Course Report 2015

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 examinations. 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 and marking instructions for the examination.

Section 1: Comments on the Assessment

Component 1: Question Paper

The distribution of marks across the different sections of the question paper, and the skills, knowledge and understanding to be assessed, are detailed in the Course Assessment Specification. The 2015 National 5 Chemistry question paper followed the distribution of marks used in the Specimen Paper. For benchmarking purposes, Section 1 of this paper shared five questions with section A of the Intermediate 2 Chemistry question paper, whilst Section 2 had ten marks in common with section B of the Intermediate 2 paper.

For teachers used to preparing candidates for the Standard Grade assessment, it is worth remembering that there are significant differences in the assessments for the two Courses. The National 5 Chemistry question paper places greater emphasis on assessing a candidate's ability to explain underlying chemistry, scientific inquiry skills, and analytical thinking skills. Consequently, there are more marks assigned to questions requiring extended responses. The National 5 Course also places significant emphasis on the development of numeracy and literacy skills. Finally half-marks are not awarded in the National 5 paper.

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

Section 2: Comments on candidate performance

Component 1: Question paper

Feedback from markers and centres indicated that the overall impression of the question paper was that it was fair but challenging. Feedback also suggested that the time allocated to the examination was sufficient to allow all candidates to answer all questions. The full range of marks was accessed by candidates and the Question Paper provided good differentiation.

Candidates seemed well-prepared for many of the different types of questions in the paper. However, they did not appear as well prepared for the open-ended questions and calculations.

Component 2: Assignment

The full range of marks was accessed by candidates and the Assignment provided good differentiation. Overall, candidate performance has improved from that of 2014.

A range of topics were submitted by candidates, including hydrogels, fuels and radioisotopes. Due to the level of understanding of chemistry involved in hydrogels, this topic often proved difficult for candidates to achieve full marks in section 7.

The investigation on fuels (alcohols) which relates the number of carbon atoms to the quantity of energy produced proved to be, on the whole, a topic where candidates could score very high marks. However, candidates who used two or more of their own practical activities/experiments as sources of data and/or information only were unable to access the full range of marks. The investigation on radioisotopes also proved to be, on the whole, a topic where candidates could score very high marks.

Candidates appeared well-prepared and an increased number of candidates had clearly followed the 'Instructions to Candidates'.

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, including data that may not be relevant, rather than limiting the resources provided to two or three pieces of data and/or information related to the chosen topic. Candidates must have the opportunity to select appropriate data from a range of materials, even if they are using a resource pack.

Section 3: Areas in which candidates performed well

Component 1: Question paper

Section 1

Question 1: Most candidates could identify the atomic number and mass number for an atom with 26 protons, 26 electrons and 30 neutrons as 26 and 56 respectively.

Question 2: Most candidates could identify which pair of particles are isotopes.

Question 3: Most candidates could identify Na^+ as the particle that contained a different number of electrons from the others.

Question 5: Most candidates could identify the diagram that represents the structure of a covalent network.

Question 8: Most candidates could identify the balancing numbers for a given equation.

Question 9: Most candidates could identify SO_2 as the molecular formula for the gas when 0·2 mol of a gas has a mass of 12·8 g.

Question 12: Most candidates could identify the name of a branched alkane from its structural formula as 2,3-dimethylpentane.

Question 13: Most candidates could identify another representation for a given structure.

Question 14: Most candidates could identify C_nH_{2n-2} as the general formula for the cycloalkane

homologous series.

Question 16: Most candidates could identify magnesium and copper as the pair of metals which would produce the highest voltage and a flow of electrons from **X** to **Y.**

Question 17: Most candidates could identify the structure of propene as the monomer used to make the polymer.

Section 2:

Question 1(a): Most candidates knew how to calculate the average rate of reaction including the appropriate unit.

Question 1(b): Most candidates knew how to draw a line graph using appropriate scales.

Question 2(a): Most candidates could name the element produced in a given nuclear equation.

