Examiners' Report/
Principal Examiner Feedback

Summer 2016

Pearson Edexcel International GCSE in Physics (4PH0) Paper 1PR

Pearson Edexcel International GCSE in Science Double Award (4SC0) Paper 1PR

ALWAYS LEARNING

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2016
Publications Code 4PH0_1PR_1606_ER

Examiner's Report International GCSE Physics 4PH0 1PR

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

Virtually all students could match the circuit symbols with their electrical component in part 1(a) to gain full marks. When components were described to students in part 1(b) they found it harder to give the name of the correct component, with only two thirds of students able to do so in each part. There was a clear trend in students' knowledge being confident in both components or neither.

Question 2

In part 2(a), many students were able to provide at least three correct responses as the extensive mark scheme provided many opportunities to score. Most common errors were not realising that Venus is smaller than the Earth and for giving Solar System instead of Galaxy.

The majority of students could identify and correctly name the force of gravity in part 2(b)(i), whilst 'gravitational field strength' and 'gravitational potential energy' were commonly seen responses that did not gain credit. A similar number of students also understood when the force of gravity would be greatest in part 2(b)(ii), although some students wrote more than one letter and hence did not gain the mark. Students clearly found the remainder of this question more challenging and only half gained the marks. A large number drew the arrow for the gravitational force along the line of travel in part 2(b)(iii). Many who drew an arrow roughly towards the Sun were careless and drew arrows which, if extended, would miss the Sun altogether. In part 2(b)(iv) many students gave A or E as their response or, in some cases, both.

Question 3

The concept of random motion as particles moving in different directions was well understood in part 3(a) and the majority of students were able to gain both marks. Students could have improved their answers further by drawing arrows of different lengths to show that the particles also have a variety of speeds. Most students who did not get full credit drew arrows that were not clearly associated with the particles themselves.

The explanation of how gas particles exert a pressure on their container has been asked several times now over the lifetime of this specification and over half the students were able to produce coherent and concise responses that deserved full marks in part 3(b). Those students who lost a mark usually did so because they did not link particle collisions to a force on the container.

The vast majority of students were able to gain the mark in part 3(c), although many referred to the temperature increasing despite the question telling them that it did not change.

Almost all students were awarded at least 2 marks in part 3(d), showing that they were able to apply their knowledge and ignore suggestions of clearly wrong Physics. Three quarters of all students were awarded full marks.

Question 4

Part 4(a) assessed students' knowledge of longitudinal waves and whilst the vast majority were able to give an example of one in part 4(a)(ii) (sound being the most popular answer) they found the drawing task in part 4(a)(i) considerably more challenging. Only half the students were able to get the mark as although the question asked for "arrows" many just drew one, showing a lack of appreciation for the need for oscillations to produce a wave. A small number of students who did draw two arrows had them in the same direction and an even smaller number drew the arrows at right angles to the direction of the spring.

Part 4(b) moved on to transverse waves and most students clearly demonstrated their understanding of wavelength to gain the mark in part 4(b)(i). Students who were not awarded the mark usually did not take enough care over their drawing and it was not clear where the wavelength line was intended to start and finish. Making a clear mark to show where they understand the start and end points to be would allow them to communicate their understanding more effectively. Only a third of students gained the mark for finding the amplitude of the wave in part 4(b)(ii), showing a clear misconception that the amplitude is measured from crest to trough; answers of '5' were very common. Three quarters of all students gained full marks in part 4(b)(iii). The unit of frequency was less well known and usually was the cause of students losing a mark. This early in the paper, rounding errors were not penalised in students' final answers despite a significant number of students not being able to round their calculated values correctly. It was pleasing to see students produce some excellent answers to part 4(b)(iv) and those understanding the definition of a transverse wave were able to apply this to the context. Most students realised that the direction of ring movement was perpendicular to the wave direction but others would have benefited from a clearer distinction between the two directions. The example of a transverse wave in part 4(b)(v) caused few difficulties and a plethora of different examples were seen, usually from the electromagnetic spectrum.

Question 5

It was clear that some students had spent little time studying geothermal power stations as less than half realised that the renewable resource was geothermal in part 5(a)(i). A lot of students thought the diagram showed an elaborate wind turbine or water wheel. However, students fared much better in part 5(a)(ii) and three quarters could name another renewable resource. Common responses that did not gain credit included unqualified 'water' and various types of fossil fuels.

It was also clear that a significant number of students think that nuclear fuels are renewable.

Part 5(b) differentiated very well with approximately 20% of students gaining each of the marks in the 4-mark range. This part of the question specifically asked for energy transfers as the basis of students' answers and those students who structured their answers accordingly scored well. Some students appeared not to link the introductory part that stated that *cold water is pumped into the hot, dry rock* but wrote about water being pumped up gaining GPE, possibly thinking about hydro-electric power. The most creditworthy responses included ideas about the rocks transferring heat to the water, the production of steam and the generator converting kinetic energy to electrical energy. Where students failed to score it was often because they described the process without referring to the energy transfers involved. Some misunderstood the diagram and referred to the turbine as being a wind turbine that powered the transport of hot water down to the rocks underground.

