Examiners' Report

Principal Examiner Feedback

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Pearson Edexcel International GCSE

In Physics (4PH0) Paper 1P

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General

On the whole, students demonstrated that they could recall facts and equations, but it is a little concerning that some fundamental concepts were not well known. (with a few notable exceptions) but were less proficient at applying these in new situations. There was evidence that students who had experience of laboratory work gained good marks on questions targeted at AO3 (experimental methods, data processing, variables etc.). Generally, students made few numerical mistakes in their calculations. However, they should be reminded that S I units are normal, and that all quantities involved should be in S I when substituted into equations.

Question 1 Waves

This question proved to be a suitably straightforward start to the paper for most students with three quarters of students gaining full marks for part (a). This does mean that 25% of students can't determine the wavelength from a diagram which is of concern. Part (b) was more discriminating. Many students were able to identify the difference between longitudinal and transverse wave motion, however the language used was often very imprecise, which adversely affected some candidate's marks. There were just over 25% of students who did not gain any marks in part (b). Almost two thirds of students gained full marks for part (c). In part (d) almost all students knew that gamma was used to treat cancer but only three quarters could identify that visible light is used in optical fibres. Students were less successful in explaining why technicians need to leave an X- ray room with just 60 % gaining any marks. Students generally considered why staying in the room was a good idea, rather than writing a fuller answer stating why leaving the room was advantageous. "X-rays cause cancer" was the most common response seen.

Question 2 Electricity

It was surprising to note that while nearly 90% of students could identify an LDR this dropped to just 70% for a fixed resistor. All parts of (b) proved to be straightforward with over 65% gaining full marks throughout. It was evident that some student had problems with rearrangement of equations as they had multiple attempts at the 'show that' until they got it right. Students should be reminded that, when asked to show something is approximately equal to a value, they should show the "true" answer to at least 2 s.f. prior to rounding to the 1 s.f. they were asked to show.

Question 3 Magnetic fields

It was expected that all parts of this question would be accessible to most students. This was not true for part (b) as almost one quarter failed to gain any marks and a further 15% only gained one mark. There were many common errors: using 'metal filings' rather than iron filings, omitting to mention 'tapping the card' and failing to mention compasses in order to determine the direction of the field.

Question 4 Pressure and density

Many students were able to correctly calculate the area of table in contact with the stack of metal squares. About a quarter of students forgot to multiply the weight by 6. As expected, the explanation questions in part (b) were more challenging and over a quarter of students were unable to make any progress. Some of the misconceptions that were demonstrated clearly were alarming: some students related the contact area to the volume, e.g. as the area had increased, so must the volume, which shows a worrying insight into 3D perception. Some students often cited an equation as a reason, without explaining how the equation related to the question.

Question 5 Electric Motors

In part (ai), over a third of students seemed to have missed the instruction to give their answer to 2 significant figures (SF). In a number of cases, the procedure of rounding was confused e.g. 8.547 was rounded to 8.55 which was then rounded to 8.6 instead of 8.547 being directly rounded to 8.5

In general students performed well in part (aii /aiii), with the following caveats: the use of the word "gravity" in the equation; using grams within the calculation – students do not realise the SI unit of mass is the kilogram; and excessive truncating or rounding to 1 significant figure. In general answers should always be given to two or more significant figures.

Part (aiv) was very poorly attempted with just less than 10 % gaining both marks.

In part (b), there was a wide spread of responses many of them poor. Students clearly had not learned this explanation, and a lot of confusion was seen with electric generators. A number of students mentioned the left-hand rule which is more useful when determining which way the motor rotates. There were also instances of students not using correct terminology: overlapping fields is not the same as interacting fields.

Question 6 The toy parachute

This first parts of this question were primarily targeted at practical skills and not all parts proved to be accessible for students. It was expected that part (a) would prove to be an easy introduction into the question. However, almost 20% of students failed to score any marks. In parts (b) and (c), identification and control of variables were equally poor with over a third of students failing to gain any marks. There was some evidence that this was centre-dependent.

Part (d) was typical for a graph plotting question and produced the usual range of mistakes. Students often failed to select an appropriate scale (so that the plotted points would use more than 50% of the y-axis); and those students who plotted on inverse axes failed to note that the use of a false origin would be advantageous. Most students plotted accurately, with the point at (60,1.11) being most frequently plotted incorrectly. Students should be reminded of the need to put units on all axes. The line of best fit produced some variation, with more "point to point" lines than expected as only 60% gained this mark.

In part (e), students were usually able to label the forces. Some students did not realise that part (ei) was an introduction to part (eii) and they failed to mention forces or their comparative sizes in their response. and hence scored few marks. Just under one quarter of students gained full marks for this explanation. Worryingly, some students thought that air resistance was related to acceleration rather than velocity. Other examples of conceptual problems include confusing acceleration with force (e.g. acceleration balances air resistance or acceleration equals drag) and incorrect use of the term 'resultant force'.

Question 7 Determination of average speed

This is a standard experiment although with a child's toy, and students performed well, over 70% of students gained four or more marks. Those who did not score full marks invariably had the correct idea but did not give sufficient detail about how or with what they intended to measure the necessary quantities.

