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Examiners' Report/
Principal Examiner Feedback

Summer 2016

Pearson Edexcel International GCSE
Physics (4PH0) Paper 1P
Science Double Award (4SC0) Paper 1P

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Physics (KPH0) Paper 1P
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Examiner’s Report International GCSE Physics 4PH0 1P

On the whole, students demonstrated that they could recall facts and equations (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 Linear movement

This question proved to be a suitably straightforward start to the paper for most students, with nearly 90% of candidates gaining the first two marks. A further 75% of candidates correctly identified that average velocity equals distance moved divided by time. The most common mistake here was to give option A: change in velocity divided by time taken.

Question 2 Nuclear reactor

Most students found that the objective question in part (a) was also straightforward, with less than 5% gaining zero marks. However, students found parts (b), (c) and (d) more problematic. Only 25% of students gained the mark in part (b).

In part (c) the role of a moderator in slowing neutrons was relatively well known as about 45% of students gained at least one mark. There were some students who lost marks due to lack of precision e.g. ‘moderators slowed particles’. It was more concerning to see inappropriate terminology e.g. ‘successful collisions’ which seems to be a term imported from Chemistry.

Students found part (d) equally difficult. This seemed to be because the students did not answer the question asked-- about controlled nuclear fission. Instead a large proportion of students described only the initial fission reaction and thus gained only one of the available marks. Under 25% of students gained two or more marks.

Question 3 Waves used in medicine

Almost 80% of candidates correctly identified speed in free space as property common to all electromagnetic waves. Very few students failed to gain both marks for part (aii). It was pleasing to find that over 60% of students gained the mark in part (aiii).

Over ¾ of students were successful with (bi). There was no particular pattern to the erroneous responses. Students found part (bii) surprisingly difficult: the idea that the ultrasonic wave travelled to the organ and back was often omitted as students struggled to express their ideas. Over 45% failed to gain any marks in this part.

Part (biii) was found to be even more difficult with only 30% of students gaining any mark. Many students stated that when the speed increased then the wavelength increased without any reference to the frequency remaining constant nor did they state where the wavelength was longer or shorter. Those students that gained one mark generally did so for giving the wave equation.

Question 4 Air Pressure

In part (a), there was evidence of poor examination technique: the basic relationship was not asked for, hence students should expect that the equation to be used in the calculation_should be given. About 60% of students failed to gain any of the available marks because they failed to use the correct equation. There were a few students who lost a mark by quoting the pressure in incorrect units.

Conversely, as recall of the appropriate equation was required, part (b) was well answered with nearly 50% of students gaining three or more marks. Again, however, a few students lost a mark by using incorrect units. There were some students who failed in part (biii) to correctly add their value from (bii) to 101 kPa.

In part (c) more students were able to make progress than in part (a) despite that both were (in part at least) based on Boyle's law. Generally, this was because students mentioned that pressure decreased as depth. Very few students mentioned possible temperature differences.

Question 5 Resistance of an LDR-- practical skills

This question was primarily targeted at practical skills and nearly parts proved to be accessible for most students. In part (ai) 70% of students accurately drew a voltmeter in parallel across the LDR in the circuit; a further 15% drew their voltmeter in parallel with another component. Over 40% of students gained both marks in (aii). Here the most common oversight was not quoting the equation in the form 'R= V/I'

In part (bi) naming the independent variable was found quite difficult with just over 50 % success rate. Stating a controlled variable had a similar percentage. It was surprising that only 1/3rd of students gained the mark for part (biii): the most common error was to think that starting from zero would improve the technique.

The graph plotting was much better attempted by the majority of students: over 2/3rd gained four or more marks. Common errors included: using an inappropriate scale (e.g. 0 ,150, 300, 450 etc.) or a nonlinear scale, omitting units on the axes and joining the points with straight line sections. It was pleasing to find that in part (ciii) over 85% of students were able to gain one or more marks for describing a relationship between diameter and resistance. Students should be reminded that: a two-mark question requires two responses and that 'negative correlation' is insufficient to describe a relationship.

Question 6 Movement of a comet

Parts (ai) to (aiii) were designed to be a relatively straightforward introduction into this question. However, over 30% of students did not make any progress in (ai) and (aii). Common errors included: placing the Sun to the right of the Earth's orbit and drawing the comet orbit too short. It was therefore not surprising that over 40% of student's also found difficulty in explaining why the comet was not visible in week 6.