Question 6

The equation in part 6(a)(i) caused little difficulty but some students still wrote 'gravity' for g and hence lost the mark. Students would benefit from either writing equations using full words or standard symbols. Problems are most commonly experienced when students try to use their own abbreviations. Many students had clearly not seen the experiment in part 6(a) demonstrated and may have been confused by the use of "height" rather than depth as applied to this situation. Consequently, some thought the water from the top hole would travel further than the others. Often it was difficult to decide whether students were working from the top down or the bottom up with their descriptions in part 6(a)(iii). The second mark was rarely awarded in this question as students were unable to relate the longer distance to a greater force or a greater speed.

It was clear that the piece of apparatus shown in part 6(b) has rarely been seen by students. Many got the levels all wrong and some drew the water levels between the tubes in part 6(b)(i). Even those who did get the levels right struggled to explain it correctly in part 6(b)(ii). A common misconception that the smaller or narrower vessels having a smaller volume and therefore the water filled them to a higher point was seen in a large number of responses. Few wrote about the vessels being connected. Many wrote about the pressure being equal for all vessels but did not identify this as air/atmospheric pressure.

Question 7

The vast majority of students were able to gain at least 2 marks when asked to name pieces of equipment in part 7(a), indicating that most were familiar with this experiment. Some students did not qualify their use of the word 'light' and hence did not gain credit. It is worth noting that the question asked for pieces of equipment and hence technical names or more detailed descriptions are always more likely to gain marks.

Virtually all students could add the normal to the diagram in part 7(b)(i) but a surprising number lost marks for the subsequent measurements either because they confused the angles of incidence and refraction or because they did not measure these angles from the normal. The explanation in part 7(b)(iii) was well answered by the majority of students and a large number of responses demonstrated excellent use of technical language. A noticeable number only scored one of the available marks as, although they wrote about light entering a different medium, they did not write about the impact this had on the speed of the wave. Many identified the phenomenon as refraction but still failed to achieve a second mark. Students would benefit from addressing the command word 'explain' more appropriately and structuring their answers as a step by step sequence of cause and effect.

The graphs in part 7(c) were usually well drawn. Most students labelled the axes correctly and chose a sensible scale. A few tried to make the sin r axis extend the full width of the grid and this resulted in an awkward scale which frequently resulted in the loss of one or both plotting marks. A minority of students displayed poor graphing skills and plotted their points at equal intervals on each axis, which gave a perfectly straight line going from the origin to the top right hand corner of the grid. Most students could draw an acceptable best fit line. The refractive index equation was recalled by most students. Where this mark was not scored it was usually due to the omission of sines. very few students used the gradient to calculate the refractive index in part 7(c)(iv) and those that did often had the axes reversed and therefore gave the reciprocal of the answer. A common error was to find the sine of the numbers being divided and so losing a mark.

Question 8

The calculation in part 8(a) caused little difficulty for students and over 90% were able to gain all 3 marks. The minority who did not score full marks usually encountered problems when rearranging the equation.

Many students realised that the clothes iron needed a larger current in part 8(b)(i). Some thought that the cable was thicker because it had to cope with high temperatures and a few looked at the picture and confused the term 'wires', simply stating that it (the cable) needed to be thicker as there were three wires. A majority of students could also recall that a fuse should be in series with the live wire in part 8(b)(ii). Less than half of students gained the mark in part 8(b)(iii) with a large number assuming that the current or voltage were too low to present a hazard.

The calculation in part 8(c) was completed successfully by most with nearly three quarters realising that they needed to change the units of time in to seconds. The majority of students who did not convert time in to seconds still gained a mark for an appropriate substitution of values. Other students misread the table and used current values from other appliances.

Question 9

It was pleasing to see most students extract the correct information from the tritium symbol in part 9(a)(i). Those not gaining marks usually thought tritium had two protons. In part 9(a)(ii) the majority of students could clearly communicate at least three differences between alpha and beta particles. Those students not scoring full marks usually struggled with the comparison element of the question and, whilst they gave a property of an alpha particle, did not always reciprocate with the relevant property of a beta particle. Slightly over half the students were able to gain the mark in part 9(a)(iii) by communicating their understanding that tritium does not have enough protons to emit an alpha particle.

The students who scored well in part 9(b) addressed the three bullet points that formed part of the question. Very few appreciated that the particles would not be harmful if they lost their energy or that the sign itself would be at such a long distance that even if the particles escaped they would be unlikely to reach people. Most of those who scored gained a mark for stating that the particles would be stopped by the glass and rather fewer used the term 'absorbed' for the interaction with the phosphor. It was clear that some confused phosphor and phosphorus and a number thought tritium gas might leak out.

