# Course report 2019

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| Subject | Chemistry |
| Level | Higher |

This report provides information on candidates' performance. Teachers, lecturers and assessors may find it useful when preparing candidates for future assessment. The report is intended to be constructive and informative and to promote better understanding. It would be helpful to read this report in conjunction with the published assessment documents and marking instructions.

The statistics used in this report have been compiled before the completion of any post-results services.

# Section 1: comments on the assessment

Overall, the demand of the assessment was slightly greater than intended so all grade boundaries were lowered.

### Question paper 1: multiple-choice

With the grade boundaries for Higher Chemistry in 2018 in mind, the proposed 2019 multiple-choice question paper was reviewed. The 2019 multiple-choice question paper proved to be less demanding than Section 1 of the 2018 question paper.

Statistical evidence shows that the questions provided an appropriate range of difficulty, and that individual questions showed good discrimination.

### Question paper 2

With the grade boundaries for Higher Chemistry in 2018 in mind, the proposed 2019 question paper 2 was reviewed. The 2019 question paper 2 proved to be slightly less demanding than Section 2 of the 2018 question paper. However, it was slightly more demanding than intended.

Statistical evidence shows that the questions provided an appropriate range of difficulty, and that individual questions showed good discrimination.

### Assignment

The 2019 assignment proved to be slightly more demanding than the 2018 assignment.

# Section 2: comments on candidate performance

## Areas that candidates performed well in

### Question paper 1: multiple-choice

A number of candidates achieved full marks in this component.

Candidates performed well in the following questions:

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| Question 1 | Identifying the electronegativity of an element in a non-polar bond. |
| Question 5 | Identifying a tertiary alcohol. |
| Question 7 | Identifying a compound from a molecular formula. |
| Question 9 | Identifying the systematic name of pivalic acid. |
| Question 12 | Identifying a secondary amine. |
| Question 22 | Identifying a factor that does not affect the rate of a reaction. |

### Question paper 2

No candidates achieved all 95 marks in the question paper, but several achieved 91 marks. Candidate performance in questions that examined calculations covered in the Higher Chemistry Course was generally good.

Candidates performed well in the following questions:

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| Question 1(a)(i) | Balancing an equation. |
| Question 1(a)(ii)(A) | Identifying correct volumes of water. |
| Question 1(a)(ii)(B) | Converting rate into the time for a reaction to occur. |
| Question 1(c)(i) | Identifying the position of the activated complex. |
| Question 2(d) | Linking a calculated radius ratio to a lattice structure. |
| Question 4(b)(ii)(A) | Calculating an $R_f$ value. |
| Question 4(b)(ii)(B) | Interpreting a chromatogram. |
| Question 4(e)(i) | Naming a carbonyl functional group. |
| Question 6(a)(ii) | Naming the thiol with one carbon. |
| Question 7(a)(ii) | Correctly identifying that UV light causes plastics to break down. |
| Question 7(b)(i) | Naming water as a product in the given reaction. |
| Question 10(c) | Calculating the percentage of magnesium chloride in the sample. |

### Assignment

A very small number of candidates achieved full marks in the assignment.

Candidates performed well in the following sections:

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| Section 1 | Nearly all candidates stated an aim, or aims, that could be investigated. |
| Section 3(b) | Most candidates supplied sufficient data from their own experiments. |
| Section 3(e) | Most candidates supplied information from an internet source. |
| Section 4(a) | Most candidates were able to select an appropriate graphical format. |
| Section 8 | Most candidates gave a clear and concise report with an informative title. |

## Areas that candidates found demanding

### Question paper 1: multiple-choice

Candidates found the following questions demanding:

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| Question 3 | Identifying carbon monoxide as a reducing agent. |
| Question 8 | Identifying compound X as a ketone. |
| Question 13 | Calculating the correct number of moles of ions. |

### Question paper 2

Candidates performed less well in questions that related to practical aspects of the course and in questions where candidates were required to state or explain terms given in the 'Skills, knowledge and understanding for the course assessment' section of the course specification.

