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Principal Examiner Feedback

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Physics (KPH0) Paper 2P

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Examiner's Report International GCSE Physics 4PH0 2P

General Comments

It was encouraging to see so many excellent responses to the more challenging questions in this examination series. In the latter stages of the paper, parts 6(c) and 7(b) highlighted the talents of some very capable physicists who could apply their understanding to unfamiliar scenarios through the compilation of coherent, detailed explanations. The paper also highlighted the need for greater understanding of the terminology used in experimental work. Very few candidates could suggest how to improve the precision of a measurement and a similar number struggled to identify independent and dependent variables in an investigation. Most importantly, candidates need to practise reading questions carefully and identifying command words. This will help them write appropriate responses that fully answer the questions being posed.

Question 1

The first question of the examination was designed to offer a straightforward start to the paper. However, completing the table in part 1(a)(i) proved to be more challenging than anticipated and just over half of all students gained both marks. Common errors included giving the charge of an alpha particle as +1 or -2 and quoting the nature of a beta particle as being a 'helium nucleus'. Candidates fared much better in parts 1(a)(ii) and 1(a)(iii), with 75% of them being able to recall the correct information. Completing the decay equation in part 1(b) required candidates to apply their understanding balancing nuclear equations. Most could do so correctly, although a common mistake was to give the atomic number of nitrogen as either 5 or 6. Candidates need to pay closer attention to the atomic number of the beta particle in future.

Question 2

Only 15% of all candidates managed to score both marks in part 2(a), with the majority failing to make any reference to either balance or equilibrium. Many more candidates did state that clockwise and anticlockwise moments had to be equal, although some went no further than stating that a moment was the product of a force and a distance. A small number of candidates confused moments with momentum and either referred to what happens in a collision or stated that clockwise and anticlockwise moments are only equal when no external forces act.

The experiment conducted in part 2(b) offered candidates the opportunity to evaluate an experimental method and use the principle of moments in a calculation. A large number of candidates did not appreciate that a balance measured mass and so did not make the necessary link to weight in part 2(b)(i). A lack of awareness of the term 'precision' was also seen in part 2(b)(ii), although most candidates who gained the mark did so for mentioning using a ruler with a smaller or mm scale. Almost all candidates could correctly recall the equation in part 2(b)(iii). Candidates who did not score the mark were usually those who used their own symbols, rather than standard ones.

A third of all candidates were able to correctly calculate the force in part 2(b)(iv). The biggest error was in not realising that measurements of distance needed to be taken from the pivot. Hence, instead of using 0.3m and 0.1m for distances, candidates used one or other, or both, of 0.8m and 0.4m, which in this instance are just numbers on the rule, not the required measurements. A minority of candidates converted from cm to m, though this should not have stopped candidates from calculating the correct answer.

References to the weight of the beaker were often seen in part 2(b)(v). However, several answers stated that the calculated force included the beaker's force without linking this to either its weight or its mass. Only a few correct answers included references to the weight of the paperclip. Blaming the discrepancy on either the weight of the ruler or inaccuracies in reading the distances were common incorrect responses.

This is a standard experiment that candidates would benefit from experiencing if it were carried out in schools.

Question 3

Two thirds of all candidates correctly answered the multiple choice question in part 3(a). In part 3(b)(i) a third of all candidates were able to calculate the correct time period and substitute this value into the frequency formula to obtain the correct answer. Candidates using an incorrect time period were still able to score two marks (the mode) if they evaluated the frequency from this incorrect value. A small number of candidates did not use the correct equation, despite it being given at the start of the paper.

Most candidates successfully gained both marks in part 3(b)(ii) and it was encouraging to see how many took care to make their plotted wave look neat and symmetrical. Some candidates made a good initial attempt to sketch a higher frequency wave but unfortunately did not keep the frequency constant. Consequently, it was the same as the original by the time they reached the last one or two squares of the grid and this did not gain the mark.

Question 4

Identifying the independent and dependent variables once again proved very difficult for candidates in part 4(a). Too often the number or amount was missing from the layer reference in (i) and 'final', 'after 15 minutes' or 'difference' was missing in the temperature reference in (ii). Candidates need to be able to extract such information from the method described in the question, even though they will probably not have performed the experiment themselves.

