GCSE

COMBINED SCIENCE: TRILOGY

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Report on the Examination

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General

This was the first series of the examination for the new specification. The majority of students made good efforts to answer all the questions. Most students were correctly entered for the foundation tier, however some students found the paper challenging.

As the content is split across two physics units, this paper is the one were the concept of energy is mostly assessed. Some students found it difficult to express themselves clearly. Using the energy stores approach has clearly lead to some confusion amongst students, with written answer now containing more misconceptions, and confused ideas that they did in previous series.

Students who identify a ‘type’ of energy in their answer will gain credit if it is clear that the ‘type’ actually refers to a store. Phrases such as ‘kinetic energy of the car increases’ or ‘thermal/heat energy of the water decrease’ would be interpreted as correctly identifying the change in an energy store by examiners. Some students found it very difficult to phrase their answers, and ended up contradicting themselves, or making their answer too ambiguous to gain credit.

To gain full credit on questions that refer to tables of data or graphs, students must use the data in their answer. Some students were not doing this, and usually failed to gain any credit. At low demand this can be a very simple statement such as ‘the use of coal decreased by 8%’. A considerable number of students did not even make simple statements when presented with data in various forms.

Levels of demand

Questions are set at two levels of demand on this paper:

- **Low demand** questions are targeted at students working at grades 1–3
- **Standard demand** questions are targeted at students working at 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 demand)

01.1 90% of students gained at least 1 mark and nearly 60% gained both marks for correctly choosing two renewable resources.

01.2 Fewer students showed an understanding of reliability with over 70% gaining no marks on this question. The majority of students ticked the box that gave the meaning of renewable.

01.3 Over three-quarters of students correctly determined the power of one turbine.

01.4 More than three-quarters of students gained at least one mark for describing or stating visual or noise pollution. 35% of students gained both marks. Some students made vague statements such as "they are big". Some students thought that the wind turbines acted as fans and would make the surrounding area windier.

01.5 This levels of response question produced a wide variety of responses. Fewer than 20% of students gained more than two marks; a similar number scored no marks with a significant number making no attempt at all. Most commented on the percentages supplied, but many students failed to expand their answer to give environmental impacts. For some students their written English impaired their ability to answer this question.

Students must read the question carefully and tailor their responses accordingly. Limiting the answer to comparing the two pie charts does not answer the question sufficiently but some credit was given for doing this – particularly if numerical comparisons were made. To access the higher marks, examiners were looking for explanations of the environmental impacts and clear logical linking between the changes and their effects.

There were frequent incorrect references to ozone layer depletion. Misconceptions about nuclear power were seen, such as carbon dioxide and toxic gases were emitted. The best answers made clear that decreasing use of coal and increasing use of renewables would decrease the amount of carbon dioxide and link this to the greenhouse effect and global warming.

Question 2 (Low demand)

02.1 This question tested students' understanding of energy stores which is new to this specification. 60% of students chose the correct answer.

02.2 A relatively straightforward calculation where the students were given the equation. Over 80% of students scored at least 2 marks and over 30% scored 3 marks. The most common incorrect unit given was the joule. Those who scored zero usually divided the quantities instead of multiplying them despite the equation being provided in the question.

02.3 If data is given in the question, it will be expected that students use the data in their answers. In this case, examiners were looking for numerical comparisons not just qualitative descriptions or simply quoting figures from the table.

26% of students scored on this question and most of those scored no more than 2 marks with a very small number scoring 3 or more.

Simple numerical comparisons such as 'twice as much mass' of '4 more charges' were given credit. Unfortunately, even these simple comparisons were rarely made. Those students that made quantitative comparisons tended to not make full comparisons between the compact and high capacity, therefore only scoring a maximum of 2 marks.

Some students provided outstanding responses and compared the mass and number of charges by calculating ratios. Some were able to analyse the charge/mass ratio correctly and form appropriate conclusions.

Question 3 (Low and Standard demand)

03.1 A straightforward calculation with a given equation. Students needed to use the height from the diagram and some did not do this and so only managed to calculate the weight but 83% of students scored both marks.

03.2 A slightly more difficult calculation but with a given equation, this question caused a few more problems with the squaring of the speed tripping up a few students but 76% were able to score both marks. A significant number made no attempt.

03.3 This multiple choice question about energy transfer proved difficult. A third of students gained both marks and just over a half scored one mark.

03.4 This question required an explanation in terms of the forces and the energy transferred. 57% of students scored zero and a only a tenth scored more than 1 mark. The concept of energy was not well understood. There were frequent references to generating more energy or increasing gravitational potential energy. Even when the students recognised that the lubrication would reduce friction, they failed to understand what effect this would have.

Question 4 (Low and Standard demand)

04.1 Very few students demonstrated an understanding of the purpose of the earth wire. The most common error was mentioning the insulation on the wires. There was a widespread misconception that earth wires are only found in 13A sockets. Many students commented that the light was on the ceiling and therefore was not near the earth.

04.2 56% of the students correctly recalled the equation. Some presented a symbol equation using incorrect letters.

04.3 67% of students obtained both marks for this item, although almost a tenth did not attempt it. The most common mistake was dividing rather than multiplying the quantities.

