GCSE

COMBINED SCIENCE: TRILOGY

8464/C/2H

Report on the Examination

8464

November 2021

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General Introduction to the November Series

This has been another unusual exam series in many ways. Entry patterns have been very different from those normally seen in the summer, and students had a very different experience in preparation for these exams. It is therefore more difficult to make meaningful comparisons between the range of student responses seen in this series and those seen in a normal summer series. The smaller entry also means that there is less evidence available for examiners to comment on.

In this report, senior examiners will summarise the performance of students in this series in a way that is as helpful as possible to teachers preparing future cohorts while taking into account the unusual circumstances and limited evidence available.

Overview of Entry

The cohort of entries was significantly smaller than usual. Each summer approximately 120,000 students usually sit the 8464/C/2H paper. This session had an entry of just over 130 students.

Comments on Individual Questions

Question 1 (standard demand)

The variables were rarely correctly identified. Well over half of the students did not score any marks. No credit was given for the use of “amount” in place of volume or mass or for simply stating magnesium or hydrochloric acid unqualified.

The graphs were accurately plotted and a reasonable line of best fit drawn which needed to include the given plot at (0.0)

The effect of temperature upon the rate of reaction was well known, and many scored highly on this question. When explaining how the rate of reaction is affected credit is given for the frequency of particle collisions not simply more collisions.

Question 2 (standard demand)

Very few were able to correctly identify what is decomposed to form crude oil, many appeared to confuse “decomposition” with “composition” and gave hydrocarbons as their answer. However, the naming of alkanes was well known.

In the comparision of methane and hexane most students focused their attention on the comparison of the boiling points and the relative numbers of atoms in each molecule, using only the information provided. There was some confusion evident around the negative values of the melting points. A significant number of students stated that methane has a higher melting point than hexane. Better answers linked the information to the physical states of the hydrocarbons. Some excellent answers were seen where the students expanded upon the data, for example, to

explain why the molecules had different melting and boiling points in terms of the strength of their intermolecular forces or they deduced their physical states.

Question 3 (standard, standard / high and high demand)

It is insufficient to simply state that a pure substance is only made up of one type of substance. Answers need to indicate that it is a single element or compound.

The principles of distillation were well known. Many students successfully described how water could be separated from the solution but often did not go on to explain how the water vapour was changed into a liquid. Cooling of the water vapour to bring about condensation was rarely seen. Many students did not link question 03.4 with question 03.5 to explain why obtaining potable water from salty water is more expensive than from ground water. No credit was given the latter being an easier process or taking less time. Some students were able to recognise that costs were linked to energy consumption. Ground water needed to be both filtered and sterilised to gain the second marking point in question 03.5

Question 4 (standard, standard / high and high demand)

Most students were successfully able to describe the general trend in the graph and account for the changes. In question 04.1, however, many failed to gain the second mark point as they did not recognise that the increase was not the same throughout the graph.

The disadvantages of phytomining compared to traditional mining tended to focus on pollution, carbon dioxide emissions and global warming as a result of the combustion of the plants. This did not gain credit as traditional mining methods also lead to a similar increase in the gas.

Students approached the calculation in question 04.6 using a variety of methods, which is to be encouraged. A significant number merely calculated the difference in mass rather than energy. Marking point 5 was awarded for an answer to a calculation using the data provided, given to 3 significant figures.

Question 5 (standard, standard / high and high demand)

The idea that nitrogen and oxygen from the air react together in the engine was not well known. Many students incorrectly stated that nitrogen dioxide was present in the fuel. Heat from the engine was insufficient to gain marking point 1 as there must be an indication of high temperature.

Non-renewable was a common response for a “finite resource” which did not gain credit as marks were awarded for the definition.

Students appeared to have a good understanding of the idea of a carbon footprint. Some excellent answers were seen where carbon emissions were linked to each stage in the life cycle of the car. Some students simply focused on the manufacture of both the car and its raw materials and failed to address the disposal.

Question 6 (standard / high and high demand)

Students have a good understanding of what catalysts are and what they do, but they failed to explain how they work and instead gave a list of features of catalysts. Some students recognised that the activation energy was lowered but that this was achieved by following an alternative pathway was rarely seen.

Likewise, students were able to successfully apply Le Chatelier's Principle to an equilibrium but were unable to explain those changes.

A common misconception is that the quantities of reactants and products are equal rather than the rates of the forward and the backward reactions. That catalysts speed up both of these rates equally was rarely seen. Students tended to describe the action of a catalyst but then failed to address the question of their effect upon the equilibrium position, for which they gained no credit.

Concluding Remarks

The demand of this paper was similar to that of papers set for this specification in previous series.

Students scored well on questions involving the use of data and knowledge of atmospheric pollution. They are advised to look at the number of marks allocated. If the question is asking to describe a trend in a graph, comments are not only required for the general trend but also the rate of change.

A range of methods were used to answer the mathematical questions. Students are always advised to show working - credit can be gained for correct working in the event that the final answer given is not correct. They should also take careful note of any additional instructions. In question 04.6, the final mark was often not gained as the answer was not given to 3 significant figures.

Practical work is at the heart of the specification. The importance of the use of variables in experiments is paramount. In question 02.1, when identifying control variables, students should refer back to the method provided where in this instance the volume of hydrochloric acid was given. Many answers referred to the "amount" of acid or metal which is insufficient to gain credit, likewise, adding a "piece" of magnesium which does not indicate that either the length or mass has been controlled. Reading through the method will also reveal what is being changed in subsequent repeats as the independent variable.

In questions, such as 02.3, where comparisons are to be made from given data, students should be encouraged to answer accordingly using a comparative and not rewrite the information that is provided without elaboration - this does not gain any credit as the student has not added any value to their answer. Some excellent answers were seen where the students expanded upon the data, for example, to explain why the molecules had different melting and boiling points or to explain how the length of the hydrocarbon chain was linked to a trend in physical properties, such as flammability.

Mark Ranges and Award of Grades

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