AQA

GCSE
COMBINED SCIENCE: SYNERGY

8465/3F: Physical sciences (Foundation)
Report on the Examination

8465
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General

There were 9 questions with questions 7–9 being common with the Higher tier.

The demand levels of the questions are designed to increase from low demand to standard demand through the paper, and as expected, students had more difficulty gaining credit in the standard demand questions towards the end of the paper. In the case of the low demand questions, most students attempted most questions. In the case of the standard demand questions there were many cases of questions being left unattempted.

There were a significant number of multiple choice questions in this paper. However, many students left several of them unattempted. Students should be told that there is no penalty for giving an incorrect response and so an attempt should always be made. Some of these multiple choice questions require the student to tick two boxes; however, in many cases the student missed the instructions given in the question and only ticked one box.

The mathematical skills shown by the students attempting the calculations was generally good, but common errors were failing to convert units correctly (eg grams to kilograms) or failing to provide the correct unit for a numerical answer.

Many students seemed unfamiliar with laboratory techniques and equipment in spite of the Required Practical Activities (RPAs) in the specification.

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 & standard demand)

01.1 This was a multiple-choice question that asked for the gas produced in the reaction between magnesium and hydrochloric acid. Over half of the students correctly identified hydrogen but more than a quarter thought that the gas would be carbon dioxide.

01.2 In this multiple-choice question, students had to identify a piece of apparatus as a conical flask. Around 67% of students chose the correct response, but about 30% thought that it was a glass beaker.

01.3 Around 72% of students gained one mark with the most common correct response being that bubbles were an indication that a chemical reaction was taking place. Few obtained the second mark, most opting for the idea that there would be a colour change.

01.4 Most students could correctly complete the left-hand column of the table showing the time in seconds, although a few tried converting the time into minutes.

There were many students who failed to complete the heading of the right-hand column. Of those who did, many failed to show the units. A few students put the unit of volume on every line of the table instead of in the heading.

About 14% of students managed to gain all three marks.

01.5 Around 67% of students knew that to make the reaction faster they should replace the magnesium ribbon with magnesium powder.

01.6 Most students could correctly read the graph and then calculate the correct answer, although several of these did not select the correct unit. Almost two-fifths of students obtained all three marks.

01.7 About 59% of students could correctly identify the time at which no more gas was being produced. However, many gave an answer of 100 seconds, being the point at which the graph line stopped.

01.8 This was a multiple-choice question in which students were required to select the two reasons why the rate of reaction increases when the temperature is higher.

Around 37% of students correctly identified both reasons. A significant number of students, around 35%, did not follow the instructions and only ticked one box instead of two.

Question 2 (low & standard demand)

02.1 Three quarters of the students could determine the ratio of atoms as being 9:1, although 18:2 was also allowed. A few students incorrectly gave the ratio as 1:9.

02.2 Around 61% of students knew that a mixture of metals is a called an alloy. The most commonly chosen incorrect responses in this question were polymer and alkene.

02.3 This was a multiple-choice question requiring students to convert grams into kilograms. Almost a fifth of the students were able to select the correct answer. It appeared that more students thought that you needed to multiply by 1000 rather than divide by 1000.

02.4 In this multiple-choice question, around 66% of students correctly identified the electronic structure of silicon as being 2,8,4.

02.5 In this multiple-choice question students were required to select two words which described the bonding in silicon dioxide. About 30% of students did not follow the instructions and ticked one box instead of two.

Around 60% of students achieved one mark on this question, with around 15% of students correctly identifying both covalent and strong.

A significant number of students appeared to show a lack of understanding of bonding by choosing both covalent and ionic.

02.6 A third of students knew that there are two silicon atoms bonded to each oxygen atom in silicon dioxide. However, almost as many answered four silicon atoms to each oxygen atom.

02.7 Almost a quarter of students correctly identified the state symbol for silicon dioxide at room temperature as being solid. However the most common response chosen by about 31% of students was (aq).

Question 3 (low & standard demand)

03.1 Around 85% of students knew that a direct current is one that always passes in the same direction.

03.2 Although most students could plot the two bars correctly, more than half of these failed to label either axis, or simply labelled them with the letters ‘x’ and ‘y’.

Some students drew a lithium ion bar that went above the 480 line and hence did not gain a mark. Approximately 44% of students gained all marks.

03.3 Around 54% of students correctly calculated the distance to be 104 km. Those who failed to do so could gain one mark if they showed a correct method.

03.4 About 79% of students obtained the correct answer of 72 000. However, a significant number of students incorrectly converted the time of 1800 seconds into 30 minutes and therefore arrived at an answer of 1200.

03.5 About 35% of students obtained the correct answer of 22.5 metres for the stopping distance. Some students tried deducting the thinking distance from the braking distance, while others tried multiplying the two numbers together.

