



Course Report 2014

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 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 and the skills, knowledge and understanding to be assessed is detailed in the Course Assessment Specification. The 2014 National 5 Chemistry paper followed closely the distribution of marks used in the Specimen Paper. For benchmarking purposes, Section 1 of this paper shared nine questions with section A of the Intermediate 2 Chemistry paper, whilst Section 2 had three 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 paper places far greater emphasis on assessing a candidate's ability to explain underlying chemistry, scientific inquiry skills and analytical thinking skills. Consequently, there is a greater total number of marks assigned to questions requiring extended answers. 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, unlike in the examination of the Standard Grade course, half-marks are not used.

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 will be awarded for applying knowledge and understanding related to the topic chosen.

Section 2: Comments on candidate performance

Component 1: Question paper

The overall impression of the paper from feedback received was that the National 5 Chemistry paper was fair but challenging.

In general, candidates appeared prepared for the examination. Feedback from Markers confirmed that the time allocated to the examination was appropriate to all candidates to answer all questions.

Centres appear to have taken care in preparing candidates for the different types of question to be found in the new examination, and candidates clearly understood what was being asked and demonstrated good examination technique.

Component 2: Assignment

The full ranges of marks were accessed by candidates, and the assignment provided good differentiation. A range of topics were submitted by candidates, including hydrogels, fuels and de-icers. 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, on the whole, an assignment where candidates could score very high marks. Candidates who used two or more of their own practical activities/experiments only as sources of data and/or information were unable to access the full range of marks.

Some centres had prepared their candidates well, and where candidates clearly followed the 'Instructions to Candidates' they tended to score well. However, in general, essay style reports did not do as well because it was difficult for the candidate to demonstrate the skills being assessed.

Candidates who undertook Assignments that involved using their own experimental data and comparing it to data from their literature research often did better than those who relied purely upon literature research.

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 materials covering several topics, rather than limiting the resources provided to two or three pieces of data and/or information related to chosen topic. Even if using a resource pack, candidates should have the opportunity to select appropriate data from a range of materials.

Section 3: Areas in which candidates performed well

Component 1: Question paper

Section 1

- Question 1: Most candidates could identify the method used to calculate average rate of reaction.
- Question 2: Most candidates could identify the chiral molecule.
- Question 4: Most candidates could identify the balancing numbers for a given equation.
- Question 5: Most candidates could identify that an acidic solution contains more hydrogen ions than hydroxide ions.
- Question 7: Most candidates could identify that magnesium hydroxide is **not** a salt.

- Question 8: Most candidates could identify the spectator ions in a given equation.
- Question 9: Most candidates could identify the molecular formula for cyclohexane.
- Question 10: Most candidates could identify the name of a branched alkane from its full structural formula.
- Question 11: Most candidates could identify the set of hydrocarbons that should be compared to test the hypothesis relating octane number to carbon chain length.
- Question 13: Most candidates could identify the alcohol with the highest boiling point
- Question 15: Most candidates could identify that copper would **not** react with a dilute acid.
- Question 18: Most candidates could identify that magnesium and silver would produce the highest reading on a voltmeter when linked in a cell.

