Course Report 2017

Subject	Chemistry
Level	National 5

The statistics used in this report have been compiled before the completion of any Post Results Services.

This report provides information on the performance of candidates which it is hoped will be useful to teachers, lecturers and assessors in their preparation of candidates for future assessment. It 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.

Section 1: Comments on the assessment

Summary of the course assessment

Component 1 — question paper

The National 5 Chemistry paper places an emphasis on assessing a candidate's ability to explain underlying chemistry, scientific inquiry skills and analytical thinking skills. Consequently, the number of marks assigned to questions requiring extended answers is greater.

The National 5 course places significant emphasis on the development of numeracy and literacy skills. In considering the marking of candidates' papers it should be remembered that half-marks are not used.

The overall impression of the question paper from feedback received from markers and centres was that the National 5 Chemistry paper was fair but challenging. Feedback from markers and centres confirmed that the time allocated to the examination was appropriate to allow all candidates to answer all questions. The full range of marks was accessed by candidates and the question paper provided good differentiation.

Centres appear to have taken care in preparing candidates for many of the different types of question to be found in the examination. However, candidates appear not to be as prepared for the open-ended questions and questions in which an explanation is required, eg Q7(b)(ii) and Q11(a).

Component 2 — assignment

This assignment requires learners to apply skills, knowledge and understanding to investigate a relevant topic in chemistry and its effect on the environment and/or society. The topic should draw on one or more of the key areas of the National 5 Chemistry course.

The distribution of marks across the different sections and the skills, knowledge and understanding to be assessed is detailed in the *Chemistry Assignment General Assessment Information* document.

The majority of marks are awarded for applying scientific inquiry and analytical thinking skills. The other marks will be awarded for applying knowledge and understanding related to the topic chosen.

The full range of marks was accessed by candidates, and the assignment provided good differentiation. Overall, candidate performance has improved from that of 2016. A range of topics was submitted by candidates, including hydrogels, fuels, cells and radioisotopes. Due to the level of understanding of chemistry involved in hydrogels, this investigation proved difficult for candidates to achieve full marks in section 7.

The investigation on fuels (alcohols) which relates the number of carbon atoms to quantity of energy produced proved to be, overall, an assignment where candidates could score high marks. However, many candidates who chose this topic were unable to carry out calculations accurately.

The investigation on radioisotopes proved to be, on the whole, problematic in that candidates selected data that was not relevant to their aim. This was also the case in assignments which aimed to determine the most effective indigestion remedy. In this instance, many candidates chose to include packaging labelling, which did not allow a comparison to be made with experimental results.

Many centres had prepared their candidates well and it was evident that an increased number of candidates had clearly followed the 'Instructions to Candidates' document.

It appeared that some centres had provided candidates with resources packs. While this is acceptable, centres should ensure good practice by providing candidates with a wide selection of material covering several topics, rather than limiting the resources provided to two or three pieces of data and/or information related to the chosen topic. Even if using a resource pack, candidates should have the opportunity to select appropriate data from a range of materials.

Section 2: Comments on candidate performance

Areas in which candidates performed well

Component 1 — question paper

Section 1 (objective test)

Q1:	Most candidates could identify the average rate of reaction.
Q2:	Most candidates could identify that an atom with 21 protons, 21 electrons and 24 neutrons has atomic number 21 and mass number 45.
Q6:	Most candidates could identify the spectator ions in a chemical reaction.
Q7:	Most candidates could identify the balancing numbers for a given equation.
Q8:	Most candidates could identify C_2H_4 as the molecular formula for the gas when 0·25 moles of the gas has a mass of 7 g.
Q10:	Most candidates could identify C_7H_{16} as the molecular formula for an alkane.
Q11:	Most candidates could identify that an alkene decolourises bromine solution immediately whereas a cycloalkane does not.
Q13:	Most candidates could identify that vinegar is a solution of ethanoic acid.

Q14: Most candidates could identify that in an exothermic reaction, energy is released to the surroundings.

Q15: Most candidates could identify the diagram that represents the structure of copper.

Q16: Most candidates could identify gold as a metal found uncombined in the Earth's crust.

Q17: Most candidates could identify that oxygen is **not** an essential element for healthy plant growth.

Q18: Most candidates could identify the Haber process as the industrial process for the manufacture of ammonia.

Section 2 (restricted and extended response questions)

Q1(a): Most candidates could state that the term used to describe different types of argon atom is isotope.

