GCSE

COMBINED SCIENCE: TRILOGY

8464/P/1F (Physics)

Report on the Examination

8464

November 2021

Version: 1.0

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General introduction to the November 2021 series

This has been an unusual exam series in many ways. Entry patterns have been very different from those normally seen in the summer, and students had a very different experience in preparation for these exams. It is therefore more difficult to make meaningful comparisons between the range of student responses seen in this series and those seen in a normal summer series. The smaller entry also means that there is less evidence available for examiners to comment on.

In this report, senior examiners will summarise the performance of students in this series in a way that is as helpful as possible to teachers preparing future cohorts while taking into account the unusual circumstances and limited evidence available.

Overview of Entry

As this exam was taken in November 2021 rather than during Summer, the cohort of students who sat the exam is likely to have been very different from the usual cohort of students taking this qualification. There were also far fewer students in this cohort than usual. It may well be possible, therefore, that issues which arose on some questions and are written about in this report may not be typical of students in the normal course of events.

General comments.

There was a fair proportion of students who did not appear to have taken a calculator into the exam, and failed to gain marks because they incorrectly calculated their answers on paper. There were also a fair number of students who made mistakes when calculating, re-wrote their calculations, and failed to cross out their incorrect working. Students should be encouraged to both cross out working that they believe to be incorrect, by drawing a line through it, and to take a calculator into the exam.

On this paper, students fared particularly poorly on questions set in a practical context, perhaps reflecting the difficulties of carrying out practical work during the Covid restrictions over the last two years.

Comments on Individual Questions

Question 1 (Low demand)

01.1 Approximately three quarters of all students answered this question correctly.

01.2 Many students were unable to make any progress with this question, with almost 50% of students failing to gain any marks and just under a fifth of students not attempting to answer at all. Some students saw the displacement can and began to describe displacement reactions, which gained no credit. A small minority of students suggested melting the limestone in order to measure its volume, which also gained no marks.

01.3 This calculation was correctly answered by around four fifths of students. A common mistake was for students to substitute the volume 62 cm^3 into the equation as a value of 62^3.

01.4 Slightly more than 60% of students answered this correctly. About a fifth of students incorrectly chose the first option, cm/g^3.

01.5 This question was well answered, with almost 90% gaining the mark.

01.6 Just under 90% of students gave the correct answer.

01.7 About one in four students gained this mark. Many students appeared to have not read the first line of the question, and instead gave a reason why they had chosen their answer to question **01.6**. Of those who did read the question correctly, a common misconception was that a rock with a different mass would have a different density.

01.8 Slightly over 70% of students selected the right answer.

01.9 Just over three quarters of students scored this mark.

Question 2 (Low demand)

02.1 Almost a quarter of students gained both marks, with about 45% giving one correct answer only.

02.2 Just over half of all students answered correctly. Almost a quarter of students stated that the gravitational potential energy of the athlete would decrease.

02.3 Nearly 90% calculated this correctly. A small minority tried to convert 50kg to g before calculating their answer, allowing them to gain a maximum of 1 mark.

02.4 Many students were unable to correctly recall the unit for speed. Many students made no attempt to use the square root sign when substituting values into the equation. Those who did use the sign often did not take the square root of the denominator, and some students merely took the square root of 2 before multiplying by kinetic energy and dividing by mass. The question differentiated well, with just over a quarter gaining full marks, about 20% gaining 2 marks, and roughly 25% gaining 1 mark.

02.5 More than three quarters of students gave the correct answer to this question.

02.6 Less than a quarter of all students gave the correct answer, with nearly half of the students thinking that power is the same as total energy transfer.

02.7 Around a quarter of the students gained both marks, with about 40% of students gaining one mark.

Question 3 (Low/standard demand)

03.1 Slightly over half the students knew the symbol for a filament lamp.

03.2 Nearly three quarters of all students answered this correctly.

03.3 This question was testing whether students were able to draw four components in series. A complete circuit was needed, with no gaps around the components. Many students drew the components at right angles to the wires, and therefore not connected into the circuit. Students were given the symbols in the question, and were expected to draw them correctly, so those who drew a line through the middle of the ammeter, for example, did not gain the mark. Roughly 45% of students gained this mark, with almost 10% not attempting the question at all.

