



GCSE

Combined Science: Synergy

8465/4F Paper 4 Physical Sciences Foundation Tier

Report on the Examination

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General comments

There were 10 questions on this paper. Questions 1, 2, 4, 6, 8 and 10 were physics content, and the others were chemistry. The questions are designed to increase from low demand to standard demand through the paper.

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.

Questions 8, 9 and 10 are common with questions 1, 2 and 3 on the Higher tier. These questions are identical with each other and are targeted at standard demand.

Question 1 (low demand)

- 01.1** More than two-thirds of students chose the correct direction of the wind. The most common incorrect response was upwards.
- 01.2** More than half of students chose the correct response of 'upthrust'. The most common incorrect response was air resistance.
- 01.3** The most popular response was the incorrect answer that the resultant force was the tension in the rope. The least popular response, given by about 20% of students, was the correct one, that the resultant force was zero.
- 01.4** The vast majority of students were able to substitute the given values into the given equation for weight and calculate the answer correctly, scoring 2 marks. A few substituted correctly but then did not proceed further, perhaps indicating that they did not have a calculator. A few substituted correctly but worked out the answer incorrectly.
- 01.5** The vast majority of students were able to substitute the given values into the given equation and calculate the spring constant correctly. Most were able to identify the correct unit from the given list. This resulted in around two-thirds of students gaining all 3 marks.

Question 2 (low demand)

- 02.1** Although some students gained a mark for realising that the current was the same in both components, very few scored the second mark for identifying that it was a series circuit. Incorrect answers tended to be equally split between the other two options. Typical reasons given were

that the heater was closer to the mains supply so would have a larger current, or that the motor would have a larger current because the fan would push the current along.

- 02.2** Around one-third of students correctly identified the potential difference as 210 V, and were often able to explain that the individual potential differences added up to that of the mains supply. The most common incorrect answer was 20 V because it was the same as for the motor.
- 02.3** The vast majority of students were able to substitute into the given equation and calculate the power correctly.
- 02.4** The vast majority of students were able to substitute into the given equation and calculate the time.
- 02.5** The least popular response, given by about 10% of students, was the correct answer of 50 Hz. The most common choice was 230 Hz.

Question 3 (low & standard demand)

- 03.1** Around 20% of students did not attempt this question - possibly not realising it was a question as there was no answer line. Many completed the diagram by showing two dots/crosses in various places, with about one-third positioning them correctly. Other answers had varying numbers of dots/crosses or additional atoms drawn in.
- 03.2** Around one-third of students balanced the equation correctly. The most common incorrect response was 4HCl .
- 03.3** Every simple mathematical combination of the two given values was seen, the most common being multiplication. Around one-quarter of students correctly subtracted the numbers to calculate the mass of chlorine reacting.
- 03.4** Many students did not seem to be aware that the question was referring to the bonds, and answered in terms of the structure of a molecule of ammonia. Those who realised what the ‘-’ symbol represented often did not know the correct term, giving answers such as linking, joining together, etc. Around one-quarter of students scored the mark.
- 03.5** Many students did not seem to know what was meant by ‘formula’ and attempted to write equations, names of elements and compounds, amongst other things. Those who made an attempt often used lower case letters, incorrect numbers, or superscript numbers. Around one-third of students scored the mark.
- 03.6** About 15% of students scored two marks for this equation. Others scored one mark for writing the correct reactants producing the correct product or for drawing the reversible symbol. Many students attempted to use formulae rather than words, mostly without success. Quite a large number wrote word equations for other (often made-up) reactions, sometimes totally unrelated to the question.

- 03.7** Around one quarter of students left this unanswered. A minority gave the correct answer of temperature. Many of the other answers referred to adding or taking away one or more of the reactants or product.

Question 4 (low demand)

- 04.1** The vast majority of students chose the correct response, the gradient increases. The other two responses were chosen equally.
- 04.2** The most common response was incorrect, 'the speed increased'. The correct response, 'the speed stayed the same', was chosen by about one-third of students.
- 04.3** This was very well done, with three-quarters of students gaining all three marks for calculating the mean speed.
- 04.4** About half of students gave the correct response, 'weight stayed the same'. The incorrect responses were fairly evenly divided.
- 04.5** About two-thirds of students chose the correct response, 'air resistance increased'. 'Air resistance decreased' was the most common incorrect choice.
- 04.6** The three responses, which compared the magnitude of the weight and air resistance, were chosen by approximately equal numbers of students.
- 04.7** The correct graph for terminal velocity was chosen by around one-fifth of students. The other two incorrect responses were fairly evenly divided.
- 04.8** The calculation of deceleration was very well done, with around three-quarters of students scoring both marks. The choice of unit was fairly evenly divided between the correct m/s^2 and the incorrect m/s .

Question 5 (low demand)

- 05.1** Around 75% of students correctly identified 'measuring cylinder' and 'stop clock' to gain two marks. A number of others gained one mark for choosing one or other of these along with an incorrect response.
- 05.2** Many students did not attempt this. Around one-quarter of students gave the correct answer, 'universal indicator'. Incorrect responses included a variety of other indicators, tests, or measuring instruments.
- 05.3** Around one-quarter of students did not attempt this. Around 5% knew 'pH meter' or 'pH probe'. As with the previous question, incorrect responses included a variety of other indicators, tests, or measuring instruments.

- 05.4** Approximately 10% of students realised that the fizzing was due to the carbon dioxide gas produced. The most common responses were along the lines of ‘because the chemicals are reacting together’.
- 05.5** The majority of students answered correctly by referring to eye protection such as goggles or safety glasses.
- 05.6** About one-third of students correctly identified ‘7’ as the pH of a neutral solution. ‘4’ was the next most common response.
- 05.7** Many students did not attempt this question, some students used the diagrams to describe a basic method, but many did not appear to understand the process. Often names of basic equipment were not known. Better answers named the residue on the filter paper and the liquid filtrate. A large number of these students did not refer to heating the calcium chloride solution to crystallisation point, then leaving to evaporate naturally.

Question 6 (low & standard demand)

- 06.1** Most students scored the mark for identifying a ruler or measuring tape for measuring length. A number of answers, eg ‘crocodile clips’, ‘measuring cylinder’, ‘ammeter’, indicated that some students had not understood what the question was asking.
- 06.2** Around 60% of students gained the mark for drawing the best fit straight line through the given points. Those who did not score had usually attempted to draw the line freehand, resulting in thick and/or uneven lines.
- 06.3** Around 75% of students gave the correct answer of 20Ω . Those students who did not gain the mark either mis-read the scale on the y-axis or gave the value corresponding to a length of 80 cm.
- 06.4** Some students gained one mark for referring to either the straight line or it passing through the origin, but very few gained both marks. The most common answer was ‘the resistance increases as the length increases’ – this did not gain any marks.
- 06.5** Most students realised that the temperature of the wire would increase if the circuit was not switched off. A small minority thought it would decrease or stay the same.
- 06.6** Fewer than one-third of students gave the correct answer that the resistance would increase if the circuit was not switched off. Many students thought that the resistance would decrease. A significant number did not answer the question asked but gave responses such as ‘the results wouldn’t be accurate’, ‘the wire would get weaker and break’.
- 06.7** All three responses were fairly evenly split, with slightly fewer choosing the correct response of ‘a zero error’.

Question 7 (low & standard demand)

- 07.1** Very few students gained both marks. Around half scored one mark, usually for identifying bubbles at the positive electrode. Many answers did not refer to observations, as the question asked, but attempted some explanation of electrolysis. A number of students repeated the information given in the question, referring to the product at each electrode. Some students stated alternative products such as hydrogen, sulfur and silver.
- 07.2** The most common response was the incorrect ‘copper is more reactive than hydrogen’. Around one-third of students chose the correct response.
- 07.3** The best answers were the ones which used the wording given in the question, eg ‘as the time increased the mass of copper produced increased’. Some students negated this type of answer by referring to incorrect values, eg ‘as the time goes up each time, the mass of copper goes up by 8’.
- 07.4** Around 60% of students realized that 0.20 g was midway between 0.16 g and 0.24 g, therefore the time would be midway between 240 s and 360 s, ie 300 s. A variety of other calculations was seen to produce a range of answers ranging from 0 s to over 600 s.
- 07.5** Approximately 75% of students were able to perform the calculation correctly. A common mistake amongst those who did not score marks for the calculation was to cube the volume of 0.5 dm³. About half of students identified the correct unit, with dm³/g being the most popular incorrect response.
- 07.6** Around one-quarter of students did not attempt this percentage calculation. Of those who made an attempt, many appeared not to know how to perform a percentage calculation; most took the given values and added, subtracted, multiplied or divided combinations of the values. A small number gained all three marks and a smaller number gained two marks for performing the calculation correctly but failing to put the answer to three significant figures.

