Course report 2023

National 5 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 in conjunction with the published assessment documents and marking instructions.

The statistics in the report were compiled before any appeals were completed.

Grade boundary and statistical information

Statistical information: update on courses

Number of resulted entries in 2022: 15,595

Number of resulted entries in 2023: 15,561

Statistical information: performance of candidates

Distribution of course awards including minimum mark to achieve each grade

A	Number of candidates	6,616	Percentage	42.5	Cumulative percentage	42.5	Minimum mark required	69
B	Number of candidates	3,152	Percentage	20.3	Cumulative percentage	62.8	Minimum mark required	57
C	Number of candidates	2,354	Percentage	15.1	Cumulative percentage	77.9	Minimum mark required	46
D	Number of candidates	1,900	Percentage	12.2	Cumulative percentage	90.1	Minimum mark required	34
No award	Number of candidates	1,539	Percentage	9.9	Cumulative percentage	100	Minimum mark required	N/A

Please note that rounding has not been applied 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 more statistical reports on the statistics and information page of SQA’s website.

Section 1: comments on the assessment

Question paper

Marker and centre feedback suggested that the question paper was fair but challenging and that the allocated time was appropriate, allowing candidates to answer all questions.

Candidates were able to access the full range of marks and the question paper provided good differentiation and discrimination.

Candidates were well prepared for the different types of questions used in the question paper.

Section 1 was intended to be slightly more demanding than in 2022.

Section 2 was more demanding than intended. This was considered when setting grade boundaries.

Assignment

The requirement to complete the assignment was removed for session 2022–23.

Section 2: comments on candidate performance

Areas that candidates performed well in

Question paper

Section 1 (multiple-choice)

Question 1	Many candidates were able to calculate the volume of gas that would be collected in the first 60 s of the reaction when given the average rate of reaction.
Question 2	Most candidates were able to describe the mass, charge, and location of a proton.
Question 3	Most candidates were able to identify the compound that forms molecules with an angular structure.
Question 4	Many candidates were able to identify the diagram that could be used to represent the structure of lithium fluoride.
Question 6	Most candidates were able to calculate and identify the solution that contained the least number of moles of solute.
Question 7	Many candidates were able to identify the substance, when shaken with water, that would cause the pH of water to increase.
Question 9	Many candidates were able to identify the correct equation, omitting the spectator ions, when sodium carbonate neutralises hydrochloric acid.
Question 11	Many candidates were able to identify an isomer of 2-methylbut-2-ene.
Question 13	Most candidates could identify the ketone formed by reacting the two carboxylic acids given.
Question 14	Many candidates were able to identify the formula mass and solubility when methanol is compared to octan-1-ol.
Question 15	Most candidates were able to identify that both butane and cyclobutane are saturated.
Question 16	Many candidates were able to identify that sodium methanoate is the product of the reaction between sodium oxide and methanoic acid.
Question 17	Most candidates were able to identify the properties of a metal when given the data on the melting point, boiling point, and its ability to conduct when solid and liquid.

Question 18 Most candidates were able to order the metals in order of increasing reactivity when given information on their reaction with oxygen, dilute acid, and water.

Question 19 Most candidates were able to identify the combination of metals in the electrochemical cell, given the direction of electron flow.

Question 21 Most candidates were able to identify the reactant and product for the Haber process.

Question 22 Most candidates were able to identify the number of alpha particles released when an atom of Th decays to form an atom of Pb.

Question 23 Most candidates were able to identify the salt that would not be prepared by a precipitation reaction.

Question 24 Most candidates were able to identify the mixture that would give the results from the Benedict's test, iodine test and flame test, as shown in the table.

Section 2 (restricted-response and extended-response)

Question 1(a) Most candidates were able to state the number of diatomic elements.

Question 1(b) Most candidates were able to state the mass number of the most common isotope in the sample.

Question 1(c) Most candidates were able to name an element that has similar chemical properties to chlorine.

Question 2(a) Most candidates were able to state the term 'hydrocarbons', as the term used to describe compounds that contain only carbon and hydrogen atoms.

Question 2(b)(i) Many candidates were able to state the name of chemical X produced in the reaction as hydrogen.

Question 2(c)(i) Many candidates were able to draw the full structural formula for ethyne.

Question 2(c)(ii)(B) Most candidates were able to state what is meant by the term 'exothermic'.

Question 3(a) Most candidates were able to state a group number in which all the elements are metals.

Question 3(b)(ii) Many candidates were able to suggest a name for metal X, based on the observations given in the table.

