Examiners' Report/
Principal Examiner Feedback

Summer 2015

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

Pearson Edexcel Level 1/Level 2 Certificate in Physics (KPH0) Paper 2P

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Examiner's Report International GCSE Physics 4PH0 2P

Overview

As in previous examinations for this specification, most students were able to recall the equations and usually they handled the related calculations well. Students who gave the best practical descriptions usually appeared to be writing from first-hand experience. Responses to the longer questions showed that the less able students tend to struggle when assembling a logical description or when asked to offer more than one idea. There was a wide range of responses and it was good to see that many students were able to give full and accurate answers.

Question 1

The vast majority of students were able to correctly offer types of radiation for the three uses presented in the question. For the few students who lost a mark, it was most commonly for suggesting radio waves as a type of radiation for treating cancer, most likely due to confusion surrounding the term 'radiotherapy'. In part 1 (b) 80% of students knew that all types of electromagnetic radiation emitted from the Sun have the same speed.

Students found drawing the refraction of an infra-red ray in part 1 (c) (i) challenging and this question was not attempted by a significant number of students. Most students knew to draw a ray refracting at both boundaries, although it was clear that some did not know where infra-red lies in the electromagnetic spectrum and so often drew the ray emerging from the prism below the yellow light. Some students resorted to drawing the full spectrum of visible light, but rarely included infra-red.

Two thirds of students successfully answered the multiple choice question in part 1 (c) (ii), whilst the majority who lost the mark chose 'red' as their response, perhaps due to association with the previous question.

Question 2

It was pleasing to see three quarters of students select the correct response in part 2 (a) (i), correctly linking watts to joules per second. The vast majority of other students chose joules per coulomb as their answer and lost the mark. Students showed a high level of understanding in the following calculation, although a small number lost a single mark for not showing their working to a high enough level of detail. In 'show that' questions such as these, it is important that students display their working clearly and give final answers to more significant figures than that shown in the question if they are to be awarded full marks.

The explanation in part 2 (b) (i) differentiated students by ability well, but over half were able to gain at least two marks for their response. Most chose to split their explanation into two parts and dealt with the fuse and earthing separately. Almost all students referred to the fuse melting or blowing but some needed to take greater care over their use of language; phrases such as 'blowing up' or 'exploding' were seen frequently. Students were able to link this with breaking the circuit and realised that this would reduce the risk of an electric shock to the user. The explanations of the role played by the earth wire were less accurate and a large number of students did not appreciate that a large current would pass through it in the event of a fault, confusing their ideas with static electricity.

When asked to select an appropriate fuse in part 2 (b) (ii) for a kettle with twice the power, 90% of students chose the correct rating, with the majority of incorrect responses indicating that they had not fully read the question and choosing the 5A fuse.

Part 2 (c) required students to apply their knowledge and understanding in an unfamiliar context of testing the rating of a fuse. The most common mark awarded for this question was one, usually for the use of an ammeter to measure the current in the fuse. Students made good use of the option of including a diagram with their answer, which assisted in providing clarity in their answers. A significant number of students did not appreciate the practical nature of this question and, although they understood that the current in the fuse should be varied, gave no indication of a method to achieve this. Very few students could give a valid method of identifying when the fuse had blown.

Question 3

The vast majority of students understood that the reaction forces on supports P and Q would be equal when the train was in the centre of the bridge and selected the correct response to the multiple choice question. In part 3 (b), although two thirds of students correctly described force X as decreasing, very few students achieved the second mark as they did not include limiting values of the force in their answer. Instead, students took the opportunity to explain why the force decreased, using moments based arguments. Such students need to pay closer attention to the command word in the question which, in this case, was ‘describe’ not ‘explain’. Therefore a comprehensive description was required for two marks, without the need for a supporting explanation.

Question 4

Most students gave a stopwatch (or stop clock) as a necessary instrument for the investigation but only a third of students gained the second mark for a suitable instrument to measure the depth of water. A significant number of students overlooked the fact that depths up to 86cm were being measured and so a standard ruler would be insufficient for the task. The use of a measuring cylinder was also a frequently seen, but irrelevant, suggestion.

Students’ graph plotting was excellent in part 4 (b) (i) and it was evident that this is a well-practised skill. Where students lost a mark, it was usually due to omitting units from the axes labels or using ‘m’ as a symbol for minutes. There was much less evidence of dot to dot line of best fits than in previous examination series, although a small number of students still found it challenging to draw a curve.

When asked to describe the relationship in part 4 (b) (ii) almost all students were able to gain the first mark for a basic description. However, only 20% received the second mark for including a correct additional detail, such as a reference to the rate of decrease changing over time. A significant number of students described the relationship as ‘inversely proportional’, showing a lack of understanding of this term.

Only a quarter of students did not receive a mark for their response to part 4 (c) as most understood that the pressure would decrease with water depth.