Section 2

- Question 2(a): Most candidates could match the type of bonding and structure with its properties.
- Question 2(b): Most candidates knew that if graphene conducts electricity the electrons in graphene are delocalised.
- Question 3(a): Most candidates, after reading a passage, could state why the human body requires a regular intake of potassium.
- Question 3(c): Most candidates could state the colour of the flame which would be seen when potassium burns.
- Question 4(a): Most candidates knew how to draw a section of poly(vinylcarbazole), having been shown the structure of the monomer.
- Question 4(b): Most candidates could state that poly(vinylcarbazole) forms by addition polymerisation.
- Question 5(a): Most candidates could name the type of radiation stopped by paper.
- Question 5(b): Most candidates knew how to calculate the fraction of a source which would remain after 16 days, given the half-life of the source is 8 days.
- Question 7(a)(i): Most candidates could name the industrial process used to manufacture ammonia.
- Question 8(a): Most candidates could state the use of an ester.
- Question 8(b)(ii): Most candidates knew how to draw a structural formula for an isomer, having been given the full structural formula of an alcohol.
- Question 8(c): Most candidates knew how to name the alcohol and carboxylic acid used to produce ethyl propanoate, having been given examples of how to name esters.
- Question 9(a): Most candidates could tick the two boxes that correctly described members of the same homologous series.
- Question 9(c): Most candidates knew how to calculate the energy required to increase the temperature of 25 kg of water from 10 °C to 30 °C.
- Question 10(a) (i): Most candidates knew how to make a general statement linking the flash point to the number of carbon atoms, having been given a table of data.

- Question 10(a)(ii): Most candidates knew how to predict the flash point of decane, having been given a table showing the flash point of other alkanes.
- Question 12(b): Most candidates knew how to calculate the percentage by mass of iron in haematite, Fe_2O_3 .
- Question 13(a): Most candidates knew how to calculate the average volume of hydrochloric acid used to neutralise a solution of sodium carbonate.

Component 2: Assignment

- Section 1: Most candidates knew how to write an aim for their investigation.
- Section 2: Most candidates could describe an application of chemistry and provided a characteristic and/or feature of their chosen application. Most candidates knew the relationship between the application and its effect on society and/or the environment.
- Section 4: Most candidates were able to include relevant data and/or information in their report.
- Section 5(b): Most candidates were able to present their data and/or information in at least two appropriate formats.
- Section 8: Most candidates were able to 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 3: Some candidates had difficulty identifying the charge on the zinc ion in $\text{Zn}_3(\text{PO}_4)_2$.
- Question 6: Some candidates had difficulty identifying calcium oxide as the oxide which, when shaken with water, produces an alkaline solution.
- Question 12: Some candidates had difficulty identifying the alkene which would **not** produce two products on reaction with hydrogen bromide.
- Question 14: Some candidates had difficulty identifying that the temperature drops during an endothermic reaction.
- Question 16: Some candidates had difficulty identifying that silver can be extracted from its oxide by heat alone.
- Question 17: Some candidates had difficulty identifying the overall redox equation from given oxidation and reduction ion-electron equations.
- Question 19: Some candidates had difficulty identifying the structure of a monomer from a section shown of a condensation polymer.
- Question 20: Most candidates had difficulty identifying that the chemical equation represented precipitation.

Section 2

- Question 1(a): Most candidates had difficulty explaining what caused positive particles fired at gold foil to be deflected. A common incorrect answer was to state the positive particles hit the electrons in the gold foil.
- Question 1(b)(i): Some candidates had difficulty determining the number of protons, electrons and neutrons in an isotope of gold, given the mass number of gold.
- Question 1(b)(ii): Some candidates had difficulty stating what is meant by the term isotope.
- Question 3(b): Some candidates had difficulty calculating the number of moles of potassium in 100 g of raisins which contain 0.86 g of potassium in every 100 g. A common incorrect answer was for candidates to divide 100 by 39.
- Question 3(d): Some candidates had difficulty writing the ionic formula for saltpetre (potassium nitrate). Common incorrect answers were KNO_3 , $\text{K}_3^+ \text{NO}^-$ or giving an ionic formula for both saltpetre (potassium nitrate) and potash (potassium carbonate)
- Question 5(c): Some candidates had difficulty naming the element produced in a given nuclear equation. Common incorrect answers were the symbol for sodium showing mass number of 23 rather than 24 or chromium.
- Question 6: Most candidates had difficulty using their knowledge of chemistry to comment on how a student could determine the rate of the reaction given a chemical equation.
- Question 7(a)(ii): Some candidates had difficulty drawing a diagram showing how all the outer electrons are arranged in a molecule of ammonia, NH_3 . A common wrong answer was for the non bonding pair of electrons in nitrogen to be missing from the diagram.
- Question 7(b)(i): Most candidates had difficulty naming substance X as water. A common wrong answer was hydrogen.
- Question 7(b)(ii): Some candidates had difficulty drawing an arrow on the flow diagram to show how the process can be made more economical. Common wrong answers included arrow from oxygen to air or an arrow pointing from nitrogen monoxide below reactor to nitrogen monoxide at absorber.
- Question 7(c)(i): Most candidates had difficulty naming the type of chemical reaction as neutralisation.
- Question 7(c)(ii): Most candidates had difficulty stating that a solid sample of potassium nitrate could be obtained from solution by evaporation. A common wrong answer was filtration.
- Question 8(b)(i): Some candidates had difficulty naming the functional group present in an alcohol. A common wrong answer was for candidates to state the functional group was hydroxide.
- Question 8(b)(iii): Most candidates had difficulty suggesting a general formula for a given family of compounds. A common wrong answer was $\text{C}_n\text{H}_{2n} + 2\text{O}$.
- Question 9(b): Most candidates had difficulty explaining why butane has a higher

