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GCSE

# COMBINED SCIENCE: TRILOGY

8464/P/2H Paper 2 Physics  
Report on the Examination

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## General

There was an increase in the number of students, but the general standard of the responses was broadly in line with that of 2019. It was noticed that students had benefitted from being given the equations, which meant that the equation recall question and the calculations performed better than in 2019. As a result, the mean mark on the paper went up.

The calculations were well answered. Most students could complete the standard demand calculations with ease. Most also did quite well on the higher demand calculations. Questions that required practical knowledge and understanding or skills, were not as well answered. Most students were unable to demonstrate much practical experience.

Questions that required extended response were also not well answered, often with poor use of scientific terminology.

## Question 1 (Standard demand)

- 01.1** 60% of students correctly identified all three parts of the electromagnetic spectrum and scored both marks. However, 30% of students scored no marks.
- 01.2** 50% of students were able to gain at least one mark on this question. The similarity was more accessible and was how the majority of the 35% that scored one mark got the mark. Many identified that both waves are transverse. For the difference, most students did not refer to a property of electromagnetic waves.
- 01.3** A little over 65% of students correctly identified that the process is called refraction.
- 01.4** Over 99% of students gained the mark. Students were given the equation sheet, which will have contributed to the overall performance on this question.
- 01.5** Over 70% of students were able to substitute correctly and give the correct answer to the question, to the correct order of magnitude. Approximately 20% of students correctly rearranged and substituted but did not use their calculator to evaluate the numbers in standard form, so scored 2 marks.

**Question 2 (standard demand)**

- 02.1** Students found describing the method for this investigation very challenging even on the higher tier paper. This is a required practical, but fewer than 10% of students wrote a level 3 response that would lead to a valid outcome. About 25% of students suggested a valid way of varying the force and described taking measurements, so wrote a level 2 response. Approximately 50% of students just suggested some measurements that could be taken, such as timing with a stopwatch or measuring the length of the runway with a ruler, so wrote a level 1 response.
- 02.2** Approximately 60% of students knew that Newton's second law predicts that the acceleration of the trolley is proportional to the resultant force on the trolley.
- 02.3** 75% of students calculated the correct acceleration. A variety of methods were seen, and any that used ratios and gave the correct answer were given credit. A small percentage of students scored one mark for calculating the mass, but did not then continue with the calculation.
- 02.4** Over 99% of students gained the mark. Students were given the equation sheet, which will have contributed to the overall performance on this question.
- 02.5** Just over 90% of students substituted into the correctly rearranged equation and then calculated correctly. Approximately 3% of students were able to substitute, but then did not rearrange the equation correctly.

**Question 3 (standard demand and standard/high demand)**

- 03.1** Many students found this question challenging, even though this forms part of a required practical. Approximately 50% of students scored marks, but only a small percentage arcuately measured across a number of wavelengths, and then applied the scale factor correctly and scored full marks. The majority of students that scored one mark measured across one wavelength and multiplied that by 5.
- 03.2** This calculation was well answered, with 90% of students scoring two marks.
- 03.3** Only 40% of students knew that for precise readings the spread of values about the mean is very small.
- 03.4** 25% of students scored marks on this question. 15% of students scored two marks. Of the 10% of students who scored one mark, most wrote vague answers stating that longitudinal waves are parallel and transverse waves are perpendicular, but didn't mention oscillations or energy transfer.

**Question 4 (standard demand and standard/high demand)**

- 04.1** Fewer than 20% of students correctly answered inertia.
- 04.2** Just over 50% of students gave the correct direction for the acceleration.

- 04.3** Approximately 50% of students gained one mark on this question. Most of those that did suggested increasing the current or the strength of the magnet. Very few went on to explain that this would increase the force on the copper rod.
- 04.4** Approximately 20% scored two marks on this question. Of the 20% that scored 1 mark, most suggested bringing both sides of the magnet close to the iron bar (or vice versa) but then incorrectly stated that any attraction proves it is a magnet.
- 04.5** Approximately 40% of students gained at least one mark on this question. Even the credit worthy responses mostly contained simple statements like 'it always points north'. Only a small percentage explained that this was because the magnet aligns itself with the Earth's magnetic field.

### **Question 5 (standard/high demand and high demand)**

- 05.1** Approximately 70% of students selected the correct relationship.
- 05.2** 90% of students correctly substituted and calculated a spring constant. However, only 35% of students converted the extension to metres and scored three marks. 55% of students did not do the conversion or did it incorrectly and scored two marks.
- 05.3** Approximately 60% of students knew that an object that is inelastically deformed will not go back to its original length but did not refer to when the force is removed. Only 2% of students were awarded both marks for this question. Many students who scored zero marks wrote vague statements such as the object will not go back to its original form.
- 05.4** 50% of students scored full marks. Many students who scored zero used an incorrect equation despite having the equation sheet. Many students tried to substitute into the correct equation but omitted the squared symbol.
- 05.5** Many students find evaluate questions challenging, particularly when they have to do a calculation. 30% of students did score at least two marks for a calculation, and 12% went on to draw a sensible conclusion and were awarded all three marks.

### **Question 6 (high demand)**

- 06.1** 45% of students did the calculation correctly and 35% gave the answer correctly to two significant figures. Of the 45% that scored either no marks or one mark, a significant number rearranged the equation incorrectly and subtracted  $u^2$  from  $2as$ .
- 06.2** Despite being clued into the fact that velocity is a vector, very few students referred to the direction of the stone. 55% of students scored one mark for referring to the magnitude, with most making simple statements like the velocity increases. Only 3% of students scored 2 marks for adding that the direction does not change.
- 06.3** This was an extremely challenging question. 85% of students scored zero marks, and of those that did score the vast majority scored one mark. The question asked students to explain why the stone slows to a constant velocity, but most students just explained why it travelled at a constant velocity. Most students that did score a mark stated that the resultant force on the stone was zero when the velocity was constant.

**Question 7 (high demand)**

- 07.1** 25% of students gained three marks on this question. 20% of students correctly determined the gradient but could not recall the unit for acceleration. A significant number of students knew to calculate the gradient but mis-read the graph and used an initial velocity of 25 m/s.
- 07.2** 5% of students gained full marks on this question. 20% of students gained two marks for correctly calculating the thinking distance. Of the 65% of students that scored zero marks the majority neither attempted to determine the area under the graph or used a correct equation.
- 07.3** 15% of students scored a mark on this question. Most of those that did score a mark wrote that large decelerations could lead to a loss of control.

### **Mark Ranges and Award of Grades**

Grade boundaries and cumulative percentage grades are available on the [Results Statistics](#) page of the AQA Website.