GCSE
CHEMISTRY
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Report on the Examination

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General

There were ten questions on this paper. Questions 1–3 were common to the Foundation Tier. The paper produced a range of responses, from students whose responses showed an excellent understanding to students who struggled throughout the paper.

The mark scheme was designed to allow students to achieve marks for showing knowledge, understanding and application of chemistry. The lower demand extended response questions caused few problems with many students achieving full marks.

A common fault was students not reading and understanding the information given and the question itself and then going on to simply repeat what they had been told or to answer a completely different question.

The majority of students appeared to have sufficient time to complete the paper. A few use up a lot of space by repeating the question, which is not needed in an examination and wastes time and space that could be used to give a creditworthy response and achieve more marks.

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.

Levels of demand

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

- **Standard demand** questions are designed to broadly target grades 4–5.
- **Standard / high demand** questions are designed to broadly target grades 6–7.
- **High demand** questions are designed to broadly target grades 8–9.

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.

Question 1 (standard demand)

01.1 80% of students gave yellow or orange. There was a lot of variety in the wrong answers with all the colours of the spectrum represented.

01.2 This was well answered. Copper was the most common answer given although a few gave barium and gained credit.

01.3 60% of students achieved this mark. Popular incorrect responses implied that the flame colours were similar or the same.

01.4 87% of students could correctly identify both of the ions in the flame emission spectrum.

01.5 33% of students identified the correct answer as bromide. A few put bromine but many seemed to guess.

01.6 The test for sulfate ions was not well known with many students gaining only the acidification mark. 27% of students achieved full marks.

Question 2 (standard demand)

02.1 28% of students recognised a formulation from this part of the specification.

02.2 This question presented little difficulty, with 81% of students achieving full marks.

02.3 Reading the stem would have avoided answers such as 'to make it more attractive to drink'. 33% of students realised that it was to warn people not to drink it.

02.4 Uses of ethanol, and therefore methylated spirits, as a solvent, steriliser and fuel were well known.

02.5 Few students could give both yeast and the reaction conditions for the production of ethanol from sugar solution by fermentation. Some knew the name of the process but could give no correct detail.

02.6 34% of students could complete the displayed formula for ethanol. Ethane was the most common incorrect answer, but ethanoic acid was also frequently seen.

02.7 45% of the students knew that hydrogen would be the gas produced.

02.8 6% of students knew that an oxidising agent was required.

Question 3 (standard demand)

03.1 80% of students realised that the other gas used in the Haber process is hydrogen.

03.2 44% of the students knew the temperature and pressure used in the process. This was made even more challenging as they had to give the correct units as well.

03.3 32% of students could explain why only the ammonia, and not the other gases, turn into a liquid: because its boiling point is higher.

03.4 This was an 'extended response', 'level marked' question. There were three levels and the command word was 'explain'. The question was marked holistically. Students were given information about the current atmosphere of Venus, believed to be similar to that on the early Earth, and the Earth's atmosphere today.

Generally, a level 1 response used the percentages given to say in which direction the amounts of these gases had moved. Level 2 moved beyond this, giving an explanation in terms of one process, such as photosynthesis or dissolving in oceans. Level 3 responses usually gave more than one process, for example both of the processes mentioned above.

Many students talked only about the changes in the last few centuries, which was not what the question was asking. 47% of students were able to provide a level 3 response.

03.5 39% of students seemed aware of the timescale under consideration here, namely the atmosphere of billions of years ago, or that there was a lack of evidence or proof. Many merely asserted that there was no-one there (to make measurements).

Question 4 (standard & standard / high demand)

04.1 The lid confused many students and they came up with many creative ways to describe how this would lead to a problem. Another common misconception was that the water level was too low and therefore would affect the R_f value calculated, or that it wouldn't move up the paper. Some students wrote a poorly expressed and confused account of the relationship of the mobile and stationary phases. Nevertheless, 39% of students achieved all four marks.

04.2 Many students described substances, inks and compounds rather than colours. Weaker responses merely described the pattern of the dots rather than the deductions that could be drawn from these patterns. Some students answered in terms of purity. 49% of students achieved both marks.

04.3 65% of students calculated the answer correctly. There was lots of incorrect rounding here. 2.08 was a common wrong answer (from 3.2×0.65).

Question 5 (standard & standard / high demand)

05.1 This question was generally well done. Most students could identify that the solution became cloudy because sulfur was produced and that it was a solid. A few students however were unfamiliar with the experiment and thought that a gas was produced, and that this was the cause. 42% of students achieved both marks.

