Course report 2024

Advanced Higher Chemistry

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. You should read the report with the published assessment documents and marking instructions.

We compiled the statistics in this report before we completed the 2024 appeals process.

Grade boundary and statistical information

Statistical information: update on courses

Number of resulted entries in 2023: 2,852

Number of resulted entries in 2024: 2,746

Statistical information: performance of candidates

Distribution of course awards including minimum mark to achieve each grade

A	Number of candidates	736	Percentage	26.8	Cumulative percentage	26.8	Minimum mark required	104
B	Number of candidates	610	Percentage	22.2	Cumulative percentage	49.0	Minimum mark required	88
C	Number of candidates	602	Percentage	21.9	Cumulative percentage	70.9	Minimum mark required	72
D	Number of candidates	453	Percentage	16.5	Cumulative percentage	87.4	Minimum mark required	56
No award	Number of candidates	345	Percentage	12.6	Cumulative percentage	100	Minimum mark required	N/A

We have not applied rounding to these statistics.

You can read the general commentary on grade boundaries in the appendix.

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 statistical reports on the statistics and information page of our website.

Section 1: comments on the assessment

Question paper

Overall, candidates found Section 1 (multiple-choice) more demanding than in previous years and one particular question did not function as intended. An adjustment was made to the grade boundary to account for this. Section 2 (extended-response) contained four questions that were more demanding than intended and again an adjustment to the grade boundary was made.

Project

This year marked the return of the project to the Advanced Higher Chemistry course. The project performed as expected

Section 2: comments on candidate performance

Areas that candidates performed well in

Question paper

Overall, there was a high response rate for the question paper with a low number of no responses for most of the questions.

Section 1 (multiple choice)

Specific areas that most candidates performed well in include:

- question 2: identifying electronic configurations for copper and its ions
- question 10: calculating the pH of a buffer solution
- question 11: concluding the feasibility of a reaction
- question 21: naming geometric isomers
- question 25: identifying a common structural fragment in drugs

Section 2 (extended-response)

Specific areas that most candidates performed well in include:

- question 1(a)(i): stating the overall order of a reaction from a rate equation
- question 1(b)(i): circling the chiral centre in 3-hydroxybutanal
- question 2(a)(ii): identifying that vacuum filtration is a faster method of separation
- question 2(c)(i): identifying the classification of drugs
- question 3(b)(i): explaining how a line is produced in an emission spectrum
- question 3(b)(ii): calculating the wavelength from an energy value
- question 3(c)(i): determining the coordination number of a metal ion
- question 7(a)(ii): calculating the pH of a solution of a weak acid
- question 8(a)(i): writing an expression for an equilibrium equation
- question 10(a)(i): calculating the standard enthalpy change
- question 10(c): suggesting the name for a type of reaction

Project

Most candidates provided an aim for their project and summarised the conclusion. Candidates were also awarded marks for complexity (a second procedure, standardisation or control experiment), duplication and having an appropriate number of significant figures in final answers. Candidates made valid conclusions from their results and compared them to literature sources. Most candidates were awarded the structure mark for the project.

Areas that candidates found demanding

Candidates still found it demanding to make accurate statements, which come straight from the Advanced Higher Chemistry Course Specification available on the subject page of SQA's website. These questions are low demand and do not involve any higher-order thinking. Candidates must learn these definitions.

Candidates also found it demanding to outline the steps in experimental techniques. The details required are given in the course specification, and candidates must learn these.

Many candidates found questions requiring numeracy skills, such as simple proportion, demanding.

Section 1 (multiple-choice)

Specific areas that some candidates found demanding include:

- question 4: comparing the energy gap between split d orbitals using colour of solution
- question 6 : arrangement of electron pairs and molecular shape using VSEPR
- question 8 : calculating the pH of water using the ionic product
- question 15: synthetic routes to propanoic acid
- question 17: reaction of amino acids with acids and bases
- question 22: determining the number of possible stereoisomers for a molecule

Section 2 (extended-response)

Question 1(a)(iii)	Many candidates did not explain which step was the rate-determining step, and instead simply stated which step was the rate-determining step.
Question 1(b)(ii)	Many candidates did not state why the sample was not optically active and instead stated that there was no chiral centre, and so did not appreciate that the compound was the same as that given in the previous part of the question.
Question 2(d)(i)	Most candidates did not identify an acid chloride.
Question 2(d)(ii)	Many candidates did not recognise that the reaction was a condensation reaction, which should have been identifiable by looking at the structures of the reactant and product molecules.
Question 3(a)(i)	Many candidates simply stated the Pauli exclusion principle rather than relating their answer to the orbital box notation in the question.
Question 3(c)(ii)	Most candidates did not recognise that the ligand had four bonds to the metal ions, and of those candidates that did, some did not use the word 'tetradentate' in their answer.