Question 2(b): Most candidates could name the type of radiation emitted by americium-241.

Question 2(c)(i): Most candidates knew how to calculate the mass of a radioisotope which would remain after 48 hours, given the half-life is 16 hours.

Question 4(b): Most candidates knew that acid rain contains more hydrogen ions than hydroxide ions.

Question 5(a): Most candidates could name the catalyst used in the production of ammonia.

Question 5(b): Most candidates knew how to predict the percentage yield of ammonia at 700atmospheres, having been given a table showing the percentage yield at various atmospheres.

Question 5(c): Most candidates could describe how the percentage yield varies with temperature, having been given a table of data.

Question 5(d): Most candidates could suggest the combination of temperature and pressure that would produce the highest percentage yield.

Question 6(c): Most candidates could state the term used to describe all chemical reactions that release heat energy.

Question 7(a): Most candidates could suggest how the student could have evaporated the solution to dryness.

Question 8(a): Most candidates could suggest why there is a difference in the energy absorbed by the water in method **B**.

Question 8(b): Most candidates knew how to calculate the energy required to increase the temperature of 100 g of water from 24 ^{o}C to 58 ^{o}C.

Question 14(a)(ii): Most candidates could suggest the type of bonding present in titanium(IV) chloride.

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 could include relevant data in their report.
Section 5(b):	Most candidates could present their data and/or information in at least two appropriate formats.
Section 8:	Most candidates could provide an appropriate title, at least two references and a report which was clear and concise.

Section 4: Areas which candidates found demanding

Component 1: Question paper

Section 1

Question 4:	Some candidates had difficulty identifying the diagram which would allow a soluble gas to be removed from a mixture of gases.
Question 6:	Some candidates had difficulty identifying the charge on the chromium ion in $CrCl_3$ as 3+.
Question 7:	Some candidates had difficulty identifying calcium appearing as a solid on the surface of molten calcium chloride, when calcium chloride is electrolysed at 800 ^{o}C.
Question 10:	Some candidates had difficulty identifying copper oxide as the oxide which, when shaken with water, would leave the pH unchanged.
Question 11:	Some candidates had difficulty identifying sodium chloride as the compound which would not neutralise hydrochloric acid.
Question 15:	Some candidates had difficulty identifying metallic bonding as a force of attraction between positive ions and delocalised electrons.
Question 18:	Most candidates had difficulty identifying the spectator ions in a given reaction.
Question 19:	Most candidates had difficulty identifying sodium iodide and silver nitrate as the two solutions which would produce a precipitate when mixed together.
Question 20:	Some candidates had difficulty identifying the colour of the chromate ion as yellow.

Section 2

Question 2(c)(ii):	Some candidates had difficulty suggesting why americium-241, and not americium-242 is the radioisotope used in smoke detectors.
Question 3(a)(i):	Some candidates had difficulty naming the functional group present in the alcohol glycerol. Common incorrect answers were hydroxide and carboxyl.
Question 3(a)(ii):	Some candidates had difficulty naming the family to which triglycerides belong.
Question 3(b)(i):	Most candidates had difficulty naming compound **X**. A common incorrect

answer was propanoic acid.

Question 3(b)(ii): Some candidates had difficulty describing the chemical test to show that compound **Y** is unsaturated. Common incorrect answers were compound **Y** would not decolourise bromine solution, bromine solution would turn clear or compound **Y** would turn colourless.

Question 4(a): Some candidates had difficulty drawing a diagram showing how all the outer electrons are arranged in a molecule of hydrogen sulfide, H_2S. Common incorrect answers were missing non-bonding pair of electrons in sulfur or for the bonding electrons to be outwith the overlap area.

Question 4(c): Most candidates had difficulty explaining that calcium oxide was able to reduce the volume of sulfur dioxide gas released as it is a base and will neutralise the sulfur dioxide. Some candidates were able to explain that calcium oxide would neutralise sulfur dioxide but very few candidates were able to explain that this was due to calcium oxide being a base.