Q2(a): Most candidates could use information in a passage to name the term used to describe a tiny rolled-up sheet of graphite as carbon nanotube.

Q2(b): Most candidates could use information in a passage to name the metal added to a pillared structure to increase the hydrogen storage capacity as lithium.

Q3(b): Most candidates could name the shape of a chloromethane molecule as tetrahedral.

Q4(a): Most candidates could use information in a passage to complete the labels on a diagram of a blast furnace.

Q5(a)(i): Most candidates could use a graph to calculate the half-life of phosphorus-32 as 14 days.

Q5(a)(ii): Most candidates could calculate the time it would take for the mass of a 20g sample of a radioisotope to decrease to 2·5g.

Q5(b): Most candidates could name beta as the type of radiation emitted during decay when the atomic number increases by 1.

Q8(a)(ii): Most candidates could state that the rate of the reaction would increase if powder was used instead of a strip of metal.

Q9(b): Most candidates could state the term used to describe a pair of alkanes such as 2-methylpentane and 2,3-dimethylbutane as isomer.

Q9(c)(i): Most candidates could write a general statement linking the structure of an alkane to the length of time taken to pass through a column using a separation technique called HPLC.

Q10(b): Most candidates could calculate the percentage by mass of aluminium in $Al_2(SO_4)_3$.

Q11(b): Most candidates could describe the general trend in the solubility of sulfur dioxide as the temperature of the water increases.

Q12(b): Most candidates could name esters as the family to which geranyl propanoate belongs.

Q13(b)(ii): Most candidates could name the type of polymerisation taking place when ethyne is converted to poly(ethyne) as addition.

Component 2 — assignment

Section 1: Most candidates could write an aim for their investigation.

Section 2: Most candidates could describe an application of chemistry and provide a characteristic and/or feature of their chosen application. Most candidates could provide a relationship between the application and its effect on society and/or the environment.

Section 3: Most candidates could explain their choice of sources in terms of relevance, reliability or perspective.

Section 4: Most candidates included data and/or information relevant to their aim in their report.

Section 5(b): Most candidates could present their data and/or information in appropriate format(s).

Section 8: Most candidates could provide an appropriate title, at least two references and a report which was clear and concise.

Areas which candidates found demanding

Component 1 — question paper

Section 1 (objective test)

Q3: Some candidates had difficulty identifying the charge on the zinc ion in $ZnCr_2O_7$ as 2+.

Q4: Some candidates had difficulty identifying magnesium appearing as a liquid on the surface of molten magnesium chloride, when magnesium chloride is electrolysed at 730 °C.

Q5: Some candidates had difficulty identifying sodium carbonate as a base.

Q9: Some candidates had difficulty identifying the solution with the lowest number of moles of solute.

Q12: Some candidates had difficulty identifying the elements which must be present in a compound burned in air.

Q19: Some candidates had difficulty identifying barium sulfate as a salt prepared by a precipitation reaction.

Q20: Most candidates had difficulty identifying a standard solution as a solution of accurately known concentration.

Section 2 (restricted and extended response questions)

Q2(c): Some candidates had difficulty using information in a passage to calculate the number of moles of hydrogen. Common incorrect answers included dividing 41 by 1 rather than the gfm of H_2 as 2 or multiplying the mass by the gfm.

Q3(c): Some candidates had difficulty describing how a chlorine atom achieves a stable electron arrangement. Common incorrect answers included it shared an electron with sodium or that it gained electrons.

Q4(b): Some candidates had difficulty writing an ion-electron equation to show an iron(II) ion forming an iron(III) ion.

Q6: Many candidates had difficulty using their knowledge of chemistry to suggest how a student could investigate whether copper could be used as a catalyst for the reaction between zinc and sulfuric acid.

Many candidates listed physical and chemical properties of copper and/or did not refer to the reaction specified in the question.

Q7(b)(i): Many candidates had difficulty drawing a structural formula for butanoic acid.

Q7(b)(ii): Many candidates had difficulty explaining why butanoic acid has a higher melting point than propanoic acid. Very few candidates were able to explain this in terms of stronger intermolecular bonding, with many candidates only stating that butanoic acid is a larger molecule. Another common incorrect answer referred to strong bonds within the molecule.

Q9(a): Some candidates had difficulty stating the meaning of the term ‘homologous series’. Some candidates stated that it was a family of compound with the same molecular or structural formula and/or same physical properties.

