Questions matter

GCSE
Chemistry
8462/2H

Report on the examination

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Question 1

01.1 Two thirds of students gained this marking point. Common incorrect responses included accurate (no comparative), more precise, easier to use and less likely to spill.

01.2 This mark was gained by three quarters of students. the most common errors were the volume of sea water and not mentioning mass.

01.3 The idea of heating to constant mass was known by a quarter of students, who gained two marks. Nearly 3 in 5 students gained no marks, often suggesting heating for longer, looking at the basin to see if there was any water left, heating above 100°C or patting dry.

01.4 Three fifths of students expressed the correct method of calculating the mass of dissolved solids. Those that did not gain this mark often missed the use of a mass or just suggested using a weighing scale.

01.5 Over half of students scored all five marks on this calculation. Where all five marks were not achieved, the most common error was an incorrect or no conversion from cm^3 to dm^3.

01.6 Half of students were able to suggest that the samples had come from different areas of the sea. Those that did not gain the mark tended to just reword the question.

Question 2

02.1 Over 90% of students correctly identified fractional distillation.

02.2 More than 4 in 5 students gained both marks here. Incorrect answers gave the state alone, rather than the change.

02.3 Over 90% of students made the link between boiling point and position of production on the column. Petroleum gases was the most common incorrect response given.

02.4 Around three fifths of students correctly linked the boiling point and flammability in this multichoice question. The distractors were equally chosen.

02.5 Nearly 90% of students gained the mark for this item. The most common error was getting the number of atoms of carbon and hydrogen the wrong way round. Very few students did not gain the mark because the numbers were too big.

02.6 4 in 5 students correctly named the alkane. Some student responses were unclear between butane and butene, most often when the handwriting was very small and indistinguishable.

02.7 Over 90% of students gained both marks in balancing the equation. Most of the remainder scored one mark, usually for balancing the number of CO_2 produced.

Question 3

03.1 Fewer than 1% of students gained no marks on this evaluation extended response question. Around two fifths of students achieved a Level 3 response. There were many excellent answers, with a large number of reasons linked to the table and to other knowledge, accompanied by a judgement. The space allowed was sufficient to score full marks, but many students unnecessarily used additional pages.
The most common linked reasons, which added information not in the table, were that aluminium ore is finite and that trees are renewable. Links to mining and deforestation were also common, as were various consequences of the disposal methods. The lack of a need for maintenance of aluminium doors was less commonly noted, as was the idea that wooden doors could be damaged more easily.
Weaker responses, which merely gave comparisons from information in the table and added no consequences, were limited to level 1. Answers which merely requoted information from the table were not creditworthy.

03.2 Fewer than 1 in 5 students achieved both marks on this item. There was much confusion, with many referring to aluminium oxide as a form of sacrificial protection rather than a physical unreactive barrier. Many also referred to corrosion of aluminium as rusting. Some referred to protecting aluminium from contact with unspecified particles. Some referred to galvanizing, which is incorrect on two levels; it is a coating with zinc not aluminium oxide, and it is a method of sacrificial protection rather than just a barrier.

03.3 Half of students identified that a formulation must contain fixed quantities of all components.

Question 4

04.1 Just over 40% of students scored both marks on this item. A further 40% were able to state that the percentage of nitrogen in the early atmosphere increased. A common mistake for those students who thought that nitrogen decreased was that it decreased because there has been less volcanic activity over time. A small number of pupils referred to nitrogen levels increasing because ammonia reacted with oxygen and because it is an unreactive gas.

04.2 Students found linking the timeline of changes to the Earth's atmosphere challenging, with only 5% gaining both marks on this item. Half of the students gaining one mark, usually for identifying that the carbon dioxide dissolved in oceans, however, many of those did not gain the second mark because they incorrectly stated that carbon dioxide decreased because of photosynthesis. Students who tried to describe that carbon dioxide formed carbonate rocks, often did not achieve the mark because they used the phrases 'trapped in' and 'locked up in' which are not equivalent to formed.

