GCSE
CHEMISTRY

8462/1F: Paper 1 (Foundation tier)
Report on the Examination

8462
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General comments

There were ten questions on this paper. Questions 9 and 10 were common to the Higher Tier. The demand levels of the questions are designed to increase from low demand to standard demand through the paper. For questions 1 to 8 the demand of each question also increases through the question. The vast majority of students attempted all the questions.

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.

A student's final grade, however, is based on their attainment across the qualification as a whole.

Question 1 (Low and standard demand)

01.1 The great majority of students scored both marks.

01.2 The majority of students scored at least one mark, with just under half scoring both marks.

01.3 Most students could substitute the values into the equation and obtain a correct value for the relative atomic mass. However, only about half could then give their answer to three significant figures. Some students did not appear to understand how to input their expression into a calculator and incorrectly calculated the value as

$$(39 \times 93.3) + \left(\frac{41 \times 6.7}{100}\right)$$

which gave a value of 3641.

01.4 Students who had correctly calculated the relative atomic mass were less successful at identifying the element, with some giving the response argon, and others mistakenly using the atomic number, giving a response of yttrium.

01.5 Fewer than 40% of students gave the correct answer.

Question 2 (Low and standard demand)

02.1 This was answered correctly by the great majority of students.

02.2 About 60% of students correctly identified diagram **A** as a mixture of compounds. **D**, a pure compound, was the most popular incorrect response .

02.3 Just over half of students correctly identified **B** as a mixture of elements. About a quarter chose **A**, which was a mixture of compounds.

02.4 Most students correctly named filtration as the method to be used. Distillation and evaporation were common incorrect responses.

02.5 Most students gave **C** as the correct liquid. A few wrote water, despite the boiling point of water not being given in the table.

02.6 This question was poorly answered. Many students seemed to think that the question was about vapours passing through the condenser rather than the water used to cool the vapours.

02.7 Very few complete descriptions of the process of crystallisation were seen; over half of students scored one of the marks, but very few scored both. Many students did not realise the starting point was sodium chloride solution and tried to produce sodium chloride from a chemical reaction before crystallising the solution. Few realised that crystallisation is a two step process - heating to concentrate the solution and then leaving the remaining solution to cool and crystallise.

Question 3 (Low and standard demand)

03.1 This question was answered correctly by the majority of students, who recognised that copper would not react. Incorrect responses were almost equally divided between **A** and **D**.

03.2 This question was answered correctly by nearly all students.

03.3 Fewer than half of students scored both marks, although three quarters named one substance correctly. Most students realised that the appropriate metal oxide would be zinc oxide. However, fewer could correctly name the acid, with hydrochloric acid being a popular response.

03.4 Nearly three-quarters of students scored at least one mark, with nearly half scoring both.

03.5 Nearly 80% of students identified the correct type of reaction.

03.6 Over 80% of students correctly identified the apparatus as a burette. The majority of the rest gave a response of pipette.

Question 4 (Low and standard demand)

04.1 This was well answered, with the majority of students giving a correct answer. Most answered in terms of elements that had not been discovered; very few answered in terms of preserving the pattern of similar properties in the same group.

04.2 Nearly three-quarters of students correctly identified Mendeleev as the scientist.

04.3 The majority of students correctly identified the missing group as the noble gases, but a significant minority gave a response of halogens.

04.4 This was well answered with over 70% of students giving the correct answer.

04.5 Nearly all students gave a sensible estimate of the melting point.

04.6 This was well answered, with over 80% of students giving a correct observation. Most described fizzing or bubbling. A few gave observations that could not be seen, such as popping sounds.

04.7 The vast majority of students managed to score at least one mark but fewer than 60% scored both. Liquid was a common incorrect answer, as were At and HAT.

04.8 Nearly half of the students chose the correct formula. The most popular incorrect response was Br, which is the formula of an atom, not a molecule.