Question 5	Most candidates did not access more than one of the 3 marks available in this question, with candidates writing answers that included information about recrystallisation.
Question 6(a)(i)	Most candidates did not state the type of electromagnetic radiation used in NMR spectroscopy.
Question 6(b)(ii)	Most candidates did not relate the restricted rotation of the double bond to the environments of the hydrogen atoms.
Question 6(c)	Most candidates did not correctly interpret the NMR spectra to draw a correct structural formula for an ester.
Question 8(b)	Most candidates did not recognise that sulfur dioxide has an extra lone pair of electrons, and to state the difference in repulsive forces that these have.
Question 9(a)	Most candidates answered this question incorrectly, relating their answer to zinc atoms instead of to the zinc ion.
Question 10(d)	Many candidates did not draw a skeletal formula from the shortened structural formula.
Question 11(a)(iii)	Most candidates did not appreciate that if different samples were weighed out, these would most likely have different masses and so the titre volumes would be different.
Question 11(b)(i)	Many candidates found it difficult to explain why the mass of KHP would need to increase as the purity decreased. It was common for candidates to simply restate the information given in the question without an explanation.
Question 11(b)(ii)	Most candidates did not calculate the concentration, in ppm.
Question 12(b)(i)	Most candidates did not state a reagent that could be used to carry out an addition reaction to produce an alcohol.
Question 12(b)(iii)	Most candidates answered this question with a statement of Markovnikov's rule, rather than giving an explanation in terms of the stability of the carbocation involved.
Question 12(c)(i)	Many candidates did not state the definition of 'homolytic fission'. This definition is from the course specification, and candidates should be able to recall these definitions.
Question 12(c)(ii)	Most candidates did not state that a mixture of products would be formed in this reaction involving homolytic fission. This is a statement that comes from the course specification.

Question 12(d) Most candidates did not access more than one of the 3 marks available in this question. It was common for candidates to answer the question in general terms, stating the names of the chemical reactions involved in synthesising an ester. Only a few candidates stated the reagents necessary for each reaction, gave the names and structures of intermediates, and gave the final product ester formed from 2-bromopropane.

Project

The most challenging aspect of the project for candidates was writing a valid risk assessment. Many candidates did not achieve this mark because they provided inappropriate hazards or precautions for the chemicals or concentrations used. In the evaluation section, most candidates achieved marks by calculating uncertainties, but few were successful in making evaluative statements with justification. Many candidates made statements, but the effect on the final results was usually missing.

Section 3: preparing candidates for future assessment

Question paper

Questions linked to statements in the course specification

Teachers and lecturers should encourage candidates to practise accurately describing and explaining terminology from the Advanced Higher Chemistry Course Specification.

Researching chemistry questions

There are approximately 24 marks assessing knowledge and skills relating to the 'researching chemistry' section of the course. Questions relating to this section tend to be poorly answered. Candidates are expected to describe the correct procedures associated with the use of the listed pieces of apparatus and techniques. Gaining practical experience of using these pieces of apparatus and techniques aids candidates' ability to answer these types of questions. The course specification provides extended detail of procedures required for each technique.

Questions requiring numeracy skills

Candidates should be encouraged to practise numeracy questions, including using an unfamiliar relationship. Candidates should also practise questions requiring converting from one unit to another.

Questions set in an unfamiliar context

Candidates should be encouraged to practise applying their course knowledge in unfamiliar contexts. Carefully reading the information the question gives, including the original stem, will help candidates to perform better in these types of questions.

Project

Centres should refer to the most up-to-date coursework assessment task on SQA's website. The Advanced Higher coursework assessment task document has been updated for session 2024–25.

Teachers and lecturers should provide candidates with a copy of the most up-to-date 'Instructions for candidates' section of the Advanced Higher Chemistry Coursework Assessment task, available on the SQA website.

Teachers and lecturers must also ensure that each candidate has a different aim for their project and carries out their own research and experimentation. Group work is not permitted.

