



External Assessment Report 2015

Subject(s)	Chemistry
Level(s)	Higher

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 Chemistry Course C012 12 based on the Arrangements document published in June 2002.

The paper followed the pattern of papers in previous years although questions knowledge and skills from Prescribed Practical Activities were embedded into other questions rather than having separate PPA questions.

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

- Question 7: Most candidates knew how calculate average rate from a graph.
- Question 8: Most candidates knew that first ionisation energy decreases as the atomic number of the alkali metals increases.
- Question 9: Most candidates were able to select the equation representing first ionisation energy correctly.
- Question 13: Most candidates knew the definition for enthalpy of neutralisation.
- Question 25: Most candidates knew how ozone protects the Earth.
- Question 29: Most candidates could work out that the conversion of linoleic acid to stearic acid was an example of hydrogenation.
- Questions 34 & 35: Most candidates showed good understanding of equilibrium.

Section B

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

- Question 2 (a) Most candidates were able to calculate the reaction time from the relative rate.
- Question 3 (c) Most candidates were able to calculate percentage yield.
- Questions 6 (a) (i) Most candidates were able to state what happens to molecules during reforming.
- Question 6 (c) Most candidates were able to predict an enthalpy of combustion for

	pentan-1-ol.
Question 7 (a)	Most candidates were able to state the purpose of the variable resistor in the circuit.
Question 8 (c)	Most candidates were able to work out how long before pellets needed replacing.
Question 8 (d)	Most candidates understood that temperature has no effect on half-life.
Question 9 (a) (i)	Most candidates could name the functional groups in the molecule.
Question 9 (c)	Most candidates were able to draw a potential energy diagram for an endothermic reaction.
Question 10 (a) & (b)	Most candidates knew the definition for a weak acid and were able to suggest a pH for a salt of a weak acid/strong alkali.
Question 12 (a)	Most candidates were able to process the information and complete the flow chart.

Areas which candidates found demanding

Section A

Only two questions in section A had a facility value less than 0.50 (ie fewer than half the candidates chose the correct answer). These questions were included to discriminate between candidates likely to achieve an A and those likely to achieve a C pass.

Question 18	Candidates found difficulty working out what would remain unreacted/would be formed in this reaction.
Question 36	This question was very discriminating. Candidates found difficulty in working out how the equilibrium would be affected by the addition of the different reagents.

Section B

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

Question 1 (b) (i)	Drawing a possible structure for P_4S_3 — any structure obeying normal valency rules was acceptable.
Question 1 (b) (iii)	Explaining fully why the melting point of sulphur is much higher than that of phosphorus.
Question 3 (a)	Completing the apparatus diagram. The standard of drawing was extremely poor both in the technical sense — this is thought to impact on candidates' ability to attain the marks — and in terms of illustrating a suitable arrangement of apparatus to carry out the technique. Many candidates did not pass the steam 'through' the leaves and drew systems that were closed.
Question 4 (a)	Surprisingly many candidates were unable to state that oils are an energy source or are important in the transport of vitamins around the body.

Question 4 (b)	Many candidates were unable to state that triglycerides were esters.
Question 5 (b)	Many candidates were unable to draw the structural formula for an amino acid formed by the breakdown of the section of protein.
Question 9 (a) (ii) &(b)	Most candidates were unable to explain why citric acid is very soluble in water and the reaction only takes place when water is present.
Question 11 (a) (i) & (ii)	Many candidates did not include the hydrogen when circling the part of the glucose that reacts with Fehling's/Benedict's solution or mention that the test tube needed to be heated when carrying out the test.
Question 11 (b)	Many candidates drew a six-membered heterocyclic ring instead of a five membered ring.
Question 11 (d)	Most candidates were unable to recognise that amylose molecules could pack closely due their shape and would be difficult to separate.
Question 12 (a) (ii)	Few candidates knew that the cost efficiency of a process could be improved by selling by-products.
Question 12 (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.
Q 13 (b) (iii)	Many candidates were unable to work through the calculation.

Advice to centres for preparation of future candidates

General

All candidates taking Higher Chemistry will now be presented for the New Higher qualification. The structure of the question paper is different with only 20 fixed-response items and 80 marks for extended answer questions. There are no Prescribed Practical activities in the New Higher but the paper will contain questions that will assess practical knowledge and skills that should be developed when covering the Researching Chemistry Unit of the course. No $\frac{1}{2}$ marks are awarded in the New Higher and the weighting of some calculations and extended answer questions has been adjusted to take account for this.

Unfortunately, due to question lengths, a blank page was included in the extended answer sections of both the Higher (Revised) and the New Higher papers. The instruction *Turn over for Question 10 on page ...* was given clearly on the blank page. A number of candidates in the Higher (Revised) paper 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 inclusion of a blank page, 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. These questions are in place of Prescribed Practical Activity questions which were included in the traditional Higher paper. 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 traditional 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 van der Waals forces in their answers.

Open questions

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 Traditional paper question 3 (c) – percentage yield; question 7 (b) time taken for electroplating; and question 9 (d) – volume of gas released by a reaction were all 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 are related to 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 have 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 require 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. Any appendices must be labelled clearly as such.

Some candidates drew graphs of data which they appended 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	10716
Number of resulted entries in 2015	6392

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	30.6%	30.6%	1958	71
B	22.9%	53.5%	1462	59
C	21.1%	74.6%	1351	47
D	9.2%	83.9%	590	41
No award	16.1%	-	1031	-

For this course, the intention was to set an assessment with grade boundaries at the notional values of 50% for a Grade C and 70% for a Grade A. A 2 mark adjustment was made at the 'A' and upper A boundaries as the question paper was deemed less demanding at the upper end. Q3(b)(iv) and 4(a) were intended to function as 'A' marks but did not function as such.

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.