Course report 2019

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 post-results services.

Section 1: comments on the assessment

Question paper

Marker and centre feedback suggest 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 very good differentiation.

Section 1 was less demanding than intended and section 2 was more demanding than intended. This was taken into account when setting grade boundaries.

Candidates were well prepared for the different types of questions used in the question paper. However, they did not appear to be as well prepared for the following questions:

- recall of chemical reactions (questions 5(b)(i) and 8(d))
- chemical definitions (questions 5(b)(i) and 8(d))
- simple calculations (question 2(d))
- open-ended questions (questions 6 and 13)
- practical chemistry techniques (questions 5(a), 9(b)(ii), 11(c), 11(d), 12(a)(i), 12(b)(i) and 12(b)(iii))

Assignment

The assignment provided as expected. Candidates were able to access the full range of marks and the assignment provided good differentiation. Assignments covered a range of topics, including ‘Rates of Reaction’, ‘Electrochemical Cells’ and, to a lesser degree than in previous years, ‘Alcohols as Fuels’.

Many candidates who investigated ‘Alcohols as Fuels’, with the aim of relating the number of carbon atoms present in the alcohol to the quantity of energy produced, did not access the mark for sufficient raw data because they did not provide the actual measurements they took during their experiment (initial mass and final mass of alcohol, initial and final temperature). Additionally, candidates had difficulty accessing the mark for mean and/or derived values.

Candidates should take their raw data into the report writing stage (this includes pre-populated tables of raw data). An increasing number of candidates are choosing to input mean and/or derived data into a pre-populated table. Candidates should either extend their table of raw data or produce a new table during the write-up stage. Candidates should ensure that they are completing labels for mean and/or derived data, units for mean and/or derived data, and calculations of mean and/or derived data in the report writing stage.

In the evaluation section, many candidates failed to evaluate the experimental procedure. Instead, they simply referred to repeating their experiment. It was evident that an increasing number of candidates had clearly followed the ‘Instructions for candidates’ section of the assignment assessment task.

Section 2: comments on candidate performance

Areas that candidates performed well in

Question paper

Section 1 (objective test)

Question 1	Most candidates were able to calculate the average rate of reaction in the given time.
Question 3	The majority of candidates were able to identify the group of the periodic table where Tennessine would be placed.
Question 4	Many candidates were able to identify the positively charged ion from the table.
Question 5	Many candidates were able to identify the true statement relating to compounds having a higher critical temperature than elements.
Question 6	Most candidates were able to describe the shape of a phosphorus trifluoride molecule as trigonal pyramidal.
Question 10	Many candidates were able to select the correct number process to calculate the percentage by mass of nitrogen in ammonium nitrate.
Question 11	Many candidates were able to identify that the concentration of hydroxide ions decreases as an alkaline solution is diluted.
Question 16	Most candidates were able to identify the alkane produced in the Clemmensen reaction.
Question 18	Most candidates were able to select the voltage produced in the silver-copper cell.
Question 22	The majority of candidates were able to identify Ba^{2+} ions as producing a green flame.
Question 23	Most candidates were able to identify carbon dioxide as the gas that turns limewater cloudy.
Question 25	Many candidates were able to select the correct pair of ions that acted as spectators in the given reaction.

Section 2 (restricted-response and extended-response)

Question 1 (b)(i)	Most candidates were able to state the terms used to describe the different types of boron atom.