Question 8 (standard demand)

- 08.1** More than 10% did not attempt this question to identify the shape of the magnetic field. Of the incorrect answers given, ‘iron rod’ and ‘rectangular coil’ were commonly seen. ‘Magnet’ was an the most common answer, but was insufficient, as there are various shapes of magnet. Fewer than 2% gave the correct answer of ‘bar magnet’.
- 08.2** Most students did not explain, or did not realise, that the iron rods would become magnetised. A common misconception was to say that there was an electric current in the two rods. Some students were able to gain a mark for saying that the two rods had the same magnetic poles next to each other, causing them to repel. A common mistake was that opposites repel. A very common mistake was saying that the rods were charged.
- 08.3** Nearly one-fifth of students left this unanswered. Around one-quarter gained the mark for saying that copper is not a magnetic material. A variety of incorrect reasons were seen, such as copper not being a metal, copper not being able to conduct electricity and copper being a good conductor of heat.

- 08.4** It appeared that many students did not understand what the question was asking. Around one-fifth did not attempt an answer. There was a range of incorrect answers, including copper/iron, input/output, repel/attract, positive/negative and many others. Around one-quarter realised that ‘identify magnetic poles’ meant saying which one was a north pole and which was a south pole.
- 08.5** Around three-quarters of students chose the correct reason for the newtonmeter reading.
- 08.6** Quite a few students realised that when the power supply was switched on, the electromagnet would attract the iron disc – this enabled them to score one mark. However, few went on to explain how increasing the current would increase the strength of the magnetic field, thereby increasing the force on the iron disc. Very few answers had the correct idea, but merely said that the electromagnet would become stronger, which was insufficient to gain a mark.
- 08.7** Around one-fifth of students left this unanswered, perhaps because they did not realise that the wording at the top of page 37 was part of the question. Incorrect answers included extending the given line, lines drawn below the original, straight lines drawn above the original, curved lines above the original which then became vertical or curved backwards. Of the few who drew a good curve above the original, many did not start the line at 2.0 N.

Question 9 (standard demand)

- 09.1** It was apparent that many students understood the concept of control variables. However, many of them failed to score marks because of their lack of scientific vocabulary. For instance, ‘amount of acid’ was frequently seen instead of ‘volume’. Similarly, ‘how much metal’ was a common answer instead of ‘mass of metal’.
- 09.2** This was well done with around three-quarters of students gaining the mark.
- 09.3** A fair number of responses linked back to the previously described experiment, saying that the test for hydrogen was if bubbles were present when the metal was added to acid. Some answers which attempted to describe a test for a gas gave the tests for carbon dioxide, oxygen or chlorine. Many students knew the ‘squeaky pop’ test; however, many failed to score marks as they did not state that a burning splint needed to be applied to the hydrogen in order to produce the pop noise.
- 09.4** More than half of students did not attempt this question - possibly because they did not realise it was a question, or possibly because they were not familiar with the apparatus shown. Of the few who attempted to add to the diagram, most labelled parts of the apparatus or added a thermometer. Of the very few who attempted to draw something like a delivery tube, fewer than 3% achieved this correctly.
- 09.5** Whilst some students appeared to have some idea of what to measure, they often failed to score because of imprecise language, eg ‘collect the gas’, ‘measure up the side of the cylinder’, ‘how long it takes’.

- 09.6** Around one-quarter of students did not attempt this question. Of those who wrote something, very few gave the correct unit. Common incorrect units given were cm^3 and s/cm^3 . Some units were unrelated to the experiment, eg N, Bq and some were not units at all, eg 100, motor.

Question 10 (standard demand)

- 10.1** About one third of students chose the correct symbol for the thermistor, and a slightly lower number chose the LDR symbol. The remaining two circuit symbols were fairly evenly split, accounting for the remaining one-third of responses.
- 10.2** Very few students related $20\text{ }^\circ\text{C}$ to room temperature. The most common answers were that the resistance would be too high or that the resistance would be too low.
- 10.3** Approximately one-third of students did not attempt this question, possibly because they ran out of time, or possibly because they failed to understand what the question was asking. A large number scored no marks. Of these a considerable number did not describe an experimental procedure, but referred to drawing a table to put results into. Of those who attempted to describe a practical method, many failed to include changing the temperature. Additionally, the method of measuring resistance using an ammeter and voltmeter did not seem to be known by many students.
- 10.4** Around 80% of students gave the correct equation from the given Physics Equations Sheet, although some chose the equation for charge flow and some for power.
- 10.5** Of those who attempted the question, most did not use the graph to find the resistance at $40\text{ }^\circ\text{C}$ but multiplied or divided the potential difference and temperature. Those who read a value from the graph often mis-read the scale. A small percentage of students calculated the current correctly and scored all 4 marks.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the [Results Statistics](#) page of the AQA Website.