05.2 This was an 'extended response', 'level marked' question. There were three levels and the command word was 'plan'. The question was marked holistically. Most students realised that the easiest way of investigating the effect of varying the concentration of sodium thiosulfate on the rate of reaction was to carry out a 'disappearing cross' experiment, and many students could describe this well.

Some students however, just carried out the experiment at one concentration of sodium thiosulfate, or varied the concentration of the hydrochloric acid instead of or as well as that of the sodium thiosulfate. The most common cause of a student failing to achieve full marks was to omit mentioning any variables that needed to be controlled. A minority of students, having noticed that sulfur dioxide is a gaseous product, attempted to collect the sulfur dioxide or to measure the loss in mass of the flask. These approaches, though they would not work well, were given appropriate credit.

44% of students provided a level 3 response.

Question 6 (standard / high & high demand)

06.1 There was a variety of incorrect answers for the small molecule lost during condensation polymerisation, some of which were not molecules. However, 56% of students knew the answer was water.

06.2 Of those students who lost marks here, there was no clear-cut marking point that caused the problem. Some students did not make it clear that the bond joined on to the C atom of the methyl group, but were given benefit of the doubt provided it didn't join to the H_3. 28% of students gave faultless answers.

06.3 This question was not answered well, mainly because students did not appreciate that they were making a comparison with both of the fibres used alone.

- Some students restated the question stem by saying 'wool wears out quickly'.
- There was little mention of land usage for wool production or that poly(propene) is not biodegradable.
- There were many uncreditworthy references to cost, and the greater comfort of wool.
- Many students failed to make it clear whether they were talking about the fibre or the carpet, or whether they were comparing the mixed fibre carpet with wool or poly(propene) alone.

Most students who achieved any marks at all (39%) were only able to score one of the available marks.

06.4 This was generally well answered with 99% of students achieving at least one mark. There were various advantages and disadvantages given for the uniform absorbing water as covered by the marking points on the mark scheme (including an advantage of 'it would absorb lots of sweat'). 44% of the students were able to achieve all four marks.

Question 7 (standard & standard / high demand)

07.1 This was generally well answered with 72% of students achieving one or two marks. The mark most commonly not achieved was for an insufficient or limited oxygen supply. This was usually because the students either did not mention oxygen or failed to say the supply was limited. However a number of students did not achieve the mark by stating that **no** oxygen was present. Global warming was a frequent response but was not creditworthy.

07.2 This was less well answered with 5% of students achieving both marks. Many students realised that CO is toxic in some way, but were too vague using words like 'harmful' or 'dangerous'. However this was the mark which was most frequently awarded.

Many students struggled to find a second reason. Again specific responses were required. Responses such as 'improved technology', 'more efficient cars' were not, on their own, sufficient to gain the 'improved engine technology' mark.

Although the question specifically mentioned new cars, responses comparing old cars to new cars did not normally contain creditworthy material.

07.3 This was not well answered with 11% of students achieving the mark. Most students did not appear to have realised that the question was asking about unburned hydrocarbons. Many who did were side-tracked into talking about wasting petrol / resources, or the flammability of unburned hydrocarbons. Again, global warming was a frequent response which did not gain credit.

07.4 There were a few good responses, but many that were not. 11% of students achieved both marks.

Students did not have to state where the oxygen and nitrogen came from, but when they did this needed to be correct. Nitrogen coming from the petrol or from combustion was not an acceptable response. The second mark was frequently not given because of the use of vague terms such as 'hot', rather than naming the conditions required ('high temperature')

07.5 This was generally well answered, although ‘2N’ was a common incorrect response. Students need to remember that gases such as nitrogen, hydrogen and oxygen normally exist as diatomic molecules. 61% of students achieved both the marks.

07.6 Again global warming and other associated responses were frequently seen, and in this case lost credit. Vague responses were also frequently seen. However most responses referred correctly to acid rain and one mark was often awarded. Some good responses included details about the pollutants that contribute to these effects. 56% of students were able to gain at least one mark.

07.7 61% of students knew that the transition metal block was the most likely source of catalysts.

Question 8 (standard / high & high demand)

08.1 Most students recognised that a gas is given off by the reaction. Sometimes it was incorrectly identified as hydrogen.

The 'escape' mark was less commonly awarded either because the students thought it was sufficient to state that a gas is given off or because they thought that the gas 'evaporated'.

43% of students achieved full marks.

08.2 The points on the graph were almost invariably correctly drawn within tolerance. Most found the question easy although there were a significant number who omitted the point at 0,0.