Two thirds of all candidates correctly completed the results table in part 4(b)(i). The following bar chart proved much more problematic but did discriminate very well between different abilities. Many candidates did not have a clear idea of how to draw a bar chart with some ignoring the instructions and trying to draw the more normal line graphs given in previous papers. Many only drew four bars or drew a graph of final temperature against number of layers. A very small number drew a graph of final temperature against temperature difference. More worrying was the failure to write the temperature unit within the label, which should be common practice.

Inaccurate terminology caused the most problems in part 4(b)(iii). Most candidates recognised there was an inverse relationship, but some could not be awarded the mark as they did not make it clear that they were talking about the relationship between number of insulation layers and temperature difference as required by the question. Again, many recognised the fact that there was no effect with more than two layers but some were unable to communicate this clearly and were not specific enough as to when the temperature difference remained constant. In part 4(b)(iv), although most candidates realised that repetition was necessary there was no indication of why this was important so the additional detail of 'average', 'mean' or 'anomalies' was often missing in answers. Others did not understand the term reliability and confused it with precision.

Question 5

It was very encouraging to see over half the candidates gaining all three marks in part 5(a). Most others gained two marks for a substitution of power and time with a correct evaluation, but missed the unit conversion mark. A good number did convert the time to seconds correctly.

Candidates were expected to use efficiency terms when responding to part 5(b) and 'wasted' or 'lost' energy in the form of thermal or heat energy was well known and communicated. The second marking point was not as well answered, with many candidates referring to not all the energy being converted to light rather than not all the 'electrical', 'input' or 'supplied' energy being converted to light.

Some very good, fully-labelled diagrams were seen in part 5(c) which, on their own, gained all three marks. Also, even where diagrams were absent, some excellent descriptions allowed all three marks to be awarded. Those scoring two marks mostly failed to mention the soft iron core although a few did this but then got the turns ratio the wrong way around. Answers scoring zero were often the result of not reading the question carefully and described the use rather than the structure of a step-down transformer.

Part 5(d) provided an excellent example of why it is useful for candidates to fully show their working on paper and then to review this at the end of the exam if they have time. The most common mistake was to confuse the primary and secondary currents when substituting into the equation. Candidates appeared to confuse $I_1V_1 = I_2V_2$ with the equation for gases $P_1V_1=P_2V_2$. It may assist candidates if the terms primary and secondary are always used when working with transformers, as in $I_pV_p = I_sV_s$.

Question 6

Candidates showed good understanding of the difference between scalars and vectors in part 6(a), with nearly three quarters able to identify energy as the scalar quantity. The calculations in part 6(b) were generally well-answered. A small number of candidates added the two forces in part (i) while a few others divided one by the other but most answers were correct. The equation in (ii) was nearly always correct. The value in (iii) was occasionally wrong, mainly due to an incorrect rearrangement of the equation. The unit of acceleration caused the most problems with both m/s and N/kg often seen. Although one can sympathise with those stating the latter, as it is dimensionally correct, it is not unit that should be quoted with values of acceleration.

The explanation in part 6(c) discriminated very well across the grade range with approximately equal number of candidates gaining each mark within the five-mark range. This part of the question also demonstrated the need to make sure candidates understand exactly what is being asked in a question. The command word used in this question was 'explain'. This meant that candidates needed to communicate what they could see from the graph and, crucially, give supporting reasons using their understanding of forces. The mode for this question was two marks, commonly given to the candidate who did nothing more than describe how the velocity changed. The best answers concisely broke the graph into stages and referred to the driving force and resistive forces (air resistance and friction) at all times. These responses often gained all seven of the available marking points. Common misunderstandings included incorrect use of the term 'decelerate' and using terms such as 'weight' presumably from rote learning answers for falling objects.

Question 7

It was pleasing to see two thirds of candidates recognised the alternative unit for pascals in part 7(a). The following explanation in part 7(b) was answered at a high level. However, only the best candidates who read the question carefully could gain all three marks. Some candidates confused the water molecules with the air molecules in the flask. They often realised that heat was transferred but did not explicitly say to the air molecules. Many gained the mark for an increase in KE and for more frequent collisions with the walls of the flask. They often stated that pressure is directly proportional to temperature. Weaker candidates thought that the collisions of water molecules with the flask somehow reduced its volume and so increased the pressure.

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.
- Only use symbols when writing equations if the symbols are correct.
- Recall the units given in the specification and use them appropriately, for instance pressure.
- 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.
- Take care to follow the instructions in the question, for instance when requested to use particular ideas in the answer.
- 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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