Course report 2022

Subject	Chemistry
Level	National 5

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	**15595**

Statistical information: performance of candidates

Distribution of course awards including grade boundaries

A	Percentage	42.5	Cumulative percentage	42.5	Number of candidates	6625	Minimum mark required	70
B	Percentage	20.6	Cumulative percentage	63.1	Number of candidates	3210	Minimum mark required	58
C	Percentage	16.7	Cumulative percentage	79.8	Number of candidates	2605	Minimum mark required	46
D	Percentage	11.9	Cumulative percentage	91.7	Number of candidates	1860	Minimum mark required	34
No award	Percentage	8.3	Cumulative percentage	N/A	Number of candidates	1295	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

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 less demanding than intended and section 2 was more demanding than intended. This was taken into account when setting grade boundaries.

Assignment

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

Section 2: comments on candidate performance

Question paper

Section 1 (objective test)

Question 1	Most candidates were able to identify the atomic number of a metal.
Question 2	Most candidates were able to select the correct statement to explain why an atom is neutral.
Question 3	Some candidates had difficulty selecting the correct statement to describe the forces of attraction between atoms and molecules when liquid water turns into steam.
Question 5	Most candidates were able to select the structure that would be described as angular.
Question 6	Most candidates were able to determine which of the bonds was most polar, using information given in the table.
Question 8	Some candidates had difficulty identifying which of the four compounds was a salt.
Question 10	Some candidates had difficulty identifying Gas X from the experimental results given.
Question 11	Most candidates were able to identify the compound with the highest boiling point.
Question 13	Most candidates were able to identify the general formulae for the alkanones.
Question 14	Many candidates were able to calculate the formula mass for a cycloalkane.
Question 15	Most candidates were able to select the correct description for metallic bonding.
Question 16	Most candidates were able to select the correct data for a metal that can be used to make aircraft.
Question 17	Many candidates could identify the metal that can only be extracted from its ore using electrolysis and forms an oxide that is insoluble in water.
Question 18	Most candidates could identify the statement that correctly describes the electron flow in the electrochemical cell.
Question 19	Most candidates could identify the metal that should be paired with magnesium to produce the highest voltage.
Question 20	Most candidates could identify the equation that described the overall redox reaction in the cell.
Question 21	Most candidates could select the structure of the monomer used to make the polymer polymethylmethacrylate.
Question 22	Many candidates were able to select the product and catalyst used in the Ostwald process.
Question 23	Many candidates were able to select the statement comparing the half-life of radon-222 in the atmosphere with radon-222 in plant cells.
Question 24	Many candidates were able to select the type of radiation and half-life that would make a radioisotope suitable to monitor the flow of blood around the body.

Question 25	Most candidates were able to select the piece of apparatus that the student should use to accurately measure out 25 cm^3 volume of sodium hydroxide.

Question paper

Section 2 (restricted-response and extended-response)

Question 1(a)(i)	Most candidates were able to name the type of radiation emitted by the iodine-131 radioisotope.
Question 1(a)(ii)	Many candidates were able to name element Y from the equation for the decay of iodine-131.
Question 1(b)(i)	Many candidates were able to calculate the length of time taken for the radioactive decay of xenon-133 to fall to one eighth of its original value.
Question 1(b)(ii)	Most candidates were able to suggest the radioisotope that would be responsible for long-term radiation.
Question 2(a)	Many candidates were able to complete the graph by choosing an appropriate scale. However, many candidates had difficulty obtaining the second mark for accuracy of plotting and drawing a line of best fit.
Question 2(b)	Most candidates were able to calculate the average rate of reaction between 1 and 4 minutes.
Question 2(c)	Few candidates were able to suggest a different measurement that could be used to follow the progress of the chemical reaction.
Question 2(d)	Many candidates were able to predict the final volume of the gas produced in the reaction when the temperature was increased.
Question 3(a)	Most candidates were able to name the two products formed when DEF is heated in the exhaust system.
Question 3(b)	Many candidates were able to calculate the mass of urea used to make 5 kg of DEF.
Question 3(c)	Many candidates were able to circle the correct words to complete the sentence.
Question 3(d)	Most candidates were able to state a reason for DEF not being considered as a dangerous substance.
Question 3(e)(i)	Many candidates were able to explain why diammonium hydrogen phosphate is not classified as a single nutrient fertiliser.
Question 3(e)(ii)	Most candidates were able to calculate the percentage by mass of nitrogen in diammonium hydrogen phosphate.
Question 4(a)(i)	Many candidates were able to name the type of chemical reaction taking place when ethene reacts with hydrogen bromide.
Question 4(a)(ii)	Most candidates were able to draw a diagram, showing all outer electrons, for molecules of hydrogen bromide.
Question 4(a)(iii)	Some candidates were able to name the chemical that can be reacted with ethene to make chloroethene.
Question 4(b)(i)	Many candidates were able to draw the structure used in step 1 that would react to produce ethanoic acid.
Question 4(b)(ii)	Many candidates were able to state the name given to a dilute solution of ethanoic acid.
Question 5	This was an open-ended question. Many candidates had difficulty obtaining all 3 marks for commenting on how the students could