The line of best fit was problematic for a number of students. A significant number assumed that the line of best fit was a straight line rather than a curve. Other students were penalised for 'double lines' or not extending the curve over the whole range of points.

83% of students were able to achieve at least two marks here.

08.3 A significant number of students did not draw a tangent at 0.95 g but used 0.95 g to calculate the **mean** rate over the first 0.95 g lost. Such students were able to score the third and fourth marking points. A small number of students drew the tangent in the wrong place choosing the other number (50) quoted in the question.

Some students had difficulty with the scales on the graph either by:

- forgetting that the *y*-axis intervals were 0.1 and calculating the difference as a whole number rather than the actual difference eg 18 rather than 0.18
- counting the number of squares on the *y*-axis or the *x*-axis eg 1.00 − 0.8 = 10 (squares) rather than 0.2

Many students were able to state that the gradient of the tangent is calculated by the *y* value divided by the *x* value and calculate a value correctly. But some students neglected to quote their answer to two significant figures. 25% of students achieved full marks.

Question 9 (standard, standard / high & high demand)

09.1 88% of students could identify an enzyme as a (biological) catalyst.

09.2 64% of students could use the equation to work out that 2.0×10^3 moles of carbon monoxide would react.

09.3 The endothermic nature of the backwards reaction was often identified as the reason the equilibrium position moved to the left; however many made no comment about the yield of methanol. Many students thought there would be a higher yield. 39% of students achieved both marks.

09.4 While many students did well, there were many others who demonstrated partial knowledge or who did not express themselves clearly. Many thought that an increase in pressure caused an increased yield of methanol because it was an exothermic reaction, rather than because the equilibrium moved to the position of fewer moles / molecules / particles.

The increased rate of reaction was better understood; students usually gave some indication that the particles are closer or there are **more particles** in a **fixed** volume or there are the **same number of particles** in a **smaller** volume. Simply saying there were more particles was insufficient.

In addition, students needed to link collisions **and** time to gain credit, usually by saying that the particles collide more often or there are more frequent collisions. Simply saying **more collisions** alone was insufficient. The idea that an increase in pressure supplied energy (and therefore increased the speed of the particles) was discounted.

73% of students were able to achieve some credit, with 12% of students achieving full marks.

09.5 Higher-attaining students achieved both marks for stating that catalysts reduce the activation energy by providing an alternative route or pathway, though the second point was less well known than the first. Sometimes one or other of these points was omitted. A popular incorrect idea was that catalysts supply energy.

09.6 47% of students knew that catalysts reduce costs, save energy or allow lower temperatures to be used. Others just mentioned that catalysts can be reused or that they speed up the reaction.

09.7 The effect of a catalyst on the equilibrium yield of methanol was not well understood. It was widely thought that a catalyst increased the yield of methanol because the reaction was faster and would, therefore, produce more of the product. 24% of students answered correctly.

Question 10 (standard / high & high demand)

10.1 This was an 'extended response', 'level marked' question. There were three levels and the command word was 'evaluate'. The question was marked holistically. Most answers considered all three relevant stages of a Life Cycle Assessment for both types of cup.

However, many answers failed to consider the environmental impact of the factors discussed. For example, students might say that paper cups are heavier to transport, but did not go on to say what environmental impact that might have in terms of more pollution from lorries, or a greater energy requirement burning more fossil fuels and adding to climate change. This limited their mark to level 2, as did failure to give a strongly linked judgement.

Some students misinterpreted 'recyclable' as 'reusable': the terms are not synonymous. The question stated that both types of cup are disposable, ie single use.

Some answers focussed on the economics or ease of use of the cup, rather than environmental impact. Most students were able to acquire at least one mark with 50% of students achieving four marks. 22% of students made it into level 3.

10.2 A mark was often missed through inappropriate rounding to a whole number of cups at an intermediate stage in the working. Others rounded 1000 ÷ 83 to 120.5, then multiplied this figure by 550 and quoted an answer to five significant figures. This gave an answer which did not fit the correct value. Had they rounded to two, three or four significant figures they would have achieved the mark. It is never appropriate to quote an answer to more significant figures than an earlier intermediate step. 50% of students achieved both marks.

10.3 Many students tainted an otherwise good answer by referring to intermolecular forces, often alongside a reference to cross-links. They seem not to realise that the cross-links are covalent bonds.

Others were confused and referred to strong bonds or cross-links between monomers. Some referred to layers rather than chains. 21% of students achieved both marks here, although many more gained a mark for 'thermosetting'.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on 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.