Question 5 (Low and standard demand)

05.1 The majority of students correctly identified hydrogen as the gas produced. Carbon dioxide and chlorine were both popular distractors.

05.2 This was not well answered. Even those who realised the independent variable had something to do with the magnesium often failed to gain the mark. The expected answer was the length of magnesium ribbon. Many students simply referred to 'magnesium ribbon' without the word 'length'. Others used vague terms such as 'amount' of magnesium ribbon, or gave a specified mass of magnesium ribbon, which was not measured. Others referred to only one length of magnesium as if it were not being changed.

05.3 This was not well answered. Many students again referred to the vague 'amount' of hydrochloric acid instead of specifying the same volume. There was apparent confusion between the different types of variable, with many students giving the length of magnesium ribbon as a control variable.

05.4 The vast majority of students correctly identified the anomalous result.

05.5 This was answered better than the questions about the variables, with about 40% of students giving an acceptable source of error. Many students recognised that replacing the stopper too late would lead to a greater loss of the gas and therefore a lower volume measured. Other answers were also acceptable if there was an explanation as to why the result was smaller than expected rather than just different. Thus, having too small a volume of acid was accepted, but just measuring the volume incorrectly was not. There were a lot of vague responses along the lines of measuring something incorrectly or random or human error; these responses were not specific enough and did not gain credit.

05.6 Nearly all students plotted the points accurately. The majority drew a correct line of best fit, but a few had doubled or feathered lines, or had clearly not used a ruler.

05.7 Nearly all students were able to give the correct relationship.

Question 6 (Low and standard demand)

06.1 Nearly two thirds of students could select the correct diagram to show graphite. The structures of the two fullerenes were popular distractors.

06.2 Fewer than half of students could identify **D** as representing poly(ethene). All three other diagrams were popular, with **B** attracting a quarter of the responses.

06.3 Although a diagram was provided, only just over a half of students gave 4 as their answer.

06.4 The great majority of students could identify that diamond is very hard.

06.5 Just over half of the students could count the atoms in the figure and then write the formula correctly. Many failed to gain credit because the numbers were not subscripts but the same size as the letters, or even larger.

06.6 Just over a third of students could demonstrate their knowledge and understanding of acids to choose the hydrogen ion, with the majority of students opting for the hydroxide ion.

06.7 Over a half of students got the correct answer. The most common error was to assume there were three atoms of carbon as well as oxygen, giving an answer of 86. Other common errors were to add 1, 12 and 16 together, or to multiply relative atomic masses together.

Question 7 (Low and standard demand)

07.1 Nearly two-thirds of students correctly identified the coarse particle as the largest, with the fine particle being the more commonly selected of the two distractors.

07.2 Most students could calculate the volume correctly. Some attempted to calculate the surface area of the cube from scratch, failing to use the value given in the question. Nearly a half of students did obtain full marks for the question, though many failed to show their working for each step and just gave the two answers.

07.3 Fewer than a quarter of the students realised that the surface area to volume ratio of nanoparticles is greater so less of the substance needs to be used. Fewer than half gained any credit at all.

07.4 This was very well answered, with nearly all students gaining at least one mark and more than two-thirds gaining both. However, some students thought that a disadvantage could be that feet would smell, not recognising that unpleasant smells would be prevented by the silver. Another misunderstanding was that the socks could cause infections, rather than prevent them.

07.5 About a half of students could work out that the radius was 100 times larger, with 2 times larger being the most commonly chosen distractor.

Question 8 (Low demand)

08.1 Fewer than 40% of students recognised the hydroxide ion as the source of oxygen; the most popular distractor was hydrogen ions.

08.2 Most students could read the volume of gas in the inverted measuring cylinder. Some tried to read the scale upwards and gave a response of 33 cm^3.

08.3 Only about 20% of students were awarded the mark. Students needed to explain why ionic solids do not conduct, rather than why solutions or molten compounds do conduct. Even when directed to answer in terms of ions, some students still thought that electrons were somehow involved.