03.6 More than a fifth of students obtained two out of the four marks available for this question. Around 2% of students gained all four marks on this question and a third scored zero.

Common misunderstandings included:

- believing that worn brakes would reduce the grip that the tyres have on the road
- saying that drinking alcohol causes reaction time to ‘slow down’
- saying that after drinking alcohol your reaction time decreases and therefore you have less time in which to stop
- confusion between braking distance and stopping distance
- saying that the thinking distance is the time it takes you to think about stopping.

Few students stated that stopping distance is equal to thinking distance plus braking distance.

There were many very vague answers concerning the effect of alcohol, such as ‘the driver can’t think clearly’.

Question 4 (low & standard demand)

04.1 More than a third of students could provide the correct formula as C_5H_{12}. However, many were putting a + sign between the C_5 and the H_{12}. In some cases 12 was not awarded as the number was not a subscript being the same size as the letter H.

04.2 About 43% of students could correctly state that the links between the atoms in the diagram represented bonds. Covalent bonding was an acceptable response but those who answered in terms of ionic bonds did not gain the mark.

04.3 In this multiple-choice question, students were required to tick two boxes to identify the two products of complete combustion of a hydrocarbon. The most popular response was to choose carbon dioxide and nitrogen. The correct responses (carbon dioxide and water) were chosen by only around 15% of students.

About 67% of students gained one mark on this question while around 15% achieved both marks. Approximately 8% of students ticked just one box.

04.4 About 78% of students correctly calculated the mean to be 22 seconds. However, a significant number of students correctly added all four values together but then failed to divide that answer by four.

04.5 The points were well plotted in general, with most students gaining at least one mark for at least three points correct. Quite a few plotted the first point at 72 (six squares above 60), then went on to plot the others correctly.

With regard to the best fit line, almost as many students plotted straight lines as curves. A few students drew a bar chart instead of a line graph.

Less than a fifth of students gained all three marks on this question.

04.6 Half of the students answered this question correctly by stating that the pattern on the graph showed a negative correlation.

Some missed the mark as they simply stated that the pattern was negative. Many students were unable to gain credit as they stated that ‘it decreased with temperature’, without stating what ‘it’ was.

04.7 Around 69% of students could state that as the temperature increase the viscosity decreases.

Question 5 (low & standard demand)

05.1 There was a good response to this question with 61% of students receiving some credit. Almost two-fifths of students scored all three marks.

A common mistake was to use the periodic table rather than the given formula and write beryllium or helium as the element in the third line and 63.5 for copper and 32 for sulfur.

05.2 More than half of the students could correctly complete the word equation. Some students tried using formulae instead of words as the question requested but usually were unable to write them correctly.

05.3 Less than a fifth of students knew that copper oxide is a base. The most popular incorrect response was metal with about 42% of students selecting this.

05.4 Half of the students chose the correct answer to this multiple-choice question. The most popular incorrect response was to say that blue crystals only would be left.

05.5 In general, the diagrams were of low quality. Around 7% of students obtained all three marks for this question. The most common mistake was either to not label the excess copper oxide or to label it as being in the filtrate.

A number of students who drew both the funnel and the paper labelled either the funnel or the paper, but not both. Also a significant number used filter paper without a funnel. Some students labelled the funnel just 'filter' or 'filterer'. Some students drew the wrong part of the experiment, eg heating the mixture over a Bunsen burner.

05.6 In this question students had to select the correct piece of equipment for measuring a mass and a volume. Although around 60% scored both marks, some students did not appreciate the state of the reactants, with suggestions such as using a beaker to measure 25 cm^3 of sulfuric acid and using a metre rule to measure 2 grams of copper oxide.

05.7 About 1% of responses were credited with both marks with a fifth achieving one mark. The most popular answers were 25 and 0.25.

A significant number of students responded with 253/1 = 15 625.

Question 6 (low demand)

06.1 Around 78% of students answered with copper as is the material from which the wires in a three-core cable are made.

A significant number selected polythene, perhaps confusing the outer covering with the inner conductors. A small number of students thought that the wires were made of diamond.

06.2 The correct answer of zero volts as the potential of the earth wire was the least chosen response on this multiple-choice question. The most popular choice, given by around 35% of students, was 1.5 volts.

06.3 About 13% of the students gained both marks for identifying the colour of the plastic on the wires.

06.4 Half of the students were able to gain one mark, and around 15% scored both marks. Many students knew that plastic is an insulator or does not conduct and stops the person getting an electric shock.

Some students appeared to confuse the words ‘conduct” and ‘insulate’. Some wrote that plastic ‘absorbs the electricity’ (to make it safe), or that it is a tough material and stops the wires touching. Others said that it ‘stops the person touching the wires’, but didn’t say it prevents an electric shock.