Question 1(b)(iii)	Many candidates were able to state the mass number of the most common type of boron atom.
Question 2(b)	Most candidates could name the type of substance used to convert ethane-1,2-diol into oxalic acid.
Question 2(c)	The majority of candidates were able to name the salt in the passage.
Question 3(c)(i)	The majority of candidates were able to describe the relationship from the data in the table.
Question 3(c)(ii)	Many candidates were able to draw the graph.
Question 4(a)	Most candidates were able to state where radioactive decay occurs in an atom.
Question 5(b)(ii)	Most candidates were able to name the chemical that reacted with propene to form 1,2-dichloropropane.
Question 7(b)(i)	Many candidates were able to name the homologous series to which $C_{25}H_{52}$ belonged.
Question 7(b)(ii)	Many candidates were able to write the molecular formula for the given number of hydrogen atoms.
Question 7(c)	Most candidates were able to predict the boiling point for the hydrocarbon, given the data provided in the table.
Question 8(a)	The majority of candidates were able to select where beryllium is formed, from the information given in the passage.
Question 9(a)	Most candidates were able to state the term ‘exothermic’ as used to describe all chemical reactions that release heat.
Question 9(b)	More than half of candidates were able to explain that the use of a heat shield prevents heat loss to the environment.
Question 9(c)(ii)	Many candidates were able to draw the full structural formula for the aldehyde produced.
Question 10(a)	Most candidates were able to identify the piece of apparatus as an ion or salt bridge.

Assignment

Section 1	Most candidates could write an aim for their investigation.
Section 3(b)	The majority of candidates provided sufficient raw data from their experimental procedure.

Section 3(e)	The majority of candidates were able to provide an internet or literature source relevant to their experiment.
Section 3(f)	Most candidates were able to provide an appropriate reference for their internet or literature source.
Section 4(a)	Most candidates were able to select an appropriate graph type by plotting either points or bars.
Section 4(b)	Most candidates were able to select suitable scales on their axis or axes.
Section 4(c)	Most candidates were able to add suitable labels and units to their axes.
Section 8	The majority of candidates could provide an appropriate title and a clear and concise report.

Areas that candidates found demanding

Question paper

Section 1 (objective test)

Question 7	Over half of candidates were unable to identify the ions that had the same electron arrangement.
Question 15	Over half of candidates were unable to identify the alkene that would produce two products when it undergoes an addition reaction with water.
Question 20	Over half of candidates were not able to identify the monomer of the co-polymer given in the question.
Question 21	Many candidates were unable to identify the method that is appropriate for collecting and measuring the volume of nitrogen dioxide.

Section 2 (restricted-response and extended-response)

Question 2(d)	Many candidates were unable to calculate the mass of one mole of the harmless product formed in the body from propane-1,2-diol.
Question 3(a)	Most candidates were unable to draw a diagram to represent a molecule of nitrogen gas, N_2, showing all outer electrons.

Question 3(c)(ii)	Many candidates had difficulty drawing a line or curve of best fit to show the relationship between temperature and percentage yield of ammonia.
Question 3(d)(i)	Over half of candidates were unable to complete the flow diagram using information from the passage.
Question 4(b)(i)	Over half of candidates were unable to state what is meant by the term ‘half-life’.
Question 4(b)(iii)	Over half of candidates were unable to identify the correct words to complete the sentence to state what happens to the half-life of a solution of iodine-131 when it is diluted.
Question 5(b)(i)	Many candidates were unable to name the addition reaction, hydrogenation, as the reaction taking place when hydrogen reacts with propene.
Question 5(b)(iii)	The majority of candidates were unable to name the polymer, poly(propene), as the polymer formed in the reaction.
Question 5(c)(i)	Many candidates were unable to calculate the mass of ethene required to make the given mass of cyclohexene.
Question 5(c)(ii)	Over half of candidates were unable to explain why cyclopentene has a lower boiling point than cyclohexene.
Question 6	Most candidates found this open-ended question demanding. Rather than comment on the chemistry of oxides, many candidates tended to discuss the chemistry of oxygen.
Question 8(c)	The majority of candidates were unable to write an equation, using symbols and formulae, to show the reaction taking place.
Question 8(d)	Over half of candidates were unable to name the type of chemical reaction taking place when beryllium ions are changed into beryllium atoms.
Question 8(e)	Many candidates were unable to write the nuclide notation for the particle discovered by James Chadwick: a neutron.
Question 9(b)(ii)	The majority of candidates were unable to explain why the use of a copper can results in more heat energy being absorbed by the water.
Question 10(b)(iii)	Over half of candidates were unable to write the redox equation for the two reactions taking place in the electrochemical cell.
Question 11(a)	Over half of candidates were unable to write the formula, showing the charges on each ion, for calcium carbonate.