Part (aiv) was well done with over 85% gaining the mark. Over 55% of students gained one or more marks for their interpretation of the data in the diagram. This percentage dropped to just over 30% for giving a reason why the comets speed changed. This was often due to imprecise technical language e.g. 'it's caused by gravity' but sometimes more worryingly caused by incorrect concepts e.g. 'the Earth pulls it' or 'the kinetic energy changes to potential when the comet gets close to the Sun'.

The calculation in part (b) proved accessible for most students with over 60% gaining full marks. Some students did make basic errors converting days to hours.

Question 7 Total internal reflection

Many students found this question relatively straightforward. Less than 10% failed to gain a mark in part (a) and nearly 50% gained all three marks for the diagram in (b).

As expected, the calculation in (ci) was well done by nearly 50% of candidates, but there were the inevitable mistakes in the equation and processing the calculation. Only the most able students were able to attempt an explanation of why refractive index has no units. Parts (di) and (dii) performed as expected with fewer than 20% failing to gain a mark.

The final part of this question was also shown to be problematic for the majority of candidates. It was expected that students use the data given in the diagram to answer this question rather than give a theoretical response. Only 8% of candidates could give two reasons for why the axes did not start at zero, although a further 40 % gained one of the marks most commonly for stating that the critical angle cannot be zero.

Question 8

Students found this question straightforward. There was a good range of answers seen in part (b) with nearly 30% gaining all five marks. The best of the responses showed some brevity: these students gave the outline of the investigation without over complications. Some students limited the marks they could gain by only focussing on recording data, without considering data handling or the criteria for assessing whether Hooke's law was obeyed.

Question 9 Electric Motor

Part (ai) proved to be a suitably straightforward start to the question for most students, with over 60% of candidates gaining the first mark. In (aii), many students seemed not to know that the brushes and commutator provide electrical contact. Over 25% of students did however know that the current is reversed to enable the motor to turn continuously. Students also found (aiii) difficult.

Students were much more successful with the calculations in parts (b) and (c). Nearly 80% gained five of the six marks available. In part (b) incorrect units was a common error. In part (d), many students used incorrect quantities from earlier part of the question and hence severely limited their marks. It was surprising how many students could not rearrange an equation, and there were also surprising conversions from MW and MJ into W and J. Nearly 60% of students were able to reason that lower power would imply a longer time.

Question 10 Measurement techniques

Most students were successful with the calculations in part (a). There were the errors with SF in the estimation and also with the mean e.g. some students divided by 6 instead of 5. In part (aiii), over 50 % calculated the diameter correctly, but a further 40% failed to notice the units and hence gave the circumference as 47cm.

Part (b) was targeted at understanding of strengths and weaknesses of different methods of finding the circumference. Many students found this challenging, with 40% failing to gain any marks. Students should be encouraged to see the whole question as one structured unit and hence use the data given in earlier parts. The most successful students did just this and made relevant comments about the ink 'dots' and the precision of digital callipers compared to using string and metre ruler. As always, many students failed to gain credit by using such vague terms as 'human error' rather than giving more detailed examples e.g. the dots may not be in a straight line when drawn.

Question 11 Energy and work

The kinetic energy calculation in part (a) proved to be an opportunity for over a third of students to gain full marks. Common errors included: using the formula for momentum, failing to convert units to SI, incorrect rearrangement and forgetting to take the square root.

As expected, students found part (b) more difficult with 50% of students failing to make any progress. However, it was pleasing to note that over a third were able to make creditworthy attempts at linking ideas of KE and GPE together to make explanations of where less work was needed.

Question 12 Data analysis and thermal energy transfer

The data given in this application based question was in mostly in diagrams. In part (a), over two thirds of students were able to interpret the thermal image and make sensible comments about temperatures. In part (bi), the more able students concentrated on thermal energy transfer mechanisms and applied it to the information given However, there was a lack of precision in the responses seen e.g. stating that the air was trapped but not where nor giving a consequence of the lack of air movement. This lack of precision was also seen in (bii) with many students using 'reflect' instead of 'emit' and 'radiate'. A small but significant number of students did identify that the reflected light is absorbed by the black skin of the polar bear.

Students found the rest of the question more challenging with more than two thirds failing to gain a mark in any part of (c). In (ci), many students did recognise that the sky and bear's fur looked the same in the diagram, but incorrectly thought that since the bear reflected visible light, it also reflected ultraviolet. Less than 20% of students gave a sensible suggestion for why the sky appears dark in the diagram. The final part was somewhat better answered with over 30% gaining a mark, usually for stating that total internal reflection did not occur. Less than 10% could give an explanation for the lack of total internal reflection.

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.

2. Some equations are not well known, e.g. the equation for kinetic energy is often misquoted. 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 substation 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.

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