GCSE
COMBINED SCIENCE: SYNERGY

8465/4H: Physical sciences Higher
Report on the Examination

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General

There were nine questions on the paper with questions 1–3 being common with the Foundation tier. A wide range of marks was obtained by students.

Standard demand calculations were generally well attempted, where the preceding question asks students to write down the required equation. A number of students attempted to write the equation down in the order of the quantities in the question, which are alphabetical, which is not needed. Therefore, many students therefore didn't score the equation recall mark but then did use the equation correctly in the subsequent question, scoring full marks. Students can write the equation down in any correct rearrangement or using the correct symbols for the quantities. At this level students are expected to be able to either rearrange an equation or convert a unit, so it is beneficial for students to be able to quickly identify if the units given in a question are correct for the use in the equation.

The extended response question 03.3 was generally well attempted and students who understood the four stages of Life Cycle Assessments scored well on this question.

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 84% of students recalled the equation correctly. The quantities in the question are listed alphabetically and there is no need for students to recall the equation in this order. Any correct rearrangement is creditworthy. A fairly common correct rearrangement was:

$$\text{distance} = \frac{\text{work done}}{\text{force}}$$

01.2 83% of students scored three marks on this calculation. Students who struggled had often recalled the equation incorrectly in the prior question. Some students made spurious unit conversions before substituting.

01.3 80% of students correctly recalled the equation. The quantities in the question are listed alphabetically and there is no need for students to recall the equation in this order. Any correct rearrangement is creditworthy.

01.4 61% of students scored four marks and 23% scored three marks. The unit mark was independent, but needed to be seconds to score the mark if the calculation was incorrect. A correctly calculated value given in minutes, with minutes as the unit scored all four marks.

Question 2 (standard demand)

02.1 31% of students scored two marks and 60% of students scored one mark for this question on energy transfer.

02.2 1% of students scored four marks and 2% scored three marks. Many students mixed up mass and weight and the way in which each should have been measured, which limited them to a Level 1 score. Since the student calculated the gravitational potential energy gained by each mass, measurements of current, potential difference and time were not needed so were treated as neutral responses. 22% of students scored two marks and 36% scored one mark.

02.3 Half of the students recalled this equation correctly. Abbreviations were not sufficient to score the mark. Some students confused total, output and useful and scored zero. The factor of 100 was allowed, provided it was in the correct position in the equation.

02.4 46% of students scored four marks. 6% of students scored three marks usually for not converting 15% to 0.15. The first mark for converting 15% to 0.15 was scored even if the subsequent efficiency calculation was incorrect. 11% of students scored one mark.

Question 3 (standard demand)

03.1 Some students mistakenly thought the number 1 meant the number of times it could be recycled. Few students indicated that it showed *how* it could be recycled; most answers stated that it could be recycled. Some students referred to putting it in the correct bin which was just enough for the mark. 8% of students answered the question correctly.

03.2 62% of students were able to calculate the mass of aluminium recycled each year from drinks cans and scored all three marks. Students who didn't put their answers in standard form scored two marks.

03.3 Generally, students were able to effectively summarise the information given in the table and complete some useful calculations. Many students failed to make a judgement on which material, in their view, was best for making the drinks container. This limited their score to Level 2 (3–4 marks). A question that uses the 'evaluate' command should include a judgement in order to score in Level 3.

Some student responses were excellent, including a strong judgement based on either an energy calculation or the issues surrounding the recycling part of the Life Cycle Assessment. 26% of students achieved Level 3, 68% achieved Level 2, and 4% achieved Level 1. The mean score for the question was 4.0.

Question 4 (standard & standard/high demand)

04.1 18% of students answered the question correctly. Common incorrect answers included changing the position or adding additional ammeters or voltmeters or making the circuit a parallel one. Closing the switch was another common answer that didn't score a mark.

Adding a resistor or another single component by itself was insufficient. Many students seemed to have limited knowledge of how changing the potential difference could be accomplished.

04.2 Some students understood why the circuit was switched off between readings, but they were in the minority. The component overheating was insufficient, as the experiment would not have been completed with high currents, but the variation in temperature of the component would have affected its resistance. Some students stated to ensure fair testing or accurate results, which were both insufficient.

8% of students scored two marks and 11% of students scored one mark.

04.3 43% of students identified the correct resolution.

04.4 The points were generally well plotted by students, although a number of students missed off the first point, so scored one out of the two marks for plotting.

30% of students added a correct line of best fit to score all three marks. Some students attempted a straight line of best fit; students should be aware in science exams that there is no prompt for whether the line is straight or curved. Other students drew a dot to dot line, when a continuous curve was needed. 42% of students scored two marks.

04.5 **A** third of students correctly identified the component.

04.6 55% of the students scored both marks for correctly sketching the graph. 7% scored one mark, usually for completing the positive quadrant line but leaving the negative quadrant blank. 6% of students did not attempt the question.

Question 5 (standard & standard/high demand)

05.1 Some students thought the oil was used to bind the ingredients together, which was insufficient. 'To give it a taste' was the least effective answer that was creditworthy. 45% of students were able to suggest a reason why peppermint oil is used in a tablet.

05.2 4% of students scored three marks. Many students scored two marks for this question with an answer of 0.762, ignoring the unit conversion.

The mark for significant figures was scored provided students made an attempt at a calculation, using the data in the question and correctly rounded their final answer. A fair number of students either ignored or didn't appear to understand what three significant figures meant.

05.3 The majority of students struggled to write a chemical equation for this reaction. 8% of students scored three marks, 1% scored two marks and 16% scored one mark.