Q10(a)(i): Most candidates had difficulty completing the labels on the diagram to show the electrochemical cell which would give the direction of electron flow indicated. A common incorrect answer was the label for each solution placed in the incorrect position.

Q11(a): Many candidates had difficulty explaining the change in pH as sulfur dioxide dissolves in water to produce sulfurous acid. Some could state that the pH would decrease but were not able to explain this in terms of a higher concentration of H^+ ions.

Q12(a): Some candidates had difficulty circling a functional group in a given structure.

Many candidates circled CH_2OH rather than OH or C=C.

Q13(a): Some candidates had difficulty writing a general formula for the alkyne family given the full structural formulae for three alkynes.

Q13(c)(i): Many candidates had difficulty using information to draw the full structural formula for the alkyne formed when 2,3-dibromobutane reacts with

potassium hydroxide. A common incorrect answer was the full structural formula for but-1-yne.

Q14(a): Some candidates had difficulty drawing a structural formula for hexan-1-ol. Many candidates did not draw the bond from the carbon to the oxygen of the OH group while others had the incorrect number of carbon atoms.

Q15: Most candidates had difficulty using their knowledge of chemistry to describe how a student could distinguish between two solutions; 0·1 mol l^{-1} sodium carbonate solution and 0·2 mol l^{-1} sodium carbonate solution. Common incorrect answers referred to reacting the solutions with a base or a metal and comparing the rate of the reaction.

Component 2 — assignment

Section 5(a): Some candidates had difficulty accurately processing their data and/or information. Many candidates who attempted to summarise their data and/or information stated a conclusion rather than producing a summary.

Section 5(c): Some candidates had difficulty providing all appropriate units, headings and labels for their processed data.

Section 5(d): Some candidates had difficulty comparing their data and/or information. Many candidates provided a conclusion related to each source rather than comparing the information provided by their two sources. Many candidates chose data and/or information which could not be compared. Many candidates who stated that a comparison could not be made did not explain why.

Section 6: Some candidates had difficulty stating a valid conclusion that related to their aim. Many candidates stated a conclusion that was too vague and did not cover all aspects of their aim, and/or was not supported by information in their report.

Section 7: Some candidates had difficulty explaining the underlying chemistry related to their chosen topic. Some candidates chose topics which were at National 4 level or outwith the key areas of the National 5 course. Some candidates' reports covered underlying chemistry but it was clear that the candidate did not have an understanding of the chemistry involved.

Section 3: Advice for the preparation of future candidates

Component 1 — question paper

Candidates should continue to make every effort to learn basic ‘routines’ for the different types of calculation. However, there has been an improvement in candidate performance in calculations in the 2017 examination.

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 multiple-step calculation.

Candidates should be encouraged to show their working clearly to maximise their chances of obtaining partial marks.

Candidates should be reminded that page 3 of the data booklet contains relationships which 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. If the candidate does provide a unit it must be correct — otherwise the candidate will only have access to partial marks. An incorrect unit would only be penalised once within the question paper.

Centres should advise candidates to consider calculations which involve rearranging the formula $E_h = cm\Delta T$ which is contained in page 3 of the data booklet. This is to allow them to calculate any of the values, including the specific heat capacity of a substance other than water.

Centres should stress to candidates 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/bonding electrons. In addition, candidates should be discouraged from showing all inner electrons as, if shown, they must be correct.

Candidates should be encouraged to practise drawing structural formulae for named organic compounds. In particular, when drawing the full structural formula for an alcohol, the bond from the carbon must be linked to the O of the OH functional group.

Candidates should be encouraged to learn basic chemistry definitions such as the definition for ‘homologous series’ as well as chemical terms such as ‘isotope’ and ‘isomer’.

Candidates should be advised to rote-learn the name of functional groups in organic compounds, as well as being able to identify them from structural formulae. Candidates should be advised that if the question asks for the name of the functional group, the formula will be accepted if this is not shown in the question. In Q7(a), COOH in place of the word ‘carboxyl’ is awarded one mark as this structure is not shown within the question.

Centres should stress to candidates that additional information given with a correct answer may negate the correct answer. For example, in Q1(a) ‘isomer’ would negate the correct answer ‘isotope’ and would be awarded zero marks.

