GCSE
COMBINED SCIENCE: SYNERGY

8465/4H: Paper 4 – Physical sciences (Higher tier)
Report on the Examination

8465
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General

Questions 01, 02 and 03 were common with the Foundation tier paper

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.

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 (Standard demand)

01.1 Around one third of students gained the mark for this question. The most common error was to refer to the time taken, or 'how long it takes', to stop the car whilst braking.

01.2 Almost all students gave the correct equation. A few rearranged it incorrectly, possibly thinking that as gravitational field strength was mentioned first, they needed to rearrange it accordingly.

01.3 Almost 95% of students were able to perform the calculation correctly to score all 3 marks. The most common error was to multiply the two numbers instead of dividing.

01.4 Around two thirds of students scored all 3 marks. Around a further 10% gained 2 marks for correctly calculating the increase in reaction time, but failing to add it to the original time.

01.5 Over 40% of students gave good answers which got into the Level 2 bracket (3 or 4 marks) by comparing the increases in reaction times using a mobile phone with the increase when at the legal alcohol limit and addressing the issue of illegality. Those whose answers were of a Level 1 standard did not make reference to the legal alcohol limit.

Question 2 (Standard demand)

02.1 Around two thirds of students gave the correct answer of 36 cm^3. Common errors were:

- subtracting 36 from 100 to give 64
- reading upwards from 40 to give 44

02.2 Around three quarters of students gained at least 1mark, usually for saying that the gas would escape.

02.3 Around three quarters of students gave the correct answer of 80 seconds. The most common incorrect answer was 100 seconds, where the line ends.

02.4 More than three quarters of students gave the correct answer (higher gradient). The other two responses were fairly evenly divided.

02.5 It appeared that the test for hydrogen gas was not well known, with around 10% of students not attempting the question, and around 40% scoring no marks. A few described the ‘squeaky pop’ result without describing what would need to be done to give the result. A random selection of other tests was stated, e.g. glowing splint relights, limewater goes cloudy, litmus paper is bleached, cross under flask disappears.

Question 3 (Standard demand)

03.1 Around 10% of students scored both marks for this question. Many just stated facts about magnets and/or compasses e.g. opposite poles attract. Very few addressed the question as to what the student would need to do. Those who did describe the method usually got 1 mark for placing the compass near the magnet. Very few realised that the compass needle would point to the south pole of the magnet – the majority got it the wrong way round ‘the compass always points N so it would point to the N pole of the magnet’.

03.2 More than three quarters of students drew the correct diagram. The most common errors were drawing the arrows the wrong way round, or omitting them entirely.

03.3 Whilst many students realised that the poles would be at the two ends of the iron core, only around one quarter showed them the correct way round.

03.4 Almost 100% of students gave the correct equation.

03.5 Around 70% of students were able to perform the calculation correctly to score all 3 marks. A further 20% gained 2 marks for substituting into the equation and rearranging correctly, but were unable to deal with the powers of 10 correctly.

03.6 This question asked about acceleration changing but there were many answers which did not refer to acceleration at all – a common response was ‘it moves faster’. Answers which did mention acceleration often did not refer to the fact that the acceleration would increase, but just said ‘the acceleration changes because…’. Question parts do not usually stand in isolation, but follow on from the previous parts. In this case, the previous parts had been about the equation $F = ma$, so a good answer would refer to the magnetic force increasing as the paperclip got closer to the electromagnet, hence the acceleration would increase. Fewer than 15% of students gained both marks.

