Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

November 2021

Pearson Edexcel International GCSE Physics (4PH1) Paper 1P and Science (Double Award) (4SD0) Paper 1P

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Question 1
Students were usually able to score at least one mark in Q1(a), usually for identifying stationary motion, constant acceleration or both. The graphs showing increasing acceleration and moving at a constant velocity were less frequently identified. The majority of students also knew that the area under the line on a velocity-time graph can be used to determine the distance travelled in Q1(b).

Question 2
Despite the definition of electric current being a recall mark in Q2(a) it was unusual to see a response that scored the mark. Most students omitted the idea of *rate* from their response. However, it was pleasing to see most students remember the name of the particles flowing in an electric current in Q2(b) and go on to complete the calculation in Q2(c) without much difficulty. Q2(c)(iii) was much more challenging; many students were able to convey that the wire had resistance and most were aware of a flow of electrons. Some students understood there was a transfer of energy. However, few related this to collisions between the electrons and lattice ions, increasing the vibrations of the latter.

Question 3
Some good coherent answers were seen in Q3(a) gaining all three marks. The majority of students gained MP1 from their understanding that there was relative movement between the coil and the magnet. However, instead of linking that to electromagnetic induction many referred to the coil having a field and the two fields interacting. While some students understood the result was an induced voltage across the coil, many simply repeated the information from the question that a current was being produced. Q3(b) was generally well understood and scored well. MP1 and/or MP2 were the most common marking points. MP3 less so but it was still seen in some responses. Some students repeated the stem of the question in selecting a stronger magnet whilst others simply stated a factor that would *affect* the current, rather than *increase* it.

Question 4
It was encouraging to see most students correctly recall the becquerel as the correct unit of activity in Q4(a). Labelling the axes and drawing the curve of best fit offered little challenge to most students in Q4(b), but the subsequent half-life determination and linked calculation proved more difficult. More students could determine the half-life from the graph than those who knew how to use it to determine the time taken for the activity to fall to $1/8^{th}$ of its initial value.

Although most students knew the definition of isotopes in Q4(c), many overlooked the requirement to *describe* the difference between the isotopes and were not awarded a mark for simply stating that the isotopes had a different number of neutrons. A similar difficulty was experienced in Q4(d), where students wrote more about the properties of the beta particle instead of the change taking place in the nucleus.

It was encouaraging to see some excellent answers to the longer response style Q4(e). Only those students who referred to a laboratory-style experiment involving radioactive sources scored poorly in this question. Most students recognised the need for some relevant form of shielding and knew that the radiation emitted from cobalt-60 would be dangerous. The best students took their answers further to include additional hazards from the gamma radiation and more detail about the site in which the cobalt-60 should be stored.

Question 5
Students struggled with the meanings of the terms *accuracy*, *precision*, *reliability* and *validity* and so found the multiple choice questions in Q5 a challenge. In Q5(c) it was pleasing to see that most students circled the correct anomaly in the table, but surprising to see a large number choose 18.98 as the anomaly instead. Only the most able knew to omit their chosen anomaly from the subsequent mean calculation, but often did not know to round their final value to a consistent number of decimal places as the data in the table. However, the vast majority of students gave the correct additional measurement needed to determine the density in Q5(c)(iii).

Question 6
Good responses were given in Q6(a) despite a number of students listing equipment that was already given in the question. It was clear that most students had performed this experiment themselves. The ray diagram in Q6(b) was completed to a high standard and most students drew a ray that refracted correctly and was parallel to the initial incident ray. However, some students did not score the mark for the drawing of the normal line since it was not perpendicular to the boundary. Students should be advised to take care over the accuracy of their drawing in these questions and always to use a ruler. Some students found it difficult to measure the correct angles of incidence and refraction in Q6(b)(iii) with the most common error being measuring the angles from the boundary, rather than the normal. Those student who could recall the correct formula in Q6(b)(iv) usually went on to score full marks in Q6(b)(v).

Some very good accounts were seen in Q6(c) where there was a clear understanding of the significance of the gradient of the graph of sin(i) against sin(r). Some students transposed the axes of the graph but very few knew that the gradient of this graph would be 1/n. Other students did not recognise the advantages of the graphical approach and suggested calculation again.

Question 7
Some excellent responses were seen in this question, which demonstrated a clear understanding of the sequence of events involved. Most students were able to score some marks as they addressed a number of the marking points but the sequence of events was incomplete to a greater or lesser degree. Some students confused the motor effect with electromagnetic induction.