Question 5

The momentum calculation in part 5 (a) was attempted to a very high standard and the majority of students could recall the correct equation and use it successfully to calculate the initial momentum of the snowball. In the few instances where marks were lost, it was usually due to using an incorrect equation or confusion with the term ‘initial’, which lead to using a velocity of zero in their calculation.

The explanation in part 5 (b) differentiated well between students, with approximately a quarter receiving each mark across the available range. In general, very few explanations were clear and concise and students attempted to use both momentum and force arguments in their response. Many students did not realise that both the skater and snowball had momentum or a force applied to them, whilst others omitted key details such as momentum being or conserved or the forces acting being equal and opposite in direction. Students appeared more confident in using forces and Newton’s Third Law to answer the question and these were generally the responses that were awarded higher marks.

There were many answers to part 5 (c) where students didn’t respond in terms of solid physics ideas, instead commenting on softness or hardness of the material, the effects of impact, energy, or compression. There were a number of different ways that students could use physics to explain themselves and it was very pleasing to see ideas about momentum, acceleration and pressure all being used successfully. Most candidates chose to base their answer around momentum and its relationship to force and these responses were generally well prepared, given that a similar question was set in 2014. Students should aim to be clearer in their explanations and pay closer attention to the vocabulary used; for example, phrases such as ‘time slowing down’ were seen frequently instead of increasing the time of the collision.

Question 6

Most students were able to gain at least one mark for their explanation in part 6 (a), using the idea of electrons being transferred between objects. Many went further to explain how a negative or positive charge is produced by electrons being gained or lost respectively. Many students found it difficult to relate surfaces 'rubbing' to this situation and resorted to repetition of the stem. Most did not mention insulators or electrons being negatively charged. The best and most concise answers achieved all three marks very quickly by using phrases such as 'when two insulators are rubbed together, electrons move from one to the other…' A small number of students referred to the movement of positive charge or electrons being positively charged, although the number was much less than in previous examination series. In part 6 (b) the majority of students were able to gain both marks through their understanding that opposite charges attract. Where students lost marks it was largely due to the use of imprecise language such as 'different charges'.

Question 7

The majority of students were able to gain both marks when completing the decay equation in part 7 (a). Students who lost a mark did so most frequently through their inability to recall the atomic number of an alpha particle.

Slightly more than half of students were awarded the mark for the suggestion in part 7 (b) (i). Although most realised that the radiation would be absorbed by either the ordinary glass or aluminium case, some did not relate this to a specific type of radiation and so were not awarded the mark.

Part 7 (b) (ii) presented students with a potential application of the radioactive glass and required them to apply their knowledge and understanding to suggest why this might be dangerous. There were some excellent answers to this question and most students were able to gain at least one mark, usually for giving a named risk such as cancer or blindness. Only a quarter were able to gain the second mark by providing an amplifying detail, most commonly that the radiation was ionising. Very few students referred to the eye being within penetrating range of the radiation, or that the astronomer would likely have long exposure to it.

Question 8

Most students correctly gave a step-down transformer as one that reduces voltage. However, the explanation of why the core of a transformer should be made of a soft magnetic material caused much greater difficulty. Two thirds of students were unable to gain a mark and usually based their explanation around the iron core strengthening the magnetic field, indicating that they had not fully understood the question. Most students who gained a mark did so by recognising that a soft magnetic material is easily demagnetised, but very few understood why this was important. Only a handful went on to gain the second mark by recognising that this would allow an alternating magnetic field to be generated.

The calculation in part 8 (b) was well attempted and over half of students were able to gain full marks. Marks were lost most frequently for not being able to give an equation in the correct form of a ratio, not using suitable symbols in their equation, or for experiencing difficulty when rearranging their equation. Many students arrived at an incorrect final answer of approximately 760 volts; such students would be well advised to place their answers in the context of the question. It would be very unlikely for an electric toothbrush to be charged at such a high voltage and this would not satisfy the transformer being a step-down type.

In part 8 (c) (i) students expressed themselves well and understood that the frequency was above the audible range of human hearing. Half were able to go further in their explanation to give the value of the upper limit of human hearing and gain the second mark. Where students were not awarded marks, their answers often focused on the amplitude of the sound or, in some cases, that the sound would be ‘trapped’ inside the casing of the toothbrush.

The following calculation in part 8 (c) (ii) was intentionally challenging and required students to select the correct equation from page 2 of the exam paper, convert milli-seconds to seconds and round their answer correctly to get the two available marks. Despite this, it was pleasing to see a quarter of students gain full marks and most others make only a single mistake, usually not converting the time to seconds, to gain one mark. There were a surprising number of students who did not know which equation to use and resorted to combining the frequency given in part 8 (c) (i) with a time of 1.5ms to arrive at some unusual answers.

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.
- Recall the units given in the specification and use them appropriately, for instance pressure.
- 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 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.

Grade Boundaries

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