Question 3(d)(i)	Most candidates were able to suggest a value for the voltage produced by the cell when metal A is iron.
Question 3(d)(iii)	Many candidates were able to suggest one factor that should be kept constant to make the experiment fair.
Question 4(a)	Most candidates were able to state where the carbon dioxide for the industrial-scale method would be extracted from.
Question 4(b)	Most candidates were able to state another advantage of using catalysts to speed up chemical reactions.
Question 6(a)(i)	Many candidates were able to name the functional group as carboxyl.
Question 6(a)(ii)	Many candidates were able to state the type of reaction that takes place as polymerisation.
Question 6(b)(ii)	Most candidates were able to draw a bar on the graph, in the correct range, to show the expected swelling for material A.
Question 6(c)(i)	Most candidates were able to suggest a more appropriate piece of apparatus to measure the volume of water.
Question 6(c)(ii)	Most candidates were able to draw a graph of the correct format, with labels and units and using an appropriate scale.
Question 7(a)	Most candidates were able to name the third member of the silane family.
Question 7(b)	Most candidates were able to calculate the number of hydrogen atoms present in a molecule of pentasilane.
Question 7(d)	Many candidates were able to draw a diagram, showing all the outer electrons, for a molecule of monosilane.
Question 8(a)	Most candidates were able to state the name of the compound from which phosphoric acid can be produced.
Question 8(c)(i)	Many candidates were able to name the other element present in ADP that is essential for healthy plant growth.
Question 8(c)(ii)	Most candidates were able to suggest a property that would make sodium phosphate suitable for use as a fertiliser.
Question 8(d)	Candidates were able to access partial marks when attempting to calculate the percentage by mass of phosphorus in phosphoric acid. Most candidates were able to access 2 of the marks available.

Question 9(a)(i) Candidates were able to access partial marks when attempting to calculate the energy absorbed by the water in the experiment. Most candidates accessed 1 mark for using $E_h = cm\Delta T$, using 4.18. Many candidates accessed a further partial mark for the correct substitution and conversion of data for the mass of water and the temperature change.

Question 9(b) Most candidates were able to access a partial mark for calculating the energy that would be found in a 30 g biscuit, with many accessing both marks.

Question 10(a)(i) Many candidates were able to suggest a method used to extract caesium metal from its ore.

Question 10(b)(ii) Most candidates were able to suggest why an alpha particle emitting radioactive isotope was not suitable for the purpose of measuring the thickness of materials, such as paper and sheets of metal.

Question 10(b)(iii)(B) Candidates were able to access partial marks when attempting to calculate the fraction of caesium-137 that will have decayed after 120 years. Many candidates were able to calculate the correct number of half-lives with the correct fraction of caseium-137 that remained after 120 years.

Question 11(b)(i) Most candidates were able to balance the equation correctly.

Question 11(b)(ii) Many candidates were able to describe the relationship between the concentration of hydrogen ions and the concentration of hydroxide ions in a solution of hydrofluoric acid.

Areas that candidates found demanding

Question paper

Section 1 (multiple-choice)

Question 8 Some candidates were able to identify that nickel sulfate is produced in the reactions of nickel carbonate, nickel hydroxide and nickel metal reacting with dilute sulfuric acid.

Question 10 Some candidates were able to name the compound given its shortened structural formula.

Question 12 Some candidates were able to identify the compound that would not be produced by an addition reaction of but-2-ene.

Question 20 Some candidates were able to identify the overall redox equation, given the ion-electron equation for the reduction of magnesium ions, and the ion-electron equation for the reduction of silver(I) ions.

Question 25 Some candidates were able to calculate the number of moles of NaOH(aq) required to neutralise the H_2SO_4(aq).

Section 2 (restricted-response and extended-response)

Question 3(c) Some candidates were able to complete the table to show the gas produced, and the test, including the result, for the gas produced in the reaction of a metal with dilute hydrochloric acid.

Question 5 Some candidates were able to access 2 marks for commenting on the chemistry of nitrogen. Few candidates were able to access 3 marks.

Question 6(b)(i) Some candidates were able to use the graph to identify the combination of material and salt solution that resulted in the most swelling.

Question 6(c)(ii) Few candidates were able to access the mark awarded for accuracy of plotting and line of best fit when drawing a graph.

Question 8(b) Some candidates were able to write the molecular formula for the chemical used to purify phosphoric acid.

Question 8(e) Some candidates were able to name the technique that could be used to separate the solid calcium sulfate from the liquid phosphoric acid.

Question 10(a)(ii) Some candidates were able to name the type of chemical reaction taking place when caesium ions are changed into caesium atoms.

Question 10(b)(iii)(A) Some candidates were able to state what is meant by the term half-life.

Question 10(b)(iii)(B) Few candidates were able to calculate the final fraction of caesium-137 that will have decayed after 120 years.

Question 11(a) Few candidates were able to identify the bonding and structure of tungsten(VI) fluoride, given its state at room temperature.

Question 11(c) Some candidates were able to complete the ion-electron equation for the reaction of tungsten(VI) ions to form tungsten(IV) ions by adding the correct number of electrons to the correct side of the equation.

Question 12 Few candidates were able to access 2 marks for describing how a student could investigate one factor that would affect the rate of the reaction of dilute hydrochloric acid with calcium carbonate. Few candidates were able to access 3 marks.

Section 3: preparing candidates for future assessment

Teachers and lecturers should refer to the National 5 Chemistry Course Specification, which is available on SQA's website.