Question 6(a): Some candidates, after reading a passage, had difficulty calculating the mass of carbon dioxide released into the atmosphere. A common incorrect answer was 297 g which is the mass of 99% of carbon dioxide.

Question 6(b): Most candidates had difficulty writing the ionic formula for iron(III) oxide.

Question 7(b): Some candidates had difficulty calculating the concentration of a solution given the mass contained in 100 cm^3. Common incorrect answers were dividing 1 by 100 or dividing 1 by 0·1. Some candidates were not awarded full marks as they gave an incorrect unit despite the unit being given in the question.

Question 9(a): Some candidates had difficulty stating the term used to describe naturally occurring metal compounds. Common incorrect answers were alloy and organic.

Question 9(b)(i): Most candidates had difficulty writing the redox equation for the overall reaction. Common incorrect answers were equations containing electrons, O_2 rather than O^{2-} given as the reactant or incorrect balancing numbers.

Question 9(b)(ii): Some candidates had difficulty stating why ionic compounds conduct electricity when molten. Common incorrect answers were electrons are able to flow or charged particles are able to flow.

Question 9(c): Some candidates had difficulty identifying the reducing agent in the reaction. Common incorrect answers were oxygen or SiO_2.

Question 10: Most candidates had difficulty using their knowledge of chemistry to suggest how the student could identify the metals aluminium, iron, tin and zinc. Many candidates mentioned adding them to water, electrolysing them to obtain a voltage or methods used to extract a metal from its ore.

Question 11(a): Some candidates had difficulty stating the electron arrangement for the Cl^+ ion having been given information on the first ionisation energy of an element. A common incorrect answer was 2.8.8.

Question 11(b): Most candidates had difficulty writing an equation for the first ionisation energy of magnesium. A common incorrect answer was
$Mg \rightarrow Mg^{2+} + 2e$.

Question 11(c): Some candidates had difficulty describing the trend in the first ionisation energy going down a group, having been given a table of data. Common incorrect answers were the first ionisation energy goes down then up then down again or that the non-metals (group 7) had higher first ionisation

energies than metals (group 1).

Question 12(a): Some candidates had difficulty naming hydrocarbon **A**. A common incorrect answer was butene.

Question 12(b): Some candidates had difficulty stating the meaning of the term isomer. Common incorrect answers were the definition for isotopes or homologous series.

Question 12(c): Some candidates had difficulty drawing a structural formula. Common incorrect answers were structures with the carbon to carbon double bond in the wrong position, too many hydrogen atoms on the carbons containing the double bond or the bond drawn to the hydrogen of the CH_3 branch.

Question 13(a): Some candidates had difficulty naming the functional group shown in the full structural formula for succinic acid. Common incorrect answers were carboxylic acid or hydroxyl.

Question 13(b)(i): Some candidates had difficulty naming the type of polymerisation taking place. A common incorrect answer was addition.

Question 13(b)(ii): Most candidates had difficulty drawing the repeating unit for the condensation polymer.

Question 14(a)(i): Most candidates had difficulty identifying **X** in an equation. A common incorrect answer was CO_2.

Question 14(b): Most candidates had difficulty suggesting the name of the process used to separate liquid titanium(IV) chloride from other liquid impurities. Common incorrect answers were filtration and evaporation.

Question 14(c): Most candidates had difficulty suggesting why the electrolysis of sodium chloride could make the extraction of titanium more economical.

Question 15(a): Most candidates had difficulty calculating the average volume of iodine that should be used in calculating the concentration of vitamin C. Common incorrect answers were the average of values other than the titre values or the average of the three titre values.

Question 15(b): Most candidates had difficulty calculating the concentration of vitamin C in the orange juice. Common incorrect answers were the use of the mass of vitamin C, incorrect mole ratio, incorrect volume and concentration combination or incorrect division by 1000 in converting cm^3 into litres. Some candidates were not awarded full marks as they gave an incorrect unit despite the unit being given in the question.