boiling than propane. Most candidates were able to state that butane was a larger molecule, however very few were able to explain the larger boiling point was due to stronger attractions between molecules.

- Question 9(d): Most candidates had difficulty suggesting a disadvantage of adding sulfur compounds to fuels. A common wrong answer was to state that the smell would be a disadvantage.
- Question 10(b): Some candidates had difficulty calculating the mass of carbon dioxide produced when 32 g of nonane is burned, having been given a balanced chemical equation. Common wrong answers included calculating the mass of 9 moles of CO_2 as 140 g or calculating mass of wrong chemical.
- Question 11(a): Most candidates had difficulty writing an ion-electron equation for the change taking place at the positive electrode. Common wrong answers included equation showing sodium and chlorine or ion-electron equation showing formation of chloride ions.
- Question 11(b)(i): Most candidates had difficulty naming solution X as sodium hydroxide or sodium oxide. Common wrong answers included water, sodium chloride or oxygen.
- Question 11(b)(ii): Most candidates had difficulty suggesting an advantage of using hydrogen as a fuel. A common wrong answer was to state that it did not produce harmful gases or to state it produced water.
- Question 11(c): Most candidates had difficulty drawing a possible structure for phosgene, COCl_2 . A common wrong answer was a diagram showing a single carbon to oxygen bond.
- Question 12(a): Some candidates had difficulty naming the type of reaction taking place when a metal is extracted from its ore as reduction. A common wrong answer was to state electrolysis.
- Question 12(c): Some candidates had difficulty suggesting electrolysis as a method suitable for extracting magnesium from an ore. A common wrong answer was to state heating would be suitable.
- Question 13(b): Most candidates had difficulty calculating the concentration of a sodium carbonate solution used in a titration experiment. Common wrong answers included the use of a 1:1 mole ratio, incorrect manipulation of mole ratio when using equation given in data booklet or using gram formula mass of sodium carbonate.
- Question 14: Most candidates had difficulty using their knowledge of chemistry to comment on whether or not the events described in a film could take place.

Component 2: Assignment

- Section 3: Some candidates had difficulty explaining their choice of sources and did not explain, as stated in the 'Instructions to Candidates', in terms of relevance, reliability or perspective. Some candidates simply stated 'source 1 was relevant' or 'source 2 was reliable' but made no attempt to explain why. Some candidates, although using the terms 'relevant', 'reliable', etc, clearly did not understand what these terms mean and gave statements such as 'source 1 was reliable because it

contained information about my chosen topic’.

