# GCSE
# PHYSICS

8463/2F
Report on the Examination

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## General

Calculations involving no more than the manipulation of two numbers were generally done well. Questions involving the recall of an equation were often poorly answered, suggesting that some students had not learnt the required equations. As a result, these students were unable to answer the subsequent calculation questions. As well as learning the equations students would be well advised to learn the units that go with each quantity.

Handwriting continues to be a problem for a significant number of students, making it very difficult for examiners to read what has been written.

## 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** Nearly all students identified the correct galaxy.

**01.2** Most students completed this calculation correctly. A small minority scored one mark by showing a correct substitution followed by an incorrect numerical answer.

**01.3** Just under half of the students gave the correct answer. Many of those students giving an incorrect answer of 4 were including Pluto as a planet.

**01.4** Over 90% of students gave a value within the correct range.

**01.5** The majority of students multiplied the given numbers, rather than dividing 9 by 0.6.

**Question 2 (Low demand)**

**02.1** The position of the principal focus was not well known. Only 15% of the students gave the correct answer 'B'.

**02.2** Despite having the diagram, only 10% of the students chose the two correct words to describe the image. A further 60% were able to correctly choose one correct word. Many students chose mutually exclusive pairs of words such as 'real and virtual' or 'inverted and upright'.

**02.3** Just over 50% of the students measured both the image height and object height accurately and completed a correct calculation to score all 4 marks. A further 22% measured one height accurately and completed the calculation correctly to score 3 marks.

**02.4** Nearly 70% of students scored this mark.

**Question 3 (Low demand)**

**03.1** 94% of the students gave the correct answer.

**03.2** This was poorly answered with just over 50% of the students scoring zero. There was a lot of confusion between wavelength and frequency, with many students stating that frequency is the distance between two adjacent waves. Those students scoring one mark understood the need to count the number of waves passing a point in a given time but not in one second.

**03.3** Most of the students were able to correctly substitute the given value for frequency into the equation and calculate the period. 24% of the students knew that the period is measured in seconds; the majority giving metres/second.

**Question 4 (Low demand)**

**04.1** Just over 60% of the students correctly indicated the north and south ends of both paper clips. Most of the other students indicated only a north pole on the top paper clip and a south pole at the lower end of the second paper clip.

**04.2** Many of the students stated that keeping all of the paper clips the same size would make it a 'fair test'. Fewer suggested that the paper clips should all have the same weight or mass to allow for a fair comparison of the results. Common incorrect answers referred to current travelling in the paper clips or implied that larger paper clips would take more of a share of the magnetic field.

**04.3** 92% of the students scored at least one mark. Few of the students failed to recognise that the number of paper clips increased as the number of turns of wire increased. Many scored two marks by stating that the relationship was directly proportional or described the number of paper clips held increasing by three for every ten extra turns of wire on the electromagnet.

**04.4** Just over 80% of the students scored this mark.

**04.5** 78% of students scored one mark for this question. Few of the students picked up on 18 paper clips being an anomalous result and as such should be disregarded as the three remaining results were similar. A mean of the three similar results could then be found and used in the table. Students scoring one mark calculated the mean of all four results but did not gain a second mark for rounding down to the nearest whole paper clip.

**04.6** Most of the students appreciated that the current would need to be changed, with many specifying how. Fewer students explicitly stated that the number of turns needed to be kept constant. Only a minority explained that the number of paper clips held could be used to show the strength of the electromagnet.

**Question 5 (Low demand)**

**05.1** 96% of students scored this mark.

**05.2** Answers were split almost equally between the three options.

**05.3** Many students seemed confused about the fact that white is not in itself a colour but is made up of the colours of the spectrum. It was common to see answers such as 'the T-shirt absorbs all the colours but reflects white'. The terms reflection, absorption, transmission and emission were often used incorrectly and many students confused their answers with comments such as 'the white light reflected the T-shirt'. Vague answers such as 'It looks white because it is white' were commonly seen.

**05.4** About 25% of the students realised that the red cap would absorb the blue light. Of those only 3% said the cap would look black, most of the students suggested that the red and blue would mix to give purple or dark blue.

**05.5** 46% of students scored both marks, with a further 32% scoring one mark.

**05.6** The difficulty in this question was distinguishing between the main hazard in the investigation and the risk that the hazard presented. The acceptable hazards were the heater, the infrared radiation and the hot metal surface. Over half of the students only stated the risk and so scored zero.

**05.7** The majority of the students were able to correctly compare the absorption of infra-red radiation by a matt black and a shiny silvered surface. Common misconceptions are that the matt black surface attracted the infra-red radiation better and that it is a better conductor.

### Question 6 (Low and Standard demand)

**06.1** This was well known with 95% of the students scoring the mark.

**06.2** Most of the students showed a substitution before calculating the final correct answer.

**06.3** Answers were split almost equally between the three options.

**06.4** 44% of the students were able to write down this equation correctly. Most of the students that gave a wrong equation simply wrote the three quantities out in the order they were given – 'acceleration = mass x resultant force' was a common wrong answer.

**06.5** 43% of the students were able to calculate the correct answer to this question.

### Question 7 (Low and Standard demand)

**07.1** Nearly 93% of the students were able to correctly use the given equation.

**07.2** Only a minority of the students (40%) understood that the anticlockwise moment would have the same size as the clockwise moment.

