External Assessment Report 2014

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

The 2014 Higher Chemistry paper was constructed to closely mirror the pattern of question types used in recent papers. The paper was constructed to assess content across the full range of the course.

The paper contained questions that ranged from the relatively straightforward to those that required detailed knowledge or processing of new information. Most candidates had little difficulty answering the straightforward questions, but those requiring detailed knowledge or processing of information (A-type questions) were found to be discriminating. Those who were more likely to gain an A or B grade performed better in these questions.

Some questions used in the examination of Higher and Higher (Revised) Chemistry are common to both papers. These benchmarked questions are used to compare candidate performance by the two cohorts and ensure equivalence in terms of the awards made to the separate cohorts.

Anecdotal feedback and feedback from markers' reports was that the paper was fair with questions at a similar level of demand to recent papers.

Areas in which candidates performed well

The following questions in section A produced high facility values

Question 3	Change taking place when an atom forms a positive ion
Question 5	Effect of catalyst on activation energy
Question 6	Reaction pathway for exothermic reaction
Question 7	Average rate calculation from a graph
Question 12	Periodic trends down a group
Question 20	Hydrocarbon structure and auto-ignition
Question 21	Processing information from a table
Question 28	Colour change associated with use of acidified dichromate
Question 36	Effect of catalyst on reaction rate
Question 40	Properties of radiations

In Section B of the paper candidates performed well in the following questions.

Question 1	Most candidates showed good knowledge of the structure and bonding in elements, and understood that electrical conductivity of metals was due to delocalised electrons. There was also good understanding of

	the reason for atom size decrease across the period.
Question 2(a)	Most candidates knew the fraction of crude oil used to produce petrol.
Question 2(b)(i) and (ii)	Candidates were able to draw the structure of the branched alkane and knew another class of compounds added to improve the burning efficiency of petrol.
Question 2(c)(ii)	Most candidates understood that the reaction was an example of reduction.
Question 2(c)(iii)	The percentage yield calculation was carried out well. The most common mistake was to neglect to take account of the stoichiometry. Resulting in a theoretical yield of 255g. Some candidates then went on to divide their theoretical yield by the actual yield.
Question 3(b)	Most candidates understood the conditions necessary for a successful collision in a chemical reaction.
Question 4(b)	Most candidates were able to predict the pH of the salt solution formed from a weak acid / strong alkali.
Question 5(a)(i)	Candidates understood that nylon was made by condensation polymerisation.
Question 8(b)	The Hess's Law calculation was done well, with candidates understanding that when equations are reversed the enthalpy value changes from positive to negative and vice versa.
Question 9(a)(ii) & (iii)	Most candidates appreciated that a safe method of heating is required when heating flammable liquids and were able to draw the structure of the ester. This was done much better than anticipated. It had been felt that the use of methanoic acid might lead to mistakes.
Question 10(a)	Candidates were able to state that the catalysis was an example of heterogeneous catalysis.
Question 10(c)	The calculation of volume gas produced by the electrolysis was well done.
Question 11(c)	The problem associated with the use of CFCs was understood.
Question 12(a), (b) & (c)	Most candidates understood that keratin was a fibrous protein, could identify a peptide link and could name the hydroxyl functional group.

Areas which candidates found demanding

In Section A the following questions were found to be demanding:

Question 4	Many candidates answered displacement for the type of reaction between copper(II) oxide and dilute sulphuric acid.
Question 10	Candidates recognised the energy profiles were for gases at different temperatures but were unable to relate molar quantities to the area beneath the curve. The item was discriminating.
Question 17	This was a discriminating question with the only the more able candidates able to process information and relate numbers to Avogadro's constant.
Question 19	A question requiring understanding of cracking and reforming.
Question 37	Most candidates were unable to identify that aluminium metal was acting as a reducing agent in the reaction.

