higher and Advanced Higher courses than it would do in a normal exam year, to help ensure fairness for candidates while maintaining standards. This is in recognition of the fact that those preparing for and sitting exams have done so in very different circumstances from those who sat exams in 2019.

The key difference this year is that decisions about where the grade boundaries have been set have also been influenced, where necessary and where appropriate, by the unique circumstances in 2022. On a course-by-course basis, SQA has determined grade boundaries in a way that is fair to candidates, taking into account how the assessment (exams and coursework) has functioned and the impact of assessment modifications and revision support.

The grade boundaries used in 2022 relate to the specific experience of this year's cohort and should not be used by centres if these assessments are used in the future for exam preparation.

For full details of the approach please refer to the National Qualifications 2022 Awarding — Methodology Report.