	experimentally determine which of the two brands of indigestion tablets would be the most effective.
Question 6(a)	Some candidates were able to state the systematic name for isopentane.
Question 6(b)(ii)	Many candidates were able to balance the chemical equation for the combustion of isopentane.
Question 6(b)(iii)	Most candidates were able to calculate the energy absorbed by water from the chemist's experiment.
Question 6(b)(iv)	Some candidates were able to draw a labelled diagram for the experimental set-up that could be used to determine the quantity of heat energy absorbed by the water when the fuel burns.
Question 7(a)(i)	Many candidates were able to calculate the mass of sodium chloride required to prepare the solution.
Question 7(a)(ii)	Many candidates were able to name the piece of apparatus that should be used to accurately measure the mass of solid sodium chloride.
Question 7(b)(i)	Some candidates were able to calculate the student's average boiling point for the measured temperatures.
Question 7(b)(ii)	Most candidates were able to present results in a table.
Question 7(c)	Many candidates were able to state the type of graph that should be drawn to present the experimental results.
Question 7(d)	Most candidates were able to suggest a conclusion for the experiment based on the student's results.
Question 8(a)	Many candidates were able to name dilute acid A.
Question 8(c)	Some candidates were able to suggest how the student would know when to stop adding the sodium carbonate to the acid.
Question 8(d)	Many candidates were able to state which of the salts would be produced as a precipitate.
Question 8(e)	Some candidates were able to state what is meant by a neutralisation reaction.
Question 9(a)	Most candidates were able to state what is meant by the term 'isotope'.
Question 9(b)	Most candidates were able to explain why the noble gases are unreactive.
Question 9(c)(i)	Few candidates were able to write a chemical equation to produce xenon hexafluoride by reacting xenon difluoride with fluorine.
Question 9(c)(ii)	Some candidates were able to state the term used to describe the structure of xenon hexafluoride.
Question 9(c)(iii)	Most candidates were able to suggest the mass of catalyst that would remain at the end of the reaction.
Question 9(c)(iii)(B)	Some candidates were able to calculate the cost of purchasing the required mass of nickel(II) fluoride.
Question 10(a)	Many candidates were able to state what is meant by the term 'homologous series'.
Question 10(b)(i)	Many candidates were able to name the functional group present in alcohols.
Question 10(b)(iii)	Some candidates were able to draw an isomer of 3-methylbutan-2-ol that had a different alcohol classification.

Question 11(a)(i)	Many candidates were able to describe the test for the presence of oxygen gas.
Question 11(a)(ii)	Few candidates were able to write the formulae for potassium chlorate, showing the charge on each ion.
Question 11(b)(i)	Most candidates were able to state what is meant by the term ‘exothermic’.
Question 11(b)(ii)	Most candidates were able to suggest why the flames were lilac in colour during the demonstration.
Question 11(c)	Some candidates were able to calculate the mass of oxygen required to react completely with the given mass of glucose, with many candidates able to obtain partial marks for showing their working.
Question 12(a)(i)	Most candidates were able to describe the trend in covalent radius going across the period.
Question 12(a)(ii)	Most candidates were able to describe the general trend in covalent radius going down a group.
Question 12(a)(iii)	Most candidates were able to predict a value for the covalent radius of strontium.
Question 12(b)	Many candidates were able to calculate the distance between the nuclei in bromine.
Question 12(c)(i)	Many candidates were able to write the electron arrangement for the sodium ions.
Question 12(c)(ii)	Some candidates were able to suggest why the radius of the sodium ion was smaller than that of the sodium atom.
Question 13	This question was an open-ended question. Many candidates had difficulty obtaining all 3 marks for commenting on the chemistry of redox reactions, although many candidates obtained partial marks.

Section 3: preparing candidates for future assessment

Question paper

Candidate performance in calculations has improved in the 2022 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 final answer 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 basic chemistry definitions, such as the definition for 'neutralisation', as well as chemical terms, such as 'fuel'. Additionally, teachers and lecturers should encourage candidates to learn chemical tests, processes, and chemical reactions, such as when to stop adding a metal carbonate to an acid.

Candidates should 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.

Candidates need to know that, when drawing a diagram showing all outer electrons in a molecule, the diagram should show all outer non-bonding electrons and not just shared or bonding electrons. In addition, candidates' diagrams should not show all inner electrons as, if shown, they must be correct.

Centres should consider the variety of practical work that candidates undertake. This will deepen their knowledge and understanding and develop practical laboratory skills. The revised National 5 course has a greater emphasis on practical techniques and the use of apparatus. There are several mandatory items of ‘common chemical apparatus’, ‘general practical techniques’, ‘analytical methods’ and importantly, ‘reporting experimental work’, that candidates must be familiar with. This year’s question paper highlighted that some candidates had difficulty drawing a table of results and calculating an average.

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. Candidates can give broad answers, covering a number of aspects of a question, or focus on one particular aspect and give a detailed explanation. 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). Candidates do not need to give a perfect answer to gain full marks for the question.

Centres should refer to the National 5 Chemistry Course Specification, which is available on SQA’s website.

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.