AQA

GCSE
COMBINED SCIENCE: TRILOGY

8464/P/1F: Paper 1 Physics Foundation
Report on the Examination

8464
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General

Overall the majority of students were able to make an attempt at every question on the paper, although as the level of demand increased towards the end of the paper, particularly in questions 5 and 6, there were more students who did not attempt some question parts.

This was the second series of the examinations for the new science GCSEs, and there are some sections of the specification which appear to be less familiar to students, in particular some aspects of working scientifically and some of the mathematical requirements.

In calculations there was an increase in the number of students who, unsure of the correct equation to use, decided to multiply two numbers together, divide the first number by the second, divide the second number by the first, and then choose which answer seemed to them to be the best one.

Levels of demand

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

- **low demand** questions were targeted at students working at grades 1-3
- **standard** questions were 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 Slightly below 60% of students recognised the LED in this question.

01.2 Around 33% of students knew that the circuit in the diagram is series circuit, so the current is the same through both components.

01.3 More than half of all students gained both marks. Many who did not score appeared to have read the scale of the graph incorrectly, for example reading 850 thousand and 1450 thousand steps when they should have read 900 thousand and 1500 thousand steps.

01.4 Almost 70% of students knew that checking repeatability requires repeating with the same method.

01.5 A simple calculation using a given formula was well answered with slightly less than 90% of students showing clear working and gaining both marks.

01.6 Fewer than 30% of students knew the formula relating power, current and resistance.

01.7 Almost 90% of students knew that a current would increase the temperature of the resistor.

01.8 This straightforward calculation using a given equation was done well, with clear working shown. Over 90% scored both marks. Some students, however, converted 180 seconds to minutes before calculating the answer.

Question 2

02.1 Nearly 70% of students correctly chose the brightness of the lamp as the control variable.

02.2 This question was correctly answered by just over 30% of students.

02.3 The anomalous result was recognised by about 70% of students.

02.4 Slightly less than half of the students identified the pattern in the data, and used this to predict the most likely value using the information in the table. Many students who didn't score a mark tried to calculate a mean using some data from the table.

02.5 This calculation was answered well, with around four fifths of students dividing the two values correctly and expressing their answer as either a decimal or a percentage.

02.6 Understanding that renewable resources are replenished was shown by three quarters of students.

02.7 Just over 5% of students gained only 1 mark on this question, for correctly substituting the numbers into an equation. Another 80% or so of students completed the calculation, but the ability to express it to two significant figures was shown by only approximately 30% of students. Some students did not try, some rounded incorrectly, but many reduced 15190 to just 15.

02.8 Just over 70% of students knew that using solar panels would reduce the need to burn fossil fuels.

Question 3

03.1 Only about 30% of students could describe alpha particles as deflecting or rebounding from the gold atom. Many described the alpha particles as not going through, which was insufficient as it was given in the question. Some students thought alpha particles would be absorbed or destroyed.

03.2 A good attempt at this question to calculate the size of a nucleus using the ratio to the size of the atom was made by around 40% of students, with approximately 30% gaining both marks. A common mistake was to divide instead of multiplying. Some students tried to do the correct sum, but instead calculated 0.18 ÷ (1/6000) instead of calculating 0.18/6000. Nearly 10% of students made no attempt at this question. Using ratios is a mathematical skill in the specification.

03.3 This question testing knowledge of electron energy levels was correctly answered by just over 30% of students.

03.4 This question required students to identify that the temperature remains constant while a substance melts, and then read this temperature from the graph. 45% of students were able to do this correctly. Some student did not associate the constant temperature with the change of state, but more commonly they failed to correctly determine the scale on the temperature axis.

03.5 About 35% of students could determine the time for the change of state from the graph. Reading values from graphs and using those values are required mathematical skills.

03.6 Nearly 60% of students correctly identified the gradient of the graph as the rate of change of temperature.

Question 4

04.1 The content of this question is shared with the chemistry specification and was answered correctly by just over 35% of the students.

04.2 Almost 70% of students gained at least 1 mark and about a third of gained both marks. Points were often plotted within acceptable tolerances but the line – which should have been a smooth curve – was often drawn dot-to-dot or as a straight line.

04.3 Almost half of the students were able to read the time value correctly from their graphs. A value consistent with their line, or with a correct line of best fit, was acceptable.

04.4 Fewer than one in four students were able to associate the answer to the previous question with the half-life of the isotope.

04.5 Just under 40% of students knew that beta particles have a range of up to a metre.

04.6 This question produced a wide range of responses but only about 30% of students scored the mark. Students were expected to describe peer review but this was rarely seen. Acceptable alternatives about data or evidence in scientific journals, and newspaper articles being inaccurate or biased enabled more students to gain the mark. Many students simply stated that articles in scientific journals are written by scientists and articles in newspapers are not, that scientists know what they are talking about, or scientists are more reputable than journalists, but these responses were not sufficient for credit. There was also a misconception, which was less common, in which students appeared to misunderstand what a scientific journal is.