Question 16: Most candidates had difficulty using their knowledge of chemistry to describe how the student could identify three different compounds each containing carbon. Many candidates answered this question in terms of graphite and diamond and had not referred to any compounds in their answer.

Component 2: Assignment

Section 5(a): Some candidates had difficulty processing their data and/or information from at least two sources. Some candidates used the same format for both sources while others choose formats which were not appropriate to the data and/or information being processed, for example using a bar chart for a continuous variable. 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 and made no statement to specify this.
Section 6:	Some candidates had difficulty stating a valid conclusion which related to their aim and was supported by information in their report. Many candidates stated a conclusion which 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 completely outwith the key areas of the National 5 Course. Some candidates' reports contained underlying chemistry but it was clear that the candidate did not have an understanding of the chemistry involved.

Section 5: Advice to centres for 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.

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.

They should be encouraged to show their working clearly in order to maximise their chances of obtaining 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. However, if the candidate does provide a unit it must be correct, otherwise the candidate will only have access to some of the marks.

Centres should advise candidates to consider titration calculations which do not involve an acid and alkali neutralisation reaction.

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 these are given they must be correct.

Candidates should be encouraged to learn basic chemistry definitions such as isomers as well as chemical terms and processes such as ore and distillation.

Candidates should be advised that when asked to write an ionic formula both charges must be given.

Candidates should be advised to learn the name of functional groups in organic compounds as well as being able to name them from structural formulae. Candidates should be advised that if the question asks for the **name** of the functional group, the formula will not be accepted if this is shown within the question. In Question 13(a), COOH in place of the word carboxyl is awarded zero marks as this is shown in the structure given within the question. In Question 3(a)(i), OH in place of the name hydroxyl is awarded 1 mark as this is not shown within the question.

Candidates should be advised that if asked for a chemical test, the test and the result must be given. In addition, if the candidate states the starting colour this must be correct. For example, in Question 3(b)(ii) the bromine test or blue bromine turns colourless is awarded zero marks. Centres should also stress to candidates that clear and colourless do not have the same meaning.

Centres should stress to candidates that additional information given with a correct answer may negate the correct answer. For example, in Question 2(a) an incorrect atomic or mass number given with the correct answer neptunium 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 Np is acceptable, NP 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.

Component 2: Assignment

Centres are advised to provide candidates with the 'Instructions to Candidates', which is available on the SQA secure website, and to encourage candidates to follow the structure outlined in this guide. It is also good practice for centres to share the Marking Instructions with candidates, before and during the research stage**.** However, the Marking Instructions must not be given to candidates during the communication stage of the Assignment, as they contain model responses.

Centres should encourage candidates to choose topics that lend themselves to the type(s) of data processing and presenting being assessed, and advise against researching topics for which little or no data can be accessed. Centres could also consider taking an approach where candidates can include and compare their own experimental data with literature research, rather than simply pure literature research.

Centres should encourage candidates to choose topics which focus on the chemistry contained within the key areas of the National 5 Course rather than on socio-economical issues. Candidates should be discouraged from investigating how an aspect of chemistry affects society or the environment, advantages and disadvantages or the uses of a chemical.

Centres should advise candidates that data and/or information submitted from their Outcome 1 (O1) report will be marked as raw data. Any calculations or processed data carried out as part of the

Outcome 1 cannot access any presenting or processing marks as part of the Assignment. A better approach, if using Outcome 1 as a source, is for the candidate to only have the raw data from O1 and then process that data during the communication phase of the Assignment.

Centres should advise candidates that they have to produce a scientific report that includes appropriate data and/or information that demonstrates the skills being assessed in the Assignment and not to simply produce essays on their chosen topic. Candidates may have produced a very good essay but if it does not demonstrate the skills being assessed it will not score highly.

Centres should advise candidates that only **one** practical activity/experiment carried out by the candidate can be used as a source of raw data.

Candidates should be advised that the raw data and/or information **must** be included in their report and this should be relevant to the aim of their Assignment.

