Course report 2019

Subject	Chemistry
Level	Advanced 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

Question paper

Overall, the question paper performed as expected. Section 2 (extended-answer questions) was slightly more demanding, since one question did not function as expected. Consequently, the grade boundaries were adjusted downwards.

Project

There were no changes to the assessment of the project and the mean mark was largely unchanged from last year. The project performed as expected.

Section 2: comments on candidate performance

Areas that candidates performed well in

Question paper

Overall, there was a high response rate for the question paper with a low number of no responses. The candidates appear to have found the question paper accessible and the evidence suggests that candidates had sufficient time.

Section 1 (multiple-choice questions)
Specific areas where candidates performed well include:

Question 1	Identifying areas of the electromagnetic spectrum.
Question 2	Choosing an appropriate experiment that could be done by heating to constant mass.
Question 4	Stating Hund's rule.
Question 11	Calculating an enthalpy change from enthalpies of formation.
Question 13	Determining a rate equation from a table of data.
Question 15	Determining the number of pi bonds in an organic substance.
Question 16	Writing a molecular formula from a skeletal structural formula.
Question 18	Writing a systematic name from a skeletal structural formula.
Question 20	Identifying the organic product resulting from reduction of a ketone.
Question 24	Calculating an empirical formula.
Question 27	Calculating a mass from ppm.
Question 28	Identifying a purification technique.

For each of these questions, over three quarters of the candidates successfully identified the correct answer.

Section 2 (extended-answer questions)
Specific areas where candidates performed well include:

Question 1(a)	Identifying an electron from a set of quantum numbers.
Question 3(b)(i)	Identifying a substance that could be used to set a colorimeter to zero.
Question 4(a)(i)	Stating the Bronsted-Lowry definition for a base.
Question 4(c)(i)	Describing a relationship between two variables.
Question 4(c)(ii)(A)	Calculating a concentration from a mass and volume.
Question 4(c)(ii)(B)	Calculating the pH for a weak acid.
Question 5(b)(i)	Naming a transition metal complex ion.
Question 7(a)	Suggesting a fast method of filtration.
Question 7(d)(ii)(B)	Identifying a functional group responsible for a particular IR absorption.
Question 9(a)(i)	Identifying a chiral centre.
Question 9(b)(i)	Identifying a type of reaction from a reaction sequence.
Question 10(a)	Identifying an ether.
Question 10(b)(i)	Drawing a skeletal structural formula from a full structural formula.

For each of these questions, over three quarters of the candidates provided the correct answer. Calculations were particularly strong this year. Candidates are improving when it

comes to writing correct units and giving an answer to an appropriate number of significant figures.

Project

The average mark achieved by candidates was similar to previous years. The vast majority of candidates stated an aim and then chose a relevant procedure to achieve that aim. Procedures were generally described well and over three quarters of candidates achieved the mark for two or more techniques, or a modification, or a control experiment, or standardisation of solutions. Almost half of the candidates achieved at least 5 out of 6 marks for presenting and processing their results.

Areas that candidates found demanding

Question paper

Section 1 (multiple-choice questions)

Question 3 — Gravimetric determination of magnesium ions in water - over half of the candidates incorrectly chose response B (silver(I) nitrate) or response D (silver(I) carbonate) instead of response C (sodium carbonate).

Question 12 — Although most candidates knew that the condensation of water involved a decrease in entropy (negative change), many did not appreciate that the process was exothermic (negative change in enthalpy).

Section 2 (extended-answer questions)

Candidates still find it demanding to make accurate statements. The course and unit support notes provide guidance on this.

Candidates should improve their understanding of definitions. Some of the questions below are mentioned because of this.

Question 2(a) — Very few candidates could state what is meant by the order of a reaction. Many candidates stated that the order of a reaction was how the reaction rate changed when the concentrations were changed. Another common error was to state that the order of a reaction was the number of reactants in the rate-determining step.

Question 5(a) — Few candidates could state that heat is responsible for the promotion of electrons when a firework is ignited.

