



GCSE

Combined Science: Synergy

8465/4H

Report on the examination

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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.

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

Question 1 (standard demand)

- 1.1** Many students were able to get at least one mark for 'as force increases, extension increases'. Very few referred to a linear relationship, but a large number referred to a directly proportional relationship, thus gaining two marks.
- 1.2** Q1.2 Around half of the students did not gain a mark, with the majority of these opting for spring A. Of those who correctly chose spring C, there were many explanations which were too imprecise to gain the mark, e.g. 'it has the least extension' but not specified 'for a given force'. Some students calculated the three spring constant values; a few used $k = \text{extension} / \text{force}$ rather than $k = \text{force} / \text{extension}$.
- 1.3** Q1.3 Many students recognised the equation needed was for elastic potential energy. Many were able to substitute and rearrange correctly to get the correct answer, thus scoring 3 marks. Some substituted into the equation correctly, scoring a mark, but then were unable to rearrange correctly. Not many gave the correct unit of N/m; N/m² was the most popular choice.
- 1.4** Q1.4 Responses were fairly evenly distributed. There were fewer correct responses than the incorrect 'work done is less than elastic potential energy stored'.

Question 2 (standard demand)

- 2.1** Most students recognized that a green colour could also be pH6 or pH8 in addition to pH7. Incorrect answers indicated that students had not followed the instruction to refer to the given chart.
- 2.2** A wide variety of answers was seen, encompassing many items of laboratory equipment. Acceptable answers were pH probe, pH meter and pH sensor, answers given by fewer than one-third of students. It was obvious that some students had seen

a pH probe, but could not remember the name, with variations of 'digital pH reader' and 'electronic pH detector' being named.

- 2.3** Both 'neutralisation' and 'exothermic' were acceptable answers, given by around half of the students. 'Chemical reaction' was a popular incorrect answer, as were 'oxidation', 'reduction', 'endothermic' and 'displacement'.
- 2.4** The vast majority were able to calculate the relative formula mass correctly. Of the few who were unable to score, the main mistakes were either neglecting to multiply 16 by 3 or adding together the given relative atomic masses and multiplying the sum by 3.
- 2.5** Around half of students chose the correct answer of OH^- . H^+ was the next most popular choice, with only a small number of students choosing the other two responses.
- 2.6** Around one-third of students scored all 3 marks, although a fair number gained 2 marks for a correct calculation with an incorrect conversion of either the volume or the concentration, or no conversion at all

Question 3 (standard demand)

- 3.1** Almost all students were able to perform this calculation correctly.
- 3.2** Not surprisingly, given that students had access to the equations sheet, almost all students chose the correct response.
- 3.3** Almost all students were able to perform this calculation correctly. There was some carelessness in writing the correct number of zeroes, either in the given value of power or in the answer.
- 3.4** Fewer than half of students gave the correct answer of 14 hours. Those who gave a value of time often just read either the first 6 hours, or the last 8 hours. Some answers indicated that students were referring to the electrical power rather than the time.
- 3.5** Many students did not gain any marks because they just repeated, or put into their own words, the information given in the question. The question prompted students to use information from the graph; many students ignored this, thus preventing them from gaining a mark in Level 2. Better answers referred to specific times when the solar panels were supplying energy to the village and charging up the battery, and specific times when the battery was also supplying energy.

Question 4 (standard and standard/high demand)

- 4.1** Whilst most students had the correct idea, many did not score the mark because their answers were absolute – 'to stop gas escaping' rather than 'to minimise the loss of gas'.
- 4.2** Whilst many students had the correct idea, a large number did not score the mark because of imprecise terminology, eg 'amount' instead of 'volume' or 'mass'. Quite a

few answers referred to items of equipment, such as 'conical flask' and 'gas syringe' as being control variables.

- 4.3** Around three-quarters of students chose the correct response, with most of the incorrect responses being 'to prevent a systematic error'.
- 4.4** The plotting of the points was done very well. The drawing of the line of best fit was not done well on the whole. Many students drew a straight line, usually omitting the point at the origin. Others connected individual dots with straight lines, and some drew curves which included the anomalous point.
- 4.5** Many students realized that the rate of reaction would increase. Fewer stated that the surface area would be greater. Very few referred to collisions, with even fewer referencing the increased frequency of the collisions.

Question 5 (standard and standard/high demand)

- 5.1** The question asked 'describe how the energy stores of the aeroplane and spring changed ...'. Many students scored no marks because they did not refer to energy, instead describing the motion of the plane. Other answers referred to 'energy' without naming the stores and often without describing a change. Around 30% of students gained two marks for correctly stating that the elastic potential energy of the spring decreases and the kinetic energy of the aeroplane increases. Only a small number referred to energy being dissipated to the surroundings, scoring the third mark.
- 5.2** Many students were able to substitute into the correct equation, rearrange and calculate an answer. Around 35% of students gained all four marks for doing this and converting the distance to metres correctly. A further 50% gained three marks, as they did not do the conversion.
- 5.3** The command word in this question was 'describe'. However, many students did not realise that they needed to describe what the graph was showing, attempting explanations involving gravity and air resistance without referring to the connection between launch angle and distance. Some students appeared to think that the graph was showing the trajectory of the plane – 'it rises into the air and then gravity pulls it down again' and similar statements. Only about 15% scored three marks, with a further 30% scoring two marks.
- 5.4** The command word in this question was 'explain' so answers which did not have a correct explanation did not score. Around 50% of students gained both marks.

