AQA

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CHEMISTRY

8462/2F Paper 2 Foundation Tier
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. 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 ten questions on this paper. Questions **08** to **10** 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 **07** 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 Just over three quarters of students identified the correct planet, with the other distractors being roughly equally selected.

01.2 Just over half of the students correctly identified the percentage of oxygen in the atmosphere. 80% was the most common incorrect response.

01.3 Around half of the students gained two marks. 'Carbonate sediments formed in oceans' was the most common distractor. Some students did not read the rubric correctly and only ticked one box.

01.4 More than a half of the students gained 2 marks for correctly completing the scale on the *y*- axis and drawing a correct bar. The most common incorrect response was to omit the scale on the *y*-axis. A minority of students achieved no marks for the bar chart as they had included a non-linear scale.

01.5 This question was answered very well with more than 90% of students correctly identifying which test tube was at the highest temperature. A small minority chose test tube B, which produced the fewest bubbles.

01.6 This was also very well answered, with more than two thirds of students correctly identifying the test for oxygen. 'Bromine water' was the most common distractor.

01.7 Just over 50% of students recognised that a catalyst does not appear in a chemical reaction. 'Manganese dioxide is used up during this reaction' was a powerful distractor.

Question 2 (Low demand)

02.1 More than two thirds of students were able to use the information provided in the table to provide two correct reasons as to why poly(propene) beakers should not be used to heat liquids. More students suggested that poly(propene) would burn rather than melt. Common incorrect responses did not refer to the effect of heat on poly(propene) instead referring to the effect of the liquid being heated on the polymer.

02.2 More than half of students used the information in the table to suggest a reason why using poly(propene) beakers could save money. The most common incorrect responses did not include a comparison to the glass beakers so that the unqualified 'because they are tough' added no value to the data in the table. Some students used the wrong column and said the poly(propene) does shatter (on impact) even though this then made no sense in the context of saving money.

02.3 More than half of students successfully identified boron trioxide as a raw material for making borosilicate glass.

02.4 More that 90% of students obtained at least one mark on this question (usually for completing the 'name' column correctly) with just over 50% achieving both marks. The most common incorrect response was to incorrectly identify the number of carbon atoms. A minority of students failed to identify the number of atoms but instead calculated the mass of each element.

02.5 This question was very well answered with over 80% of students correctly identifying the repeating unit of poly(propene). The distractors attracted roughly equal support.

02.6 Students struggled to recognise and correctly identify the stages needed to produce poly(propene) from the descriptions provided in the question. Quite often, correct processes were identified but sequenced incorrectly. Less than one-third of students obtained all three marks and less than half achieved 2 marks.

02.7 Just over one third of students achieved 2 marks to identify both of the words that described a hexene molecule during a polymerisation reaction. About half of students achieved 1 mark by identifying hexene as an alkene or by identifying it as a monomer.

Question 3 (Low and standard demand)

03.1 Less than 50% of students achieved all 3 marks on this question. Frequent incorrect responses were for MP1 incorrectly identifying chromatography paper as being litmus paper, wrongly identifying the spot as black ink in MP2, negating the information in the

question and for MP3 incorrectly identifying the start line as the solvent front. A number of students said that the spot was 'pen' rather than 'ink'.

03.2 Less than one third of students were able to identify the correct reason for the mistake identified in the question. The most common incorrect response was to suggest that the student had used the incorrect solvent, which was more popular than the correct answer.

03.3 More than half of students achieved this mark. Common incorrect responses suggested that the dye had changed colour, or that the orange spot was not seen as either the dye was insoluble or that the dye had gone off the top of the paper.

03.4 About one third of students achieved all four marks for this question. A commonly seen incorrect response was to wrongly measure the distance travelled by the dye and/or to a lesser extent the solvent. Most students correctly substituted and evaluated the equation. A minority of students went on to incorrectly round their answer and so did not achieve MP4.

03.5 More than two thirds of the students correctly identified the dye with the largest Rf value. Around one-fifth thought that the red spot had largest R_f value.

Question 4 (Low and standard demand)

04.1 Students found this question challenging, with fewer than 50% of students being able to interpret the information provided in the table and achieve marks. Incorrect responses often failed to identify that the colourless gas was water vapour or confused reactants and products. Less than 20% of students achieved 2 marks for this question.

