Examiners' Report/
Principal Examiner Feedback

January 2016

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

Pearson Edexcel Certificate
in Physics (4PH0) Paper 2P

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January 2016
Publications Code UG043302

General Comments

This examination series highlighted problems when candidates were asked to recall equations. A significant number of candidates could not recall the density equation correctly and candidates also used incorrect symbols throughout, but notably for current (I). It should be stressed that there is no necessity to give equations in symbol form, as word equations are perfectly satisfactory. Responses to the longer questions showed that the less able students tended to struggle when assembling a logical description, or when asked to offer more than one idea; this was particularly noticeable in questions 7b and 9. However, 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

It was encouraging to see that the vast majority of students were able to answer at least three out of the four multiple choice questions correctly. Those that caused the most confusion were 1b and 1d, with roughly a third of students not being able to choose the correct option. In 1b a common distractor was 'acceleration', where students were not comfortable with the idea that this variable has a direction and hence is a vector. In 1d the most common distractor was 'the resultant vertical force is downwards' illustrating a common misconception that a moving object always requires a resultant force.

Question 2

Over half of all students were able to gain both marks in part 2(a) for correctly deducing the weight of the object and the accompanying unit. A further quarter of students lost only a single mark, commonly for failing to multiply the mass by 'g' or for giving the wrong unit. A common occurrence was giving the unit for weight as $kgms^{-2}$ which, as a derived unit, was not given credit.

Part 2(b) was answered well by the majority of students and two thirds were able to gain full marks. A surprising number of students gave the equation as density = mass x volume and so failed to gain any credit for this part of the question. Some students who did give the correct equation were then unable to rearrange it successfully in part 2(bii) and so did not get more than 1 mark for this part.

The vast majority of students successfully identified the type of graph in part 2(ci). Although the term 'histogram' was condoned, some students referred to the graph as a 'histograph' which was not given any credit. Students found part 2(cii) much more challenging and less than a quarter could give a reason why a line graph was inappropriate for displaying this type of data. Most students seemed unfamiliar with the terms 'categoric', 'discrete' and 'discontinuous' and their corresponding relationship with graph type. Those students who did gain the mark usually did so by conveying the idea that a line graph couldn't be used for variables that had no numerical values. Part 2(ciii) was answered to a higher standard but a large number of students failed to read the question and did not refer to density at all in their answers. Instead they chose to compare the volumes of cork and water using data from the graph, usually arriving at the conclusion that cork was denser than water, and so gained no credit. However, those students who correctly interpreted the question offered some thorough analysis and most calculated the densities of water and cork separately to show that water is denser. Only a small number of students gave their answer as a ratio and said that water was 4 times as dense as cork.

Question 3

Virtually all students could correctly match up particle descriptions to states of matter to gain two marks for part 3(a). Part 3(b) demonstrated that most students knew to add or subtract 273 when converting between degrees celsius and kelvin, but also that there was confusion when applying this. Over half of students gained both marks for this part, whilst the majority of others got neither of the calculations correct. Calculating a negative kelvin temperature should be a clear indicator to students that a mistake has been made. Part 3(bii) required a comment that the kinetic energy of the gas molecules decreased and most students were able to convey this correctly. Others answered in terms of the motion of the gas molecules and received no credit for stating that the kinetic energy slowed down. The final part of this question, 3(biii), was misinterpreted by many students to mean the volume of the gas, rather than the volume of the molecules themselves. Consequently, many students talked about the volume reducing and did not gain this mark.

Question 4

A quarter of students were able to gain both marks for part 4(ai) but such answers often came in groups, no doubt signifying centres where such information had been covered extensively. Many referred to friction and it was pleasing to see less evidence than usual of positive charge/proton movement, although vague references to charge were insufficient to gain the *electron transfer* mark. Very few students were able to suggest why the charge remained on the car in part 4(aii). Most used ideas about the car not being earthed or borrowed ideas from part 4(b) such as the car not having a metal strap. Only those students with a strong grasp of static electricity realised that the car was insulated from the ground and that this was due to the rubber tyres being insulators.

The majority of students gave answers containing one of the acceptable responses in part 4(bi), albeit in numerous ways. A minority thought the strap would prevent the car being struck by lightning or thunder. Answers to part 4(bii) were not always sufficiently clear to gain two marks, although nearly half of students were able to do so. Good candidates started well by stating that the strap was a conductor or that it had a low resistance. The second marking point was often seen stated in many ways. However, one of either the source or sink of the charge flow was often missing when it came to the awarding of the third marking point.

Question 5

Part 5(a) required students to relate pitch to frequency and two thirds could do so successfully. The most common acceptable response was that they are directly proportional. Some confused pitch and loudness; others simply gave definitions of the terms, without actually relating them to one another. The calculation in 5(b) was answered very well and over three quarters of students gained full marks. Marks were, on occasion, lost for expressing the equation using incorrect symbols, and students should note that it is perfectly acceptable to give word equations if they are not totally confident of the correct symbols to use. Seeing ‘s’ for speed was a common example of the use of incorrect symbols.

