GCSE
COMBINED SCIENCE: SYNERGY

8465/3F
Report on the Examination

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General

There were 10 questions on the paper with questions 8–10 being common with the Higher Tier. A wide range of marks were obtained, with good differentiation seen on most questions. However there were a number of questions that were not attempted by a significant number of students.

Students generally demonstrated competence in the questions involving mathematical skills. It also appeared that students who attempted questions involving the Required Practical Activities had good practical experience, although a large number did not attempt the common ‘extended response’ practical question. The question involving a non-required practical from the specification was not answered well.

Students found the ‘extended response’ questions difficult with very few marks being awarded at the top levels. Students found it difficult to include sufficient creditworthy information in their responses, as well showing a lack of precision with language in these and other prose responses. They are advised to avoid the use of words such as ‘it’ and ‘they’ as there is often a lack of clarity in the responses given.

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 Students found this difficult with more students giving the distractor of the mixture being heated to show that the reaction was exothermic than the correct response.

01.2 33% of students were able to correctly use the law of conservation of mass to calculate the answer. Incorrect responses gave a variety of methods of using the three numbers given in the question.

01.3 Students found using the state symbols in the equation to determine the physical state of zinc oxide difficult, with gas being the most common response.

01.4 45% of students were able to identify zinc as the substance which had been oxidised.

01.5 More students answered in terms of the reaction between zinc and copper oxide being an example of combustion rather than displacement.

01.6 44% of students were able to identify the structure of atoms in pure copper.

01.7 Most correct responses were in terms of electrical conduction, with a few continuing to give a detailed description of how the metal conducted electricity which was not required at this level. 57% of students achieved this mark. A few answered in terms of flexibility. Some didn't realise that the question related to electrical wiring and gave responses in terms of thermal conductivity.

01.8 67% of students were able to identify the simplest ratio from the data used in the question.

01.9 52% of students were able to identify both of the correct advantages of recycling copper, with nearly all obtaining at least one mark. Conserves copper ores was more commonly known than less energy used.

Question 2 (low demand)

02.1 70% of students identified the decrease in melting point as the trend with others correctly answering in terms of negative correlation. A number of students referred to boiling points rather than melting points.

02.2 Nearly all students correctly identified the atomic number of caesium as 55. But a significant number failed to read the scale on the graph correctly in order to obtain the melting point of caesium, usually giving an incorrect response of 24 °C or 25 °C. 61% of students achieved the mark.

02.3 The most common distractor was '3', where students had determined the number of electrons in a lithium atom rather than in the outer shell. 40% of students were able to select the correct response.

02.4 Most students were able to identify oxygen as an element but many thought lithium oxide was a metal. 76% of students achieved at least one mark.

02.5 Students found complete the balancing of the equation difficult with the vast majority of responses placing 2 in front of Li. 15% of responses were correct.

02.6 More students thought lithium oxide was covalent rather than ionic.

02.7 20% of students gave the correct answer of 30. Incorrect calculations were seen involving every possible combination of the numbers 7 and 16. 112 (7×16) was the most common incorrect response.

Question 3 (low & standard demand)

03.1 77% of students were able to give at least one correct suggestion for factors that might affect the thinking distance; usually the consumption of alcohol or distractions such as the use of a mobile phone. ‘Drinking’ by itself was insufficient for a mark as it needed to be linked to alcohol.

03.2 56% of students could suggest an appropriate factor that would affect the braking distance. Some were confused between braking distance and overall stopping distance, and were therefore suggesting factors that might affect the thinking distance.

03.3 83% of students were able to correctly calculate the thinking distance to be 7.8 m.

03.4 14% of students realised that the overall stopping distance was equal to thinking distance plus braking distance. A very common response was to subtract 7.8 m from 14 m.

03.5 53% of the students knew that a greater speed would result in a greater braking distance. Common incorrect responses were to say that a greater speed resulted in a slower braking distance or would take longer to brake but without reference to the distance.

03.6 Most students realised that applying a large braking force could cause damage to the car or injury to the occupants. Few students made any reference to the effect on the brakes. 9% of students achieved full marks.

Question 4 (low & standard demand)

04.1 75% of students were able to determine the correct values for the mass of iron and the mass of nickel from the bar chart.

04.2 A significant number of students were unable to use the values calculated in question **04.1** to determine the mass of chromium. 16% of students did not attempt this question. Often the values obtained were above the total mass of the alloy which was 80 g. Students who determined a value that was suitable in size for the bar chart were then usually able to correctly plot the value (40% of students).

04.3 The higher-attaining students were able to calculate correctly the mass of iron present in 0.80 g of the alloy. The conversion factor was not well known and students often attempted to calculate the mass of the alloy rather than iron.