Question 4 (Standard and standard/high demand)

This was an extended response 6 mark question relating to a life cycle assessment (LCA) for paper and plastic shopping bags. Many students merely stated in words the information which was given in the table, or made simple comparisons such as ‘the mass of a paper bag is greater than the mass of a plastic bag’. This limited them to Level 1 (1 or 2 marks). Around 25% of students fell into this category. To achieve Level 2 (3 or 4 marks) students needed to make some links or ‘add value’ to their statements. Such links could be quantitative comparisons of the resources needed, or extra information such as ‘the raw material for the paper bag is wood, which is renewable, whereas crude oil for the plastic bag is non-renewable’. The majority of students made these extra points. A Level 3 answer (5 or 6 marks) needed a range of linked ideas, addressing most of the aspects of the LCA. It would also need to have a ‘judgement’, such as ‘plastic bags are better in terms of the resources used in manufacturing’ or ‘paper bags are better in environmental terms’. Fewer than 10% of students gained a mark in Level 3.

Question 5 (Standard/high demand)

05.1 Fewer than one fifth of students scored the 2 marks for this question. Some tried to give an explanation, although the command word was ‘describe’. Explanations tended to show a lack of understanding of electrical circuits. There were some incorrect expressions such as ‘current goes faster’ and ‘potential difference moves’.

05.2 More than 90% of students failed to score any marks, with around 2% scoring both marks. The question asked about the resistance. Many just described the relationship between current and potential difference, and did not address resistance at all. Others stated that ‘as the potential difference increased, so did the current, so the resistance…’ - there was a fairly even split between ‘increased’ and ‘decreased’.

05.3 Around two thirds of students failed to score any marks. Whilst a number of students said that the temperature was not constant, or the temperature was affected, few specified that the temperature would increase. Some realised that if the current had decreased, the resistance must have increased, but then did not link this to an increase in temperature.

05.4 This was a 4 mark extended response question, where students were asked to describe an experiment. Around 6% of students described a reasonably coherent method which would lead to a valid outcome. A few attempted to describe the experiment to investigate the resistance of different lengths of wire. Many just described what (they thought) would happen to the total resistance when more resistors are added in parallel, rather than describing a method.

Question 6 (Standard, standard/high and high demand)

06.1 Around half of students chose the correct response, that the equilibrium position shifts towards the side with the smaller number of molecules. The next most popular response was ‘towards the side with the larger number of molecules’.

06.2 Fewer than half of students chose the correct response (relative amount of ammonia decreases). The next most popular response was ‘increases’.

06.3 Around one quarter of students did not attempt this question, and around one fifth scored the mark. Incorrect answers included strong, insulated, heatproof, large surface area. There were also a number of answers which did not address the question.

06.4 Around one third of students scored at least 1 mark, usually for stating that the relative amounts would stay the same. However, very few were able to give a correct reason.

06.5 Around one third of students scored at least 1 mark. Whilst these students had the correct idea, they did not necessarily gain both marks because of unclear expression.

06.6 Around 15% of students were able to gain full marks by performing the calculation correctly. Many students (around 40%) scored 1 mark for working out the M_r value of NH_4Cl but then did not know what to do with it and left it as their answer. Another common error was to multiply this M_r value by 6.8.

Question 7 (Standard, standard/high and high demand)

07.1 Those who picked the correct transformer equation were generally able to perform the calculation, and nearly 70% scored all 3 marks. The main error was trying to use the equation $P = I V$ for the primary coil without equating it to P in the secondary coil.

07.2 Around one half of students performed the calculation correctly to score 3 marks. A further one third gained 2 marks for a correct calculation, but failing to convert the time from seconds to minutes.

07.3 Around four fifths of students failed to score any marks. Only a few students appeared to understand that the electrician was earthed, or at 0V potential. Even fewer stated that there was a potential difference between the circuit and the electrician. A number scored one mark for saying that charge would flow through the electrician. ‘Current’ was acceptable for ‘charge’, but ‘electricity’, which many students used, was not acceptable.

07.4 Around one quarter of students gained 1 mark, with fewer than 1% scoring 2 or 3 marks. Many students did not appear to understand the table. Quite a few answers did not relate to pain at all, but talked about electrical appliances operating better with a larger current. Many answers seemed to indicate that a lower current causing pain was an advantage and therefore tried to explain why a supply which gave higher current values was better. Those who understood that the 50Hz supply gave pain at a lower current often did not compare both of the other two supplies.