03.4 Just over 40% of students answered correctly, with more than a third opting to place an additional ammeter in the circuit.

03.5 Over 90% gained both marks.

03.6 Just under half the students correctly recalled the equation, but almost 1 student in 8 did not attempt to answer.

03.7 A fair proportion of students attempted to convert 15 seconds into minutes, and then multiplied this by 200, gaining no marks. It was uncommon for students to attempt to convert milliamps into amps. Just over half of all students gained at least 2 marks.

03.8 Many students struggled to answer this question, and less than a quarter of students answered correctly.

03.9 Around than one in ten students selected the correct answer. Roughly a third of students selected the third option, suggesting that the vast majority of these students were not familiar with the ± symbol.

Question 4 (Low/standard demand)

04.1 The graph was read correctly by slightly more than 50% of the students.

04.2 Many students did not use the information provided in the question. It was not uncommon to see answers such as the equator being closer to the Sun, which gained no credit. Around one in eight students scored a mark.

04.3 The majority of students recalled that carbon dioxide contributes to global warming and is released when fossil fuels are burned.

04.4 Over 90% of students gained both marks.

04.5 Answers such as “bigger panels will heat more water” or “water can be heated up quicker if the panels have a larger surface area” did not answer the question. There were misconceptions which also arose when answering this question, such as the idea that bigger panels hold more water and therefore would take longer to heat up.

If students are asked how the size of the heating panels affects the input power, then their answers need to be in terms of the size of the heating panels and the input power.

Only about a third of students gained this mark, with nearly 10% of students not attempting to answer the question.

04.6 Fewer than half of the students chose the correct definition of specific heat capacity.

04.7 Despite being directed to the Physics Equations Sheet, and being given the specific heat capacity value in the question, more than 5% of students did not make any attempt to answer this question. Nearly a third of students gained full marks, but over half of the students gained no marks.

04.8 Just under a third of students answered correctly, with nearly half thinking that thermal insulation increases the rate of energy transfer.

04.9 Only about one in ten students selected the correct answer, with more than 80% choosing option C. Questions 04.8 and 04.9 together suggest that many of the students were confused about the relationship between thermal conduction and thermal insulation.

Question 05 (Standard demand)

05.1 Slightly over a third of students selected the correct equation.

05.2 Full marks were gained by approximately a third of the students, with more than 50% failing to gain any credit.

05.3 This equation was correctly recalled by slightly less than half of students.

05.4 Most students did not attempt to convert 2500 minutes into seconds. Very few students gained all 3 marks, although over 60 % gained at least 2 marks.

05.5 Only a very small proportion of foundation tier students were able to correctly identify the symbol for a thermistor.

05.6 Most students failed to recognise that the resistance of the thermistor would decrease as temperature increased, with many students stating that because the potential different across the thermistor was constant, the current in the thermistor must also be constant. Another misconception demonstrated in a number of responses was that the current would increase because the increased temperature gives the current more energy. Nearly one in five students did not attempt the question.

Question 06 (Standard demand)

06.1 This question was answered correctly by roughly one in three students.

06.2 Around 15% of students gained both marks, with slightly over half gaining just one mark.

06.3 Many students gave answers which were too vague, such as “beta radiation is not strong enough”, or stated that beta radiation is not ionising, which is incorrect. Very few students answered correctly.

06.4 Most students struggled to answer this question, with many unable to write answers containing any relevant content. Many answers suggested placing the piece of paper or aluminium into the radioactive source holder, for example. A fair proportion of students did not read the question carefully, and suggested changing the radioactive source to test the equipment using one source of just alpha radiation, one of just beta, and one that emits just gamma radiation, although it was still possible to gain full credit if they did this.

Some students recalled that paper stops alpha radiation, that aluminium stops beta radiation, and that gamma would penetrate both, but didn't describe how to set up the equipment. Others described how to set up the equipment, but not how to use any measurements to draw conclusions.

Nearly a quarter of students did not attempt to answer the question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.