Candidates found the following questions demanding:

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| Question 1(c)(ii) | Starting and finishing the dotted line for the catalyst potential energy curve at the correct points. |
| Question 2(a)(ii) | Explaining why the first ionisation energy of potassium is less than that of lithium. |
| Question 2(b)(ii) | Explaining the increase between the $5^{th}$ and $6^{th}$ ionisation energies. |
| Question 2(c) | Explaining why the ionic radius of phosphorus is greater than that of aluminium. |
| Question 4(b)(i) | Identifying compound X as carbon dioxide. |
| Question 5(a)(ii) | Explaining the difference between bond enthalpy and mean bond enthalpy. |
| Question 5(b)(i) | Stating the measurements required to calculate the mass of heptane burned. |
| Question 6(a)(i) | Stating that propan-1-ol and ethanethiol have the same number of electrons. |
| Question 6(b)(ii) | Drawing the other isomer produced in an addition reaction. |
| Question 7(b)(ii) | Drawing the correct structure of a cyclic ester. |
| Question 8(b)(i) | Preparing a solution of accurately known concentration. |

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| Question 10(a) | Explaining why distilled water should be used rather than tap water. |
| Question 10(b)(ii) | Showing the correct order of steps in an experiment. |
| Question 12(a)(ii) | Naming the reaction to make soaps from fats and oils. |
| Question 12(a)(iii) | Stating how emulsifiers are made from edible oils. |
| Question 12(b)(i) | Giving a correct explanation for a pure covalent bond. |
| Question 12(c) | Explaining fully why equilibrium would shift to the right. |
| Question 12(d)(i) | Writing an ion-electron equation. |

## Assignment

Candidates found the following sections demanding:

Section 3(a) Many candidates were unable to summarise their experimental method. Many candidates failed to include a statement identifying additional safety measures or a statement indicating that additional safety measures were not required.

Section 5 Many candidates did not provide a valid comparison of their experimental data with data from their internet or literature source.

Section 7 Many candidates did not provide an appropriate justification for their evaluative statements.

# Section 3: preparing candidates for future assessment

## Question paper 1: multiple-choice

### Questions linked to statements in the course specification

Candidates need to be able to accurately recall and use statements from the 'Skills, knowledge and understanding for the course assessment' section of the course specification, eg question 3.

### Calculations

The multiple-choice question paper contains questions that ask candidates to perform calculations that are covered in the course, and general numeracy calculations set in a chemical context. Calculations were mostly done well, but candidates would benefit from further practice answering questions where the number of moles links to oxidation or reduction (eg question 4) and where they are asked to write chemical formulae (eg question 13).

## Question paper 2

### Questions linked to statements in the course specification

Candidates need to be able to accurately recall and use statements from the 'Skills, knowledge and understanding for the course assessment' section of the course specification, eg question 5(a)(ii) on bond enthalpy and mean bond enthalpy.

### Calculations

Question paper 2 contains calculations that are covered in the course, and general numeracy calculations set in a chemical context.

Calculations that are covered in the course were generally well done, for example question 5(a)(i) on bond enthalpy and question 9(c) on Hess's Law.

Calculations linked to practical work, such as question 5(b)(ii) on enthalpy of combustion and question 12(d)(ii) on titration were not as well done as they have been in previous years.

Candidates should be encouraged to set working out clearly, as they can gain partial credit. In question 12(d)(ii), when looking to assign partial marks, credit was given for applying $n = c \times v$ correctly and for applying the stoichiometry of the equation.

General numeracy calculations set in a chemical context were also generally done well, however, selecting the correct units in question 6(a)(iii) proved challenging.

### Questions requiring more detailed answer

Questions that require more detailed answers are signalled by the words 'explain fully' or 'explain clearly' and are worth a minimum of 2 marks. Candidates need to be aware that, to gain full marks for these questions, they need to give a detailed explanation.

When the question is worth 2 marks, candidates are expected to make at least two correct points in their answer. For example, in question 12(c), candidates needed to mention the increase in concentration of $H^+(aq)$ ions. The second mark was awarded for a correct explanation linking the shift in equilibrium to the right to the increase in rate of the forward reaction. However, many candidates answered this part of the question by restating information already given in the question.

**Open questions**

As in previous years, a proportion of candidates did not attempt the open questions. Candidates would benefit from more opportunities to practise answering this type of question.