Question 6 (standard and standard/high demand)

- 6.1** Many students gained a mark for 'high temperature', but 'it needs to be hot' was insufficient to score the mark. Fewer than 10% also gained a second mark for referring to a catalyst or to steam. There were a number of answers which indicated that the students thought that cracking was the same as fractional distillation.

- 6.2** Around two-thirds of students gained one mark for explaining that cracking breaks down larger molecules into smaller molecules. The second mark was more difficult to achieve – many students merely repeated the wording ‘to meet the demand for fuels’ which was stated in the question, rather than comparing the low demand for long chain molecules with the higher demand for short chain molecules.
- 6.3** A wide variety of answers was seen, most of which were incorrect. Of the correct answers, ‘making polymers’ or similar expressions, was the most commonly seen.
- 6.4** Around 40% of students gained all 3 marks for this calculation. Many others understood how to work out the energy change but made mistakes either in the addition or by missing out or adding in bonds. These students were able to score 1 or 2 marks, accounting for a further 30%.

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

- 7.1** Not surprisingly, given that students had access to the equations sheet, almost all students chose the correct response.
- 7.2** More than half of students performed the calculation correctly. Most of these showed clearly the substitution into the kinetic energy equation, then the rearrangement, then the working to give the answer. Some students struggled at the rearranging stage, others forgot that the equation involved the square of the velocity.
- 7.3** Very few students were able to quote ‘total momentum before collision = total momentum after’ with only just over 10% gaining the mark. Some answers showed some understanding, for example ‘the white ball transfers its momentum to the black ball’. Many answers referred to energy and/or force.
- 7.4** Around 5% of students did not attempt this calculation. Most students who made an attempt did not seem familiar with the concept of momentum conservation, many attempting to use equations of motion. Those who used the equation for momentum often mistook the given velocity for the momentum. Others subtracted the two given velocities, rather than working out the two values of momentum and subtracting those. Around 10% of students gained full marks.

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

- 8.1** The correct two responses were chosen by about one-fifth of students. Around 60% of the responses were ‘mass of glider’ and ‘time for card to pass light gate’ which therefore scored one mark.
- 8.2** Many students did not appear to know how to work out the uncertainty. Some calculated the mean, often incorrectly, and put this as their value of uncertainty. Others did the same with the range. Only about 6% scored both marks for correctly using their value of mean or range to calculate uncertainty.

- 8.3** The majority of students, around 90%, did not gain any marks for this question. Most of these answers stated 'as the mass increases, the acceleration decreases, so it is inversely proportional' or words to that effect. A small number went on to quote ' $m \times a = \text{a constant}$ ' for which they were awarded 1 mark but did not back it up with data from the graph. Fewer than 1% scored all 3 marks.

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

- 9.1** Around half of students gave the correct answer for the general formula for alkanes. Many of the incorrect answers featured 'n' and '2' in some combination, e.g. $2+n$, $2n$, n^2 , whilst others contained random numbers and symbols for other elements.
- 9.2** A value in the range -10°C to 10°C was accepted; nearly two-thirds of answers fell within this range.
- 9.3** The vast majority of students were able to gain one mark for correctly describing the trend in the boiling points. Some students were confused by the negative numbers and thought that the boiling points were decreasing down the table. The command word in this question was 'explain' - many students did not attempt an explanation. Explanations, when attempted, usually referred to stronger bonds being broken; the bonds referred to were within the molecule itself, rather than the forces between molecules. Surprisingly, for a higher tier paper, quite a few students referred to carbon 'molecules' or alkane 'atoms'.
- 9.4** Very few, just over 10%, gained all three marks for balancing the equation correctly. A further 20% gained one mark, usually for realising that combustion involved the propane reacting with oxygen. The vast majority of students, however, did not realise that combustion of a fuel was a reaction with oxygen, producing the products carbon dioxide and water.
- 9.5** Around three-quarters of students showed some knowledge of fractional distillation, but explanations tended to be partial, with fewer than 10% gaining all four marks. Those who gave a partial explanation often gained marks for realising that the heated crude oil evaporated, and for explaining that the fractions were separated because of their different boiling points.
- 9.6** Around 70% of students chose the correct response, with a further 20% opting for the incorrect '...least viscous...and...highest boiling point'.

Question 10 (standard/high and high demand)

- 10.1** Very few achieved a Level 2 answer, describing a method which would lead to a valid outcome, with key steps identified and logically sequenced. Common statements were that the voltmeter reads resistance, or that the resistance can be read from the variable resistor. Some answers appeared to be referring to the experiment involving the resistance of a wire varying with length.

- 10.2** Around two-thirds of students gained full marks for this calculation, firstly working out the current from the given information, and then calculating the power. Some were able to work out the current but either thought that was the final answer, or did not know how to proceed further.

Mark Ranges and Award of Grades

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