- Section 4: Some candidates chose data that was not relevant to the aim of their report. Some candidates failed to include any raw data within their reports. Where a candidate had referenced the source(s) of data, markers made strenuous efforts to find it in order to be able to award marks for the accuracy of processing in the next section. However, if the data wasn’t referenced or accessible to the marker this meant the accuracy could not be checked and both the selecting data marks and processing data marks could not be awarded.
- 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 pie 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 all processed data.
- Section 5(d): Most 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 choose 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 choose topics which were at National 4 level or related to topics outwith the key areas of the National 5 course. Some candidates' reports contained underlying chemistry but it was clear they 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 the Course.

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 partial marks.

Candidates should be reminded that page 3 of the data booklet contains formulae 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 partial marks.

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

Candidates should be advised that when asked to draw a full structural formula, a shortened structural formula is not acceptable.

Candidates should be advised to rote learn the name of functional groups in organic compounds.

Candidates should be advised that when a question asks for a general statement the candidate's answer should include the relationship stated in the question. The relationship must be stated in terms of the correct cause and effect.

Centres should stress to candidates that additional information given with an answer may negate the correct answer provided by the candidate.

Centres should stress to candidates that when writing molecular formulae the number should be smaller than the symbol — eg CO₂ is acceptable, CO₂ 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 might find the following advice on some of the new aspects of assessment helpful.

Open-ended questions

To allow candidates the opportunity to demonstrate their understanding of underpinning chemical concepts and their ability to apply these ideas creatively in unfamiliar contexts, the

examination for the National 5 Course contains open-ended questions. These questions are signposted for candidates by use of the phrase, 'Using your knowledge of chemistry' printed in bold text within the question stem.

The nature of these questions is such that there is not a single, definitive correct answer.

There are three marks allocated to each open-ended question. Markers will allocate a mark based on the level of understanding illustrated by the candidate's answer.

1 mark: The student has demonstrated a limited understanding of the chemistry involved. The candidate has made some statement(s) which is/are relevant to the situation, showing that at least a little of the chemistry within the problem is understood.

2 marks: The student has demonstrated a reasonable understanding of the chemistry involved. The student makes some statement(s) which is/are relevant to the situation, showing that the problem is understood.

3 marks: The maximum available mark would be awarded to a student who has demonstrated a good understanding of the chemistry involved. The student shows a good comprehension of the chemistry of the situation and has provided a logically correct answer to the question posed. This type of response might include a statement of the principals involved, a relationship or an equation, and the application of these to respond to the problem. This does not mean the answer has to be what might be termed an 'excellent' answer or a 'complete' one.

Literacy

To provide candidates with the opportunity to demonstrate their literacy skills, the examination for the National 5 Course contains questions signposted for candidates by use of the phrase, 'Read the passage below and answer the questions that follow' printed at the top of the passage. Centres are advised to provide scientific passages for candidates to allow them to develop their literacy skills.

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. Centres should also share the Marking Instructions with candidates, so that they understand what they will be awarded marks for.

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 should 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 advise candidates that they have to produce a scientific report that includes appropriate data, which demonstrates the skills being assessed in the Assignment and not to produce essays on their chosen topic. Candidates may feel that they 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.

Centres should advise candidates that if the data and or/information cannot be compared the candidate should 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, where the candidates then have to make a statement that the data cannot be compared.

Candidates should be advised that to access 2 marks for presenting information in section 5 **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 their conclusion must relate to **all** aspects of their aim and **must** be supported by data and/or information in their report.

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 candidates under controlled conditions, and the assignments should be kept secure until submitted to SQA. Centres are advised that once the assignments have been completed and submitted by the candidates, staff and candidates should not have further access to them.

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 the reports over a number of periods, they are reminded that the teacher/lecturer should retain the reports between periods so that the candidates cannot work on them outwith the controlled conditions.

Statistical information: update on Courses

Number of resulted entries in 2013	0
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Number of resulted entries in 2014	14157
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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	29.5%	29.5%	4175	69
B	23.7%	53.2%	3350	58
C	19.7%	72.8%	2786	48
D	7.9%	80.7%	1116	43
No award	19.3%	-	2730	-