Candidates need to be made aware that, while there are no definitive answers to open questions, their answer should make statements that are relevant to the situation or problem given. For example, answers to question 3 would be expected to relate to bonding and structure in elements. Answers relating to bonding and structure in compounds were not relevant and gained no marks.

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 (for example, 1 point 1 mark; 2 points 2 marks). 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 do not need to give a perfect answer to gain full marks for the question.

**Questions relating to practical work**

Approximately 12 marks are allocated to assessing knowledge and skills relating to practical work. The 'Skills, knowledge and understanding for the course assessment' section of the course specification lists the apparatus and techniques that candidates should be familiar with.

As in previous years, candidates performed less well in these questions, particularly when:

- describing the measurements required to calculate the mass of heptane burned
- calculating the enthalpy of combustion
- describing a procedure to make a solution of accurately known concentration
- drawing a diagram to show the bubbling of chlorine gas through water
- explaining that tap water may contain metal ions, chloride ions or salts

Candidates need time during the course to develop the practical skills associated with Higher Chemistry. In order to develop understanding, candidates need to be taught the proper use of equipment and the techniques listed in the 'Skills, knowledge and understanding for the course assessment' section of the course specification.

## Assignment

Some reports showed that candidates had processed raw data before writing their report. The report, including the processing of experimental data within the report, should be a candidate's own work, and must be completed within the 2-hour writing-up time period.

There was also evidence of some redrafting in a few reports. Centres are reminded that teachers and/or lecturers are not allowed to give feedback on reports, and that candidates are not allowed a draft report or draft sections of the report.

In a few cases, all the candidates from the same centre had identical raw data. Centres are reminded that candidates must carry out their experiments in small groups and that results may not be shared between groups in the same class or centre.

The *Higher Chemistry Assignment Assessment Task* contains information about how to conduct the research and report stages of the assignment. Particular attention should be paid to the 'conditions of assessment' and 'level of supervision and control' sections. The 'Instructions for candidates' section lists the permitted resources for the report stage. Centres and candidates must adhere to the instructions in the *Assignment Assessment Task*.

# Grade boundary and statistical information:

## Statistical information: update on courses

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| **Number of resulted entries in 2018** | 9990 |

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| **Number of resulted entries in 2019** | 10047 |

## Statistical information: performance of candidates

### Distribution of course awards including grade boundaries

| Distribution of course awards | Percentage | Cumulative % | Number of candidates | Lowest mark |
|---|---|---|---|---|
| **Maximum mark** | | | | |
| **A** | 29.7% | 29.7% | 2985 | 101 |
| **B** | 23.8% | 53.5% | 2391 | 85 |
| **C** | 22.0% | 75.5% | 2214 | 69 |
| **D** | 16.4% | 92.0% | 1650 | 53 |
| **No award** | 8.0% | - | 807 | - |

## General commentary on grade boundaries

SQA's main aim is to be fair to candidates across all subjects and all levels and maintain comparable standards across the years, even as arrangements evolve and change.

SQA aims to set examinations and create marking instructions that allow:

- a competent candidate to score a minimum of 50% of the available marks (the notional C boundary)
- a well-prepared, very competent candidate to score at least 70% of the available marks (the notional A boundary)

It is very challenging to get the standard on target every year, in every subject at every level.

Therefore, SQA holds a grade boundary meeting every year for each subject at each level to bring together all the information available (statistical and judgemental). The principal assessor and SQA qualifications manager meet with the relevant SQA head of service and statistician to discuss the evidence and make decisions. Members of the SQA management team chair these meetings. SQA can adjust the grade boundaries as a result of the meetings. This allows the pass rate to be unaffected in circumstances where there is evidence that the question paper has been more, or less, challenging than usual.

- The grade boundaries can be adjusted downwards if there is evidence that the question paper is more challenging than usual.
- The grade boundaries can be adjusted upwards if there is evidence that the exam is less challenging than usual.
- Where standards are comparable to previous years, similar grade boundaries are maintained.

Grade boundaries from question papers in the same subject at the same level tend to be marginally different year to year. This is because the particular questions, and the mix of questions, are different. This is also the case for question papers set by centres. If SQA alters a boundary, this does not mean that centres should necessarily alter their boundary in the question papers that they set themselves.