GCSE
CHEMISTRY

8462/1F Paper 1
Report on the Examination

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General comments

Around 20,000 students sat this component, so a wide and varied range of responses was seen.

Some students gave responses which showed excellent and comprehensive understanding of chemistry at this Foundation Tier GCSE level, while others had difficulty even with core chemical concepts.

The majority of students appeared to have sufficient time to complete the paper. The vast majority of students attempted all the questions with the exception of **07.1**, which was not attempted by more than half of the students.

In general, the number of writing lines provided is an indication of the length of response expected, though students are of course free to use the blank pages at the back of the booklet if required.

Knowledge and understanding of how science works in everyday situations, including in the laboratory, were tested throughout this paper. This means that it was essential that students read and analysed the information provided, then read and understood the question before writing their response.

Levels of demand

Questions are set at two levels of demand for this paper:

- **Low demand** questions are designed to broadly target grades 1 – 3
- **standard demand** questions are designed to broadly target grades 4 – 5.

There were eleven questions on this paper. Questions **09** to **11** were common to questions **01** to **03** on the Higher Tier paper. The demand levels of the questions are designed to increase from low demand to standard demand through the paper. For questions **01** to **08** the demand of each question also increases through the question. A student's final grade, however, is based on their attainment across the qualification as a whole, not just on questions that may have been targeted at the level at which they are working.

Comments on Individual Questions

Question 1 (low demand)

01.1 The vast majority of students gave the correct answer, neutrons, with the others evenly split between protons and electrons.

01.2 Fewer than half of students gave the correct answer, with more choosing an electron and a neutron than the correct answer.

01.3 The great majority of students answered correctly, with the most common error being two oxygen atoms and one nitrogen.

01.4 Three quarters of students identified the element correctly as lithium. The most common incorrect response was zinc.

01.5 This question discriminated well. Fewer than a third of students scored all the marks. Many students drew their protons and neutrons around the edge of the nucleus instead of inside it. Many of those who did do this part correctly however then used the edge of the nucleus as the first electron shell. The need for clear presentation in answers applies to diagrams as well as to written answers. Many students caused confusion by not using the symbols given in the key in the question.

Question 2 (low and standard demand)

02.1 Students found this question difficult, with only a fifth of students gaining both marks.

02.2 Three quarters of students knew that the solution would be alkaline.

02.3 Students found this question difficult, with two thirds of students selecting a beaker as a piece of equipment suitable for measuring 25.0 cm^3 of a solution. Students seemed unfamiliar with the use of a pipette to measure volumes accurately.

02.4 This was well answered, with the vast majority recognising a burette as the correct piece of equipment.

02.5 Nearly all students recognised Trial 3 as the anomalous result.

02.6 This question proved difficult, with only a quarter of students scoring the mark. Many concentrated on why Trial 3 was chosen, rather than a source of the inaccuracy. Those who did try to find a source of inaccuracy were often successful, with the acid not being added dropwise or too much sodium hydroxide being measured out, being the most popular answers.

02.7 Two thirds of students scored no marks on this question. Those who attempted to use the information given to convert their volume to dm^3 often scored at least two marks. There were many answers where the figures 1000, 4 and 25 had been manipulated almost at random; 160 was a common response.

Question 3 (low and standard demand)

03.1 Three quarters of students recognised that carbon is an element. Most of the others thought carbon is a compound.

03.2 A third of students scored both marks, with another third scoring just one. Few students chose ions or molecules, but many could not select the correct sub-atomic particles for the correct space. Protons and neutrons were often seen the wrong way round.

03.3 A third of students gave the correct answer on this standard demand question. The most common incorrect response was the inverted expression.

03.4 Only a half of students recognised diagram B as buckminsterfullerene, with nearly as many selecting **C**, which was a diagram of a nanotube.

03.5 The majority of students scored at least one mark. The role of the delocalised electrons in electrical conduction was well known. The lack of covalent bonds between layers causing the softness was less well known, with many opting for the hexagonal rings being the cause.

Question 4 (low and standard demand)

04.1 This question discriminated well. Nearly a third succeeded in calculating the percentage of lead atoms as 20%, though it was less common to show the working as a simple mathematical expression. A response of 25% was fairly common, as a result of assuming the total number of atoms was 24 instead of adding all the atoms together. This answer scored two marks.

04.2 Few students scored both marks, although two fifths scored one mark. Many did know that it was the layers' ability to slide over each other that was reduced, but fewer knew that this was due to the different sizes of the two types of atom.