04.4 21% of students could correctly give the definition of an alloy. Students often referred to a combination or joining together of metals or just mentioned metals but made no mention of mixing. To make a new metal was also a phrase seen quite frequently.

A significant number of students thought that an alloy was something that was fixed to the wheel of a car.

04.5 18% of students could provide an acceptable reason why alloys are used. A variety of alternative responses were given, most commonly in terms of cost.

04.6 Almost as many students thought copper was a magnetic metal as knew that cobalt was.

04.7 50% of students knew that bar magnets are permanent magnets, though induced was a very common distractor.

04.8 This was well answered with 69% of students knowing that the magnetic field is strongest at the poles of a magnet.

04.9 This is a practical method that appears in the specification but many students demonstrated little knowledge of the process, despite being given a prompt as to how the method started. In this 'extended response' question marks obtained were generally for a description of how to mark the direction of the compass needle. 2% of students were able to go further than this and give a method with a valid outcome and hence accessing level 2 of the mark scheme.

32% of students made no attempt to answer the question. And of those who did make an attempt, it was often describing a method using iron filings to see a pattern or describing the pattern that was drawn for question **04.8**.

A significant number of students referred to the compass when they meant the bar magnet, and vice versa. Others thought that a compass meant a pair of mathematical compasses and consequently were using the compasses to draw curved lines and semicircles around the bar magnet.

Question 5 (low & standard demand)

05.1 51% of students were able to obtain the correct answer, by determining the volume using the graph, then substituting correctly into the given equation to find the mean rate.

Most students showed their method; which meant that students could obtain a mark for either

- determining the correct volume of gas produced after 10 seconds
- determining an incorrect volume value from the graph but then using this correctly to determine the rate.

A few did not read the question correctly and used a time of 120 seconds.

05.2 72% of students were able to determine the units for the rate of this reaction.

05.3 Many students described the shape of the graph rather than providing a conclusion. Others gave two conclusions but often just gave the same point twice. 10% of students achieved full marks.

Students do need to be clear in their use of language with many using the word 'it' or 'they' as the subject of the sentence, without specifying what 'it' or 'they' referred to, for example, it got higher. Few appreciated that the reaction had finished and even less that one of the reactants was used up. Most correct responses related to the volume of the gas.

05.4 More students identified the dependent variable as the independent variable rather giving the correct variable.

05.5 50% of students did not attempt this question. Students need to be aware that where a question number and allocation of marks is presented ie **05.5** and **[2 marks]**, an answer is required, even though no answer lines are given.

4% of students achieved both marks. Most who answered the question appreciated that it would be a faster rate of reaction and drew a curve with a steeper gradient, but very few realised that the final volume of gas collected would be the same, usually stopping at a much higher value. Those who incorrectly drew the gradient to the right almost always stopped at a much lower level.

Question 6 (low & standard demand)

06.1 Nearly all students were able to identify the thermometer as the equipment needed to measure temperature but a number answered in terms of a beaker rather than a measuring cylinder as being the most suitable piece of equipment to measure volume. 71% of students achieved both marks.

06.2 41% of students successfully identified the anomalous result and went on to calculate the correct value for the mean.

A significant number of students added all four values together and divided by four, the answer obtained by this method, 6.6, was credited with one mark for being able to calculate a mean.

A significant minority of students gave the mode value rather than the mean.

06.3 44% of students answered correctly, with most popular distractor to use a thermometer with a resolution of 1 °C.

06.4 6% of students were able to name both products in this neutralisation reaction, with a significant number of students answering salt or sodium oxide instead of sodium chloride and hydrogen instead of water. There was often no link to the reactants and it was difficult to see where students had obtained their answer from.

06.5 36% of students were able to identify the colour of universal indicator at both the pHs given. Others were not able to link the colours of universal indicator at different pHs to the relative strength of acids and alkalis.

Question 7 (low & standard demand)

07.1 57% of students were able to recall the typical mean speed for a person walking.

07.2 33% of students knew this with a greater number of students answering in terms of the typical mean speed for a person cycling being 4.5 m/s.

07.3 55% of students were able to determine the figures of 3.8 (s) and 8.6 (s) from the graph. Those who did not appreciate the scale used generally answered 3.9 (m).

Most realised that they had to subtract values determined for C and D (though a few did add) to determine the time taken.

07.4 35% of students did not attempt this question. Of those that did, most students were able to achieve one mark usually for finishing the line at 14 seconds, often just by continuing the line from D to E. 29% of students achieved two marks. A few students drew the lines freehand, which were often not credited due to the number of ‘wobbles’.

07.5 58% of students were able to interpret the graph and determine the region in which the athlete was moving at constant velocity.