Question 5

05.1 Just under half the students knew the function of the earth wire.

05.2 Nearly 80% of students gained at least one mark and around 37% gained all three marks for knowing the colours of the wires in a plug.

05.3 Over 90% of students gained at least 1 mark and the vast majority of these gained 2 marks for a calculation using a given formula. A few students incorrectly converted the time in seconds into minutes.

05.4 More than half of the students gained both marks for correctly identifying both energy stores from the given list. Around a quarter of the students made one correct choice. Often, the correct energies were chosen but placed in the wrong order.

05.5 About 30% of students could write an equation linking gravitational field strength, gravitational potential energy, height and mass. Some kept the order in which quantities were written the same and inserted incorrect mathematical operators into the given sequence (GFS = GPE × h × g was a very common incorrect answer, as was GFS = GPE ÷ h × g without brackets around h × g). 15% of students did not attempt the question. For this examination, the abbreviations GFS and GPE were acceptable, as were upper and lower case letters E for energy, h for height and m for mass. A capital G was not acceptable for g, as G is the universal gravitational constant which has a different meaning to g, the gravitational field strength.

05.6 Students found rearrangement of E_p = mgh difficult, even if they had written the correct equation in the previous question. About 15% of students scored marks on this question and about 10% did not attempt it. Many students just multiplied all of the numbers in the question together. Some students produced answers that could not be reasonable for the change in height of the toast – such as 1mm or less, and 1 000m.

Question 6

06.1 Slightly over 35% of students made the correct choice in this question. Some students who used a computer to type their answer did not gain the mark because they typed answers such as 'the ammeter is in series and the voltmeter in parallel' which could have meant either the third or fourth options in the table.

06.2 Just under one in four students knew that increasing the resistance would cause the current to decrease. Current slowing down was not an acceptable alternative but a reduced rate of flow of charge was accepted. Almost 10% did not attempt the question.

06.3 Although this question is based on a Required Practical Activity, fewer than 5% of students could suggest how to give negative readings on both of the meters. Many students suggested making changes to the other components in the circuit that would not have the desired effect, such as swapping the positions of the meters, adjusting the variable resistor, or adding more resistors. Others suggested using a 'negative battery'. Around 20% of students made no attempt. A small proportion stated that the direction of the current needed to be reversed but did not describe how the circuit should have been changed to achieve this.

06.4 This question required the *type* of relationship; around 5% of students could describe the relationship as proportional or directly proportional; about 15% made no attempt.

06.5 The equation linking current, potential difference and resistance was correctly described by around 35% of students in words or symbols. Many students used lower case letters i, v and r to represent current, potential difference and resistance, which was allowed. Also acceptable was a correct combination of symbols and words. Of those who did not gain the mark, many appeared to be making up their own symbols to represent each of the quantities

06.6 Full marks were scored by just under a quarter of students, but almost 10% of students made no attempt to calculate the resistance.

Question 7

07.1 This question tested students' understanding of the links between temperature and pressure via the motion of the particles in a gas. Over 30% of students scored at least one mark but fewer than 5% scored all three marks. Roughly 20% made no attempt. Many students wrote about successful collisions, which was condoned here. However, writing about particles moving less was not seen as equivalent to writing about particles moving more slowly. The most common reason for gaining 2 marks rather than three was the omission of any mention of collisions. One common misconception is that, as the particles cool down, the number of particles increases. There were also a number of students who did not mention pressure in their answer, instead discussing how the movement of particles changed as they cooled and how this linked with temperature.

07.2 Just over 25% of students scored at least one mark while around 1 in 5 students scored all three marks; approximately 10% made no attempt at all. Some students did not show an equation and just divided one number by the other – sometimes achieving the correct result. Others multiplied the two numbers and therefore did not score. Some chose the wrong equation, while others multiplied or divided by zero, because it was in the question. Those students who scored 2 marks had usually made an erroneous conversion of either kJ to J or kg to g. Many students tried to answer the question using the equation $E = mc\Delta\theta$, with 20 °C as their change in temperature, gaining 0 marks.

07.3 Slightly over a quarter of students scored on this question, and half of those scored both marks. Many students drew a temperature line, which then enabled them to come to the correct conclusions and gain both marking points. A small number of students chose to fill the boxes with numbers representing temperatures, rather than ticking one box for each row of the table.

07.4 Many students who gained 0 marks on this question failed to talk about particles, instead naming and describing changes of state. Many students were able to get into Level 1 (1 or 2 marks) because they knew something about the arrangement and movement of particles in one state. A common misconception was that particles cease to move at all in the solid state. A large number of students gave a basic description of the change of arrangement such as the particles getting closer together as the change of states occurs or the movement of the particles slowing down, but then gave very little additional detail. Fewer students managed to link the changes to energy changes or forces between particles. Very few students achieved Level 3. Some students referred to the energy decreasing at each change of state and some talked about ‘bonding’ occurring. However, often the relevant points regarding the changes to arrangement or movement were not effective and prevented them from acquiring Level 3. Around 15% made no attempt at the question, about 20% scored 0 marks, around 30% scored in Level 1, approximately 30% in Level 2, with the remainder reaching Level 3.

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.