Question 8 Acceleration and velocity time graph

In part (a) the formula, like many of the others on the paper, was well known and was quoted correctly. Over 60% of students gained full marks. In a small number of cases the formula was wrongly rearranged. There were incorrectly rounded or truncated answers seen. Both of these errors caused students to lose marks. However, in part (aiii) 80% of students gave incorrect answers. They did not relate the question to the "constant velocity” part of Newton’s First Law, but instead interpreted it as a need to have an unbalanced force to start the sledge from rest. There were some very “interesting” wrong answers.

In part (b), many students missed out the word “change” in the definition of acceleration, which inevitably led to losing marks. Students who answered part (bi) using the correct equation usually produced the correct final answer. Over 75% of students gained two or more marks.

In part (c), it was surprising that almost 40% of students could not relate distance travelled to the area under the graph. Most students who remembered the word “acceleration” scored two marks in part (ii). However, very few tried to further describe the shape by comparing acceleration to deceleration, or by stating the acceleration/deceleration was constant. It should be suggested to students that attempting to draw the graph from their description will highlight what they have missed out.

Question 9 Background radiation

There is evidence that this topic is not well understood. It is possible that this is because few students have seen radioactivity demonstrations even on video. Almost 40% of students could not name a Geiger-Muller counter. A similar number of students could not name a source of background radiation. In part (bii) a large number of students repeated the stem of the question here, rather than discussing the procedure. It is worth reminding students that repeating information given in the question is not creditworthy. Less than 40% of student gained two or more marks for (bii).

In part (c), the responses seen were variable: some students gave brief correct answers but others described the properties of beta particles. In general, this question was not well answered as 60% of students failed to gain a mark.

In part (d) some weaker candidates were able to score marks as 85% of students picked up at least one mark. It was clear to see a distinction between the students who had experience of demonstrations of radioactive sources and those that hadn’t, as the latter group had some unusual ideas of what was needed to be safe e.g. full decontamination suits.

Question 10 Pressure of gases

In part (a) some very poor responses for what is essentially a recall question were seen – many students mentioned collisions with other particles but not the wall. Few mentioned force or momentum. Just 25% gained full marks and almost a third failed to gain any marks.

Very surprisingly in part (b) given the poor answers seen for (a), students did much better with a third gaining full marks – it is difficult to explain the reason for this, as (b) is more challenging question with more precise concepts and precise terminology needed.

Part (c) this question produced either fully correct responses (60% of students) or fully incorrect responses (almost 30% of students). The incorrect answers resulted from a wrong choice of equation of an incorrect equation. A further 10% of students who chose the correct equation lost a mark due to truncation of their final answers (c.f. 8ai-ii).

Question 11 Total internal reflection

It was unfortunate that some students were not sufficiently precise in their responses to part (a). Almost half of the students identified that the incidence angles needed to be greater than the critical angle, but the need for the ray to be inside the more optical dense medium was seen in only 20% of responses.

Part (b) was found to be more accessible than similar questions in previous years. The normal was often well drawn and the angle measured within tolerance. Two thirds of students gained both marks for a clear diagram; it was rare to see diagrams where the ray did not leave the water thus scoring no marks. The equation in was less well known than other equations on this paper: the 'sin' was missing in a significant number of responses seen and some students gave the Snell's law equation instead. The calculation did cause some problems with $sine^{-1}$. Approximately one quarter of all students gained full marks for all parts of this question. Overall it was pleasing to note the improvement in this topic compared to previous series.

Question 12 The filament lamp

This question was aimed at the more able students and did very well in discriminating between them. Approximately 25% of students gained six or more marks over this entire question.

In part (a), less able students were not able to produce a functioning circuit in part (a) with often an incorrect symbol for a lamp. Most commonly able students omitted a variable resistor.

In spite of the question in part (b) instructing students to refer to the data, only a minority of students did, and an even smaller minority actually performed calculations with them. It should be noted that students can easily be prepared for this style of data analysis question. Answers to part b(ii) were also generally poor, and very few two- or three-mark responses were seen.

Recommendations for improvement

1. Wherever possible, centres should ensure that students do the suggested practicals. If this is not possible for whatever reason, students should be encouraged to use good simulations, some of which are available with minimal cost online. When doing revision, it may be prudent to concentrate on generic methods, identifying equipment, and identifying all the variables.

2. Some equations are not well known, e.g. the equation for critical angle. It is strongly suggested that students be tested regularly on recall of equation. Students can't gain marks for calculations if they don't know the equation or how to transform it.

3. While many students are very proficient at substitution into equations, they are less so with transforming the equation. In a similar manner, many students make mistakes when converting power of tens in units. There is no requirement that students work in standard form, but students should know what the standard prefixes mean. It is strongly recommended that this be an area of focus during revision.

4. Students should practice different types of data analysis e.g. from graphical data and from text or tables. There has been at least one of these on all recent examination papers in this subject as it is forms part of the required AO3 skills.

5. Students should also practice recognising areas where poor technical vocabulary loses otherwise easy marks. This can be done by for example giving students (photo) copied but otherwise unidentified sections from internal examinations where they can try to spot errors. Teachers can discuss why confusing say power and energy loses marks. Teachers can also see such areas by reading the notes section on the mark schemes.

This is especially so for the vocabulary needed for AO3 skills.

6. Graph work is becoming an area of concern. Some students are insufficiently accurate with plotting or with the need for their points to occupy at least half the available grid. Both of these can be remedied by a good choice of scale and a false origin. In addition, the drawing of a smooth curve or straight line of best fit (with an even distribution of points above and below the line) should be practised.

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