



External Assessment Report 2015

Subject(s)	Chemistry
Level(s)	Higher (Revised)

The statistics used in this report are prior to the outcome of any Post Results Services requests

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 question papers and marking instructions for the examination.

Comments on candidate performance

General comments

This was the last paper for Higher (Revise) Chemistry Course C273 12 based on the Arrangements document published in December 2010

The paper followed the pattern of papers in previous years.

Unfortunately a small error crept through the paper setting process unnoticed into the final paper. The state for sodium carbonate in the target equation in Question 12 (c) should have been solid (s) rather than in solution (aq). Markers were asked to feedback if they felt this had an impact on candidate performance. The overwhelming view was that this had little, if any, impact on candidate performance. This is supported by the relatively high facility value (0.66) for the question meaning that candidates scored an average of 1.32 out of 2 marks.

Areas in which candidates performed well

Section A

In section A the following questions were answered very well:

Question 1	Most candidates knew the property that the four elements had in common.
Question 2	Most candidates knew that the first ionisation energy decreased as the atomic number of the alkali metals increased.
Question 3	Most candidates were able to select the equation representing first ionisation energy correctly.
Question 4	Most candidates were able to select the successive ionisation energies for a group 3 element.
Question 13	Most candidates knew the mole ratio of glycerol to fatty acids in fats.
Question 15	Most candidates were able to select a secondary alcohol given the names of alcohols.
Question 16	Most candidates knew that glycerol is always produced by hydrolysis of oils.
Question 18	Most candidates were able to select the correct arrangement of atoms in a peptide link.
Question 19	Most candidates recognised the reaction sequence as hydration followed by oxidation.
Question 20	Most candidates were able to identify an amino group and a carbonyl group.
Questions 23 & 24	Most candidates showed good understanding of equilibrium.

Section B

In section B of the paper candidates performed well in the following questions:

Question 1(b) (ii)	Most candidates were able to explain why the covalent radius of sulfur is smaller than that of phosphorus.
Question 2 (a) (ii)	Most candidates stated that distillation could be used to separate the mixture into pure compounds.
Question 2 (b)	Most candidates were able to draw the structure for methyl cinnamate given the structure of cinnamic acid.
Question 2 (c) (i) & (ii)	Most candidates could show by calculation that cinnamic acid was the limiting reactant and could calculate the percentage yield for the reaction.
Question 3 (b) (i)	Most candidates could identify a hydrogen atom that would be replaced when citric acid reacts.
Question 3 (c) (i) & (ii)	Most candidates could complete the diagram to show an endothermic reaction and knew the measurement that should be made in order to calculate energy released.
Question 3 (d)	Most candidates could calculate the volume of gas released during a reaction.
Question 4 (a) & (c)	Most candidates were able to process information from gas chromatograms and suggest why helium was used as a carrier gas in the chromatograph.
Question 4 (d) (i) & (ii);	Most candidates were able to state that terpenes consist of joined isoprene units and deduce a systematic name for linalool from the systematic name for another molecule.
Question 9 (a)	Most candidates were able to process the information and complete the flow chart.
Question 10 (d) (ii)	Most candidates were able to recognise a propagation step from a free-radical chain reaction.

Areas which candidates found demanding

Section A

Five questions in section A had a facility value less than 0.50 — ie fewer than half of the candidates chose the correct answer. These questions were included to discriminate between candidates likely to achieve an A-grade pass and those likely to achieve a C- grade pass.

Question 6	Candidates needed to realise that they had to use the electrochemical series from the data booklet to be able to answer this question.
Question 7	Candidates found difficulty working out what would remain unreacted/would be formed in this reaction.
Question 25	This question was very discriminating. Candidates found difficulty in working out how the equilibrium would be affected by the addition of

the different reagents.

- Question 29 Most candidates chose A ie did not realise that water should go in at the bottom of the condenser so as to completely surround the inner tube.
- Question 30 Many candidates did not realise that repeating does not help determine the end point of a titration.

Section B

In the extended-answer section of the paper candidates performed poorly in the following areas:

- Question 3 (a) &(b) (ii) Many candidates were unable to explain why citric acid is very soluble in water and the reaction only takes place when water is present;
- Question 7 (b) Many candidates drew a six-membered heterocyclic ring instead of a five membered ring;
- Question 7 (d) Most candidates were unable to recognise that amylose molecules could pack closely due their shape and would be difficult to separate;
- Question 8 An Open question – Many candidates did not use chemistry from Higher level, ie aspects of periodicity covered in the Higher course, to illustrate their answers;
- Question 9 (a) (ii) Few candidates knew that the cost efficiency of a process could be improved by selling by-products;
- Question 9 (b) Many candidates omitted to say adding concentrated sodium chloride solution increases the concentration of sodium ions and simply stated the equilibrium shifts to the right;
- Question 10 (b) (i) Few candidates mentioned aspects such as rinsing the burette with the solution to be used and checking for air bubbles in the jet of the burette when setting up the burette.

Advice to centres for preparation of future candidates

General

All candidates taking Higher Chemistry will now be presented for the New Higher qualification. The course is very similar in terms of content and structure to the Higher (Revised) course. The course assessment includes an assignment with a weighting of 20 marks. The structure of the question paper is different with only 20 fixed-response items and 80 marks for extended answer questions.