04.2 Students found this question challenging with less than 20% of students achieving this mark. From the responses it appears that many students are unfamiliar with the term 'stopper'.

The most common incorrect responses were those that suggested that the solid would still be able to escape the tube or that the reaction in some way required oxygen. Others correctly suggested that the pressure in the tube would increase but failed to include a possible consequence of this.

04.3 Less than half of students were able to identify the other measurement needed to calculate the mass of the contents in the test tube. 'The mass of the contents of the test tube at the start' was a very common incorrect response.

04.4 More than two thirds of students correctly identified the minimum heating time for the calcium hydroxide. '6 minutes' was often seen.

04.5 Less than 50% of the students gained two marks. The most common incorrect response was to total all the individual mass readings.

04.6 Around 40% of students correctly identified that in this reversible reaction the energy taken in from the surrounding would equal that released in the reverse reaction.

04.7 Over two thirds of students correctly identified the forward reaction as endothermic. Very few selected 'combustion'.

Question 5 (Low and standard demand)

05.1 This question was well answered with over two thirds of students successfully identifying both greenhouse gases.

05.2 Fewer than 15% of students could identify why greenhouse gases are essential for supporting life on earth. The most frequently seen incorrect responses identified carbon dioxide as the greenhouse gas and answers were given in terms of the importance of photosynthesis for life on earth or described global warming or the effects of global warming. There were a large number of incorrect responses linked to the ozone layer.

05.3 A fifth of students correctly completed the sentence using radiation. The most commonly seen incorrect responses included rays, energy or named incorrect types of electromagnetic radiation.

05.4 This question was well answered with over 80% of students achieving 2 marks. The distractors attracted roughly equal support.

05.5 This was a more challenging calculation which needed a unit conversion and the use of a percentage. Less than 50% of students gained a mark on this question and less than 20% gained full marks. The most commonly seen incorrect response was where students incorrectly identified the percentage in the question as being 25% and just divided the mass of water vapour in the atmosphere by 4. Few students attempted the unit conversion and of those that did a large number were unable to do so correctly.

Question 6 (Low and standard demand)

06.1 Students struggled to express themselves when answering this question with just over 40% of students achieving 1 mark by usually stating that coal was a solid. Less than 30% of students achieved both marks. Most incorrect responses failed to recognise that coal would not flow or pass through the pipeline but suggested it would be in some way difficult to get coal through the pipe. Many other incorrect responses used information from the table and suggested possible dangers to the pipeline, the environment, or operatives due to coals' high sulfur content.

06.2 Over 70% of students gained 1 mark by correctly identifying the fuel as coal. Less than 30% of these students went on to use the information in the table to provide a correct reason that compared coal to the other fuels.

06.3 Fewer than 25% of the students could correctly identify a problem caused by sulfur dioxide emissions.

Frequently seen incorrect responses included that sulfur dioxide:

- is a greenhouse gas
- causes global warming
- is a toxic gas
- causes unspecified pollution.

06.4 Over 85% of students gained 1 mark by correctly identifying the fuel as natural gas. However, less than 25% of these students went on to use the information in the table to provide a reason that compared natural gas to the other fuels.

06.5 Students found this question challenging with fewer than 15% of the students correctly identifying a problem caused by particulates. Over 20% of students did not attempt this question. A common incorrect response was to link particulates to global warming or the effects of global warming.

06.6 Over 60% of the students were able to successfully complete the sentence. A common incorrect response was to include burning.

06.7 Almost 30% of students obtained all 3 marks and a further 35% 2 marks. Weaker responses tended to just describe the changes in the lines on the figure without linking the changes in fuel use to the passage of time. Some students struggled to express how natural gas use remained fairly constant from 2014 to 2020.

Question 7 (Low and standard demand)

07.1 Almost 70% of the students were able to identify carbon. The two distractors were seen equally as often.

07.2 Around 10% of the students were able to identify the two elements added to iron to make stainless steel and over half of them could identify just one of the metals. ‘Zinc’ was very often chosen as one metal in the pair.

07.3 Over half of the students gained both marks for correctly identifying both of the properties of stainless steel with a further third gaining 1 mark.

07.4 This calculation discriminated well. Approximately one quarter of students successfully completed the calculation, usually showing full details of their working.

07.5 Almost 90% of the students gained the mark by expressing the idea of strength in a variety of ways, including the positive effect of high strength in the context of aircraft.

