Questions matter

GCSE
Physics

8463/2H Paper 2 Higher Tier

Report on the Examination

8463
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Higher Tier

There was a demonstration of good Maths skills for many students taking the Higher paper with the majority of marks available on calculations being scored. There has been an improvement in students showing their working. As with Foundation Tier, a significant number of students think that a value with a square or cubed in the unit needs to be squared / cubed when substituted into an equation.
Students had access to the Physics Equations sheets for this examination series.

01.1
69% of students correctly gave the resolution of the protractor. Answers of 10, 90 and 180 degrees were frequently seen.

01.2
Answers to this level of response question about the refraction of light included details, such as drawing round the block, that suggested that most students were familiar with this practical. Most students were aware of the need to incorporate the drawing of a normal into their account and described the need to measure the angles of incidence and refraction. Many students, however, described a method that would not necessarily lead to a valid outcome because they did not clearly identify the location of the angles or describe a method to mark the path of the ray of light through the glass block. Most students failed to describe the range and interval of angle of incidence that should be used to obtain the results recorded in the table reproduced in the question. A small number had not read the question carefully and described reflection at a mirror. 38% of responses were level 2 and16% level 3.

01.3
Very few errors were made in the plotting of the 2 points on the graph of angle of incidence against angle of refraction, but many students drew a straight line of best fit. This is connected to the misconception that a line of best fit is always straight.

01.4
74% of students were able to answer this question about the relationship in the graph correctly. Of those who drew a straight line of best fit in **01.3**, a large number described the points as not lying on the line of best fit.

01.5
Students did not always take sufficient care in drawing the reflected ray to show that i = r. A significant number of students appeared to have only read the first part of the question and, consequently, had not drawn a normal. 61% scored both marks, 21% scored one.

01.6
73% of students identified the correct ray diagram for refraction of light.

02.1
79% of students scored the first mark, with a minority citing 9.8 N / gravity for the resultant vertical force. Many quoted Newton's laws as an explanation; very few students said, 'the child isn't accelerating' and a number stated that the forces were equal but failed to explain that the forces were in opposite directions.

02.2
99.6% of students wrote down the correct equation for work done.

02.3
95% of students scored all 3 marks for this calculation of force. There were some errors rearranging.

02.4
84% of students gained the first mark point for explaining why the speed of the baby walker increased as the baby moved onto the hard floor, but few referred to the resultant force. A significant number of students thought there was no friction on the hard floor. Some responses were in terms of energy rather than forces.

02.5
99.7% of students wrote down the correct equation for the moment of a force.

02.6
75% of students scored all 3 marks for the calculation of the moment; 24% did not convert 7.5cm to 0.075m or converted incorrectly.

02.7
This question related to interaction of two gears. When marks were gained, this was primarily for the first mark point. Some expressed ideas for the second mark point and but rarely in the correct terms, sometimes referring to momentum, rather than moments. There were a number of responses in terms of energy transfers. 10% of students scored both marks, 73% scored 1 mark.

03.1
Generally, well answered with 50% of students gaining all 3 marks for naming types of object that make up our solar system, and 35% getting 2 marks. Many students did not make the distinction between artificial and natural satellites. A number listed different stages in the life cycle of stars.

03.2
94% of students chose the star mostly likely to become a black hole. A common incorrect answer was Cynus A, the star with the lowest mass.

03.3
56% of students were able to convert gigametres to metres.

03.4
This is always a difficult topic for students. Many students recognised that galaxy A is travelling faster. A large number of students didn't clearly state the light spectra were showing red-shift or that the galaxies were moving away from us, so were unable to achieve the first and / or the second mark points. Students who stated the light spectra were showing red-shift often went on to achieve all 3 marks (17%).

03.5
63% of students scored all 4 marks for this calculation of time. The most common error was not converting the distance to metres. Some students got confused dividing numbers in standard form, ending up with an incorrect power.

03.6
23% of the students were able to give a complete account of how all the elements larger than hydrogen formed and achieve level 2. 24% gave partial accounts that missed out a stage and a 25% gave only a beginning, a middle or an end. The remainder mentioned the lives of stars without mentioning fusion or the processes at all, or clearly had no idea what a star was or described chemical bonding of gas molecules. 47% of the students gained 1 or 2 marks in this question but those who achieved level 2 showed a good understanding beyond recall, suggesting that this topic has been well established in the teaching and is one that many students have a passion for.

04.1
This question asked students to explain the effect of increasing depth on the pressure on a submarine. A common error was repeating the question stem "as depth increases" rather than referring to increasing height (volume or mass) of water above the submarine.

04.2
Quite a well answered question with over 72% of students gaining all 4 marks for calculating the depth of the Mariana Trench. Another 20% did not convert the pressure, or converted incorrectly.

04.3
75% of students knew what types of waves P and S-waves are.

04.4
68% of students selected the position where only P-waves are detected following an earthquake. However, the reasons often referred to "it was in a straight line" or "it was below the earthquake". A number of students just referred to the core without specifying the inner or outer core. Others confused which layers are liquid and which are solid, even though this information was given in the diagram.