06.5 Although most students could correctly calculate the power, many of these did not select the correct unit for power. A common mistake was to think that 4^2 is the same as 4×2.

Around 31% of students gained all four marks, with almost two-fifths gaining three marks.

Question 7 (standard demand)

07.1 Very few students knew that an enzyme is a protein molecule. The most common response was to say that it was a catalyst.

07.2 Over two fifths of students did not attempt any response to this question. Of those who did, very few attempted to describe a test for any sort of gas, and of these few the majority described the ‘squeaky pop’ test for hydrogen. Around 4% of students gained both marks.

07.3 About 2% of students gained both marks for this question. Around 29% of students left this question unattempted.

Of those who did attempt it, many could not name which indicator should be used. Those who did specify universal indicator often failed to say how they would determine the pH value from the colour indicated.

07.4 Around 47% of students could correctly interpret the data and state the optimum pH as 7.

07.5 About 30% of students chose the correct response of using smaller pH intervals. Almost a third of students thought that the pH range should be increased.

07.6 About 28% of students had not attempted this question. Of those who did, the mark most commonly gained mark was to say that the pH was too low. A few went onto say that the enzyme had become denatured, but hardly any referred to a change in the active site.

Common mistakes and misunderstandings included:

- saying that there wasn't enough or too little pH
- the idea that the reaction hadn't yet started.

Question 8 (standard demand)

08.1 Around 2% of students were able to give the resolution of the metre rule. Most students failed to realise that in order to quote the resolution of an instrument, both a number and a unit are required. In this question it was therefore insufficient to write down simply ‘1’ or ‘mm’.

Common incorrect answers included:

- 3 or 30 (with/without units) as that was the length of the paperclip
- 5 or 5 (with/without units) as that is the starting point of the paperclip
- 8 or 80 (with/without units) as that is the end point of the paperclip
- 10 or 100 (with/without units) as that is the last number on the ruler.

08.2 Around 13% of students managed to score one mark on this question, usually for saying that the paper clip was made of a magnetic material. Hardly any referred to the induced magnetism in the paper clip.

Common mistakes were:

- all metals are attracted by a magnet
- the paperclip is magnetic
- opposites attract – often said of forces, poles and charges.

08.3 Around 27% of students realised that it was important that all the magnets used should have the same strength and thereby gained the mark.

A common answer that was not creditworthy was to say that this would make it a fair test, without any further explanation such as keeping the experiment to a single independent variable. There was a general misconception that bigger magnets have a greater strength and smaller magnets are weaker.

08.4 Two fifths of students correctly suggested either 6.9 or 7.0 as an appropriate value. Several suggested 6.8, which would be too low.

08.5 Approximately 29% of students could provide a correct form of the equation linking resultant force, mass and acceleration. Most of the successful ones were those who made resultant force the subject of the equation.

Around 23% of students left the question unattempted and others wrote down equations linking entirely different factors.

08.6 More than a fifth of students calculated the value of the acceleration correctly. However, many of these were not able to provide the correct unit for acceleration.

The most common reason for not giving the correct answer was writing that:

$\text{acceleration} = \frac{\text{mass}}{\text{force}}$ instead of: $\text{acceleration} = \frac{\text{force}}{\text{mass}}$

08.7 About 31% of students knew that the part of the Earth in which movements take place is the outer core. Examiners allowed the student to say just ‘core’, but not ‘inner core’ as that is solid.

08.8 Around 3% of students gave a correct answer to this question and many students did not attempt the question. The most common reason given was global warming, followed by climate change, tectonic plates moving, earthquakes or the movement of land mass.

Question 9 (standard demand)

09.1 More than two-fifths of students could correctly convert metres into nanometres in this multiple-choice question.

09.2 Around 38% of students mistakenly thought that graphene could be used to produce polymers. Less than a fifth of students knew the correct answer: that graphene could be used in composites.

09.3 More than a fifth of students scored a mark by saying either that graphene was stronger or a better electrical conductor. A common mistake was to not refer to the comparative properties of the materials, eg saying that graphene is a good electrical conductor rather than being a better electrical conductor.

09.4 Some students wrote a lot that was often contradictory or irrelevant, eg the bonding was both ionic and covalent. Many answers comprised a page about electric motors and the need for lubrication.

How graphite was a good conductor was not well explained. Very few wrote about charge being carried or the electrons moving through the structure. The use of the word ‘electricity’ was often misused with students sometimes writing about electrons ‘carrying electricity’.

Nearly a third of students did not attempt this question with about 35% gaining one mark or more. Most marks were awarded for references to delocalised electrons and layers.

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.