GCSE

COMBINED SCIENCE: TRILOGY

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

8464/C/2H
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General

Around 140,000 students sat this component, so a wide and varied range of responses was seen.

Students found this paper more accessible than previous series with the average mark on the paper increasing significantly.

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

There were seven questions on this paper. Questions **01** and **02** were common to the Foundation Tier. The demand levels of the questions are designed to increase from standard demand to high demand through the paper. From question **03** onwards, the demand of each question also increases through the question. As expected, students generally had more difficulty gaining credit in the high demand questions towards the end of the paper. However, the vast majority of students attempted all the questions.

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

01.1 Four in five students successfully balanced the equation.

01.2 Just over two 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 weren't 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.

01.3 Nearly nine in ten students identified oxygen as the common element in the compounds released from a car engine.

01.4 Just over a third of students were able to identify that nitrogen came from the air. Much more common suggestions were from the engine or the diesel fuel.

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

01.6 Just below three quarters of students answered that carbon monoxide is either colourless or odourless. Many students gave both, despite being asked for one.

01.7 Around one in ten gained two marks on this question, with a further quarter gaining one. The question 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.

01.8 Around half of 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 known by about a quarter, however, around than one in ten knew that sulfur enters the atmosphere as sulfur dioxide and so gained all marks. Again, global warming was the most common incorrect response here.

Question 2

02.1 Nearly nine in ten students knew that the stationary phase was the other phase in chromatography.

02.2 Approximately one in five 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.

02.3 Just under three quarters were able to deduce that there would be one spot. Lots of random numbers were seen for this question, with little pattern.

02.4 Just under three quarters of students were able to correctly calculate the R_f from the values given. There were examples of multiplying the numbers, subtracting them, or dividing them upside down.

02.5 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 R_f values.

To access level 3, which was done by around two in five students, the plan needed to lead to a valid outcome. This required students to identify the key steps in the indicative content. Students were able to explain how to determine the R_f values but few recognised that the values needed to be compared to known R_f values and how this should be done.

To access level 2, which was done by nearly half 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 line needed to be drawn in pencil.

Question 3

03.1 This question required an application of the definition of a formulation, which students found difficulty with. Only a quarter of students gained at least one mark, usually for the idea that a formulation is made for a specific purpose. Few went on to give the idea that crude oil has a variable composition.

03.2 The steps in fractional distillation were not well known and often produced muddled sequencing. Two thirds of students gained at least one mark, usually for the idea that fractions have different boiling points (though some referred to melting points). Fewer than two in five went on with further descriptions, and one in five gained either three or four marks.

03.3 About one third of students gained two marks, with a further one in five getting one mark. This was usually for the idea that cracking produces smaller molecules. A specific use such as fuels or as a starting material for making polymers was credited for the second mark, whilst many students said that smaller molecules were more useful, were more in demand, or had more uses, all of which were creditworthy.

03.4 About half of students were able to describe the test for hydrogen, which had to be identified from the given equation. The gas tests are not well known and need to be learnt, so that they are expressed clearly.

03.5 Four in five students correctly identified the alkene.

Question 4

04.1 Only one in ten students could give the improvement in the method. Common insufficient responses included heat for longer, whilst giving no reasoning, heat for shorter time, or put a lid on.

04.2 An alternative approach to a mean calculation proved to be straightforward as nearly four in five students gained both marks.

04.3 Fewer than a quarter of students gained at least one mark for this question. It relied on students recognising that pure substances boil (or melt) at a fixed temperature. Some students realised this but did not go on to measure and quote the boiling point. A few students did approach it from the melting / freezing point but still did not refer to measuring the value.

04.4 Over four in five recognised that the symbol was for a reversible reaction or for a description of a reversible reaction. The most common insufficient response was for saying that the reaction was at equilibrium, which it may be but in industry often is not.

04.5 Around half of students correctly identified the correct direction of movement. The opposite change was most often given as the incorrect response.

04.6 Fewer than a quarter of students identified the correct gas test for chlorine for both marks. It was essential for the award of both marks that the litmus paper was damp.

However, if just litmus paper was given, one mark could be credited for being bleached or turning white.

04.7 Just over one in ten students gained both marks for the idea that dissolved particles are too small and pass through the filter paper. One in five gained one mark, with similar numbers achieving both marking points.

Question 5

05.1 Over four in five students could identify an effect of global climate change, with most giving melting ice or rising sea levels.

05.2 Two in five students were able to gain at least one mark, but few were able to continue with the explanation. Effective sequencing is required to gain full marks, and it is hoped that students will utilise mark schemes to identify expectations on questions like this in future examinations.

05.3 Over a third of students gained all three marks on this question. A further third missed the link of carbon dioxide being a greenhouse gas. Where students gained one mark, it was usually for the idea that trees absorb carbon dioxide.

Question 6

06.1 Fewer than half of the students were able to identify oxygen from the equation then recall the test for oxygen gas and its result. Frequently, a description of a glowing splint was inadequate, such as a blown out splint or just a splint.

06.2 Practical errors are not well known by students and fewer than one in ten gained any marks on this question, usually for the idea that a smaller volume of hydrogen peroxide would lead to a smaller volume of gas. Students did not then make the link to a greater percentage reading error.

06.3 Understanding what a systematic error is was not well known by students with fewer than one in twenty five gaining this mark. There is significant confusion with a zero error, which could be systematic, but there was little realisation that the error has to be the same for every reading taken.

06.4 Three quarters of students were able to correctly plot the points on the graph. However, with the anomaly (which was not flagged in the question) and the curve, only about a quarter actually scored all three marks. It did appear that many thought the line had to be straight because the two already on the graph were. However, there was no realisation that these would also slow as the maximum volume of oxygen had been produced.

06.5 Nearly half of students correctly identified manganese oxide (not magnesium oxide) as the catalyst that gave the fastest rate of reaction with the reason. Since the question asked for the fastest rate, the superlative was required in the answer, which many students missed, so a quarter gained one mark, most frequently for this.

06.6 Most students did not answer the question, preferring to talk about what the reaction was dependent on. Some talked about concentration, temperature, or surface area affecting rate without linking it to this specific question so failed to gain any credit.

06.7 Nearly a quarter of students gained full marks on this question. It appeared that if a student knew to draw a tangent, they could often work it through to an answer. The most common way of not gaining marks when a tangent was drawn was for misreading the scales, or not giving an answer to three significant figures. If a tangent was not drawn, then the mark was limited to a maximum of one for a correct calculation of an expression given to three significant figures.

Mark Ranges and Award of Grades

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