4.3 This question discriminated well, with the majority of students scoring at least one mark and about two fifths scoring all three. Students generally followed the sequence when describing the effect of the mass of tin on melting point and took note of the instruction to 'Use data from Figure 5.' Often, however, the data was contradictory, with many students quoting 60% tin rather than 62%, which meant that even though they quoted 183°C, they could not be awarded the mark for identifying the turning point.

04.4 Most students did not realise that pure tin means 100% tin, so did not read the correct value of temperature from the graph. Many gave 323 °C as a result of two errors: looking at 0% tin (ie pure lead) and misreading the scale on the y-axis.

04.5 This was well answered, with well over half choosing the correct option.

Question 5 (low and standard demand)

05.1 This piece of knowledge from the specification was not at all well known. Fewer than a quarter of students gave the correct answer, with the rest being evenly split between the two distractors.

05.2 The vast majority answered this correctly.

05.3 This question discriminated very well; about two fifths of students scored all four marks and two thirds scored two or more. Many could not use the given expression to calculate the surface area of one face and then multiply it by 6. Many also recalculated the volume of the cube, despite being given that value, and often disagreeing with the provided value. Students could gain the last two marks by using their answer for the surface area, but some did not know which two values to use in their ratio or could not simplify the ratio to the simplest whole number ratio.

05.4 This question proved difficult with more students giving the third option rather than the correct answer.

05.5 Fewer than a fifth of students gave the correct answer, with the majority opting for Ti_4O_2 rather than TiO_2.

Question 6 (low and standard demand)

06.1 Only a third of students gave a property of platinum which was relevant in its use for jewellery. Many gave properties which are not relevant, such as high density, high melting point or high strength.

06.2 The great majority scored at least one mark. Students were asked for observations which could be seen, so those which could be heard did not gain credit. Bubbling and fizzing are the same observation; many gave both terms and no other observation so scored only one mark. Some incorrectly said that the water changes colour (possibly because they have seen the reaction carried out in the presence of an indicator).

06.3 Most students scored at least one mark, with the vast majority knowing that copper is less reactive than sodium. The differences in physical properties were less well known, with many thinking that copper has a lower melting point.

06.4 Three quarters of students could compare the three properties and therefore achieve a mark in level 1. However, far fewer reached level 2, where there needed to be links to these properties, such as a copper pan cooking food more quickly because of copper's higher thermal conductivity. Many students incorrectly linked density to strength or longevity of the pan. Some students referred incorrectly to electrical conductivity: a property which is not relevant here and for which no data were provided. Many students also provided a simple judgement as to which pan is better overall. Many students simply quoted the values in the table, but did not add any value to the data.

Question 7 (low and standard demand)

07.1 This question was answered by fewer than half of the students showing that many students do not read the entire question, but focus only on the sentence above an answer line. As there was no answer line, the instruction to complete Figure 8 was missed. Of those who did respond, most scored at least one mark.

Most of those who did answer realised that two of each ion should be drawn, but many placed the ions directly under the same type of ion, instead of in the alternate positions.

07.2 This standard demand question proved to be difficult even with the prompt to refer to ions. There were few references to electrons, showing that students had taken note of this prompt; however, the idea that ions can move in the liquid state was not given by many students.

07.3 This question was well answered, with more than three quarters of students scoring both marks. Potassium was nearly always correct, but bromine was often incorrectly described as bromide.

07.4 Only a half of the students knew that the mixture has a lower melting point than pure aluminium oxide, with the majority of the rest opting for a higher melting point.

07.5 Only a half of students knew that the source of the hydrogen and oxygen is water. Most of the other chose sulfate ions.

07.6 Again, roughly a half of students knew the reason for the production of hydrogen rather than sodium, with nearly as many choosing the incorrect statement that hydrogen is more reactive than sodium.

07.7 Some students were not specific enough about the relationship of the volumes, merely stating that as one increased, so did the other. However, many gave excellent descriptions of the volume of hydrogen being twice that of oxygen. Just over a half of students scored the mark.

Question 8 (low and standard demand)

08.1 The great majority of students scored at least one mark, with three-fifths scoring both. Most could give the correct coefficient for Fe, but that for CO proved to be more challenging, with values of 5 or 6 being seen quite frequently. This question discriminated well.

08.2 Just over a quarter of students were able to articulate that iron oxide loses oxygen. Many expressed their answer as if decomposition of iron oxide were occurring.

08.3 There were many correct answers, with three fifths of students scoring both marks. However, many students do not realise that all they have to do is add the relative atomic masses of two Fe and three O atoms. 56 x 112 was frequently seen. Some students used three Fe atoms and two O instead of the other way round, misunderstanding the subscripts in the formula. Those who made an arithmetic error but had shown their working were able to score one mark. The question discriminated well.

