Examiners' Report/
Principal Examiner Feedback

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Pearson Edexcel International GCSE
in Physics (4PH0) Paper 2P

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As in previous examinations for this specification, most students were able to recall the equations and usually they handled the related calculations well. Responses to the longer questions showed that the less able students tend to struggle when assembling a logical description, explanation or when asked to offer more than one idea. There was a wide range of responses for many of the questions and it was good to see that many students were able to give full and accurate answers. This paper highlighted a good example of when diagrams can be just as powerful a communication tool as writing (part 4(c)).

Question 1

This question offered students four multiple choice questions associated with radioactivity. Approximately three quarters of the students were able to successfully answer parts 1(a) and 1(b) as these were basic recall of knowledge. Parts 1(c) and 1(d) represented a greater challenge to students. In part 1(c) a common mistake was selecting 50 metres as the maximum range of beta particles in air. In part 1(d) approximately half of students chose the incorrect answer, with no common trend seen. As the question required students to apply their knowledge of beta decay to assess the impact on proton and nucleon numbers, it is likely that students who did not know how to solve the question simply guessed.

Question 2

The inclusion of sound as an option in the multiple choice question of part 2(a) required students to do more than simply recall the order of the EM spectrum. Consequently, slightly less than half of students chose the correct answer of light. Only those students with an understanding of the relative orders of magnitude of the frequencies (or wavelengths) of the EM spectrum could compare these frequencies to the maximum audible sound frequency of 20 000 Hz.

In part 2(b)(i) less than half of the students could successfully communicate why the graph showed a digital signal. A common response that did not gain credit was that the signal strength did not vary, showing a lack of awareness that the signal was varying between two values. Those students who did gain the mark frequently did so by referencing there being only two values or that the signal strength was either 9 or 0. Part 2(b)(ii) posed a much greater challenge with less than 10% of students gaining both marks. Most students could give at least one acceptable response, usually increasing the frequency. Quantisation and multiplexing were also often seen together. Limited language caused problems for those trying to talk about additional levels. There were signs that this topic was new to some centres and a minority of students focussed in on the context in the stem to try to explain that the remote control should be moved nearer to the TV or have its batteries changed.

Question 3

Most students could relate pitch to frequency in part 3(a) to gain MP1. However, there were numerous students who related pitch to amplitude or volume. Some also referred to wavelength and therefore did not gain the mark. A third of the students went further to gain MP2, usually with a concise sentence such as "high pitch has high frequency".

The majority of students were able to give either a ruler or measuring tape as a suitable instrument to measure length in part 3(b)(i). It was also encouraging to see that over half of the students could also give an oscilloscope as an instrument to measure frequency. This second instrument clearly caused the most difficulty, especially with spelling. Although not essential for the mark, the word 'oscillator' was seen on numerous occasions and did not gain credit. The use of a stopclock was also a frequently seen incorrect answer, potentially due to confusion with measuring time and then using $f=1/T$. The majority of students gave the two correct variables in part 3(b)(ii), although too many had them reversed and so did not score. This part of the question therefore highlighted a weak understanding of the difference between dependent and independent variables.

Part 3(c) differentiated extremely well between students and the open ended nature of the question allowed the best students to provide some intelligent improvements for the investigation, often covering more than just three marking points. Many students understood the idea of repeating and calculating a mean or eliminating anomalies, although there were several who gave these as separate suggestions. The idea of additional lengths was often seen but the further details required to gain two of the marking points (greater range MP2, or more intermediate values MP3) were less common. MP4 was awarded most frequently for references to measuring in cm. In future series students would benefit from focusing their answers to the number of suggestions requested and trying to include as much detail as possible with each suggestion.

Question 4

The vast majority of students marked the direction of the magnetic field correctly in part 4(a)(i) but some students did not follow instructions and marked the direction on more than two lines and, in some unfortunate cases, contradicted themselves. Almost all students understood that the force on the wire should be horizontal but only a third correctly drew the force arrow pointing to the left. This was likely due to misapplication of Fleming's Left Hand Rule.

The magnetic field requested in part 4(b) was drawn well, with over three quarters of the students gaining both marks. Where students lost marks it was almost always due to a lack of care when attempting to draw a uniform field. Whilst use of a ruler is not expected (although highly encouraged) it should be clear that lines are intended to be straight, parallel and evenly spaced to indicate a uniform field. In this particular example, a well-drawn non-uniform field was also given full credit due to the poles of the magnet not being very close together and the magnets not being specified as very strong.

In part 4(c) it was clear that a lot of students had not done this investigation, but nonetheless very encouraging to see that students could use their knowledge and understanding to compile a sensible method. Half the students were able to gain all three marks in this part of the question. In a large number of cases all three marks could be awarded for the diagram alone and this highlights the fact that a diagram can be just as effective a communication tool as a written method. Where students did not gain full credit it was usually due to failing to mention the need to join marks together to make a field line (if this was not clear from their diagram). A significant number of students also reverted to describing an iron filings method, despite the question specifically referring to the use of a single plotting compass.

Question 5

The straightforward calculation in part 5(a) was answered very well and the majority gained all four marks. Marks were most commonly lost in part 5(a)(iii) when students thought a further calculation was required to find the amount of energy transferred. However, most students understood that the energy transferred was equal to the work done.