Question 11(c)	Most candidates were unable to complete the instruction for step three of the given procedure.
Question 11(d)	Over half of candidates were unable to name the two techniques, in the correct order, that must be carried out to obtain a dry sample of calcium propanoate.
Question 12(a)	Many candidates could not state the term given to a solution of accurately known concentration.
Question 12(b)(i)	Over half of candidates were unable to suggest an improvement to the student's experimental technique.
Question 12(b)(iii)	Many candidates could not state the term 'concordant' to describe titre volumes within 0·2 cm^3 of each other.
Question 12(b)(iv)	Over half of candidates were unable to calculate the concentration of hydrochloric acid from the titration.
Question 13	Most candidates found this open-ended question demanding. Candidates were able to explain forces of attraction in terms of the basics of bonding, but failed to add depth to their answers.

Assignment

Section 2	Some candidates had difficulty explaining the underlying chemistry related to their chosen topic. Some candidates' reports contained underlying chemistry, but it was not clear that they understood the chemistry involved.
Section 3(a)	Some candidates had difficulty summarising their experimental method, with many candidates giving a detailed description of each step taken through the procedure.
Section 5	Some candidates had difficulty analysing their data and/or information. Many candidates provided a conclusion related to each source rather than comparing the information provided by their experimental data with their internet or literature source.
Section 6	Some candidates had difficulty stating a valid conclusion that related to their aim. Many candidates stated a conclusion that was not supported by information in their experimental data and/or their internet or literature source.
Section 7	Some candidates had difficulty describing a factor that could or did have an impact on their experimental results.

Section 3: preparing candidates for future assessment

Question paper

Although candidate performance in calculations has improved in the 2019 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 will be given for the correct demonstration of chemical concepts or for intermediate results in a multi-step calculation.

Candidates should be encouraged to show their working clearly to maximise their chances of obtaining some marks. Candidates should meet calculations using a mole ratio other than 1:1, 1:2 or 2:1.

Candidates should be reminded that page three of the data booklet contains relationships that can be used for National 5 calculations.

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

Centres should advise candidates to consider calculations that involve the specific heat capacity, as they should be able to calculate any value from within this relationship. Given relevant data, the quantities Eh, c, m or ΔT can be calculated in the correct units.

Candidates should be encouraged to learn basic chemistry definitions such as the definition for 'homologous series' and 'half-life' as well as chemical terms such as 'isotope' and 'network'. Additionally, candidates should be encouraged to learn chemical tests, processes and chemical reactions, such as the test for unsaturation, reduction and hydrogenation. Candidates need to use appropriate terminology when answering questions.

Candidates should be encouraged to write balanced nuclear equations, which include neutrons, using nuclide notation. Candidates need to 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 should be discouraged from showing all inner electrons as, if shown, they must be correct.

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 symbols and in the position and size of numbers and charges within a formula.

Centres should consider the variety of practical work that candidates undertake. This may deepen their knowledge and understanding as well as developing practical laboratory skills. In the question paper it was evident that many candidates lacked knowledge and understanding of experimental work, for example, neutralisation reaction to prepare soluble salts, and the use of appropriate terms such as 'standard solution' and 'concordant'.

The revised National 5 course has a greater emphasis on practical techniques and the use of apparatus. There are several mandatory items of laboratory apparatus, practical techniques and analytical methods with which candidates must be familiar. Centres should refer to the *National 5 Chemistry Course Specification,* which is available on SQA's website.

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.

Grade boundary and statistical information:

Statistical information: update on courses

Number of resulted entries in 2018	15930

Number of resulted entries in 2019	16035

Statistical information: performance of candidates

Distribution of course awards including grade boundaries

Distribution of course awards	Percentage	Cumulative %	Number of candidates	Lowest mark
Maximum mark				
A	34.6%	34.6%	5544	89
B	21.6%	56.2%	3461	74
C	20.7%	76.9%	3321	59
D	15.9%	92.8%	2553	44
No award	7.2%	-	1156	-

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.