08.4 This question also discriminated well. Most students could substitute the values correctly into the given expression. However, some did not know how to evaluate that expression and some incorrectly rounded a value of 77.9% to 77% instead of 78%.

08.5 About two thirds of students gave an acceptable observation**.** The majority of students gave bubbling as an observation. This was accepted as bubbles do form as a side reaction to the main displacement reaction. The expected observations of a colour change in either the metal or the solution, or a temperature change, were more rarely seen.

08.6 About three-quarters of students placed the metals in the correct order, but fewer could give a coherent reason. It was common to see the metals listed in reverse order. Students sometimes did not understand the difference between a metal and a metal sulfate, giving incorrect statements such as ‘C had most ticks’.

Question 9 (standard demand)

09.1 The description of the plum pudding model in the specification (a ball of positive charge with negative electrons embedded in it) is not well known. Very few students scored both marks and fewer than a quarter scored one. Many students believed that the positive

charge represented a proton, or that the atom as a whole is positively charged. Some referred to a 'sea' or 'cloud' of positive charge, but these terms do not convey the shape.

09.2 Fewer than a third of students knew the correct order of discovery of the particles.

09.3 About a third of students scored both marks. Most missed the relevance of the instruction to use the period table. Many tried to work out the electron configuration, instead of simply locating element 117 in Group 7 and deducing that there must be 7 outer shell electrons.

09.4 This question was very poorly answered and did not discriminate well. Students seemed unfamiliar with the concept of the need for peer review. Most answered in terms of the rarity of the element, but this was also true for the original scientists and does not explain the time lag before acceptance.

09.5 Whilst one in ten students scored all three marks, overall, few remembered how to do this standard calculation. The four numbers in the table were manipulated in various random ways. Some students did not even use all the data. Most did not realise that the answer must lie somewhere between 6 and 7, the two mass numbers. One in five students made no attempt to answer.

Question 10 (standard demand)

10.1 Nearly half of students scored at least one mark. Many realised that the two required variables were those in the table headings or in the description of the investigation. However, some had these the wrong way round. 'Amount' is not synonymous with 'mass' and is not an acceptable alternative. Some just mentioned the name of the substance rather than its mass.

10.2 This question discriminated well, with a third of students scoring all three marks and two thirds scoring at least one. Many excellent graphs were seen, with correctly plotted points and a straight line of best fit, with an even scatter of points about the line. Some students had difficulty in handling the different scales on the two axes, and some drew a 'point to point' line instead of a line of best fit. A line of best fit where the points do not all lie on the line should have an even scatter of points about the line. This was often not the case, with a line skimming the bottom of some points and most of the others above it.

Students should use a pencil for plotting points as well as for drawing the line. It is very difficult to 'cross out' points or lines drawn in ink if the student changes their mind. Where two points are given, the examiner will not choose which one to mark for the student.

10.3 Fewer than a half of students extended their line to the axis and read off the intercept value correctly. Many did extend their line to the axis, but then gave a value that was merely to the nearest major gridline, or was the temperature of the highest or lowest data point.

10.4 Nearly a half of students gave an acceptable answer. Many gave a definition of an endothermic change in terms of energy transfer, rather than referring to the results as required. Reference to the temperature decrease was all that was needed. Some contradicted a correct reference to temperature decrease with an incorrect reference to heat being released.

10.5 This was very poorly answered. Only a handful of students scored both marks, with just over one in ten scoring one. Students are unfamiliar with the idea of uncertainty as the range about the mean, as stated in the specification. There were some good descriptions of the highest value being 0.3 °C above the mean and the lowest being 0.3 °C below the mean, but very few used the word uncertainty.

10.6 This question did not discriminate well, with roughly equal numbers of students choosing each response. The correct answer, random error, was the least popular.

Question 11 (standard demand)

11.1 This extended response question discriminated well, although over a fifth of students gave no response. The majority of answers were at Level 1, but some students did reach Level 3. Many students described the crystallisation part of the process, but not how they made the necessary zinc chloride solution in the first place. They merely mixed the reactants and then heated them in a crystallising basin or other receptacle, missing out the essential steps of starting with the acid, adding the zinc carbonate to it until the zinc carbonate is in excess, and filtering to obtain the filtrate. Very few named the acid that is necessary to produce the chloride.

11.2 Few students gave two correct answers, although over a third could suggest one, zinc being the most common correct answer. Nearly a fifth of students did not give an answer.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.