04.3 Over 90% of students correctly plotted the points on the graph. The quarter of students who only scored one mark struggled with the line of best fir, with some drawing straight lines or missing plotted points by a wide margin.

04.4 Over half of students gained all three marks on this item. Where all three marks were not achieved, it was usually for not stated what happened to the concentrations on carbon dioxide and oxygen in the atmosphere. Many gave the description of photosynthesis, but this was insufficient for the mark.

Question 5

05.1 Over four fifths of students correctly estimated the boiling point. Those that did not gain the mark were often giving values that were just outside of the range given in the mark scheme.

05.2 Fewer than half of the students correctly identified ethanol as the product of the reaction between ethene and steam. Many of those who did not gain this mark gave the product as alcohol, which was insufficient.

05.3 Over half of students gained both marks on this item. Where students gained one mark, about 20%, it was because 'damp' was omitted from the test and only litmus paper was given.

05.4 The product of the chlorination of butene was well known by over 90% of students.

05.5 Around three quarters of students correctly identified propene. The most common incorrect response was butene. Very few students did not identify an alkene.

05.6 Around two fifths of students knew that alkenes burn with a smoky flame due to incomplete combustion. Many of the incorrect answers seen referred to there being a double bond present, or that there was insufficient oxygen.

05.7 This multi-step calculation was well answered by over 40% of students who gained all five marks. The most common error was the omission of the volume conversion from dm^3 to cm^3. Some students divided by the volume, rather than multiplying. Equally, a number multiplied by the M_r to calculate the number of moles. In both instances, marks were awarded where clear working was shown for correct

additional steps. when one mark alone was awarded, it was for the correct determination of the M_r.

Question 6

06.1 Three quarters of students correctly identified either calcium or magnesium. A few students gained credit for zinc.

06.2 Just over a quarter of students scored both marks on this item. Many students repeated the information given to them in the stem of the question, stating that they would add sodium hydroxide and observe a white precipitate, which did not gain marks. Some described adding more sodium hydroxide, without specifying that this should be until excess and whilst these students were not awarded the first marking point, they still had access to the second marking point.
Descriptions of the result were often vague. Some responses stated that 'the precipitate would dissolve' but failed to identify the reagent. Others simply said, 'it' will redissolve, become clear, or turn colourless, which was insufficient. There was a misconception that the aluminium dissolves, rather than the precipitate.

06.3 Both the correct symbol and the charge on the ion were required to gain the mark for this item. A quarter of students did this. Many others wrote the name, or the symbol without a charge.

06.4 As with 06.3, both the symbol and the charge on the ion were needed to gain the mark. As with 06.3, a quarter of students answered this correctly. Similar mistakes, writing the name or a symbol without a charge were commonly seen.

06.5 Around two thirds of students gained both marks on this item. A small number of students described adding limewater to solution C, rather than bubbling the gas produced through limewater.

06.6 Around half of students identified ethanoic acid as a weak acid and stated that the rate of reaction was lower. Fewer students were able to describe a lower concentration of hydrogen ions, with some describing fewer hydrogen ions without making any reference to volume. Credit was given to those who described ethanoic acid as partially ionised, however, there was the misconception that less hydrogen ions were ionised. Only a minority of students made a correct reference to the frequency of collisions.

Question 7

07.1 Although these compounds are clearly identified in the specification, very few had learnt them. Common attempts to give the names included di-ethanol and di-butanoic acid.

07.2 Around 15% of students correctly identified a polyester. The most common incorrect response was for an ester.

07.3 Just over two thirds of students correctly identified water as the small molecule produced during this condensation polymerisation reaction.

07.4 1 in 5 students gained the mark for this item by correctly identifying a polypeptide. Polyglycine was the most common incorrect response, but protein was also seen. The definition of a polypeptide is given in the specification, but many students could not apply the definition to the context given.

07.5 The structural formula of glycine is given in the specification, but only 15% of students were able to recognise that the displayed structure of the carboxylic acid functional group was required. It was expected that all bonds were shown, so -OH was insufficient, when -O-H was required. Many students added bonds to the amine, as well as adding amines to the carbon atom where the carboxylic acid group was required.

