Examiners' Report/
Principal Examiner Feedback

January 2014

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

Edexcel Level 1/Level 2 Certificates
Physics (KPH0) Paper 1P
Science (Double Award) (KSC0) Paper 1P

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4PH0 & KPH0 (1P) Principal Examiners' Report – January 2014

General

Many students scored very well across all aspects of this paper, indicating that their preparation fully covered the specification. However, some responses to the longer, more extended questions indicated that this preparation lacked depth. This was seen particularly in the optics section of the specification (section 3). Students should take care to write equations either as word equations or in accepted abbreviations rather than using a mnemonic or writing only units.

Numerical work was usually handled very well, including simple rearrangement of equations. Some students neglected to change quantities into S.I. in particular; time was often left in hours rather than in seconds and base units such as newtons or coulombs were left in compound units.

Questions relating to experimental work and other skills covered by AO3 often allowed students greater freedom of expression and examiners were pleased to see many responses that indicated the students had experience of practical physics and were able to describe their ideas clearly. However, a number of blank responses were also seen.

There was evidence that some students did not see each question as *structured* and tackled each part as a discrete question. There was also evidence that students did not read questions with sufficient care: in many cases details asked for were omitted and far too frequently students answered 'explain' as 'describe'.

Question 1

The first two parts of this question served to form an easy introduction into the paper with over 95% gaining both marks. Students found part (c) to be more challenging.

In (ci), most students who gained marks did so by correctly identifying that air is a poor conductor, with only a few others gaining a second mark for fibres being an insulator. The other marking points (conduction requires solids, and air particle spacing) were seen infrequently. Many students confused the conduction with convection and discussed trapped air.

In (cii) the most frequently awarded mark was for the idea of trapped air, with convection currents often mentioned, although not always in sufficient detail to gain credit. Many students described convection without reference to the aim of the question.

Question 2

In part (a), it was pleasing to see that there was widespread (but not universal) use of rulers in ray diagrams. Many students found the question challenging, and gained only the mark for drawing a normal line. Common errors included: drawing so many lines that it was almost impossible to see where the rays were meant to go, rays without arrows and arrows pointing in opposite directions on a single ray.

Many students also stumbled with the definition of an imaginary image in part (b).

The most frequent creditworthy response was the inability to be projected onto a screen. Many responses were almost sufficient but were too vague. Many unsuccessful students simply referred to the properties of an image in a mirror.

Part (ci) was well answered with nearly 90% gaining a mark. In part (cii), examiners saw a wide spectrum of responses with a high proportion (over 40%) of correct and well worded answers. However, some students were imprecise with their use of language especially with the difference between vibrations and waves and between vibrating and travelling. Students often had ideas about 'parallel' and 'perpendicular' movement but found difficulty in articulating what was moving e.g. "The wave moves at 90 degrees to the wave movement". More able students made good use of the chance to draw a diagram.

Question 3

Most students were successful in part (ai), with less than 10% giving an incorrect response. The most frequent incorrect response had equated power to current / voltage. A few students drew a mnemonic triangle. Part (aii) was also well answered, with only a few students making simple mistakes or leaving the current as a fraction.

Section (b) tested understanding of fuses and safety in the context of an extension lead. In (bi) students showed a better than previous knowledge of how a fuse works. However there were still those who described the role of the earth in a 3 pin plug and others who were so vague they lost marks here. MP1 was particularly poorly expressed and students should ensure that they indicate that the current is higher than the fuse value: a large current is insufficient. There were some surprising responses in (bii) as many students failed to recognise that the fuse would blow. Some students even suggested that the 5A fuse was too high. Only 20% of students gained both marks. Most students found (biii) challenging: less than 15% suggested overheating in some form, more usually students' suggestions were imaginative but showed little understanding of current.

Question 4

Part (a) was well attempted with most students (over 75%) gaining both marks. A minority gained only the position mark giving incorrect polarity. The most frequent non scoring attempts located the poles within the outer magnetic field.

For (b) a large number of students reproduced the answer to a similar question from June 2013. This often meant that they omitted the finer detail (e.g. tapping the card). Common errors included using a non-magnetic metal, placing the magnet on top of the paper, or having the arrows on the compasses pointing in random directions. A few students gave methods which involved coils and batteries.

Question 5

This question was not well done as many students seemed not to be familiar with the practical details. Only 20 % of students were able to identify the independent variable in part (ai). In (aii) approximately 1/3rd of students gave a sensible pattern answer. The most common reason for not gaining marks was due to lack of precision e.g. 'height' rather than 'starting height of car' and 'the speed increased as the car went down the ramp' rather than 'the higher the starting height, the faster the car is at the bottom'. A similar lack of precision was seen in (b) where some students suggested a 'scale' or even a 'trundle wheel' rather than a 'metre-rule'. A small but noticeable minority of students responded with a Pythagoras based method.