Many students thought that a product of the reaction would be CO_3 which would mean they couldn't score the first marking point. Very few students knew that magnesium chloride was $MgCl_2$ so didn't score the second mark. Students who could write the symbol equation were usually successful in balancing it.

05.4 Students found this question difficult, with 16% being able to identify the dependent variable. This could've been because they focused on the method to identify the variable, rather than the simpler introductory sentence at the top of the page.

05.5 Students found this question to suggest and explain changes to the accuracy of the experiment difficult. The improvements suggested sometimes scored, but the reasons were often insufficient or spurious reasons.

The lid was a common correct answer, but to *stop* heat loss was not creditworthy. A number of students thought that replacing the polystyrene beaker with a glass beaker would help, because polystyrene is not a good insulator, when it is actually better than glass, so didn't score any marks.

11% of students scored two marks, 29% scored one mark and half gained no marks.

05.6 7% of students scored two marks and 73% of students scored 1 mark. Many students identified a line graph as the best way to display the results, but their reason for doing so was insufficient, to draw a line of best fit or to see a pattern being common responses.

Question 6 (standard, standard/high & high demand)

06.1 This question was set at the higher levels of demand. Students found it difficult to score many marks as it was an unfamiliar practical. Students who did score marks usually did so for methods of measurement and novel ways of detecting where the ball landed. A number of students misunderstood the investigation and stated that time of flight should be measured as well as how far the ball rolled.

Very few students achieved marks in Level 3, 12% of students achieved Level 2, while 51% achieved Level 1. 31% of students scored zero.

06.2 Student responses for this question were often insufficient to score a mark. 'They are anomalies' being a common response. The question asked why some of the points were not on the line of best fit, rather than asking for the term used to describe them. 'Inaccurate readings' was insufficient, but 'inaccurate readings of the horizontal distance' would have been just enough to score. 13% of students scored the mark for this question.

06.3 40% of students scored one mark on this question, usually for pointing out that the line should be straight, or that the line was curved and therefore the quantities couldn't be directly proportional. Few students also stated that the line should pass through the origin.

Some students thought that the two quantities on the axes should go up in the same values, revealing a misunderstanding about the directly proportional relationship. Some students referenced one pair of values, without quoting a second pair, and therefore scored zero. 13% of students scored two marks on this question.

Question 7 (standard/high & high demand)

07.1 36% of the students gave correct definitions for scalar and vector quantities and scored both marks. 18% of students scored one mark for identifying that scalar quantities didn't include direction, but vector quantities did, usually giving examples, which were ignored.

07.2 A large number of students did not understand the term 'conservation of momentum' and mixed up the idea of conservation with other environmental ideals like wildlife, trees, etc.

Those students who did understand the idea usually scored the second marking point. 13% of students scored one mark, while 2% of students scored two marks. A number of students confused the ideas of conservation of momentum with energy conservation, scoring zero.

07.3 This was very demanding calculation question. 8% of students scored full marks; some of these students set their calculations out as shown in the mark scheme. However, some students calculated the difference in momentum of person A (330 − 240=) 90 kgm/s and then divided this by the velocity of person B (2 m/s) which was probably a simpler way to complete the calculation. Students who didn't provide the correct final answer usually scored two marks for the calculation of 330 kgm/s. 66% of students received no credit for this question.

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

08.1 37% of students scored one mark in identifying the energy resources using falling water. Hydropower was insufficient, but a common response. Other insufficient responses were water mills and hydro dams.

08.2 9% of students were able to suggest an advantage of producing aluminium in Iceland.

08.3 Students found this reacting masses calculation difficult with 15% scoring four marks. Some students were able to start and score one mark for calculating the relative formula mass of aluminium oxide but gained no further marks for the rest of the calculation. 13% of students did not attempt the question.

08.4 Most students were unable to complete the half equation with 18% scoring one mark. Of those who provided incorrect answers many students wrote Al_2O_3 instead of Al^{3+}.

08.5 Students found it difficult to explain why cryolite was a mixture with approximately 68% of students scoring zero. Students mainly thought that the cryolite was there for conduction rather than melting point reasons. Other students thought it had to do with reactivity. 3% of students scored two marks, while 23% of students did not attempt the question.

08.6 Students found this question difficult with 3% scoring three marks and 13% scoring one mark. The idea of carbon and oxygen reacting was the mark that was most likely to score.

The second marking point was the least likely to be seen. Many students thought that carbon dioxide was given off as a waste product due to the burning of non-renewable resources. About 17% of students did not attempt the question.

08.7 This question proved to be a difficult question for students to answer. 14% of students did not attempt the question.

There were many incorrect responses relating to durability, conductivity, magnetism and charge of the electrode. High melting point was the most common answer to score, but many students didn't then point out that there would be (very) high temperatures in the electrolytic cell.

Students who scored the 'does not react with oxygen or aluminium oxide' mark often failed to state unreactive/inert/not reactive to score the property mark. 1% of students scored three or four marks, with 27% scoring one or two marks.

Question 9 (standard/high & high demand)

09.1 19% of students identified what the area under the graph represents.

09.2 This question differentiated well between students. There were some very effective answers from students who understood the relationship between forces and terminal velocity. However, most responses didn't score higher than two marks due to incorrect physics.

There were many confused explanations. Common incorrect responses referred to accelerating at a constant speed, mixing up ideas of forces and energy and relating unbalanced forces to constant speed. A number of students thought the velocity–time graph was a distance–time graph. Others thought the velocity–time graph was for the plane not the skydiver.

09.3 This was a very challenging calculation question. Some students scored two marks for the correct calculation of the kinetic energy. Some students scored one mark for the 3 500 000 J conversion. 1% of students put the two ideas together to arrive at a correct answer and scoring five marks.

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