07.6 Three quarters of students correctly identified the definition of a protein that is given in the specification.

07.7 Two thirds of students gained all three marks on this familiar application for an unfamiliar polymer. Far fewer students than previously left the double bond between the two carbon atoms. The most common mistake was adding the trailing bonds incorrectly, often not breaking the line of the brackets.

07.8 The description of the structure of a thermosetting polymer was not well known by students with only 1 in 5 gaining any marks on this item. More students knew the idea of cross links between chains than the idea of the structure consisting of long chain molecules. A lot of the incorrect responses were definitions of thermosetting polymers in terms of heating and melting.

Question 8

08.1 Three quarters of students described correctly how gas escaped from the flask to cause the decrease in mass, however, students did not always say that the gas was a product of the reaction which was marking point 1. A few students incorrectly said that the gas evaporated, which was not accepted.

08.2 Three quarters of students described how catalysts provide an alternative pathway for the reaction. A description of a shorter pathway is not equivalent to an

alternative pathway. Marking points 2 and 3 needed comparative statements between catalyst A and B. Some students just described in general how catalysts lower activation energy. This was not enough for these two marking points. Students needed to say the activation energy was lower using B. Saying catalyst B requires a lower activation energy was also not accepted, because a catalyst provides or allows a lower activation energy rather than requiring or needing one.

08.3 This style of question is becoming more familiar to students, with over 4 in 5 gaining at least 2 marks, which would require the drawing of a tangent. Over half of all students went on to correctly calculate the rate and give the answer in standard form. Answers were often well set out showing clearly which graph points had been used to calculate the gradient. Students could successfully quote the number in standard form. There were still quite a few students who just read the value of mass and time from the graph. Without a tangent, students could only gain the mark for an answer given in standard form.

08.4 Over 40% of students gave good answers that scored full marks. Students are well versed in describing how particles have more energy at higher temperatures. The idea of particles colliding more frequently was still a stumbling block for some; some students forgetting to include the word frequently. Very few students used the idea of a greater chance of collision that is not equivalent to frequency, which is a positive sign.

Question 9

09.1 Three quarters of students scored at least one mark on this item. This was for either identifying the forward reaction as endothermic, or giving the allow statement for marking point 3, that a high temperature increases the rate. The answers for marking point 2 were often quite vague, talking about the reaction moving to the right-hand side, rather than the position of the equilibrium. Many students gave answers in terms of the Haber process, rather than the given reaction, so answers that suggest an increase in the yield of ammonia were incorrect.

09.2 Fewer than half of students scored either or both marks for this high demand item. The most common response was for identifying that the equilibrium position moved to the right, with far fewer giving the link to the number of molecules on either side of the equation. Many incorrect answers were seen in terms of rate of reaction, or because safety is a factor.

09.3 Two thirds of students correctly identified that catalysts have no effect on the position of the equilibrium.

09.4 It is quite rare to ask for an estimate in a calculation question and this was included because the percentage of nitrogen in the air is given as four fifths in the specification. Around 40% of students recognised that nitrogen makes up between

78 and 80% of the atmosphere, so would require between 62 and 65 dm^3 of air to produce 50 dm^3 of nitrogen. Where students did not score was because they did not know the percentage of nitrogen in the air.

09.5 Around half of students gained at least one mark on this item, usually for the idea that ammonia condenses. Far fewer students knew that this is done by cooling the mixture or that both nitrogen and hydrogen stay as gases and are recycled, many only mentioning recycling, which was given in the diagram.

09.6 Around two-thirds of students gained at least one mark for this high demand interpretation question. The most common answer was for linking carbon dioxide to climate change. Many students did not gain this mark as there was a need to mention that the production of hydrogen causes this, if further detail was given. Mant talked about hydrogen producing carbon dioxide, which is incorrect and did not gain credit. The next most common response was for the idea that nitrogen was abundant in the atmosphere.

Mark Ranges and Award of Grades

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