The six marks in part 5(b) offered very good differentiation between students. The best students were able to locate the centre of gravity of the wheelbarrow and realised that the principle of moments was necessary in part 5(b)(iii), before going on to successfully implement it. However, even some students who could complete the calculation did not understand that the centre of gravity should be in line with the weight arrow and so lost the mark in part 5(b)(i). Almost all students could recall the equation in part 5(b)(ii) but the calculation in part 5(b)(iii) proved difficult for most. Too many students failed to realise that the calculation required them to apply the principle of moments and even when they did so they did not write it in their working. Many responses gained 2 marks (352.5) as they did not realise that the correct distance to force F was 1.4 or 0.6+0.8. Many realised that they had to calculate a moment and wrote a correct one but failed to get any further in the calculation.

Question 6

Part 6(a) offered students a straightforward momentum calculation, followed by a slightly more complicated link to forces. Virtually all students gained the marks in parts 6(a)(i)-(ii) and it was very pleasing to see over two thirds also gain the marks in part 6(a)(iii). Where students lost marks it was most regularly due to omitting the fact they had already calculated the momentum previously and, instead, students attempted to use either the mass or velocity in the equation relating force, change in momentum and time.

Newton's Third Law was only known or seen as relevant by less than half of the students attempting part 6(b). Those students who understood the relationship between the forces occasionally lost marks through using the word 'same' instead of equal or quoted Newton's Law of motion but failed to add 'third'. Those students who failed to score often thought that the forces must be different sizes as the nail goes into the wood.

The explanation in part 6(c) saw a large number of responses being awarded both marks. A small number of students said that the nail in contact with the wood was sharp or small but left out 'area'. There was good understanding shown by a lot of students about the relationship between the variables as this was stated and given credit. A small number of students did not clarify which end of the nail had a smaller surface area, despite realising that the areas were different. MP1 and MP3 were regularly seen but MP2 only in the best answers.

Question 7

Although not previously in this context, the idea of how an object becomes charged has appeared in numerous past papers and the majority of students answered part 7(a) well. Most students gained at least one of the marking points but students would benefit from applying a cause and effect structure in their explanations. It was good to see some responses going even further than was required by explaining that the man's shoes act as insulators and hence the charge stays on the man.

Most students recalled the equation correctly in part 7(b)(i). The main issues arose in part 7(b)(ii) as a result of the time being given in milliseconds. This frequently led to power of ten discrepancies in their final answers, resulting in a loss of one mark. It was surprising to see that a large number of students could not recall the correct unit for current and many chose to give the unit as coulombs per second instead.

Many students failed to realise that the electric shock in part 7(c) was a result of static discharge and it was clear that the use of the earth wire in this context confused a significant number of them. Such responses referred to faulty circuits and fuses and did not gain credit. In responses that did gain credit, MP1 and MP3 were the most frequently seen, but not always together. Only those students producing well-structured explanations thought to consider the initial cause of the electric shock and so comment on the voltage between the button and the man. MP4 was also rarely seen but, where it was, it was clear that the student could apply their understanding confidently and coherently.

Question 8

Convection is a topic that has challenged students since the beginning of this specification, particularly where they have been required to produce an extended explanation of it. Therefore, it was very pleasing to see a large number of exceptionally detailed responses to part 8(a) and a significant number of students gain all four marks. However, some students still referred to the density of the particles changing rather than the air. In addition, students should pay closer attention to the number of marks a question is worth as a significant number of students simply did not cover enough points to merit four marks. At the other end of the spectrum some students chose to structure their answer using bullet points and hence ensured they covered enough detail whilst keeping their answers concise.

Part 8(b) was generally not well answered but was intended to challenge students at the end of the paper. Many students missed out the need to explain what evaporation involved and so did not get anywhere in their answers. A number of students appeared to have looked at the diagram and assumed that they needed to write a similar answer to part 8(a). Very few responses included the idea of proportionality between temperature and kinetic energy of molecules or particles. Most often, students only gained one mark for the water changing to a gas rather than (water) particles leaving the bulk of the water. Only a relatively small number stated that the particles leaving the liquid were those with the highest energy. They often thought that the particles were taking energy from others. However, approximately 20% of students were able to successfully apply their understanding to compile a logical argument as to why the water would cool down and hence gain all three marks.

Summary Section

Based on the performance shown in this paper, students should:

- Take note of the number of marks given for each question and use this as a guide as to the amount of detail expected in the answer.
- Take note of the command word used in each question to determine how the examiner expects the question to be answered, for instance whether to give a description or an explanation.
- Be familiar with the equations listed in the specification and be able to use them confidently.
- Be familiar with the names of standard apparatus used in different branches of physics.
- Practice structuring and sequencing longer extended writing questions.
- Show all working so that some credit can still be given for answers that are only partly correct.
- Be able to identify independent, dependent and control variables and be ready to comment on data and suggest improvements to experimental methods.
- Take care to follow the instructions in the question, for instance when requested to draw a specific number of arrows.
- Take advantage of opportunities to draw labelled diagrams as well as or instead of written answers.
- Allow time at the end of the examination to check answers carefully and correct basic slips in wording or calculation.

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