GCSE
CHEMISTRY

8462/2H Paper 2 Higher Tier
Report on the Examination

8462
November 2020

Version: 1.0

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General Introduction to the November Series

This has been an unusual exam series in many ways. Entry patterns have been very different from those normally seen in the summer, and students had a very different experience in preparation for these exams. It is therefore more difficult to make meaningful comparisons between the range of student responses seen in this series and those seen in a normal summer series. The smaller entry also means that there is less evidence available for examiners to comment on.

In this report, senior examiners will summarise the performance of students in this series in a way that is as helpful as possible to teachers preparing future cohorts while taking into account the unusual circumstances and limited evidence available.

Overview of Entry

There were just over 600 entries for the paper, compared to over 100 000 in a normal summer series. A full range of abilities was seen.

Comments on Individual Questions

Question 1 (standard demand)

01.1 The majority of students were able to answer this item.

01.2 Most students were aware that the wire should be cleaned, though many suggested the wire (loop) should be sterilised. Far fewer were able to describe the effect on the results with many just repeating the third line of the question stem.

01.3 Few of the students were able to give correct precipitate colours for both copper and calcium ions. There was no real pattern in the incorrect responses, but green or brown were often seen.

01.4 Few students were able to name barium chloride (solution). Many unsuitable reagents were named, including silver nitrate

01.5 Some students were able to name the solution. Those who gave the correct solution sometimes gave the result for a different halide ion.

Question 2 (standard demand)

02.1 Some good answers were seen, with many students giving a Level 2 response. However, the sources of fresh water were frequently omitted, and many students went beyond the requirements of the specification and added information about screening, flocculation and sedimentation, often adding confusion to the filtration process. The sterilisation phase was quite well known, but then further information about addition of fluoride and water softening was often added. A significant minority thought that water treatment works boiled the water as part of the process.

02.2 Many students made the link between sea water and energy and scored this mark. The most common errors were to mention only boiling the water with qualification or filtration.

02.3 A number of students knew neither of the processes. Some of these reversed the two responses but overall there was no discernible pattern in the errors.

02.4 This part was extremely well done. A minority of students used data for the wrong year or showed that they didn't understand the concept of significant figures.

02.5 The majority of students were able to make the link with population increase. Weaker responses merely referred to an increase in the amount of unspecified waste produced or treated.

02.6 Many students were able to give one valid reason – usually linked to increased demand for food or food production. Few though were able to give a second reason. The most common response that gave insufficient detail was that less sludge was sent to landfill.

Question 3 (standard demand)

03.1 The vast majority of students scored both marks here. Again some reversed the responses and there was no pattern in the selection of the distractors.

03.2 Quite well answered, with the majority of students gaining at least one mark. A very wide range of colours for bromine water were seen in addition to orange, including red, yellow, brown and intermediate shades. A common error was to assert that the bromine water **becomes** orange upon addition to hexane. The difference between colourless and clear is now well understood by most.

03.3 This part was not very well answered by many, usually because they focused exclusively on structure and bonding at the expense of reactions, which could indicate that they didn't read the question carefully enough or didn't refer back to the question when constructing their response. Structure and bonding were well understood, but few of the reactions were mentioned. Additionally, students often reversed their answers because they confused ethane and ethene or the formation of their handwriting made it unclear whether a compound name ended 'ane' or 'ene'. The command word 'compare' demands that students mention both compounds to access level 2 and there were some imprecise comparisons such as 'ethane undergoes complete combustion whereas ethene undergoes incomplete combustion'. Because of these points, rather fewer than half of students were able to access level 2.

Question 4 (standard / high and high demand)

04.1 Well answered. Some students left contradictory working in place (e.g. 5.7 / 0.60 = 9.5 left alongside 5.7 x 0.60 = 3.42) which compromises their ability to score marks. Once students have decided which answer is correct, they should cross the other out.

04.2 Very few students scored this mark. Some didn't appear to have read the first sentence and just stated that there are two spots because there are two dyes. Many thought that the other compounds were insoluble; very few suggested that compounds could be colourless.

04.3 A majority of students gained one mark here, with many going on to score both.

04.4 Quite well answered by many students. Most referred to consistency of the green colour, with some referring to the ink being a formulation so having to have the same proportions. A few students tried to refer back to the experiment – 'to make it a fair test' or 'to produce the same R_f value'.

04.5 A minority of students selected the correct response.

Question 5 (standard and standard / high demand)

05.1 A significant number of students did not realise they were being asked to name the processes for which the energy requirement needed to be known, but instead tried to guess which material would use more energy.

05.2 Very few students gave a reasoned judgement and so were unable to access level 2. Some did not even have comparisons, but simply described the characteristics of each material in isolation. Some referred to deforestation, missing the point that more trees can be grown. Many made valid comparisons of the number of plates that could be packaged in a box and of the number of times each plate could be used, but did not go on to look at the consequences, such as the relative energy cost of transporting the plates or the need for replacement of the plates. Few referred to the conservation of raw materials, either in the context of the number of uses or the lack of recyclability. There was confusion between the terms reusable and recyclable. Some were highly focused on energy usage, even though no energy data was provided.

05.3 Some students knew that moulding and heating were involved, but often did not mention a furnace, kiln or oven. There were some references to heating clay **before** it is shaped.