In Section B candidates found difficulty in answering questions relating to PPs and questions that required more detailed answers or required candidates to process information. The following questions highlight specific areas that were found to be demanding by some candidates:

Question 2(c)(i)	The answer required understanding of optimum temperature and enzymes denaturing. Many candidates answered in terms of energy cost.
Question 3(a)(i)	A PPA question. Many candidates' answers, eg add water, didn't give enough detail to be sure that they understood procedure.
Question 4(a)	Explain **fully**. The question stated that in their answers candidates should mention the intermolecular forces and how they arise. Candidates were able to identify hydrogen bonds and van der Waal's forces (as per definition in this course). However, few candidates extended their answer to describe how the forces, particularly van der Waal's forces, arise.
Question 5(a)(ii)	Many candidates were unable to deduce that ethanoic acid would stop the polymerisation due to molecules having a single functional group.
Question 5(b)	Many candidates stated that polymer was photoconductive rather than it could conduct electricity.
Question 6	Again candidates were asked to 'Explain fully'. Many simply said equilibrium will move to right and indicator turn yellow without giving explanation of why equilibrium moves to the right.

Question 7(b)	Most candidates were unable to relate beta emission to a neutron decaying to give an additional proton in the nucleus.
Question 8(a)	Energy calculation. Candidates were able to use equation $E_h = cm\Delta T$, but were unable to relate energy requirements to mass of calcium oxide.
Question 9(a)	Surprisingly few candidates gave concentrated sulphuric acid as their answer. Many candidates gave the answer acidified potassium dichromate.
Question10(b)	When combining the equations many candidates failed to cancel the carbon monoxides from the overall equation.
Question 10(c)(ii)	Many answers mentioned no harmful products but didn't mention carbon dioxide and associated problems.
Question 11(b)	Many candidates recognised molecule represented a ketone, ie gave an answer ending in one, but were unable to give the systematic name.
Question 12(d)(ii)	Many candidates drew the hydrogen bond from a hydrogen atom attached to a carbon.
Question 13(a)	A question relating to PPA experience. Very few candidates gave a correct answer.
Question 13(d)	This question operated as an A-grade question. Most candidates were unable to progress the calculation past the concentration of the vitamin C in the orange juice sample.
Question 14(b)	A processing information question that required candidates to systematically follow the rules given. Many candidates failed to process Rule 3 changing some of the carbon monoxide to carbon dioxide.
Question 15(a)	Another processing information question. Many candidates removed the hydrogen from the hydroxyl group rather than the carboxyl group.
Question 15(b)	Many candidates were able to identify that the pH was 9 but didn't give a clear explanation of what would happen.

Advice to centres for preparation of future candidates

General

The last Higher paper based on the Arrangements document published in June 2002 has been set for 2015. As in previous papers, some of the questions will relate to chemistry covered in earlier courses. Candidates from S6 will likely have had experience of Standard Grade or Intermediate 2 courses. However, candidates from S5 will have followed National 5 courses in 2013–14. It will be important that candidates from S5 have an understanding of chemistry that would be covered in Standard Grade or Intermediate 2 course and that would be seen as fundamental to understanding of chemistry covered in the Higher course.

Advice regarding particular types of questions

PPA questions

Each year approximately 6 marks are allocated to the assessment of knowledge and skills relating to the Prescribed Practical Activities. It is noticeable that performance in these questions seems to be centre related — ie candidates from some centres are well prepared and have good knowledge of the activities, whilst candidates from other centres have very limited knowledge. It is important that candidates have a record of important points from all of the PPA's that they can refer to when preparing for the exam.

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 full explanation needs to be given.

As an example, question 6 required candidates to explain fully the colour that would be observed when methyl orange indicator is added to dilute sodium hydroxide solution. Many candidates simply said the equilibrium given moved to the right and the colour became more yellow. A full answer would have included removal of hydrogen ion by reaction with hydroxide ions and an increase in concentration of the yellow negative ion.

Calculations

Some calculations were fairly well done, eg 8(b) Hess's Law, and 10(c) Faraday calculation, whilst others were poorly done eg 8(a) Enthalpy, and 13(d) titration calculation.

Candidates obviously benefit when following a set method. This, again, appears centre-related, with candidates from centres where they are obviously drilled in set methods benefitting. 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.

Statistical information: update on Courses

Number of resulted entries in 2013	10001

Number of resulted entries in 2014	10716

Statistical information: Performance of candidates

Distribution of Course awards including grade boundaries

Distribution of Course awards	%	Cum. %	Number of candidates	Lowest mark
Maximum Mark 200				
A	30.1%	30.1%	3222	73
B	23.2%	53.3%	2490	60
C	23.0%	76.3%	2464	47
D	10.1%	86.4%	1085	40
No award	13.6%	-	1455	-

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.