GCSE
PHYSICS

8463/2H
Report on the Examination

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General

About 75% of students were able to state the required equations and apply them correctly in a subsequent calculation. The high demand calculations, involving the use of two equations, are new to this specification. In general, the example on this paper was well done by the higher attaining students.

Question 02.1 that required basic recall of a required practical was done well. However other questions such as 05.2 and 05.5 that required the application of knowledge in a practical context were less well done.

Handwriting was a problem in many questions and some students were unable to communicate their ideas with the amount of detail required.

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 Most of the students realised that the falling ball was accelerating or speeding up, but few wrote that the ball was accelerating at a constant rate. Some students did try to explain this, however they were often unable to express this uniform acceleration clearly. Phrases such as "accelerating at a constant speed" were common and did not score any marks.

01.2 Just over 70% of the students understood that the ball would be moving upwards.

01.3 Most of the students understood what is meant by 'a system' with nearly 90% choosing the correct answer.

01.4 Only about half of the students realised that the velocity of the ball was reduced after the bounce or that the ball would not reach the height it was dropped from. If this was written it was generally followed by a statement that repeated the stem of the question; the energy was transferred to the ground. Those students that did state that energy was lost from the ball did often refer to this as kinetic energy. Students often stated that as the velocity became more and more negative, the ball was continuing to slow down.

Question 2 (Standard demand)

02.1 Almost all students made a good attempt at describing this investigation but many omitted one of the necessary actions such as adding 2N weights up to 10N or a method of ensuring accuracy. Most of the students drew a diagram of the apparatus which, although often in sketch form, was generally enough to show what was intended. However having done this there was no need to write a lengthy description of the diagram. Most students were aware of the need to determine the extension of the spring, and many described in detail how to do this. Many students quoted a correct range of weights. Students were more likely to describe how to ensure accuracy, rather than pointing out inaccuracies. Most frequent answers included; clamping the ruler vertically, using a pointer on the end of the spring and marking the original length of the spring on the ruler with a piece of tape. All of these were worthy of credit.

02.2 Fewer than 40% of students scored the mark. The most common correct answer was in terms of improving accuracy, the idea of identifying anomalous results was rare.

02.3 Nearly all students plotted the two data points accurately. However some students did not draw the line with adequate precision and so scored only one mark.

02.4 Just over 75% of students correctly recalled the equation.

02.5 For those students who correctly recalled the equation in question 02.4, most scored at least 3 marks here. About 35% converted centimetres to metres to score all 4 marks.

02.6 Those students who used the graph to answer this question usually wrote that it was a straight line, but generally failed to write that the line went through the origin. Some students explained that the line would curve if the spring was overstretched. Those students that attempted to answer this in terms of direct proportionality often simply stated that as the force increased, the extension increased. This answer scored zero.
Only a small minority correctly explained what is meant by two quantities being directly proportional.

Question 3 (Standard demand)

03.1 Just over 50% of the students scored this mark

03.2 Only 30% of students were able to use the information in Figure 3 to calculate the frequency of the wave.

03.3 Just over 75% of the students were able to write the correct equation.

03.4 Nearly 70% of the students who could recall the equation calculated the wavelength correctly.

03.5 This is a topic new to this specification. 19% of the students knew that S-waves do not travel through a liquid and could relate this to the Earth having a liquid (outer) core.

03.6 23% of the students scored the mark, generally for simply stating ‘generator effect’.

03.7 37% of students realised that this was to do with the movement of the magnet.

03.8 This was well answered with just over 76% of students choosing the correct answer.

03.9 Just over half of the students scored zero. Answers such as 'bigger magnet' or 'more coils' were too vague to gain credit.

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

04.1 Less than 50% of the students realised that the shape of the container makes no difference to the liquid level and that the level in each tube would be the same.

04.2 Many students were able to give a statement matching the first mark point, but few were then able to relate the increase in pressure to an increase in force to score the second mark.

04.3 This question was well done with nearly 90% of the students calculating a correct numerical answer. However only 50% knew the unit for pressure.

Question 5 (Standard/**high** demand)

05.1 There were very few correct answers. Most answers described a specific error rather than a type of error. Many students incorrectly think that 'human error' is an acceptable answer.

05.2 There were many vague answers such as; 'knocked the ray box' that were not worthy of credit. Many students simply stated that there was a measuring error without further detail. Few students took the hint from Figure 7 that the rays were wide and so there would be difficulty in marking the exact position of each ray.

05.3 Nearly 70% of the students scored at least one mark for either calculating the mean or for calculating the range. Around 33% then calculated the uncertainty correctly.

05.4 Over 90% of the students scored at least one mark for either writing 'I agree / disagree' and quoting relevant data but not identifying the trend or for doing the converse.