Question 6 (standard and standard / high demand)

06.1 A number of students knew that this was incomplete combustion but far fewer mentioned insufficient oxygen. Some thought the soot was a product of a reaction involving the limestone.

06.2 This item was poorly answered, with a very small number of students able to access all the marks. Many thought that sulfur itself is released to the atmosphere, rather than producing sulfur dioxide in the engine, which is then released. Of those who did, most got the link to acid rain, but a lot did not say there would be less sulfur dioxide and therefore less acid rain. The last point was rarely scored – many just repeated the word erosion or its variants. Very few stated that acid rain reacts with limestone.

06.3 Not very well answered by most students. Many thought that nitrogen comes from the fuel. Others just stated that nitrogen oxides are a product of combustion. Of those who did realise that oxygen and nitrogen were reacting, some thought that this was happening outside the car rather than in the engine and very few mentioned that a high temperature was needed, some just referring to heat.

Question 7 (standard, standard / high and high demand)

07.1 Propanoic acid was named correctly much more often than a correct formula was given for methanoic acid. CHCOOH was a commonly seen error here.

07.2 Many students scored at least one mark here. A common misconception was that incomplete / partial ionisation means that each CH_3COOH molecule produces only one H^+ ion, i.e. that the three hydrogen atoms in the CH_3COO^- ion would also form H^+ ions if ionisation were complete.

07.3 This part was quite well answered. Most students stated that the mass decreases. Not all of the students who identified carbon dioxide as a product of the reaction went on to explain that it is the escape of this gas that causes the mass to decrease.

07.4 This part was poorly answered by many students. Many recognised that the pH of methanoic acid was lower but far fewer made the link to hydrogen ion concentration. Only a small proportion of students referred to collisions between particles and, of those that did, a significant minority referred to 'more collisions', which was insufficient for the mark, or incorrectly justified the increased collision frequency in terms of the particles having more energy.

07.5 A minority of students were able to name ethyl ethanoate.

07.6 A majority of students were able to identify the displayed structural formula of ethyl ethanoate.

Question 8 (standard and standard / high demand)

08.1 The point that was most frequently plotted incorrectly was the final one (180, 0.0040). A number of students failed to plot (0,0). There were some examples of rulers being used to to complete lines of best fit, with a number of straight lines seen. Some students produced excessively thick or ‘feathered’ lines. However, the majority of students were able to score at least two marks.

08.2 If either of the mole values were incorrectly determined from the graph, it was still possible to gain credit for using these values correctly. Some attempted to determine the instantaneous rate at a particular time by drawing a tangent to the curve. Units were sometimes written imprecisely e.g. moles per s, and some wrote ‘m/s’. Many students were able to score at least two marks.

08.3 This part was quite well answered by many. Most students preferred to answer in terms of line steepness rather than time and moles collected.

08.4 This item was quite well answered by many students. The most common error was to fail to multiply the area of one face by six.

08.5 Only a very few students scored here, with many just responding ‘smaller’ rather than stating by what factor it was smaller. A few assumed that because the cube was larger, so too was the surface area : volume ratio. Only a tiny number of students gained a mark here.

Question 9 (standard / high and high demand)

09.1 This part was not very well attempted. Those students who gave the correct test almost always gave the correct result too. However, many tests for carbon dioxide were seen, because students had focused on the first bullet point rather than the whole question. Splints that have been **put out** do not relight. Nor do **lighted** splints as they are already burning.

09.2 These polymers were not well known. Other naturally occurring polymers were frequently seen, such as DNA and proteins. Many students stated that water, oxygen and carbon dioxide are polymers.

09.3 The majority of students knew that there are two functional groups in amino acids.

09.4 The majority of students knew that water was the other product of the polymerisation.

09.5 The vast majority of students scored the mark for nitrogen. Very few scored the mark for ammonia.

09.6 Most students identified a double helix, fewer mentioned four monomers, nucleotides or bases and very few referred to two polymer chains.

Question 10 (standard and high demand)

10.1 A minority of students identified water as the solvent.

10.2 The mark for describing the colour change was scored more often than the mark for the shift in the position of equilibrium that caused this colour change. The mark for the application of Le Chatelier's Principle was rarely scored by students.

10.3 Once again, the shift in equilibrium position and the identification of the forward reaction as exothermic were seldom justified in terms of Le Chatelier's Principle. The distribution of marks awarded to students was very similar to that for **10.2**.

10.4 Students answered this question poorly. A minority recognised that the position of equilibrium had not changed, but fewer still linked the non-effect of pressure with the absence of gases. A common error was to state that there there are equal numbers of moles on each side of the equation, as though this **were** a gaseous reaction.

10.5 A minority of students were able to identify cobalt as the only transition metal ion in the list.

Concluding Remarks

Many students gave responses which showed an excellent understanding while others had difficulty even with core chemical concepts.

The majority of students appeared to have sufficient time to complete the paper. A few used up a lot of time and space in practical and extended writing contexts by providing detailed additional information that did not contribute to a fully answered question.

Basic 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.

There is still some evidence that command words are misunderstood or ignored. This limits the marks awarded, especially in extended response questions. In this paper **compare** and **evaluate** were often too loosely interpreted.

Students seemed well prepared for questions based on Rate and Extent of Chemical Change and Organic Chemistry. In this series they seemed less equipped to deal with Chemical Analysis, Chemistry of the Atmosphere and some aspects of Using Resources.

Mark Ranges and Award of Grades

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