07.6 Around one third of students gained this mark. Weaker responses did not include the consequences of the presence of tin in the alloy if used for medical purposes.

Question 8 (Standard demand)

08.1 Around 10% of students gained this mark by recognising that adding the stopper would reduce the loss of gas. Weaker responses tended to be absolutes including stating that no gas would escape.

08.2 The calculation discriminated well. Approximately 30% of students successfully completed the calculation, usually showing full details of their working. Most students gained the first 2 marking points by discarding the anomalous result and calculating the mean. The alternative approach detailed in the mark scheme was seldom seen.

08.3 25% of students gained both marks and more than 45% gained 1 mark. The most frequently seen incorrect responses were those that identified factors that would increase rather than decrease the rate of reaction.

08.4 Only 25% of students were able to give the correct test and result for hydrogen gas. Weaker responses failed to include the test and only described the result usually as a squeaky pop and gained no marks. Incorrect tests were less commonly seen but the most frequent incorrect test used was a glowing splint.

Question 9 (Standard demand)

09.1 The calculation discriminated well. More than 25% of students successfully completed the calculation, usually showing full details of their working. Students need to be sufficiently familiar with their calculator to understand when it is appropriate to include a recurring dot over one or more digits, and also when it is not. Weaker responses included rounding errors.

09.2 Around half of students obtained both marks for correctly plotting all the points. Over 20% of students incorrectly plotted at least two of the points, with the most frequently seen error being to incorrectly identify the number of carbon atoms present, for example, plotting ethanol as having one carbon atom. If a line of best fit was drawn, this was ignored, as this was not required and is inappropriate in the context of a discrete variable on the x-axis.

09.3 Over 40% of students gained this mark. Any line of best fit drawn was ignored. The answer, within the tolerances stated in the mark scheme, was estimated from the plotted points alone and was as stated in the mark scheme unless misplotted points (usually for hexanol and/or heptanol) suggested otherwise.

09.4 Over 30% of students gained this mark, but the other three distractors were all popular.

09.5 Over 40% of students gained this mark. A small number asserted that the limewater became colourless or clear.

09.6 Less than one third of students gained this mark. ‘Water’ was not a popular distractor, but ‘a halogen’ and ‘an alkali metal’ were both frequently selected.

09.7 The carboxylic acid functional group was not well known.
Less than 2% of students were able to successfully complete the displayed structural formula for this functional group. Many students completed a square of points around the 4 atoms provided.

09.8 Over 20% of students gained both marks and a further 40% gained 1 mark. A number of students drew multiple lines from the boxes on the left.

Question 10 (Standard demand)

10.1 This extended response question used the command word ‘plan’.

A simplistic approach to the level descriptors might be:

Level 3 – will produce the expected outcomes.
Level 2 – might produce the expected outcomes with additions or modifications.
Level 1 – will not produce the expected outcomes.

However, the marking of extended response questions must always be holistic, so a best-fit approach must always be followed.

Key steps were shown in the indicative content in **bold**.

Most students found this question very difficult with only around 6% of students managing at least a mark in Level 2 and only 25% of students gaining at least 1 mark.

The flame test for the potassium ions was seen more often than the test for the bromide ion, with some students identifying the flame colour but not being able to describe how to carry out the test. Many responses failed to include putting the sample of medicine on the wire or making it clear that the Bunsen was lit. A number of students placed the wire under the Bunsen or did not make it clear that the Bunsen was lit. Some students thought that they needed to sterilise an inoculating loop before using in a flame test.

Many students mixed up the tests by carrying out flame tests on all the reagents.

The test for bromide ions was poorly understood with less than 1% of students recognising that silver nitrate should be added to the medicine and being able to state the correct test result.

Around one-fifth of students scored a Level 1 mark by using the medicine or correct test result in their response and including some relevant points in the correct context from the question.

10.2 The instrumental method was known by very few students with only 1% of students being able to correctly identify flame emission spectroscopy. Most students who attempted the question mentioned laboratory or industrial processes such as fractional distillation or electrolysis. More than a third of the students did not attempt this question.

10.3 Over 30% of students correctly identified an advantage for using an instrumental method over a chemical test. The most popular correct responses were rapidity and accuracy. One quarter of the students did not answer this question.

Mark Ranges and Award of Grades

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