Candidates should be advised that the term 'relevant', 'reliable' or 'perspective' must be included in justifying their selection of sources. In justifying their choice of a source in terms of relevance, they must explain why the source is relevant. Statements such as 'it is relevant to my topic' or 'to my aim' do not explain why the information in the source is relevant. Candidates should also be advised that stating a website is reliable because it has .org in its address is insufficient to access the mark.

Candidates should be advised that to access 2 marks for presenting information in Section 5(b) **one** of the formats must be a graph, table, chart or diagram and the two formats chosen must be **different** from one another and appropriate to the data/information.

Candidates should be advised that all calculations, including rounding and units, must be correct to access the mark for accuracy. To access the presenting mark at least one full calculation must be shown in a logical and coherent manner.

Candidates should be advised that graph paper, rather than square or lined paper, should be used for drawing graphs to access the mark for accuracy. It is essential that graphs have both minor and major gridlines to allow the accuracy of processing to be checked.

Candidates should be advised that if a general trend is given as a summary, the accuracy mark cannot be accessed.

Candidates should be advised that to access the mark for labelling, all graphs, tables, charts or diagrams used in presenting the processed data must have appropriate units, labels and headings included. They should also be advised that if their presentation of the processed data does not include a graph, table, chart or diagram, the labelling mark **cannot** be accessed.

Centres should advise candidates that if the data and or/information cannot be compared the candidate must make a statement to this effect. Centres should also consider advising candidates on making an appropriate choice of sources. It is better for candidates to choose sources that allow comparison rather than disparate sources which mean that the candidate can only make a statement that the data cannot be compared.

Candidates should be advised that their conclusion must relate to **all** aspects of their aim and **must** be supported by data and/or information in their report. Some candidates were still losing marks because they had stated multiple aims but only addressed a proportion of them in the conclusion.

Centres should advise candidates that an appropriate title is awarded 1 mark. The mark for the title and the mark for the aim are separate marks. Therefore, a candidate who does not provide an appropriate title cannot access this mark through their aim. Titles such as National 5 or N5 Chemistry are not appropriate.

To access the mark for referencing in section 8, the format must allow retrieval by a third party — eg www.bbc.co.uk is not acceptable. To access this mark **two** references must be given, to include:

- websites — a full URL
- textbooks — title, author, page number and either ISBN number or version/edition number
- journals — title, author, volume and page number
- experiment/practical activity — title and aim

Centres are advised that the communication stage of the Assignment should be written up by the candidate under controlled conditions. A candidate's report must not be scrutinised by staff, and no feedback or redrafting is permitted. The Assignment should be kept securely until submitted to SQA. Once the Assignment has been completed and submitted by the candidate, staff and candidate must have no further access.

Centres are also reminded that the communication phase is not a timed assessment and may be completed over a period of time. Where centres are taking the approach that candidates complete their reports over a number of periods, they are reminded that the teacher/lecturer should retain the reports between periods so that candidates cannot work on them out with the controlled conditions. Centres are advised that if this approach is taken, staff must not read the reports and must not provide feedback to candidates during the next period.

Statistical information: update on Courses

Number of resulted entries in 2014	14157

Number of resulted entries in 2015	16659

Statistical information: Performance of candidates

Distribution of Course awards including grade boundaries

Distribution of Course awards	%	Cum. %	Number of candidates	Lowest mark
Maximum Mark - 100				
A	32.3%	32.3%	5380	68
B	20.8%	53.1%	3459	58
C	19.4%	72.5%	3235	48
D	8.5%	81.0%	1417	43
No award	19.0%	-	3168	-

For this Course, the intention was to set an assessment with grade boundaries at the notional values of 50% for a Grade C and 70% for a Grade A. A 1 mark adjustment was made for Q14(b) at the 'A' and 'C' boundaries as it did not function as intended. A 1 mark adjustment was made at the 'C', 'A' and 'UA' boundaries for the open ended questions as it was felt there was an increased level of demand and an insufficiency of support available for centres.