07.6 Although the majority of students were able to interpret the graph and determine the region in which the athlete was moving at constant velocity, fewer then realised that the resultant force when travelling at constant velocity would be zero. 35% of students were able to do this.

07.7 The correct answer was the most popular response, with 42% of students selecting ‘distance travelled’.

07.8 25% of students were able to correctly recall the equation. A variety of incorrect answers were seen with arranging the terms incorrectly, or subtracting one term. A significant number of students answered in terms of $v^2 - u^2 = 2as$, despite force and mass being in the question.

07.9 72% of students answered correctly achieving both marks. However, some students rounded their response to 3.62 rather than 3.63

Question 8 (standard demand)

08.1 28% of students did not attempt this question. Of those that did the majority of students were able to draw a bonding electron pair. However, many were not able to work out or recall that chlorine had seven electrons in its outer shell and included 17 electrons on the outer shell. Others tried to draw the inner shells and then overlapped these with the hydrogen electron shell. 23% of students achieved full credit.

08.2 This question was not answered well with 6% of students achieving one or two marks.

Most students were not able to recall that chlorine gas is a molecule with the formula Cl_2 but some were however able to access mark point two which required the correct balancing of an equation with HCl given. Others, despite Figure 1 showing a hydrogen chloride molecule, gave formulas such as H_2Cl_2 or H_2Cl

Some students gave a word equation despite the instruction in the question to complete a balanced chemical equation.

08.3 5% of students achieving one or two marks. A variety of responses were seen including amplitude and wavelength descriptions. Very few students appeared to know the term 'activation energy' and even less that B was the overall energy change.

08.4 Responses needed to be specifically linked to the reaction profile diagram rather than stating what an exothermic reaction is. 3% of students managed to obtain this mark with many describing the pattern, for example, it goes up then down or talking about an energy decrease but without a link. 27% of students did not attempt this question.

08.5 30% of students did not attempt this question. Those that did attempt the question displayed a lack of understanding of the structure of a small molecule. Many students stated that gases do not conduct electricity but liquids do.

6% of students achieved one mark which was usually for stating that hydrochloric acid contains ions. A few students could also state that hydrogen chloride does not contain ions. Hardly any students referred to how these ions would enable an electric current to flow.

Question 9 (standard demand)

09.1 38% of students made no attempt at answering the question. Of those who did, most used a lit splint or added universal indicator with 8% of students knowing the correct test for carbon dioxide.

09.2 43% of students did not attempt this 'extended response' question on a Required Practical Activity. It was expected that students would have knowledge of the methods of preparing a soluble salt.

Key steps in the process were: using the correct reagents, mixing in a suitable container; adding the magnesium carbonate in excess then filtering; a crystallisation method (not just evaporation to dryness).

Very few students realised that magnesium carbonate should be added to excess or the mixture should be filtered. Most responses that were creditworthy included some or all of the following points: heating the reactants, evaporating the solution (often to dryness), leaving until crystals formed. A suitable container for the addition of magnesium carbonate to the acid was often not given, with the reagents being heated in a plastic bowl or petri dish.

Approximately half the students who attempted the question obtained at least two marks, usually either for a good description of the crystallisation process or for a partial description of the first and last stages.

A significant number of students started with the product itself which made it difficult to access level 2. As the question was asking for the procedure, not for observations, any colour changes given were ignored.

Question 10 (standard demand)

10.1 33% of students failed to attempt this question. Of those who did, most stated that efficiency equalled total input energy divided by useful output energy. Some used different equations such as $V = IR$ or didn't write an equation at all but just gave numbers. 9% of students achieved the mark.

10.2 32% of students failed to attempt this question. 4% of students gave a correct answer.

There was evidence that some students were unable to work with standard form as students who had the correct equation shown in their working often gave an answer that included 10^{35}

Many others just used 1.2×10^{18} and gave answers based on this number.

10.3 More students answered in terms of low potential difference and a high current than the correct response.

10.4 There are two equations applicable to this question given on the Physics Equations Sheet. The great majority of students who gave correct responses answered in terms of energy = power × time

The most common incorrect response was energy = power ÷ time. 29% of students did not attempt this question.

10.5 25% of students achieved all three marks for this question. As the power was in kW and with the answer required in kJ, students often attempted a unit conversion, usually obtaining an answer of 9600, which gained two marks. Although in some cases this answer was given on the answer line with no working shown and therefore no marks could be awarded.

10.6 This question on environmental advantages and disadvantages of wind turbines discriminated well between students. Students had to give both advantages **and** disadvantages to achieve full marks, with referring to just one of these eg advantages resulting in a maximum of three marks. 40% of students achieved at least one mark with 1% receiving full credit.

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.