Question 8 (Standard, standard/high and high demand)

08.1 Around 90% of students failed to score a mark. Where a mark was scored, it was usually for saying that Mg lost electrons, which is oxidation. Hardly any answers referred to hydrogen ions gaining electrons thereby being reduced. Whilst a number realized that oxidation and reduction involved losing and gaining electrons, these were often given the wrong way round.

08.2 Around one third of students chose the correct response (pH increases by 1). The most popular incorrect response was 'decreases by 1'.

08.3 It appears that many students do not know what an ionic equation is, with more than one quarter not attempting this question. The few who got the equation correct often did not include state symbols, or put them incorrectly. As a result, fewer than 3% of students scored both marks.

08.4 More than four fifths were able to give at least one observation. The most popular observation was fizzing or bubbling. Some students wrote things which were not observations, such as 'a gas is produced', 'the temperature increases' etc.

08.5 Around one third of students gained one mark for recognizing that the solution was alkaline, however very few gained more than one mark. Many answers indicated that, as potassium was in the group of alkali metals, it was itself alkaline. Very few stated that the alkalinity was as a result of hydroxide ions, or that potassium hydroxide was formed.

08.6 Whilst a number correctly chose option Z, only around 3% of students were able to explain why they had chosen it. Quite a few just said 'it is a weak acid with the highest concentration', repeating the question. The idea of a weak acid being only partially ionised was rarely mentioned. A few students said that Z had more particles but did not explicitly link this to the concentration. Many did not know what the circles represented – protons, electrons, neutrons, atoms, acids, alkalis were all mentioned.

08.7 Around 10% of students gained one mark, usually for saying that the model showed the particles in 2D not 3D. Very few mentioned that the sizes of the particles were not shown to scale.

Question 9 (Standard, standard/high and high demand)

09.1 The majority of students were able to manipulate the equation correctly, although most did not convert the 25g to kg, or incorrectly converted it. Around one-quarter scored all 4 marks, with a further 50% scoring at least 1 mark.

09.2 The vast majority said that as the mass increases, the acceleration decreases – a true statement but not showing inverse proportionality. Hence, around 90% gained no marks. A very few students used data to show that as the mass doubled, the acceleration halved. It was very rare to see students using the data to find the value of a constant of proportionality.

09.3 Fewer than 10% of students gained the mark. The majority of incorrect answers were along the lines of making the table smooth. Only a few said to lubricate the axle or wheels. Quite a few students said about putting the trolley on a ramp, or tilting it, but did not get credit unless they referred to the idea of compensating for friction.

Question 10 (Standard/high and high demand)

10.1 More than one third of students gained the mark, either for writing the equation, or stating the relationship in words. Many students stated 'as the force increases, the extension increases'. A true statement but insufficient to describe the relationship.

10.2 Most used the correct equation but quite a few then struggled to rearrange it correctly. Those who did a correct rearrangement often failed to convert the extension from cm to metres. Around three-fifths of students gained 2 or more marks.

10.3 This was a high demand question at the end of the paper, so it was not surprising that around 1% of students gained all 3 marks. Nevertheless, many students attempting this high demand question. Some approached the problem by saying the two stones would have the same momentum, which is incorrect. Some said that the two stones would experience the same force (a correct statement) and then tried to build an argument based on F=ma and speed, which didn't work out. Quite a few students realised that the elastic potential energy and therefore the kinetic energy, would be the same for both stones. The few who pursued this idea by substituting numbers into the kinetic energy equation were sometimes able to score all 3 marks.

10.4 Around 10% of students scored one mark, but very few scored 2 marks. The most common answers were along the lines of 'it would make the conclusion more accurate' or 'you could spot anomalies easier'. A few referred to drawing a line of best fit more accurately, so scored 1 mark. Very few realized that the additional readings would 'fill in the gaps' on the graph.

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.