**07.3** Nearly 50% of the students scored this mark.

**07.4** Not all of the students who knew the equation scored three marks. Some of the students were distracted by the vertical distance of 2.60 metres given in question 07.1 and multiplied either the given moment or the given force by 2.60 before substituting into the equation.

**Question 8 (Low and Standard demand)**

**08.1** Position 'C' was the most popular answer with 65% of the students scoring the mark.

**08.2** The direction in which the wavelength and the frequency change in the electromagnetic spectrum was less well known, with 45 % of the students choosing the correct answer,

**08.3** Of the students that scored this mark (44%) most responded with 'skin cancer', fewer referred to 'premature aging of the skin'**.** The majority of the students gave responses that were too general and often not related to the skin. The most common was to state that the radiation causes cancer, rather than specifying skin cancer.

**08.4** 78% scored at least one mark for recognising that the risk of developing cancer increased with increased radiation dose. Fewer were able to quantify that it was fifty times more likely. Some of the students assumed that having an X-ray on a part of the body would mean that the cancer would be in the same part of the body.

**Question 9 (Low and Standard demand)**

**09.1** Nearly 90% of the students were able to complete the calculation correctly but far fewer (34%) knew the correct unit for pressure.

**09.2** The majority of the students understood the information presented in the diagram and completed the missing water path correctly.

**09.3** The majority of the students were able to conclude from the given diagram that liquid pressure increases with depth. Some of the students scored the mark by relating the increased liquid pressure to the distance that the water jets travelled.

**09.4** The most common incomplete response was that liquids are incompressible. Very few appreciated that the pressure would act in all directions or that it would create a force on the sides of the container.

**Question 10 (Standard demand)**

**10.1** Many of the students found the velocity-time graph difficult to interpret and relate to the motion of the ball, with many stating the ball was going upwards at an angle between A and B. However about 50% of students correctly stated that the ball accelerated between points A and B on the graph, however very few of these recognised that a straight line velocity-time graph represents a uniform acceleration and so failed to score the second mark available. Comments such as 'the ball accelerates at a constant speed' did not score a mark.

**10.2** 54% of students were able to give the correct direction.

**10.3** As a new part of the specification this was answered well with about 60% of the students giving the correct answer.

**10.4** Few students appreciated that the negative velocity indicated that the ball was moving upwards, and that BC represented the ball hitting the ground. It was rare to read that the ball had a reduced velocity and therefore a reduced kinetic energy. Some students wrote that the ball would not rebound as high but did not relate this to an overall loss of gravitational potential energy. A small number of the students did recognise that the ball had lost energy overall in the bounce but did not state that because total energy is conserved, some of the ball's energy must have been transferred to the Earth. The majority of students simply described, correctly or incorrectly, the energy change as the ball fell or landed. There little appreciation that the question required students to consider the energy changes within a closed system.

**Question 11 (Standard demand)**

**11.1** This question related to one of the required practical activities. Students were asked to describe a method and to include causes of inaccuracy. Many students wrote at length about safety issues, reducing risks, repeating results and removing anomalies which were not asked for in this question. Most students drew a labelled diagram which was helpful, and then described what they had drawn, which wasn't necessary. Only a minority of the students appreciated that the force increased in steps of 2N, up to a maximum of 10N, and an extension was measured for each force. Even fewer mentioned a cause of inaccuracy. Some students appreciated that a range of weights were needed to obtain a table of results and made a relevant comment about measuring the extension. Those students working at level 1 hung a single mass on a spring and measured its length giving no indication how the extension would be determined.

**11.2** Students were asked why more than one pair of data was collected. Few students stated that it was so anomalous results could be found or to reduce random error. Most students who gained the mark stated that the accuracy of the results would be increased. Several students suggested that several data points would enable a mean to be calculated but did not state that it would be the mean of the spring constant.

**11.3** 43% of students plotted the two missing points correctly and drew a line of best fit that passed between (0, 0) and (10, 20). A significant number only plotted the two points or drew a line without having plotted the missing data. It was evident that many students did not use a ruler to draw a straight line.

**11.4** 24% were able to write the correct equation.

**11.5** Nearly 70% of the students scored zero. Only 4 % of the students were able to score 4 marks by using the correct equation, choosing relevant data from the table and converting centimetres to metres. The students who correctly found the average force and extension and substituted into the correct equation scored full marks.

**11.6** Students were asked to show how a given set of data or a graph demonstrated that two variables were directly proportional.
It was expected that students would state that the graph was straight and passed through (0, 0). Only a very small number did so. More of the students gained both marks for stating that as one variable doubled, so did the other. Students were given some credit for stating that every time the force increased by 2N the extension increased by approximately 4cm. This was accepted as an alternative to the graph being linear. Many students just stated that as the force increased so did the extension.

**Question 12 (Standard demand)**

**12.1** Regrettably, this part of the question assessed content that we had stipulated would only be assessed on the Higher tier. All students were awarded full marks for this part of the question.

**12.2** Only just over 6% of the students were able to use the information presented in Figure 16 to calculate the frequency of the wave.

**12.3** 34% of the students were able to give this equation.

**12.4** Those students that could recall the correct equation generally scored all three marks. Most of the students that scored zero did so because they either substituted the values into an incorrect equation or did not use the frequency calculated for question 12.2. It was common to see a frequency of 10 Hz being used instead.

**12.5** Regrettably, this part of the question assessed content that we had stipulated would only be assessed on the Higher tier. All students were awarded full marks for this part of the question.

## 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](Results Statistics) page of the AQA Website.