AQA

GCSE

COMBINED SCIENCE: TRILOGY

8464/P/1H

Report on the Examination

8464

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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 higher tier, however for some students the paper was a struggle. There were some students who would have been more successful if they had been entered for the Foundation tier.

As the content is split across two physics units, this paper is the one were the concept of energy is mostly assessed. Using the energy stores approach has clearly lead to some confusion amongst students, with written answer now containing more misconceptions and confused ideas than 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. Often students did not do this, and usually failed to gain any credit. A high demand question will involve some comparative statement or some interpretation of the given data.

Levels of demand

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

- **Standard demand** questions are targeted at students working at grades 4–5
- **Standard / high demand** questions are targeted at students working at grades 6–7
- **High demand** questions are targeted at students working at 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 This question required students to label diagrams with given labels and the majority gained all 4 marks.

01.2 59% of students scored zero on this item. Of the students who gained 1 mark, this was usually for identifying that a proton has a positive charge. Many answers were ambiguous.

01.3 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 arose when students simply multiplied 300,000,000 by 7. Problems arose when students either used a totally incorrect method, struggled with the arithmetic, or then went on to calculate 93% instead. A fifth of students scored zero marks.

01.4 Nearly 40% of students scored a mark on this question with 27% scoring two marks.

The range of values acceptable for full marks ensured that most students who knew what to do gained the two marks.

A few students obtained an incorrect ratio these could gain one 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 chose a number to multiply by with no evidence of a ratio attempt, or 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 weaker students – some changed the 10^{-11} by multiplying, adding or subtracting this power

Question 2 (Standard demand)

02.1 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 Practical Activities on the specification, so a displacement technique should have been described but this was not always the case. To achieve a level 3 response students should state:

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

25% of students we able to write an answer which would lead to a valid outcome with key steps identified and logically sequenced and were judged to have written a level 3 response. A further quarter of students achieved a level 2 mark. Level 1 was awarded to 30%. A significant minority scored zero or did not attempt the question.

02.2 67% of the students scored full marks. There were good answers putting 0, 250, 500 etc. on the *y*-axis and accurate plotting of the three bars required.

Some students tried to put far too many values on the *y*-axis making it difficult to judge if they were correct and giving more of a chance of getting one or more of the values wrong.

02.3 Only a fifth of students gained both marks and just over half scored zero. It was possible to get the correct answer of 80 in a variety of ways, and students did, but the concept of uncertainty seemed to be poorly understood.

Question 3 (Standard and Standard/high demand)

03.1 Over 90% of students scored at least 1 mark and 73 % scored 2 marks.

03.2 69% of students answered correctly. Many students who weren't awarded the mark probably intended to say that the speed increased, but simply offered 'increased' as their response, which is ambiguous. Many incorrect responses referred to increased vibration or faster vibration in the air.

03.3 A little over 70% of students recognised that the canister was in danger of exploding/bursting. 33% went on to say that the increase in pressure was the cause. Of the students that failed to score any marks, most just made simple statements such as 'the diver will not be able to breathe'.

03.4 Only 31% of students deduced that the pressure would stop dropping when the pressure inside the can was the same as the atmospheric pressure.

03.5 32% of students scored all three marks on the question. 27% were able to calculate the final pressure but then read the value from the graph incorrectly.

A number of students incorrectly calculated 75% of the initial pressure and then read the value off the graph correctly as t = 6, and scored one mark.

Question 4 (Standard/high demand)

04.1 51% of students knew what an alpha particle consists of.

04.2 70% of students knew that a particle of beta radiation has a negative charge.

04.3 63% of students knew that gamma radiation has a very long range in air.

04.4 45% of students scored marks on this question. Students who failed to score often understood there is a risk associated with nuclear radiation but were unable to relate that to the changing levels of radiation with time. There were lots of misconceptions about half-life, the most common being that iodine-131 would not emit any radiation after two half-lives.

Question 5 (Standard/high and High demand)

05.1 Very few students gained more than one mark on this question. This is a new specification point this year but the answer to the question is straight recall from the specification. Most students wrote vague answers about heat being contained inside and the cold not being allowed to enter. The starting point about the thickness of the wall was rarely mentioned and nor was the low thermal conductivity of the material.

05.2 72% of students calculated this correctly, either using the method in the mark scheme, or by calculating the midpoint using (20.8 + 17.4) /2. Of the incorrect responses, some students attempted to adjust the result to take into account the decreasing rate at which the temperature decreased, but were not always successful. Some students calculated the differences between the given temperatures, then the differences between the differences in order to determine the trend and then estimated the temperature at 30 minutes. Some students attempted to find an average temperature over a range of time, using various ranges.

05.3 49% of students scored no marks. Only 17% of students scored more than one mark and fewer than 2% scored three marks. Many students appeared confused by the reference to energy stores, rather than being asked to simply identify a chain of energy changes. Most commonly, one mark was scored for referring to thermal energy being added to the water. There were very few who considered the thermal store of the air.

A fairly common misconception was that, despite clearly shown exiting the boiler as hot water, the water would be heated enough to boil and leave the boiler as steam – the implication being that the hot exhaust gas was formed in this way.

05.4 75% of students gained at least one mark. Just over a tenth of students correctly carried out both conversions and achieved four marks. The most common mistake was in the conversion of 15 MJ into J but most students knew the equation and could substitute their sometimes incorrect conversions into the equation and calculate it correctly. A very simple answer saw 15 / 10 = 1.5 often written down and this gave the student two marks. Unfortunately a few students calculated energy × time and could only obtain the conversion marks if done correctly.

Question 6 (Standard/high and High demand)

06.1 33% of students drew a curve in the correct quadrants which passed through the origin with decreasing gradient to score two marks. 25% of students then curved their lines back towards the *x*-axis at the ends and so did not score the gradient mark. The most common mistake was to draw a straight line in the correct quadrants through the origin as for a fixed resistor. A few drew the graph for a diode. Some students drew a curve or straight line through the second and fourth quadrants, and some drew a line or curve which was in one quadrant only, or intersected more than two quadrants.

06.2 Responses to this question were very mixed. 24% of students scored two marks and 24% of students scored one mark. Many students talked about the current being strongest close to the battery, and weaker further away. Voltage was also discussed in some responses.

Many students just stated that the current split which was not sufficient. However, there were some excellent concise answers that demonstrated a very good understanding of current in parallel circuits.

06.3 Half of the students found this multistep calculation question very challenging and scored no marks. 13 % of students scored five marks for correctly calculating a charge flow of 30 C but did not double this to determine the total.

Those who were unable to calculate the correct current could still have scored three marks for multiplying their incorrectly calculated current by 60, then doubling this number and finally naming the correct unit. Very few of these scored anything other than the unit mark. Those that did multiply a number by 60 often did not gain credit because it was unclear what their number represented.

06.4 Very few students achieved a level 3 response in this question. 38% of students gained at least one mark. A large number of students listed what they could recall about circuits despite this not being relevant to the question – information such as which meter is connected in series, which in parallel and what other components are in the circuit.

The majority of students were unable to recognise the symbol for the LDR with many stating it was a thermistor. Those that did recognise the symbol for the LDR often did not recall the correct link between light intensity and resistance or even the function of the LDR. Many students thought that the LDR was the actual light that was switched on and off by the light intensity. Many students who started the question well, correctly identifying the LDR and linking that correctly to how the resistance of the LDR would change, failed to explain how this change in resistance would affect the readings on the ammeter and voltmeter. Very few students demonstrated an understanding of how resistance affects current.

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.