Unfortunately, due to question lengths, a blank page was included in Section B of the paper. The instruction 'Turn over for Question 10 on page 30' was given clearly on the page. A

number of candidates obviously did not read this instruction and stopped answering after Question 9. It is very important that candidates check all pages of their exam script as it cannot be guaranteed that this situation, for question layout purposes, will not occur again in future papers.

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 support notes. In this year's paper candidates performed poorly in these questions, particularly the question that required candidates to complete a diagram and the question in which candidates had to show knowledge of how to set up a burette. It is important that centres spend time ensuring that candidates develop skills in using the listed apparatus and are given experiences that allow them to carry out the listed techniques.

Questions requiring more detailed answers

Questions that require more detailed answers are often signalled by the words '**Explain fully**' or '**Explain clearly**' and are worth a minimum of two marks. Candidates need to be aware that to gain full marks for the question a detailed explanation needs to be given.

When the weighting of the question is two marks, candidates would be expected to make at least two correct points within their answer. The equivalent question to question 12 (b) in the traditional paper was question 8 (b) in the new Higher paper. Instead of being asked to 'State why' candidates were asked to 'Explain clearly' and the question was given a weighting of 2 marks.

An acceptable answer for two marks would have been: 'Adding concentrated sodium chloride solution increases the concentration of sodium ions. This increases the rate of the forward reaction pushing the equilibrium to the right and producing more sodium carbonate as a solid.'

Candidates may be given prompts within the questions to help them structure their answers. In the Higher (Revised) paper question 1 (b) (iii) was structured in this way. Candidates were given the prompts *In terms of the structures of sulphur and phosphorus molecules and the intermolecular forces between molecules of each element.*

In order to gain the full marks, candidates were expected to mention S_8 and P_4 molecules and London Dispersion forces in their answers.

Open questions

Like the Higher (Revised) paper, the new Higher paper contains two open questions. These are questions where there is no definitive answer. 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 by assessing 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.

Candidates need to be given greater experience of answering this type of question than is afforded by a prelim exam alone.

Calculations

The New Higher 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 candidate performance in calculations is compared to overall course performance.

Calculations that are taught as part of the course tend to be fairly well done in the Higher (Revised) paper. Question 2 (c) (i) & (ii) A — limiting reactant and percentage yield; question 3 (d) — volume of gas released by a reaction — were well done. However, a number of candidates lose marks through setting out working poorly. Candidates obviously benefit when following a set method. 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.

Assignments

The following advice on assignments was given to centres that presented candidates for the New Higher in session 2014–15.

This was the first year of assignments being an assessable component of Higher Chemistry. Many candidates seemed well prepared for the task and produced well-structured reports. However, many reports indicated that candidates would have benefited from greater engagement with their teachers throughout the course of the research phase of their assignment.

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

The following points cover specific criteria within the assignment.

Title and aim of the assignment

A title can be broad in nature; an aim needs to be specific. It is better to state the aim separately from the title. A candidate who started his/her report with *Aim: the aim is ...* would not be deemed to have given the report a title and would therefore lose the mark for report structure in presentation.

Candidates need to be **clear about their aim**. If their aim relates to socio/economic or medical information taken from literature sources then, to gain the mark for the sufficiency of data, this information needs to be given as raw data, eg in the form of a photocopy of the literature. This can be appended to the report. It is not sufficient simply to give a reference to the literature source.

Raw data

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 the reference in the reference section of their report.

Results from an experiment

One of the sources of information that candidates **must** use is data from an experiment in which they had taken part. Candidates must link their data to the title and aim of the experiment either by stating the title and aim of the experiment with the data or by clearly indicating that the title and aim are given in the reference section of the report.

Processing and presenting

Candidates must provide the raw data that they 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 and making comparisons between data sets. Candidates need to be given the opportunity to engage in this type of activity in advance of writing their reports.

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.

The only material that should come after the reference section is any appendices that a candidate may wish to include. Appendices should not need to be marked. The only allowable exception to this is for the risk assessment mark where candidates have indicated within the body of the report that their risk assessment was given as an appendix. Appendices must be labelled clearly as such.

Some candidates drew graphs of data which they attached to the back of the report. Candidates lost a mark for structure of the report since their reference section did not come at the end of the report. This was a lesser penalty than would have been the case if the graphs had been deemed to be appendices and not marked.

Statistical information: update on Courses

Number of resulted entries in 2014	702
Number of resulted entries in 2015	481

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	30.1%	30.1%	145	70
B	25.2%	55.3%	121	59
C	22.5%	77.8%	108	49
D	7.3%	85.0%	35	44
No award	15.0%	-	72	-

For this course the intention was to set an assessment with grade boundaries of 50 for the C, 72 for the A and 83 for the upper A. A 2 mark adjustment was made at the 'C', 'A' and 'UA' boundaries for two questions in the multiple choice section - Q11 and Q22 - these questions did not function as intended. A 1 mark adjustment was made at the 'A' and 'UA' boundaries for both Q(3)(b)(ii) and Q(7)(d) as these questions did not function as intended. A 1 mark adjustment was made at the 'C', 'A' and 'UA' boundaries for Q(9)(a)(ii) as it didn't function as intended. A 1 mark adjustment was made at the 'C' boundary only for Q(10)(c) as it functioned as an 'A' question when it was intended for the 'C's. A 1 mark adjustment was made for the 'C', 'A' and 'UA' for Q10(b)(i) as it did not function as intended.

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.