04.4 The majority of students scored zero on this question. Quite a number of students drew the characteristic graph for a filament bulb or a diode. Another common error was drawing a straight line with a negative gradient through the origin or a line drawn as a mirror reflection. Some drew lines parallel to the one given or drew curves.

04.5 Only 22% of students scored on this question and 11% did not attempt it. Many students put the symbol for a resistor or thermistor instead of the fuse. Some tried to draw a fuse rather than its circuit symbol.

04.6 Less than a fifth of students scored on this question. Many students had the idea of more energy/movement as the copper melted, but not adequate detail of the movement or arrangement before and after. Getting the 'moving freely' mark was more common than getting the 'fixed position/regular arrangement' mark.

04.7 75% of students scored at least two marks but only 1% scored three marks. In this calculation, students were required to choose the correct equation from the Physics Equations Sheet but a significant minority did not do this. Most students multiplied 200 × 500 and gained 2 of the 3 marks. Very few students performed the necessary unit conversion of 200 kJ/kg first while some converted incorrectly. Students should be aware that kg is the SI unit so does not need converting but in many other scenarios, any unit preceded by kilo will need converting by multiplying by one thousand. Another common mistake was getting the number of zeros incorrect.

Question 5 (Low and Standard demand)

05.1 In the first of three multiple choice questions about radiation the majority of students chose the correct answer for the most penetrating.

05.2 Just 51% knew the most ionising radiation.

05.3 46% knew which radiation has the longest range.

05.4 77% of students scored at least 1 mark and 66% scored both for correctly determining the number of protons and neutrons in the nuclei.

05.5 In this calculation, students were asked to choose the appropriate equation from the Physics Equations Sheet and most did so successfully. The majority of students gained all 3 marks. Some students did not use the correct temperature change. As in other questions, students should check the number of zeros in their workings and final answer.

Question 6 (Standard demand)

06.1 This question required students to label diagrams with given labels. A third of students gained all 4 marks.

06.2 Three-quarters of students scored zero on this item and only a tiny number gained both marks. Of the students who gained 1 mark, this was usually for identifying that a proton has a positive charge. Many answers were ambiguous or did not answer the question asked.

06.3 Students were required to calculate 7 per cent of the speed of light and many students managed to do this from either multiplying by 0.07, by 7/100, or by finding 10%, 5% and 1% or similar and adding appropriately. Occasionally the latter method led to a wrong answer because adding large numbers with plenty of zeros it was possible to slip a zero somewhere and so only the method mark was gained.
The most common mistake was students multiplying 300,000,000 by 7. Problems arose when students either used an incorrect method, struggled with the arithmetic, or went on to calculate 93% instead. 40% of students scored both marks, 48% scored zero while 10% made no attempt.

06.4 A fifth of students made no attempt at this question with a tiny minority scoring both marks. The range of values acceptable for full marks ensured that most students who knew what to do gained the 2 marks. A few students obtained an incorrect ratio – these could gain 1 mark if they then calculated correctly with their ratio value. Some students assumed that they needed to measure radii, these students were more likely to get an incorrect ratio with smaller measurements and the centre not clearly defined. Some appeared to choose a number to multiply by with no evidence of a ratio attempt, or even substituted the 2.5 from the hydrogen radius with a measurement of 7.5 or similar from the magnesium diagram. Powers of 10 were confusing for some students – some changed the 10^{-11} by multiplying, adding or subtracting this power.

Question 7 (Standard demand)

07.1 This levels of response question had three tiers. When students are asked to describe a plan or method, their answer must contain all of the key steps in a logical sequence and lead to a valid outcome. This practical is one of the required practicals on the specification, so a displacement technique should have been described by students but this was not always the case. To achieve a level 3 response students should state:

- the variables are to be measured
- the measuring instruments to be used
- how the measurement is to be made
- how the gathered data is to be processed.

Some students described the method without stating that the volume of the displaced water would equal the volume of the object. Measuring cylinders did not always get a mention with a significant number assuming that beakers would give an accurate enough measurement. Whilst some described how the object needed lowering carefully into the water to avoid splashes and excess spillage, others would have obtained very inaccurate measurements by collecting what overflowed from buckets and bowls. Some went no further than the volume measurement which was occasionally described as the density. ‘Weighing’ the object to get the mass, often without a mention of a balance or scales, was common.

There were some methods described which would not work, such as measuring dimensions, timing falls, or checking for sinking and floating. Some students described melting, smashing and breaking the object.

Very few students we able to write an answer which would lead to a valid outcome, with key steps identified and logically sequenced. Just over a third of students scored zero.

07.2 57% of the students scored at least 2 marks with 39% gaining full marks but 17% did not score on this question and 5% made no attempt. There were some good answers putting 0, 250, 500 etc. on the y axis and accurate plotting of the three bars required.
Some students put too many values on the *y*-axis making it difficult to judge if they were correct and giving more chance of getting one or more of the values wrong.

07.3 Only a small minority of students scored both marks and over two-thirds scored zero. It was possible to get the correct answer of 80 in a variety of ways and students did so but the concept of uncertainty seemed to be poorly understood.

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.