Despite being told to draw a straight line in part 5(c), many answers were drawn dot-to-dot. Most of the straight lines drawn fell within the permitted boundaries, however lines were often not extended to 20°C resulting in speeds being read off at 0°C, 15°C or estimated at 20°C, the latter often being more than 0.5°C away from the true value for their line. In part 5(d) students applied the speed, frequency, wavelength equation well, often giving all three possible marking points. Students who failed to gain marks tended to give responses totally in terms of particles, or describe longitudinal and transverse waves, or state that wavelength and speed increased. There were also those who gave wavelength and speed both increasing and decreasing when temperature decreases.

Question 6

Radioactivity proved to be a troublesome topic for many students. Despite this, over half of students gained the mark in part 6(a) through using subtraction or a similar term. Some subtracted the reading from the half-life, which is wrong physics and was not given credit. Others misread the question and described how to obtain the background count.

In part 6(b) students were asked for a standard definition of a half-life. Despite asking this question on many previous occasions it is clear that students still struggle with the keywords required in an accurate definition. Over three quarters of students gained the first mark for recognising that it is a measurement of time but only a third could clearly communicate what was halving in this time. Incorrect responses included singular use of the word atom/nucleus and a lack of precision through the use of words such as ‘material’ or ‘substance’. The simplest correct definition seen was ‘the time for the activity to halve’.

A small majority of students gave an acceptable answer in part 6(ci) but many did not really know what half-life is nor how to obtain a value from the graph. Those scoring took the initial activity as their first point and drew a single line at 1200 Bq, which gave the correct answer. Unfortunately, too many misread the initial activity as 2500 Bq and then read across at 1250 Bq, which gave an answer out of range. A very small minority chose two suitable values (e.g. 2000 Bq and 1000 Bq) and these pairs also obtained 56 s as the correct answer. In part 6(cii) many answers simply referred to achieving accurate readings, or getting several readings so that an average could be found. Very few students appreciated that taking more frequent readings provided more points to plot on the graph. The majority of marks were scored for either 'decays quickly' or 'short half-life' references and two thirds of students were awarded the mark overall.

Question 7

Most students appeared to have very little knowledge of the set-up used in part 7(a) and there were several blank responses to this question. Many attempts showed either a horizontal magnetic field above and below the coil, or a magnetic field curving from one side of the coil to the other. Several of the better answers failed to add a central vertical field line or had conflicting/non-existent arrows. Additions to the diagram were often poor making it difficult to judge whether a field line was actually circling the wires and virtually impossible to interpret the direction in which it was doing so.

Responses to part 7(b) were generally better, although a large number of students tried to explain the effect in terms of like and unlike charges. Those who appreciated that this followed on from part 7(a) and therefore involved magnetism, tended to score the second marking point by recognising that there was attraction or repulsion. Several students also linked the coils to bar magnets by referring to poles. Only a small number of students understood that attraction or repulsion was caused by the interaction between the separate magnetic fields.

Question 8

Part 8(a) was generally well answered by students with half the cohort able to gain all three marks. The majority could apply their understanding of the link between volts and joules per coulomb to gain the mark in part 8(ai). However, some students did not know which equation to use in part 8(aii) and occasionally arrived at the correct answer through the use of the wrong equation altogether. Generally, students would benefit from taking greater care over the setting out of their working, particularly in questions such as this where we require them to ‘show’ how to get to the answer. Students found part 8(aiii) much more challenging and only a third managed to secure any marks. Many gave vague responses about the charging station needing extra energy without realising that energy is wasted in the process. Although this question made no mention of transformers, a number of students gave an answer more suited to Q9 and usually managed to avoid mentioning waste of energy or heat.

Of the three parts of the paper requiring recall of an equation, part 8(b) proved to be the most troublesome for students. A large number of students used the symbol ‘C’ for current and were not awarded the mark. Others simply did not know the equation and so lost all marks for this part of the paper. Despite this, nearly two thirds of students successfully gained full marks for their calculation, with a small number losing a single mark for failing to deal with the time being in minutes appropriately.

Question 9

Nearly half of all students did not gain any marks for this question. Students either misread the question, did not understand the context or just described how step up and step down transformers were put together. However, there was a very even distribution of marks for students who were given credit and approximately 10% of the cohort gained each of the marks in the range 1-5. The majority of students who gained full marks were most commonly awarded MP1, MP2, MP3, MP4 and MP8 and these students had clearly been taught this particular application of transformers. Those that got three marks generally were awarded them for describing how step-up and step-down transformers change the voltage and current. However, their answers failed to go beyond these descriptions and link these effects with this particular application. The factors which allow the cables and transformers to increase their efficiency (MP6 and MP7) were rarely included in answers and if they were the effects were often confused.

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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