GCSE

COMBINED SCIENCE: TRILOGY

8464/C/2F Paper 2 Chemistry
Report on the Examination

8464/C/2FJune 2023

Version: 1.0

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General

Around 218,000 students sat this component, so a wide and varied range of responses was seen.

Students found this paper equally accessible to last year and to the 2019 paper.

This report should be read in conjunction with the published mark scheme.

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 seven questions on this paper. Questions **05** and **06** were common to questions **01** to **02** 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 **04** the demand of each question also increases through the question.

A student's final grade is based on their attainment across the qualification as a whole, not just on questions that may have been targeted at the level they are working to.

Question 1

01.1 Nearly three quarters of students were able to identify that a finite resource was a limited resource.

01.2 Around two thirds of students knew that coal came from plankton.

01.3 Just over half of students identified crude oil as a mixture.

01.4 Nearly four in ten students successfully identified both changes of state during fractional distillation. Three quarters of students gained at least one mark. There were few patterns in incorrect responses, however, the most common was evaporate and condense in the wrong order.

01.5 Just over half of students identified fuels, with a similar number choosing either of the two distractors.

01.6 Gas tests are not well known by students. Under half were able to identify the burning splint as a test for hydrogen.

01.7 Around a quarter of students gained all three marks for this percentage calculation. Fewer than one in ten correctly calculated the percentage without going on to expressing it to three significant figures. The remaining students attempted to calculate a percentage, frequently missing multiplying by 100, or getting the expression upside down. One in ten of students gained a mark for giving the answer to the calculation they had done to three significant figures.

Question 2

02.1 Around a quarter of students gained both marks on this question. Half of all students gained one mark, most frequently for the idea that the oceans were formed from water. Far fewer were able to make the link between rock formation and carbon dioxide.

02.2 Nine in ten students were able to identify nitrogen as having the highest percentage.

02.3 One in five students gained all three marks here. A quarter completed the calculation correctly without then expressing it in standard form. Of the remaining students, very few were able to make progress, with one in twenty achieving one mark, usually for expressing an incorrect calculation in standard form. There were all combinations of calculations seen by examiners using the numbers 95 and 0.04.

02.4 This question proved to be the easiest on this year's examination, with over 97% achieving the correct answer.

02.5 Three quarters of students correctly calculated the mass of carbon dioxide. The most common incorrect response saw students multiply rather than divide the two numbers.

02.6 Around half of students correctly identified photosynthesis as the correct answer. The most common incorrect responses were respiration, distillation and deforestation.

02.7 Approximately one third of students gained two marks for this question, with one in ten gaining one mark. Many students did not identify the direction of change, suggesting Africa or South America changed the most, which was not creditworthy. Also, students often responded with ideas about developing areas and industrialised areas, without talking about the continents on the bar chart.

02.8 Students were able to calculate the percentage of landfill methane emissions from the pie chart with over 85% of students completing the question correctly.

02.9 Around half of students achieved both marks for interpreting the graphic. Only one in ten gained one mark. The most common response that gained no credit was for reuse and recycle the wrong way round. However, all of the other responses were commonly seen.

Question 3

03.1 Around six in ten students gained the mark here. The most common answer was for goggles, which was allowed on its own. However, glasses were not as safety was required. Tie hair back was the only other acceptable answer, as many responses were vague and were general laboratory care.

03.2 Only one in five students identified both improvements to the method. However, a further six in ten did gain one mark. All the distractors were seen in the responses. It is important that students read the question carefully as there was a significant number of students who ticked only one box rather than the two requested.

03.3 Fewer than a third of students gained this mark. This is an example where taking the heading from the table was essential, and students needed to talk about dissolved solids, rather than vague statements about 'nothing in it'.

03.4 Just over 85% of students identified why water is sterilised.

03.5 Fewer than one in five students gained the mark here. Most thought that the reactions occur at the same time, rather than the same rate.

03.6 Students did not know the tests for gases very well. Only one quarter were able to give the correct answer here.

03.7 Three quarters of students were able to gain at least one mark on this question by making one simple statement. The most common creditworthy statement was that of 'adding fluoride ions reduces tooth decay'. 'Tooth decay increases as you get older' was also common. As there is a lot of data available within the graph and there are many ways of making statements, many students were prepared to give more than one statement and so by making three simple statements, 2 marks were obtained by a quarter of students.

Students who compared the effects of with and without fluoride ions, for example 'fluoride works best in the 55-64 age group' (a higher level magnitude statement) in conjunction with one other simple statement gained 2 marks. Some students made a creditworthy magnitude statement by including more than one age group, for example 'fluoride works best in the 45-64 age group' or 'fluoride is not as good at ages 25-44', which incorporate 2 age groups and are correct statements.

The majority of students were restricted to 1 or 2 marks (level 1) since they failed to fulfil the command word of 'compare', and made only simple statements of data from within the graph without comparing the effects of with and without fluoride ions. Where students did state the differences between with and without fluoride and carried out the correct arithmetic, by selecting at least two age groups they were able to gain full marks. Fewer than one in ten students made creditworthy comparative statements by comparing the total percentage across all age groups with and without fluoride ions, or even working out the mean percentage difference across all age groups.

Generally, there were very few incorrect statements made, but the commonest errors were giving incorrect percentage values from the graph which were not creditworthy, or giving an age group which was contradictory to their statement.

03.8 A quarter of students gained credit here by referring to possible 'health effects', 'allergies', or 'side effects'. A few pointed out that there should be 'a choice'. Of the uncreditworthy responses seen, vague and unfounded statements such as 'it causes cancer', 'it can kill you' or 'not suitable for children' were the most common.

Question 4

04.1 Around two thirds of students were able to extract the necessary information to write a word equation. Where they found difficulty was when they attempted to write a formula instead of the word.

04.2 Only a quarter of students successfully identified two control variables. Over half of the students identified one of the control variables. Once again, it is worth noting that several students ticked only one box. Students must be encouraged to read the question carefully.

04.3 A quarter of students gained all three marks for plotting the graph and drawing a curve of best fit. A further two fifths plotted all the points correctly but, drew a straight line of best fit. Fewer than one in ten students gained one mark for plotting at least three points correctly. Students need to be exposed to as many examples as possible of lines of best fit that are not straight lines.

04.4 Just over a third of students either used their graphs or the lines given to choose the best catalyst and explain why for two marks. It should be noted that the mark scheme was looking for the steepest, greatest etc. A simple comparative was insufficient to get the mark as there were three lines being compared. A similar number gained one mark for identifying manganese dioxide as the best catalyst.

04.5 Just over a third of students knew the definition of accurate, with the most common incorrect response being approximate.

04.6 Over four in five students were able to identify that the rate increased with an increase in temperature.

Question 5

05.1 Around a third of students successfully balanced the equation. Having to balance two numbers in the equation led to many students trying to add other atoms, usually C and/or H to the equation.

05.2 One in five students gained both marks for comparing petrol and diesel. A further third gained one mark. On this occasion, students needed to interpret what the table headings meant, so many were not able to gain credit as they referred to the range of numbers of carbons, rather than the number of carbons and similarly, though more infrequent, for the boiling points.

05.3 Three in five students identified oxygen as the common element in the compounds released from a car engine.

05.4 Only 15% of students were able to identify that nitrogen came from the air. Much more common suggestions were from the engine or the diesel fuel.

05.5 This question tested a little known part of the specification, with fewer than one in twenty identifying global dimming as a consequence of particulates in the atmosphere. By far the most common incorrect response was for global warming.

05.6 Just below half of students could answer that carbon monoxide is either colourless or odourless. Many students gave both, despite being asked for one.

05.7 Fewer than one in ten gained any marks on this question, which was applying ideas from across the specification. Just a statement that water evaporates was insufficient for credit, as there needed to be a realisation that water is produced as a vapour, rather than turning into a vapour during the process.

05.8 Around one in ten students gained at least one mark on this question, usually for recognising that sulfur is responsible for acid rain. The consequences of acid rain were not well known, and even fewer knew that sulfur enters the atmosphere as sulfur dioxide. Global warming was the most common incorrect response.

Question 6

06.1 Over half of students knew that the stationary phase was the other phase in chromatography.

06.2 Only approximately one in fifty students knew that separation of inks in chromatography was due to either a difference in solubility or different attractions for the paper. Many students thought that the separation was dependent on melting point, concentration, density, or formula mass.

06.3 Lots of random numbers were seen for this question, but just over a quarter were able to deduce that there would be one spot.

06.4 Just under a quarter of students were able to correctly calculate the Rf from the values given. There were many examples of students multiplying the numbers, subtracting them, or dividing them upside down.

06.5 Students were asked to plan an experiment using paper chromatography to separate the colours in black ink and to subsequently identify the colours from their Rf values.

To access level 3, which was done by fewer than one in ten students, the plan needed to lead to a valid outcome. This required students to identify the key steps in the indicative content. Some students were able to explain how to determine the Rf values but very few recognised that the values needed to be compared to known Rf values and how this should be done.

To access level 2, which was done by nearly one third of students, the method did not necessarily lead to a valid outcome. Common mistakes included the idea that the pencil line should be submerged in the solvent and that the experiment should be left for too long for example, until the ink reached the top of the paper.

Common weaker responses usually gained credit for identifying that the pencil line needed to be drawn in pencil.

It should be noted that just over a quarter of students did not attempt this question at all.

Mark Ranges and Award of Grades

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