Abstract

Many candidates included the word 'purity' in their aim. For example, the aim given is to calculate the percentage purity of calcium carbonate in eggshells. This aim would not be awarded a mark. Teachers and lecturers should advise candidates to avoid the word 'purity', unless it is being used in conjunction with an analysis, such as of melting point or thin-layer

chromatography (TLC). Candidates can avoid inconsistencies between the conclusion and abstract by copying the conclusion into the abstract, instead of typing a new version.

Underlying chemistry

Many candidates still included irrelevant, historical or biological information in their underlying chemistry. Although this information does not affect the mark awarded, it may appear to candidates that they have provided sufficient underlying chemistry. Candidates must focus only on the reactions and techniques used in their project and the chemistry behind these.

Data collection and handling

Candidates must avoid writing an equipment list, but instead include all apparatus and concentrations of chemicals used in the procedure description. Candidates will not be awarded marks if it is not clear which piece of apparatus was used for each measurement — an equipment list is not sufficient. Some candidates still used numbered or bulleted lists; this should also be avoided.

Candidates must provide concentrations and/or states when giving hazards associated with chemicals. Hazards should be appropriate for these concentrations and/or states. For example, some candidates were stating ‘harmful by inhalation’ when describing solutions that do not give off gas. An online search will provide candidates with an appropriate risk assessment for the concentrations or states used.

Candidates should clearly label raw data, such as spectra or graphs from data-loggers. This may require the candidates to amend labels by hand. For chromatography, candidates must include photographs or the original chromatograms.

If candidates are unsure about the format of data tables, SQA chemistry past papers are a good source of correctly formatted tables with appropriate headings and units.

The ‘Instructions for candidates’ section of the Advanced Higher Chemistry Coursework Assessment task provides guidance on the best method of citation and referencing to use. Candidates must use this number system and must ensure that citations and references are in numerical order.

Data analysis

Most candidates duplicated their procedures; however, some candidates averaged their duplicate raw results before processing. This meant that these candidates did not have access to the full range of marks for data analysis. Candidates must carry out calculations on duplicate raw results separately to produce two final values.

Candidates should be discouraged from producing bar charts. It is unlikely that a bar chart is appropriate in any project report. Line graphs should only be produced if necessary, such as for calibration graphs or rate graphs. There is no requirement for a graph in an Advanced Higher project. If a graph is provided, then it must be appropriately labelled with correctly formatted units and with sufficient gridlines to allow the accuracy of plotting to be checked. Candidates may have to amend labels and/or units by hand in electronically produced graphs.

When candidates make a comparison of experimental results with an internet/literature source, they should state whether their results are higher or lower than the source. Also, it may be necessary for candidates to convert their results so that they can be compared. For example, the concentration of a substance may be given by the manufacturer as a percentage, but the candidate has calculated the concentration in mol l^{-1}. One unit will need to be converted into the other before a comparison can be made.

Evaluation

When making evaluative statements about the procedures used, candidates must state the precise effect this will have on the final results. For example, some candidates who identified transfer losses during a synthesis did not go on to say that this would result in a lower percentage yield value. Stating that the final result would be inaccurate is not sufficient.

Candidates should only calculate uncertainties for measurements where the measurement is used in a calculation, leading to the final result. For example, candidates should not include uncertainties associated with measuring cylinders used to add substances in excess. When calculating uncertainties associated with burettes, it is the titre volume that is used in the calculation, and not the total volume of the burette.

Structure

Candidates should be encouraged to check their project report after printing to make sure the headings for sections and tables are not split over multiple pages. The contents page should only include the main sections of the report.

Appendix: 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.

Every year, we evaluate the performance of our assessments in a fair way, while ensuring standards are maintained so that our qualifications remain credible. To do this, we measure evidence of candidates' knowledge and skills against the national standard.

During the pandemic, we modified National Qualifications course assessments, for example we removed elements of coursework. We kept these modifications in place until the 2022–23 session. The education community agreed that retaining the modifications for longer than this could have a detrimental impact on learning and progression to the next stage of education, employment or training. After discussions with candidates, teachers, lecturers, parents, carers and others, we returned to full course assessment for the 2023–24 session.

SQA's approach to awarding was announced in March 2024 and explained that any impact on candidates completing coursework for the first time, as part of their SQA assessments, would be considered in our grading decisions and incorporated into our well-established

grading processes. This provides fairness and safeguards for candidates and helps to provide assurances across the wider education community as we return to established awarding.

Our approach to awarding is broadly aligned to other nations of the UK that have returned to normal grading arrangements.

For full details of the approach, please refer to the National Qualifications 2024 Awarding — Methodology Report.