08.4 This was well answered, with the great majority of students naming both correct products.

08.5 Over a half of students gave the correct reason in terms of the relative reactivity of carbon and sodium. The electrical conductivity of carbon was a popular distractor.

08.6 About a half of students gave (aq) as the state symbol for a molten substance.
Only about 30% gave the correct answer (l).

08.7 Correct answers to this calculation were given by the great majority of students.

Question 9 (Standard demand)

09.1 Fewer than a quarter of students recognised that element **Q** must be a non-metal because of the lack of conductivity, and therefore in section **D**. **B** and **C** were both seen more often than the correct answer, though responses were fairly evenly spread across all options.

09.2 This was slightly better answered than the previous question. However, again responses were spread across all options.

09.3 Most students described a property of either a Group 1 element or a transition element without reference to the other; this did not gain credit as a comparison was needed. Of those students who did answer in comparative terms, most knew that Group 1 metals are softer than transition metals, but there was confusion about which had lower melting points. Some students thought that one group or the other would not conduct electricity. Very few students were awarded both marks; about a sixth scored one mark.

09.4 Most students could draw the electronic structure correctly. The most common error was to draw only one electron on the outer shell.

09.5 Most students referred to electrons in their answer as required, but fewer than a third described those electrons as delocalised. Some also referred to the electrons carrying charge. However, very few articulated the idea that the electrons themselves move through the metal in a particular direction. Of those who referred to electrons moving, many implied that the movement was random. Some students incorrectly referred to electrons bumping into other atoms or electrons.

09.6 Just over half of students correctly identified the type of bonding. The most common incorrect response was covalent.

09.7 Many students gave good descriptions of the transfer of two electrons from a magnesium atom to an oxygen atom to produce magnesium ions and oxide ions. However, some students subsequently referred to electrons being shared. About 40% of students were awarded at least one mark, with about a sixth gaining all four marks.

Question 10 (Standard demand)

10.1 Many students found planning this practical challenging; less than 5% of answers reached Level 3. Of those who did realise they simply had to add measured masses of sodium carbonate to a measured volume of hydrochloric acid and measure the highest temperature, many compromised their response by heating the mixture with a Bunsen burner. Incorrect approaches included heating the sodium carbonate powder alone to melt it or measuring the loss in mass during the reaction. A significant minority answered in terms of one of the Required Practical Activities, usually the preparation of a salt.

10.2 The calculation was done well, with over 60% of students scoring 3 or more marks. Many students determined the gradient correctly, with most using the coordinates of the points at the limits of the printed line. However, many appeared to misread the scale on the *y*-axis, reading 28.6 as 28.3 and 22.2 as 22.1. Many did not annotate their graph, making it very difficult for examiners to judge whether the *x*-coordinates corresponded to the given *y*-coordinates. Students should always show their working in full, including annotating the graph to enable working marks to be awarded. A sizeable minority of students took a single point on the line and divided the temperature by the mass. Very few correct units were seen; many students did not obtain the unit by dividing the units on the *y*-axis by those on the *x*-axis.

10.3 Most students extrapolated the line to the *y*-axis correctly to read off the value of initial temperature. Some misread the intercept as 20.3 °C. Some students appeared to ignore the information in the question and gave the value of temperature at one end or the other of the printed line. Others attempted to give a value without extrapolating the line.

10.4 Two-thirds of students chose the correct graph, **C**.

10.5 This was poorly answered, with many students appearing to think the vertical axis involved temperature and/or time. Of those who did mention energy, many gave activation energy as one, or even both, of the answers. Only a quarter of students scored one mark and less than 10% scored both.

10.6 Only one third of students scored the mark. Most students did not refer to the relative energies of the reactants and products. Some students appear to believe that an exothermic reaction is one where substances are lost to the surroundings, rather than energy.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account of how students have performed for each question.

Mark Ranges and Award of Grades

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