Question 5(b)(ii) — Most candidates were unable to demonstrate understanding of absorption and emission. Many candidates stated that the light emitted by the zinc complex was not in the visible spectrum. Some candidates tried to explain this lack of colour in terms of the energy gap between the HOMO and LUMO. Most candidates did not appreciate that the 3d subshell was full of electrons. A very small number of candidates managed to achieve the second mark in this question.

Question 6(c) Very few candidates could suggest a plausible reason for the experimentally determined percentage of ethanol being higher than expected. Simply mentioning impurities was not enough to achieve the mark. There needed to be a reason why the ethanol concentration was higher than expected.

Question 7(d)(ii)(A) Most candidates stated that IR radiation caused bonds to vibrate, bend or stretch. However, for the second mark, very few candidates were able to state that different functional groups absorbed different wavelengths of IR radiation. Most candidates simply stated that different functional groups produced different peaks in the spectrum.

Question 9(a)(ii) Few candidates could define what is meant by an optical isomer. Most candidates stated that optical isomers were non-superimposable or that they were mirror images but did not state that optical isomers were both of these.

Question 10(b)(ii) Most candidates found the naming of this branched ether quite difficult.

Project

The evaluation is usually the most demanding part of the project report. Many candidates find it easier to evaluate the procedures by considering uncertainties in equipment and areas where the procedure went wrong. They find it much more demanding to evaluate the results. Quite often, all the candidate supplies is a restatement of the findings. It is also common for candidates to attribute differences between the actual and theoretical or literature values to uncertainties and human error in reading equipment when this is not the case. Many candidates determine values that are very far from literature or packaging values, or impossible for the qualities used, and yet make no comment on this.

Section 3: preparing candidates for future assessment

Advanced Higher Chemistry has undergone a review and there is additional exemplification in the course specification. There have also been changes to the question paper. Advice is given in the following section.

Question paper

Questions linked to statements in the course specification

Candidates should practise accurately describing and explaining terminology from the 'Skills, knowledge and understanding for the course assessment' section of the course specification, for example, question 2(a), stating what is meant by the order of a reaction.

Researching chemistry questions

There will be around 28 marks assessing knowledge and skills relating to the researching chemistry section of the course. Questions relating to this section tend to be poorly answered.

Candidates are expected to describe the correct procedures associated with use of the listed pieces of apparatus and techniques. Gaining practical experience of using these pieces of apparatus and techniques helps ensure candidates can answer these types of questions. The 'Skills, knowledge and understanding for the course assessment' section of the course specification provides extended detail about the procedure required for each technique.

Changes to naming and formulae of transition metal complexes

Transition metal complexes are named according to The International Union of Pure and Applied Chemistry (IUPAC) rules and are available on the IUPAC website. The significant changes are that negatively charged ligands ending in 'ite' are given the ending 'ido'. For example, a chloride ligand in a complex would be given the name chlorido. There has also been a change to the writing of formulae of transition metal complexes, with ligands being listed in alphabetical order as they appear in the formula, for example a carbonyl ligand, CO would appear in a formula before an iodide ligand, I^-.

Changes to symbols for quantum numbers

There has been a change to the symbols used to represent the magnetic quantum number (was *m* and is now m_l) and the spin magnetic quantum numbers (was *s* and is now m_s). There is no change to what these symbols represent.

Project

From session 2019–20, the project criteria is changing. The revised project structure and mark allocation are included in the project assessment task on the Advanced Higher Chemistry page of SQA's website. You can also access the Advanced Higher Chemistry webinar on this page. The Understanding Standards Website has example candidate evidence and accompanying commentaries.

Unless a centre is presenting a large number of candidates (more than 10) for Advanced Higher Chemistry, there is no reason for two candidates from the same centre to be doing the same or similar projects.

There are some changes to be aware of when preparing candidates for this assessment. You should ensure that candidates are following the guidance given in the ‘Instructions for candidates’ section of the project assessment task.

Grade boundary and statistical information:

Statistical information: update on courses

Number of resulted entries in 2018	2591

Number of resulted entries in 2019	2452

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	33.8%	33.8%	828	90
B	26.3%	60.0%	644	77
C	22.2%	82.2%	544	64
D	7.3%	89.6%	180	57
No award	10.4%	-	256	-

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.