Question paper

Candidate performance in calculations has again improved in the 2023 question paper. Candidates should continue to learn basic 'routines' for the different types of calculation. In all calculations worth more than 1 mark, candidates should be aware that credit is given for the correct demonstration of chemical concepts or for intermediate results in a multi-step calculation. Teachers and lecturers should encourage candidates to show their working clearly, to maximise their chances of obtaining partial marks.

Candidates should be prepared to meet calculations with a mole ratio other than 1:1, 1:2 or 2:1.

Teachers and lecturers should remind candidates that page three of the data booklet contains relationships that can be used for National 5 calculations.

Candidates should understand that they must correctly round their answers in all calculations.

Candidates should understand that if a unit is provided in the stem of a question, it is not necessary to state the unit with their answer. However, if a candidate does provide a unit, it must be correct, otherwise they will only have access to some of the marks. The use of incorrect units is only penalised once across the question paper.

When drawing graphs, candidates should understand that, along with accuracy of plotting, they must be able to draw a line or curve of best fit.

Teachers and lecturers should encourage candidates to learn chemistry definitions, as provided in the National 5 Chemistry Course Specification, such as the definition for half-life and electrolyte.

Teachers and lecturers should encourage candidates to learn chemical tests, processes, and chemical reactions, such as the tests for common gases.

Candidates should know how to write molecular formula, and practise writing these. Candidates should also practise writing chemical equations. When writing formulae, charges must be superscript, and numbers of atoms and ions must be subscript. Many candidates did not access marks due to errors in writing chemical symbols, and in the position and size of numbers and charges within a formula.

Candidates should know that when a 2-mark question asks for an explanation, they must demonstrate a deeper understanding of the concept to achieve full marks.

Teachers and lecturers should consider the variety of practical work that candidates undertake. This will deepen their knowledge and understanding and develop practical laboratory skills. The National 5 Chemistry Course Specification details the common chemical apparatus, general practical techniques, analytical methods and reporting of experimental work that candidates must be familiar with.

Candidates would benefit from more opportunities to practise answering open-ended questions. Candidates need to be aware that, while there are no definitive answers to open-ended questions, their answer should make statements that are relevant to the situation or problem given. Where a candidate is asked to describe how a student could investigate a chemical reaction, there is an expectation that there will be a degree of planning or designing an experimental procedure.

Candidates can give broad answers, covering a number of aspects of a question, or focus on one particular aspect and give a detailed explanation. Candidates are not expected to give a perfect answer to gain full marks for the question. These questions are marked holistically, rather than on a number-of-points basis (for example 1 point, 1 mark; 2 points, 2 marks). Marks are assigned according to whether the candidate's answer displays no understanding (0 marks); limited understanding (1 mark); reasonable understanding (2 marks); or good understanding (3 marks).

Assignment

This course will return to full assessment requirements from session 2023–24 onwards. Please refer to the course specification for more information on the course assessment structure.

The National 5 Chemistry Assignment Assessment Task outlines the assessment conditions for the assignment. Teachers and lecturers must use the most up-to-date version available on the National 5 Chemistry subject page of SQA's website. They can also refer to the candidate evidence, with accompanying commentaries, that is available on the Understanding Standards website.

The information below, from section 3 of the 2019 course report, may support centres in preparing candidates for the assignment.

Centres should refer to the most up-to-date assignment assessment task on SQA's website.

Candidates must be provided with the 'Instructions for candidates' section from the assignment assessment task, and encouraged to follow the outline structure. The 'Instructions for candidates' section must not be altered in any way and templates are not permitted in the report writing stage. The marking instructions should be shared with candidates, before and during the research stage. However, the marking instructions must not be available to candidates during the report writing stage.

Candidates must carry out an experiment that allows measurements to be made, and these measurements must be included in their report. This includes initial mass and final mass. Change in mass and change in temperature on their own is not raw data, and would not be sufficient for the marks in section 3(b).

In addition, candidates must understand that their choice of internet or literature source should allow them to make a comparison with their experimental results.

The report stage of the assignment must be written by the candidates under a high degree of supervision and control in a maximum of 1 hour and 30 minutes. If centres allow candidates to complete the reports over a number of periods, then the teacher or lecturer must retain the reports between periods, as candidates must not work on their reports outwith these controlled conditions. Candidates' reports must not be scrutinised by teachers or lecturers and no feedback or redrafting is permitted. The assignments must be kept securely until they are submitted to SQA.

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.

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 was developed to support learners and centres. This included modifications to course assessment, retained from the 2021–22 session. This support was designed to address the ongoing disruption to learning and teaching that young people have experienced as a result of the COVID-19 pandemic while recognising a lessening of the impact of disruption to learning and teaching as a result of the pandemic. The revision support that was available for the 2021–22 session was not offered to learners in 2022–23.

In addition, SQA adopted a sensitive approach to grading for National 5, Higher and Advanced Higher courses, to help ensure fairness for candidates while maintaining

standards. This is in recognition of the fact that those preparing for and sitting exams continue to do so in different circumstances from those who sat exams in 2019 and 2022.

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 2023 and the ongoing impact the disruption from the pandemic has had on learners. 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 the removal of revision support.

The grade boundaries used in 2023 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 2023 Awarding — Methodology Report.