The standard definition of half-life in part 9(c)(i) still caused problems with less than half the students gaining both marks. Although most student understand half-life to be a measurement of time, many got confused when trying to describe what was being halved. The most straightforward definition of it being the time for the activity to halve was rarely seen. Although many students did not indicate how they arrived at their final answer, the majority could successfully use the graph in part 9(c)(ii) to find the half-life. It was disappointing to see that some students misread the time axis to give answers of 10.3 years but, with no evidence of working, could not be given any credit.

Students did not always appreciate the significance of being asked to evaluate the claim in part 9(d) and there was some clear unfamiliarity with the command word used in this question. Many answers were vague and did not support their assertion with figures from the graph.

Question 10

Question 10 discriminated well between students with an even distribution of marks within the 6-mark range. However, only the very best students managed gain the maximum 6 marks, showing a clear structure in their answers to match the demands of the question. Ideas about metals being good conductors of heat, convection currents and hot air being less dense were the common marking points awarded. The impact on how the methods mentioned helped to cook the food appeared to be the missing link to scoring full marks. For example, when students wrote that hot air expands and rises, they failed to include that the potato received hotter air near the top and students frequently wrote about the black surface being a good absorber of thermal radiation but did not go on to add that it was a good radiator/emitter and hence cooked the potatoes from all sides.

Question 11

A significant number of students overestimated the demands of part 11(a) and thought that a calculation was required, despite the command word 'state' being used in the question.

Few students were troubled by the calculation in part 11(b) with virtually all able to successfully recall the equation. Those not gaining full marks usually made errors when rearranging the equation, with the reciprocal of the correct answer being seen on several occasions.

Part 11(c) caused some confusion and students often started their answer with the acceleration increasing, rather than the speed increasing. It was not until they got to considering a drag force that the correct answer began to emerge. Many students did not realise there was a drag force at all and usually did not score.

The context of the question was not well understood by a large number of students in part 11(d) who thought that sand was being poured from the bags in to the balloon, thus making it heavier. Students who realised the mass of the balloon was decreasing could usually link together further points in their explanation to gain full marks.

Question 12

The vast majority of students could complete the table in part 12(a)(i) but the method behind taking multiple readings in part 12(a)(ii) proved a more difficult question. The most popular correct responses to this question were that it would allow the student to calculate a mean or average and that it would improve the reliability of the investigation. When students did not score it was often because they wrote that the measurements enabled the student to be more accurate or allowed comparison of the results without further expanding on this idea. A small number of students achieved a mark for the idea that it would allow the students to identify anomalies in their data.

Only a third of students could offer a sensible suggestion as to why the graph axes didn't start from (0,0) in part 12(b)(i) with most giving answers referring to inverse proportionality. Students fared similarly in part 12(b)(ii) as they failed to fully interpret the meaning of the command word 'discuss'. Students needed to reference the relative merits of both lines of best fit in this style of question but virtually all chose the line they thought was correct and provided, often, a suitable justification. A large number of students showed a poor understanding of the term 'validity' despite the added detail of it being related to the experiment being a fair test in part 12(b)(iii). Most students who gained the mark did so by saying the temperature should be kept constant. Responses to part 12(b)(iv) showed a lack of attention to detail and very few students were able to gain both the marks available. Many wrote about increasing the accuracy of the experiment but did not make any reference to increasing the precision or using equipment that would increase the precision in some way. A number made a bald statement that using an electronic measuring device of some sort would improve the quality of the data. It appeared that some students confused improvement of the quality of the data with how the tests could be made fairer and wrote about taking more readings in order to improve reliability or other answers that would have been applicable to part 12(b)(iii).

The final part of this question, 12(c), differentiated well with an even distribution of marks across the 3-mark range. Many students scored at least two of the available marks as they performed at least two accurate calculations of pV. A number of students missed these marks as they either did no calculations or did calculations that were irrelevant in the context of the question. The third available mark was awarded less often and answers were too vague, for instance 'as *p* increases *V* decreases'.

Question 13

Part 13(a) was generally well answered by a number of students who often achieved all four marks available. When students did not perform well it was common to see them write about the rod spinning or about commutator rings and the current reversing every half turn. It was disappointing to see a number of students writing about magnetic fields cutting one another or the current cutting through a magnetic field as this showed confusion with electromagnetic induction. Students would benefit from a more extensive use of keywords. For example, the use of the word 'electricity' instead of current was frequently seen.

As part 13(b) also had a magnet and a current in a wire, the same standard answers were given without consideration of the effect of the alternating current. Occasionally there was a marking point in the diagram that had been drawn but this was usually repeated in the written work. Most students realised that the speaker cone would be made to vibrate but few were able to relate this to an alternating force and then back to the alternating current.

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 frequency.
- 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 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.

Pearson Education Limited. Registered company number 872828
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE