GCSE
COMBINED SCIENCE: TRILOGY

8464/C/1F
Report on the Examination

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General

There were seven questions on this paper. Questions 5–7 were common to the Higher Tier and were targeted at grades 4–5.

There were some common misinterpretations of questions due to lack of understanding of common scientific terms. Students need to read and pick out or highlight the key words in questions, such as 'describe' and 'explain'. Other problems in interpretation arose because students had not always read the question carefully enough to grasp what was being asked.

The question paper and mark scheme were designed to allow students to gain marks for showing knowledge, understanding and application of chemistry. The majority of students appeared to have sufficient time to complete the paper. This paper was more demanding than previous, and tested a wider range of mathematical skills and provided more opportunities for extended response.

A few students used up a lot of space by repeating the question, which is not needed as it does not gain students any credit. There were a number of students whose scripts were difficult to read, either due to poor handwriting or due to the use of pens with other than black ink.

Basic knowledge and understanding in familiar and in unfamiliar situations, including in the laboratory, are tested throughout this paper. This means that it is essential that students read and analyse the information provided, then read and understand the question before writing their response. Students should then check their answers, especially those that are descriptions or explanations. Many students use 'it' or 'they' without any clear indication of what the student is referring to.

To improve their performance, students need to know and use scientific terms correctly. They need to learn the different types of bonding in elements and compounds and to understand reactions represented by chemical equations.

Security breach

Unfortunately, due to a security breach at a school, some questions from this paper were shared in advance of the exam.

To make sure that no student was unfairly advantaged or disadvantaged none of the responses to those questions were marked.

As a result, we have been unable to give a report on the following questions:

- 02.1, 02.2, 02.3, 02.7, 02.8, 02.9
- 03.1, 03.2, 03.3, 03.4, 03.5
- 04.1, 04.5, 04.6, 04.8

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.

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 (low demand)

01.1 47% of students correctly identified that the diagram for calcium oxide showed ionic bonding.

01.2 41% of students recognised that the bonding diagram for methane showed a molecule of methane.

01.3 The diagram of a fullerene was not recognised by 71% of students.

01.4 44% of students correctly identified, from the diagram, that the type of bond in graphite is covalent.

01.5 This question proved to be difficult because it required students to understand that in one covalent bond there is a shared pair of electrons, so one electron comes from each atom. 11% of students gave a correct answer.

01.6 This question was accessible to most students (76%) because the answer should have been obvious from the diagram that showed a solid between the electrodes.

01.7 66% of students knew that copper conducts electricity by the movement of delocalised electrons.

01.8 49% of students could use the labelled diagram to understand that the sodium chloride was dissolved to form the sodium chloride solution.

01.9 19% of students knew that solid sodium chloride does not conduct electricity because the ions are fixed, whereas molten sodium chloride conducts electricity because the ions are mobile. Some students did not follow the instructions and drew more than one line from each statement box. 56% of students were awarded at least one mark.

Question 2 (low & standard demand)

02.4 47% of students knew that the type of reaction between chlorine and potassium bromide solution is called displacement.

02.5 73% of students knew that chlorine is more reactive than bromine because chlorine gains electrons more easily.

02.6 60% of students understood that a chlorine atom is smaller than a bromine atom.

Question 3 (low & standard demand)

No reportable questions.

Question 4 (low & standard demand)

04.2 Even though the stem informed students that the products were a metal oxide and a gas, very few students (6%) could name both of the products formed when calcium carbonate ($CaCO_3$) is heated.

04.3 63% of students knew that the type of reaction when a compound breaks down is called decomposition.

04.4 60% of students knew that the type of reaction that takes in energy from the surroundings is called an endothermic reaction.

04.7 This question discriminated between students well. The two mistakes made in the student's calculation were often poorly expressed or ambiguous such as, 'the calculation is wrong'; 'used the wrong numbers'; 'the volume is wrong'; and 'readings are taken from the wrong place'.

Many students correctly identified at least one of the mistakes but several of these students continued to use either the incorrect mass or the inverse formula for their calculation.

13% of students expressed the mistakes well and correctly calculated the gradient. There were 12% of students who did not attempt to answer this question.

Question 5 (low & standard demand)

05.1 Halogens are produced at the positive electrode if an aqueous solution contains a halide ion. 27% of students correctly selected chlorine as the gas produced.

05.2 Students could have linked their understanding of the reactivity series, with which ion is discharged when an aqueous solution is electrolysed. In this case, the production of copper at the negative electrode informs students that copper is less reactive than hydrogen. 30% of students were able to correctly deduce this.

05.3 Students needed to look at the data and see that the mass produced at three minutes was missing from the table. Experimental errors account for the trend not being exactly directly proportional. 42% of students noticed the relationship and correctly deduced the mass within the allowed range of 1.7 to 1.9 (mg).

05.4 This question discriminated well. 28% of students achieved full marks for this question giving an answer of 3.15 (mg), however, some did so without showing their working. This was not an issue where they obtained the correct answer, but some did not and therefore gained no credit as it was not possible to see how they had obtained their answer. 15% of students did not attempt to answer this question.

05.5 A unit conversion is essential to make progress in this calculation. A conversion between cm^3 and dm^3 requires a division of either 50 by 1000 to convert cm^3 to dm^3 or 300 by 1000 to convert mass per dm^3 to mass per cm^3. 1% of students understood this concept to achieve the maximum three marks for this question. 28% of students did not attempt to answer this question.

Question 6 (standard demand)

06.1 This question discriminated well with 27% of students achieving some degree of credit. Many students did not consider the most obvious difference and similarity in the electronic structures of sodium and chlorine. Students often used the periodic table shown in the stem of the question to answer this question, but most of these students referred to periods or rows and groups or columns and so failed to gain any marks.

06.2 This question discriminated well. 23% of students achieved all four marks, often with concise statements about the transfer of the outer electron of sodium to chlorine.

Some students contradicted their description by mentioning covalent bonding, or the sharing of electrons, which restricted the number of marks they could attain. Poor expression and the use of incorrect terms were the main problem for most students. It was common to see the term ‘atom’ used instead of ‘electron’. 19% of students did not attempt to answer this question.

06.3 This question discriminated well. 26% of students achieved both marks; whereas 185 of students achieved a single mark. It was common for students to have incomplete reaction profile diagrams, by failing to include a horizontal line for the products.

Some students confused the two types of energy changes (endothermic and exothermic), while others provided a wide range of incorrect diagrams. Labels were ignored because they were not required to answer the question. 20% of students did not attempt to answer this question.

Question 7 (standard demand)

07 Students found this 'extended response' question, based around Required Practical Activity 8, difficult to answer. Most of the correct responses (33%) were at level 1. Those students that just repeated the stem of the question gained no marks.

The question stated that the method contains several errors and does not produce copper sulfate crystals. Most students missed that the wrong two chemicals were being used in the stem of the question. Common improvements that gained no credit included quoting volume or masses, while some responses just changed the apparatus, expanded the method or included safety issues.

In a few cases students mentioned a correct improvement but failed to explain the reason for the change. For example, students:

- mentioned the need to filter but failed to state that filtering removed the excess solid
- stated add more solid but did not justify that this was to ensure all of the acid reacts.

42% of students gained no credit for an answer, while a further 18% of students did not make an attempt to answer at all.

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.