05.5 About 23% of the students realised that the extra evidence would come from using a larger number of angles of incidence. Most answered in terms of repeating the same angles or comparing with another student's results.

05.6 Many students simply wrote 'change the mirror' but did not say for what. Others suggested' replacing the mirror but with a non-reflecting surface or a glass block. In this question it was important to realise that the replacement was in the context of an investigation and not simply recalling the meaning of diffuse reflection.

Question 6 (Standard/**high** demand)

06.1 Most students knew there should be two arrows in opposite directions and there was evidence of attempts by most to use a ruler and to make the arrows the same length. Most put arrow heads on their lines. A small number of students did not know that the arrows should start from the same point and drew them on a diagram of the boat. Most students added a label but only 50% of the students used 'upthrust'. Incorrect labels included gravity, water resistance, buoyancy, air resistance, drag and upward pressure.

06.2 Many students used the values 24, 24.5 or 25 kN and so knew how to use the scale correctly. A common incorrect value was 5 kN. A wide variety of marks were given for values not in the range but correctly used. In general the conversion to newtons was done correctly, but a significant number of students did not do the conversion. A number of students were unable to re-arrange W = mg correctly.

06.3 Just over 64% of the students identified the correct law.

06.4 9% of the students scored all four marks. Most drew two lines to scale, usually with the 150N horizontal, but sometimes vertical. Many lines did not have arrows to indicate the direction of the forces and it was rare for the resultant force to have an arrow drawn. Values for the tension force were often obtained by calculation rather than scale drawing. Few students measured the direction of the force from the diagram and gave vague compass directions with no numerical angle.

Question 7 (Standard/high and High demand)

07.1 Many students had the correct idea, but imprecise detail such as 'wrong number of turns' or 'number of turns was miscounted' were insufficient to score the mark.

07.2 Many students tried to answer the question from a general knowledge about transformers, rather than using information from the graph, and so did not gain credit.

07.3 Most of the answers were correct. A very small number of students wrote 'hotter' but made no reference to infrared or thought it was just a temperature increase.

07.4 This question involved a two stage calculation, a new feature of the examination. Nearly 33 % of students knew the equations to use and how to use them, scoring all five marks. A further 35% of students correctly used one equation to give a partially correct answer, scoring three marks.

Question 8 (Standard/high and High demand)

08.1 Just over half the students wrote answers that were worthy of some credit but often only gained a single mark, which was usually for a match to the third marking point. It was very unusual to see acceleration mentioned. Frequent incorrect answers were in terms of variations in the radius of the satellite's orbit, despite it being shown as circular in Figure 14. Other students commented on the physical geography of the Earth having an effect on the orbit or the velocity being affected by the Earth's magnetic field. A few students stated that the satellite was falling on the right hand side and getting faster as a result.

08.2 Over 50% of the students completed this calculation correctly to score all five marks. A further 10% of the students scored four marks because they rounded the number of orbits to 16. Some of students incorrectly used 300 km as the length of the orbit.

08.3 This part was generally well answered with just over 70% of students scoring this mark.

08.4 About 50% of the answers matched one of the marking points but few students scored both marks. Some students expressed the view that the predicted and actual values for the radius of Uranus' orbit were too different to support the prediction. Many answers referred to Uranus or the Solar System rather than Bode's prediction or equation.

Question 9 (Standard/high and High demand)

09.1 Nearly 80% of the students chose the correct description for a model.

09.2 This part was not answered well. Some students appeared to answer the question 'why do scientists use models?'.

09.3 Most students scored either one or two marks. The idea of new evidence or data was often expressed although not always very clearly. When giving an example many students did describe a model and what replaced it but a significant number only mentioned one of the models.

09.4 Nearly 80% of the students scored zero on this question. Some students were aware that the waves changed speed but did not state what the change was. There were many answers in terms of the refraction of light at a boundary and references to water having different density depending on its depth.

09.5 80% of students scored zero. Many answers were simply descriptions of Figure 17. A common error was to state that the wavefronts did not cross the boundary.

Question 10 (Standard/high and High demand)

10.1 Many diagrams looked like the field around a bar magnet or solenoid. Shapes similar to the electric field around a point charge were also drawn.

10.2 About half of students knew the value equivalent to 4 microtesla.

10.3 Very few students gave a coherent, detailed answer to this question. Most concentrated on what made the coil move, although ideas were not always expressed with clarity. It was unusual to see an answer that considered moments. The action of the commutator was not understood well and its function was often not mentioned. Some students appreciated that current direction needed to be reversed but thought an alternating current was the solution. There were significant numbers of students unsure whether the question was about an electric motor or a generator. Many answers made reference to induced currents in the coil and the coil cutting field lines to induce a potential difference.

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.