Question 8
A large number of students did not draw their diagrams with enough care in Q8(a) to merit the awarding of the mark for a circular orbit. Some students annotated their diagram to state that the orbit is circular, which was acceptable. Some students did not label their diagram at all, which prevented any marks from being awarded.

The calculation in Q8(b) was completed with varying degrees of success, but overall most students performed well in this question. The most common reasons for not scoring full marks were not converting hours to seconds or not presenting the final value to 3 significant figures, as requested in the question.

Students found Q8(c)(i) challenging and a significant number thought that the lower gravitational field strength was due to a greater distance from the Sun. The most commonly awarded mark was for Callisto having a lower density. Many good answers were seen in Q8(c)(ii) scoring full marks. Use of $W = mg$ was seen in almost all answers. Where errors did occur, they were usually through selecting the wrong gravitational field strength or incorrect substitution/rearrangement of the equation.

Question 9
Rearranging the formula posed the greatest challenge for students in Q9(a), but most students performed well in this calculation. Q9(a)(iii) proved to be a good discriminator at the higher grade boundaries. Weaker responses omitted collisions with all the walls and/or had a focus on collisions with each other.

Many good answers were seen in Q9(b)(i) either by drawing on and annotating the graph or describing extrapolation of the line until the x–axis is reached. There was generally a good understanding that at this point the gas would have zero pressure. Although most students scored both marks when asked to redraw the graph with a kelvin scale in Q9(b)(iii) some lost a mark for either not drawing a straight line or not drawing their line passing through the origin. Very rarely were no marks scored.

Question 10
There was generally a good understanding in Q10(a) that the extension requires the difference between the extended and original lengths so MP1 and MP3 were commonly awarded. MP2 would have been awarded more frequently if more students had realised that a ruler (or equivalent) was required for the measurements. In Q10(b)(i) many students described 'stretching beyond the elastic limit' instead of relating the curved line to non-proportionality. There were also a significant number of quotes of Hooke's law without relating that to the graph shown. Few students scored all four marks in Q10(b)(ii). 3 marks was common where students had applied suitable methods of estimating the area, but converting from centimetres to metres was rarely seen. 2 marks were also

commonly awarded where there was a valid attempt to calculate the area but little more progress towards the correct evaluation. A significant number of students ignored the rubric of the question and tried to apply a range of methods other than calculating the required area.

Question 11

Students generally performed well in Q11(a). The formula was well known and most students could use it correctly to evaluate the resistance of resistor X. Marks were most commonly lost for not converting mA to A or, less frequently, for incorrectly stating the voltmeter reading.

Most students knew that current is conserved at junctions in parallel circuits in Q11(b)(i). Students most often did not score the mark for vague statements such as 'the current is shared', which did not do enough to convey the idea of conservation. The two stage calculation in Q11(b)(ii) was more challenging. Most students applied $V = IR$ here and so scored MP1. There was also generally a good understanding of the need to convert mA to A. The great majority were hence able to either calculate the total circuit resistance or the voltage across the 250Ω resistor. A significant number were able to progress further through an understanding of the summation of the resistance or voltage depending on the method chosen.

Q11(c) was not well understood and therefore not well scored. Few students demonstrated a sound understanding of the comparative resistance in series and parallel circuits. Many erroneously argued the reverse case – i.e. when the components are removed the resistance is decreased giving an increase in current.

Question 12

Scoring in Q12(a) was not as high as expected for a relatively straightforward principle. Many students did not recognise that convection was the process here. Of those who did, most understood that the air inside the pipe was being heated and became less dense – but fewer explained this was due to the expansion of the air.

Q12(c) was generally well understood. Some students scored MP1 as they recognised the ground was cooler than the air. Some realised energy transfer was occurring. More accounted for the process occurring due to conduction. Very few were able to link these ideas into a coherent complete explanation to score full marks.

Students gave some pleasing responses in Q12(d). Of those who correctly chose black/dark colour most were able to explain that dark colours are better absorbers of radiation (although there were also many more vague references to heat) and hence the air in the pipe was heated more quickly.

Paper Summary

Based on their performance in this examination, students are offered the following advice:

- Attempt all questions even if the student is unsure of their response.
- 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 formulae listed in the specification and be able to use them confidently.
- Know the SI units for physical quantities and be able to convert from non-SI units to SI units when required.
- Show all working so that some credit can still be given for answers that are only partly correct.
- Take advantage of opportunities to draw labelled diagrams as well as, or instead of, written answers.
- Be ready to comment on data and suggest improvements to experimental methods.

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