



Course Report 2017

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| Subject | Chemistry |
| Level | Higher |

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 question paper consists of two sections:

- ◆ Section 1 (Objective test) has 20 fixed-response (multiple-choice) items each worth 1 mark.
- ◆ Section 2 consists of questions worth 80 marks of the 100-mark question paper total. This section contains questions that require single-word answers worth 1 mark, as well as extended written answers worth 2 or 3 marks, and calculations worth 1 to 3 marks. Calculations cover general numeracy calculations in a chemistry context, as well as specific chemistry calculations taught as part of the Higher Chemistry course.

The question paper, in particular section 1, did not perform as anticipated. Therefore, the Grade Boundaries for the paper were adjusted.

Component 2 — assignment

The chemistry assignment has a weighting of 20 marks from the total 120 marks available for the course assessment. The marks for each of the criteria assessed as part of the assignment are:

| Criterion | Mark allocation |
|---|------------------------|
| Aim(s) | 1 |
| Applying knowledge and understanding of chemistry | 4 |
| Selecting information | 2 |
| Risk assessment | 1 |
| Processing and presenting data/information | 4 |
| Analysing data/information | 2 |
| Conclusion(s) | 1 |
| Evaluation | 3 |
| Presentation | 2 |

This component performed as anticipated and the average mark has risen. A number of candidates managed to achieve full marks with few candidates scoring very low marks.

Section 2: Comments on candidate performance

Areas in which candidates performed well

Component 1 — question paper

Some candidates achieved 20 marks for Section 1 of the paper. No candidate achieved all 80 marks in Section 2 of the paper, but a number achieved 79.

Candidate performance in questions that examined calculations taught as part of the Higher Chemistry course, and in questions with unfamiliar contexts, was generally good.

Candidates performed less well in questions that related to practical aspects taught as part of the Researching Chemistry unit of the course.

Section 2

- Q1(a) Naming a covalent network.
- Q2(a)(i) Identifying which bond would break first using bond enthalpies.
- Q2(a)(iv)A Stating that the unstable arrangement of atoms is an activated complex.
- Q2(a)(iv)C Stating that a catalyst has no effect on activation energy.
- Q2(b)(ii) Calculating a reaction time from a relative rate.
- Q4(b)(i) Naming fats and oils as esters.
- Q6(a)(i) Drawing a structural formula for a secondary alcohol.
- Q6(a)(ii)C Stating that tertiary alcohols cannot be oxidised.
- Q6(b)(ii) Predicting the boiling point of a molecule by processing data from a table.
- Q6(b)(iv) Stating what is observed when an aldehyde is heated with Tollen's reagent.
- Q7(b)(i) Suggesting why it is not necessary to add an indicator to this titration.
- Q7(b)(iii)A Stating that the first titration is rough / not concordant.
- Q9(a)(ii) Stating that hydrophobic describes the non-polar hydrocarbon chain.
- Q9(c)(i) Stating that amino acids are the small molecules that make up proteins.
- Q9(c)(ii)A Naming the functional group as an amide / peptide link.
- Q9(c)(iii)A Stating that denatured describes the change in shape of enzymes.
- Q10(a)(i) Calculating the relative concentration of linalool (numeracy).

Areas which candidates found demanding

Section 2

- Q1(c) Strength of London Dispersion Forces are linked to number of electrons.
- Q2b(i) A dry beaker is used to prevent changes to concentration of reactants.

- Q3 An open-ended question relating to estimation of oxalic acid. Some candidates restated information in the question but did not develop this into a full answer.
- Q4(a)(ii) A demanding question requiring candidates to draw a structural formula of the sodium salt formed.
- Q5(a)(i) Drawing apparatus for the drying of sulfur dioxide gas.
- Q5(c)(i) Treatment of a rogue point.
- Q5(c)(ii) A demanding question that required candidates to link shape and polarity to solubility.
- Q6(a)(iii)(B) Completion of the ion-electron equation.
- Q7(b)(ii) Identifying that the titration is carried out under acidic conditions in order to provide hydrogen ions for the reaction.
- Q7(b)(iii)(C) Stating what is meant by a standard solution.
- Q7(c) Presenting an answer in different units.
- Q8 An open-ended question relating to the compounds in skin care products.
- Q9(b)(i) Suggesting another action of bleach.
- Q9(d)(i) Correct identification of a condensation reaction.
- Q10(c)(ii) Writing a molecular formula for farnesene.

Component 2 — assignment

Overall, candidates' performance was good.

Aim: 1 mark

Nearly all candidates stated an aim or aims that could be investigated. There was evidence that centres had taken the advice given in previous Course Reports and the General Assessment Information to ensure that aims were clear and that all aspects of candidates' aims could be investigated. However, a few candidates still had no aim at all.

Applying knowledge and understanding of Chemistry: 4 marks

Most candidates provided chemistry that was relevant to the topic. However, certain topics give more opportunities to allow candidates to describe underlying chemistry 'at a depth appropriate to Higher Chemistry'.

Selecting Information: 2 marks

Candidates are required to select at least two data sources that are relevant to the aim and which, when analysed, should allow the candidate to draw a conclusion related to the aim. One of these sources **must** be a candidate's own experimental data.

Many candidates were able to provide relevant information that would be sufficient to allow a conclusion relating to the aim to be drawn. However, in some cases, the information provided by the candidate was not sufficient to cover all aspects of the stated aim.

Risk assessment: 1 mark

For the risk assessment mark to be awarded, candidates needed to clearly link precautions taken to the nature of the hazard and the associated risk.

The Higher Chemistry Assignment Assessment task (Appendix 1: Instructions for Candidates; Section 'Guidance on producing your report', sub-section 'Experimental procedure') states:

*There **must** be a valid risk assessment in your report. This should include:*

- ◆ *any hazardous substances or procedures*
- ◆ *the type of hazard*
- ◆ *the safety precautions taken*

If there are no hazards and precautions beyond normal lab practice then this must be clearly stated.

It is acceptable to provide the experimental procedure as an appendix to the report.

Processing and presenting data/information: 4 marks

Only one set of data needs to be processed and presented. As of 2017, this data must come from an experiment carried out by the candidate. Most candidates processed and presented their own experimental data.

Processing and presenting of experimental data was generally well done, with candidates scoring highly. Candidates chose appropriate formats (table, chart or graph) to present data.

Processing of experimental data should involve calculating or skills such as plotting on a graph etc.

Some candidates failed to gain the mark for citing information. When experimental results were given as raw data, either: the title and aim of the experiment needed to be given with the results data within the body of the report; or the title and aim needed to be given in the reference section of the report. A full reference for the second data source needed to be given with the data, or the data clearly linked to a reference in the reference section of the report.

Analysing data/information: 2 marks

Many candidates were unable to be awarded both marks for this section mainly due to the limited nature of the analysis of the data. Most candidates only made simple comparisons of data sources or described data trends.

Conclusion(s): 1 mark

Most candidates gave conclusions that related to their aim. However, many candidates with multiple aspects to their aims failed to gain the conclusion mark due to the conclusion either not addressing all aspects of the aim, or failing to be supported by information in the report.

Evaluation: 3 marks

A number of candidates evaluated their experimental procedure but failed to provide details of the experimental procedure. Marks can only be awarded for evaluating the experimental procedure if the candidate includes the experimental method in their report so that markers are able to judge whether an evaluative comment is valid.

When commenting on the validity/reliability/robustness of sources, candidates need to justify their comment. For example, if commenting on the robustness of data from a website, stating that the same information is given on other websites, and stating these websites.

Presentation: 2 marks

Most candidates structured their report appropriately with a title, then the body of the report, finishing with a reference section, which contains only references. The only information that is allowed to follow the reference section is any clearly-labelled appendices that the candidate wishes to include with their report.

The most frequent mistakes made in terms of the presentation of the report were:

- ◆ Attaching processed charts and graphs to the report after the reference section.
- ◆ Including material other than references in the reference sections — for example, evaluative comments which should have been stated separately.

Section 3: Advice for the preparation of future candidates

Component 1 — question paper

Open questions

A significant proportion of candidates did not attempt the open-ended questions; in particular question 3.

Candidates need to be given more opportunities to answer this type of question than is afforded by a prelim exam alone.

Candidates need to be made aware that there are no definitive answers to open-ended questions. Candidates can give broad answers covering a number of aspects of a question, or focus on one particular aspect and give a detailed explanation.

These questions are marked holistically rather than on a number-of-points basis (eg 1 point 1 mark; 2 points 2 marks etc). Marks are assigned according to whether the candidate's answer displays no understanding (0 marks); limited understanding (1 mark); reasonable understanding (2 marks); or good understanding (3 marks). Candidates are not expected to give a perfect answer to gain the full mark allocation for the question.

Researching chemistry questions

Approximately 10 marks are allocated to the assessment of knowledge and skills relating to the Researching Chemistry unit. Apparatus and techniques that candidates should be familiar with are listed in the Course and Unit Support Notes.

As was the case in previous years, candidates tended to perform less well in these questions. This was particularly true of the definition of a standard solution, the treatment of a rogue point, and the drying of sulfur dioxide gas.

The Researching Chemistry unit has a notional time allocation of 20 hours in the course. This is to allow time to develop practical skills associated with the unit. It should not be assumed that candidates will gain understanding of the proper use of equipment and the techniques listed without these being specifically taught.

Questions requiring more detailed answers

Questions that require more detailed answers are signalled by the words 'Explain fully' or 'Explain clearly', and are worth a minimum of two marks.

Candidates need to be made aware that, to gain full marks for the question, a detailed explanation needs to be given.

When the weighting of the question is three marks, candidates would be expected to make at least three correct points within their answer. For example, in Question 1(c) candidates needed to mention strength and type of intermolecular forces for two marks. The third mark was awarded for a correct explanation linking the relative strength of London Dispersion forces to the number of electrons in a molecule/ atom.

Calculations

The paper contains calculations that are taught as part of the course, and general numeracy calculations set in a chemical context. Calculations tend to be highly discriminating when candidates' performance in calculations is compared to overall course performance.

Calculations that are taught as part of the course were well done, for example, question 7(b)(iii)(B), a difficult titration calculation.

Candidates should be encouraged to set working out clearly, as partial credit can often be given to those who fail to gain full credit for the questions. This is particularly true where a concept marking approach is adopted. In question 7(b)(iii)(B), when looking to assign partial marks, credit was given for $n = cV$ being applied correctly and for the stoichiometry of the equation being applied correctly. Manipulation/conversion of units should also feature in calculations that are taught as part of the course.

Component 2 — assignment

All candidates have to undertake an assignment relating to a key area within the course. Whilst candidates can work collaboratively, in small groups, when undertaking the research phase of the assignment (ie when carrying out practical activities and carrying out literature/internet research), they must work independently during the communication phase, (ie when producing their report that is submitted to SQA for assessment).

Candidates will therefore benefit from keeping a record of the work they carry out as part of the assignment. This can be in the form of a day book similar to that used in Advanced Higher Chemistry.

It is important for the integrity of the process that the guidance given in the 'Chemistry Assignment General Assessment information' is adhered to.

Some candidate reports indicated that candidates would have benefited from greater familiarity with the 'Instructions for candidates' and from greater engagement with their teachers/lecturers throughout the research phase of their assignment.

Some reports showed that candidates had collaborated when processing raw data prior to writing their report. The report, including the processing of experimental data within the report, should be a candidate's own work, and therefore should not be done collaboratively.

There was also evidence of re-drafting of reports in a few centres. Centres are reminded that teachers/lecturers are not allowed to give feedback on reports, and that candidates are not allowed a draft report.

Whilst it was pleasing to see that the conditions of assessment for coursework were adhered to in the majority of centres, there were still a number of cases where this was not the case. SQA's criteria on assessment conditions 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.

Candidates must process their own experimental data.

The following advice covers specific criteria within the assignment and should be read along with comments on the assignment in Section 2 of this report.

Title and aim of the assignment

A title can be broad in nature, whilst an aim needs to be specific

The title should give some indication of the key area that the assignment relates to ('Higher Chemistry Assignment' does not constitute a title).

Candidates should ensure that aims are clear and that all aspects of the aim could be investigated.

Raw data

At least two sources of raw data must be included in the report and should allow conclusions to be drawn relating to the aim. One of these sources **must** be experimental data from the candidate's experiment.

Candidates must cite the raw data that they include in their report by giving a full reference with the raw data, or giving a link to a reference in the reference section of their report.

Candidates must link their experimental data to the title and aim of their experiment either by stating the title and aim of the experiment with the data, or by clearly indicating that the title and aim of the experiment are given in the reference section of the report.

Processing and presenting

Candidates **must** provide the raw data from their experiment that they then process. The presentation marks are associated with processed data and not with raw data.

Analysing data/information

These marks are given for stating data trends, making comparisons between data sets.

Very often candidates carried out a simple analysis and then failed to develop their analysis further to gain the second mark.

Candidates need to be given the opportunity to engage in activities where they are asked to analyse data in advance of writing their reports in order that they develop the skills of analysing prior to writing their reports.

Evaluation

To access marks through evaluating experimental procedures, it is important that the candidate has included a description of the procedures in the report, so that the marker can judge the validity of the evaluative comment.

It is not acceptable for candidates to carry out experimental procedures badly so they can then state in an evaluation section how the procedure could be improved — for example, carrying out titrations and then stating in the evaluation section that a white tile could be used to see the colour change more clearly.

Apparatus used by the candidate should be appropriate to standard laboratory experiments. Improvements in apparatus or procedures should be accompanied by a qualifying statement.

Structure of the report

Although the structure of the report need not follow the assignment criteria, the report must have a title and a reference section at the end.

Any materials that come after the reference section must be in clearly-labelled appendices. Material in an appendix will not be marked, with exception of a risk assessment mark where the experimental procedure is given in an appendix.

If candidates include materials such as graphs after their reference section, they cannot be awarded a mark for the structure of the report.

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 | 10077 |
|------------------------------------|-------|

| | |
|------------------------------------|-------|
| Number of resulted entries in 2017 | 10134 |
|------------------------------------|-------|

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 | 30.3% | 30.3% | 3067 | 90 |
| B | 24.2% | 54.5% | 2451 | 79 |
| C | 21.3% | 75.7% | 2157 | 68 |
| D | 8.4% | 84.2% | 855 | 62 |
| No award | 15.8% | - | 1604 | - |

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.