04.5
95% of students gained at least 2 marks in this calculation of wavelength. Converting was sometimes unclear, often being done at the end rather than the beginning of the working, preventing students gaining all 3 marks. .

04.6
This question was about the relationship between the distance an earthquake is from a seismometer, and the time difference between P and S-waves arriving at it. 15% of students gained both marks and 30% gained 1 mark. Those who didn't score had misunderstood the question stem. A small number had identified that greater distance meant a greater time difference, but then called this inversely proportional.

05.1
Only 25% of students were able to name the force acting through the string. There are a significant number of students on higher tier who are unable to distinguish between forces and types of energy.

05.2
29% of students gained this mark by identifying a control variable. There is a misconception that 'keeping things the same' equates to a control variable. The idea that you would, for example, change the string or the bench in the middle of an investigation is not creditworthy.

05.3
Very few students (0.94%) scored full marks for a description of how to calculate acceleration with the given data. Very few appreciated the necessity to use the maximum velocity in the calculation and did not gain the second mark point as a result. Many students merely quote two formulae, often simply using symbols and not quoting the correct subject of the formula. Describing a calculation, rather than performing one, appears to be a skill that few students have practised.

05.4
This uncertainty calculation was generally well done, and those students who knew the difference between range, mean and uncertainty found the question straightforward. 62% gained both marks. However, it was clear that many students were unsure of the meaning of these terms and were therefore unable to calculate an uncertainty successfully.

05.5
This was a demanding question, requiring an explanation of how the raising of the runway affected the acceleration of the trolley. Very few students (0.3%) scored the full 2 marks. Many were able to appreciate the idea of acceleration increasing because of an increased resultant force, but virtually none could link this to the correct component of the weight. Those who adopted the energy approach in their answer similarly found the question challenging and failed to give a complete response relating work done to the energy transfer causing the increase in final velocity and hence acceleration.

06.1
Some students displayed a good factual knowledge in answering this item, although a good number thought electromagnetic waves are both transverse and longitudinal. Some students tried to answer this question in terms of the uses of the waves rather than their properties and scored few marks as a result.

06.2
72% of students (scored the mark for this item, displaying a good factual knowledge in giving a wide range of medical uses for gamma rays. However, there were students who did not focus on gamma rays, incorrectly giving MRI scans, X-ray imaging or ultrasound as their response and hence failing to score the mark.

06.3
Only 20% of students scored both marks on this question, comparing the dangers of gamma rays compared with radio waves. The most common errors were not stating that radio waves are not ionising, saying gamma rays are more ionising than radio waves or that gamma rays are highly ionising. Many stated that gamma rays cause cancer or kill cells, but those who mentioned mutations did not always link them to genes / DNA.

06.4
Many students could not explain how radio waves of a specific frequency are produced. Students that achieved the first mark point usually mentioned alternating current. Only 15% scored any marks here.

07.1
Most students appreciated the idea of using the area under the graph to calculate the distance travelled with 55% scoring full marks. Some, however, tried to calculate the area under the whole graph rather than limiting their calculation to the first 600 s. Common mistakes were seen in those who could not read the scale on the axes correctly, or who tried to calculate the areas of incorrect triangles or rectangles.

07.2
A minority of students gained the first mark point for interpreting the velocity-time graph. Weaker responses referred to acceleration, or a slower deceleration, or stated that the rate of deceleration was slower. Only 49% gained marks on this question.

07.3
Students needed to determine the maximum deceleration from the velocity – time graph. Many incorrectly used the whole of the final section of the graph, calculating 2 gradients and adding them together, or used the section from 720s to 960 s. A minority calculated the average deceleration and were awarded a compensation mark. Most gradients were calculated with the correct values, but a small number read the velocity as 58 m/s or the time as 700 s or 1000 s. 41% scored all 3 marks.

07.4
30% of students scored full marks on this multi-step calculation of distance. These students tended to use the preferred method, or the first alternative method, given on the mark scheme. 45% scored 3 marks, usually because they used the final velocity instead of the mean velocity in distance = speed × time, so could not access the final 3 marks.

07.5
77% of students scored at least one mark in this question about how alcohol affects stopping distance. There was references to time being slowed down, and confusion between distance and time. 15% scored all 3 marks.

08.1
Just under 50% of students were able to identify this as the generator effect. Common errors were ‘motor effect’ or ‘motor and generator effect’.

08.2
Well answered for a normally difficult topic about the generator effect. 8% of students scored all 3 marks and 37% gained at least 1 mark. Many failed to explain that the wire was cutting the magnetic field lines or thought there was already a current in the wire.

08.3
80% of students were able to work out which way the ammeter needle would deflect.

08.4
The students' understanding of the operation of a microphone was often good, although some did describe the operation of a speaker. Knowledge of the term 'inducing' was widespread although many students failed to appreciate that an alternating current was induced in the circuit. Some students did not appreciate the longitudinal nature of sound waves and described oscillations in the wrong direction as a result. Most students attempted this item, although a thorough knowledge and understanding of the principles was not always evident in their answers. Only 4% achieved full marks, but 49% scored at least one mark.

Mark Ranges and Award of Grades

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