Centres should stress to candidates that when writing the symbol for an element, the first letter must be a capital letter and the second letter (if appropriate) must be lower-case eg Cu is acceptable, cu is unacceptable.

Centres should stress to candidates that when a two-mark question asks for an explanation, it is necessary to demonstrate a deeper understanding of the concept to achieve the full mark allocation.

Centres should consider the variety of practical work that students undertake. This would deepen their knowledge and understanding as well as developing practical lab skills. In the 2017 paper it was evident that a significant number of candidates did not have an adequate awareness of experimental work.

Centres are asked to note that in the revised National 5 course from session 2017–18 a greater emphasis is placed on practical techniques and use of apparatus. In the revised National 5 course there are a number of mandatory items of lab apparatus with which candidates must be familiar. This also applies to the mandatory practical techniques and analytical methods. Centres are advised to refer to the N5 Chemistry Course Specification 2017–18 session, which is available on the SQA website.

Component 2 — assignment

Centres are advised to refer to the Coursework assessment task for National 5 Chemistry 2017–18 session, which is available on the SQA website.

Centres must provide candidates with the section 'Instructions for Candidates' from the assessment task for National 5 Chemistry, and to encourage candidates to follow the structure outlined in this guide. Centres should also share the marking instructions with candidates, before and during the research stage**.** However, the marking instructions must not be given to candidates during the report stage of the assignment

Candidates must carry out an experiment that allows measurements to be made, and these must be included in their report. In addition, the candidate must choose a second source which allows them to make a comparison with their experimental results.

Centres are advised that the report stage of the assignment must be written up by the candidates under a high degree of supervision and control. A candidate's report must not be scrutinised by staff, and no feedback or redrafting is permitted. The assignments must be kept secure until submitted to SQA.

Centres are also reminded that the report stage is a timed assessment with a maximum of 1 hour 30 minutes. Where centres are taking the approach that candidates complete the reports over a number of periods, they are reminded that the teacher/lecturer must retain the reports between periods so that the candidates cannot work on them out with the controlled conditions. Centres are advised that staff must not read the reports and must not provide feedback to candidates during this time.

Whilst it was pleasing to see that the conditions of assessment for coursework were adhered to in the majority of centres, there were a small number of examples where this may not have been the case. Following feedback from teachers, we have strengthened the conditions of assessment criteria for National 5 subjects and will do so for Higher and Advanced Higher. The criteria are published clearly on our website and in course materials and must be adhered to. SQA takes very seriously its obligation to ensure fairness and equity for all candidates in all qualifications through consistent application of assessment conditions and investigates all cases alerted to us where conditions may not have been met.

Grade Boundary and Statistical information:

Statistical information: update on courses

Number of resulted entries in 2016	17046

Number of resulted entries in 2017	16399

Statistical information: Performance of candidates

Distribution of course awards including grade boundaries

Distribution of course awards	%	Cum. %	Number of candidates	Lowest mark
Maximum Mark -				
A	35.2%	35.2%	5769	74
B	21.8%	57.0%	3578	63
C	19.4%	76.4%	3182	52
D	8.6%	85.0%	1415	46
No award	15.0%	-	2455	-

General commentary on grade boundaries

- While SQA aims to set examinations and create marking instructions which will allow a competent candidate to score a minimum of 50% of the available marks (the notional C boundary) and 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.

- Each year, SQA therefore holds a grade boundary meeting for each subject at each level where it brings together all the information available (statistical and judgemental). The Principal Assessor and SQA Qualifications Manager meet with the relevant SQA Business Manager and Statistician to discuss the evidence and make decisions. The meetings are chaired by members of the management team at SQA.

- The grade boundaries can be adjusted downwards if there is evidence that the exam is more challenging than usual, allowing the pass rate to be unaffected by this circumstance.

- The grade boundaries can be adjusted upwards if there is evidence that the exam is less challenging than usual, allowing the pass rate to be unaffected by this circumstance.

- Where standards are comparable to previous years, similar grade boundaries are maintained.

- An exam paper at a particular level in a subject in one year tends to have a marginally different set of grade boundaries from exam papers in that subject at that level in other years. This is because the particular questions, and the mix of questions, are different. This is also the case for exams set in centres. If SQA has already altered a boundary in a particular year in, say, Higher Chemistry, this does not mean that centres should necessarily alter boundaries in their prelim exam in Higher Chemistry. The two are not that closely related, as they do not contain identical questions.

- 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.