In part (ci) surprisingly few students could correctly state that the average speed had been calculated. Students gave timing errors as a reason, instead of factors affecting the car. Some students related ideas of a person driving the car and discussed "thinking time/ breaking distance". In (cii) very few students realised that the speed at the end of the slope was to be measured. In the main, students gave methods that would not achieve this or muddled a potentially correct method in such a way that they found the average speed for the whole of the distance the car moved. The measuring instruments were often omitted or were described in such little detail to indicate that the student had never worked with light gates or ticker tape timers.

Part (d) gave a wide range of correct responses. There were some very good suggestions clearly expressing the ideas of timing and distance variations and the friction effect. The poor launch idea was generally only expressed by the better students who often gained all the available marks. Disappointingly there were students who gave timing error starting the stopwatch, timing error stopping the stopwatch and reaction time as their three responses and therefore only gained one mark. Similarly for the friction idea some students gave three ways that friction could affect the experiment. Students who mentioned 'human error' with no detail failed to gain credit. Other common errors included 'wind' rather than air resistance, wet ramps and assuming the situation was on a real road. Regrettably some students failed to read the question and gave responses describing improvements to the experiment.

Question 6

On the whole students did make a good attempt at (a) and a poor attempt at (b). In (a), a quarter students gained full marks with a further 45% gaining three marks by not dividing by two. Unfortunately there were some students who couldn't rearrange the equation (still a distressingly large number), others who divided by 1000 to get to metres and those who left their answer in km. There were also a few powers of ten errors seen. Part (b) was badly answered, with very few students gaining any credit – usually for the idea of different depths of fish and/or sea floor. Common misconceptions included a delay time on reflection, various refraction or diffraction effects and variation of frequency.

Question 7

Both parts of (a) were well answered. Students should be advised to remember that 'g' is 'gravitational field strength' not simply 'gravity' and that forces are measured in N not kg m/s^2.

In part (b), it was disappointing to find that many students described the shape of the graph instead of explaining it. Weaker students gained two marks for initial acceleration and terminal velocity, but omitted any mention of the forces and their balance at each stage. It was evident that some students still confuse velocity and acceleration. Very few students mentioned that drag increased with the speed. Students should be encouraged to refer to terminal velocity or constant velocity rather than maximum velocity. It was unfortunate that a few students reproduced responses relating to similar questions in previous papers and mentioned his parachute opening when the stem of the question clearly precluded this. Nearly 40% of students were able to gain all three marks in part (c). Common errors included: gravity rather than weight, upthrust rather than drag (and upthrust) and unequal l length of arrows.

Over 80% of students were able to suggest a suitable reduction in speed for the graph line in (d). Approximately half of these students correctly showed a new lower terminal velocity. A small but significant number of students drew the line extension going up again (often off of the graph and sometimes then levelling off again) possibly due to watching film of sky diving from the point of view of a person who had continued to fall with the higher constant velocity.

Question 8

As this question was composed of a series of linked calculations, many students gained eight or nine marks. The mistakes that students made were consistent across all centres. In (a), some students omitted the factor of x10.3. In (biii) students did not recognise that work done = energy transferred: some students added (or subtracted) the work done to the electrical energy to get 80 J (or 46J) while others thought that the useful energy was KE. The efficiency equation needs to be learnt more carefully as many students confused total and useful energy and input and output energy. These errors produced some interesting answers in the final calculation.

Question 9

Part (a) required that students write at some length about the details to ensure accuracy in a fairly standard extension of a spring. It was clear that most students understood the basics of this experiment. However, they failed to take on board the five marks available by not coming up with 5 different points. Only three of the five available marks were for the basic plan of the experiment. There were surprisingly few full marks as students showed a lack of skill with extended writing, giving answers that were poorly structured without a logical chain of events. Approximately 25% of the students mentioned any of the accuracy marking points. Students should be reminded to think far beyond what readings they will take and focus much more clearly on how to make their data as high quality as possible.

Nearly 50 % of students gained all three marks for part (b). The most common errors were not labelling the axes and showing the line beyond the elastic limit. In part (c) over 50% of students correctly referred to the restoration of the original length of the spring, but only a third of students communicated effectively that they realised this would only happen when the load had been removed. Common mistakes included: plastic and elastic definitions the wrong way around, stating Hooke's Law as the answer or describing what happens past the elastic limit (and thus trying to define elastic behaviour by what happens before the plastic deformation occurs).

Question 10

Many students were able to gain valuable marks in this question. On the whole the multiple choice questions were well answered, but students were less adept at giving a reason for using microwaves with satellites.

Despite the challenges due to the complexity of units, 50% of students gained full marks for part (b) with the most common error being unsuccessful conversion of time into seconds. There was also some poor rearrangement of the equation seen. Students should be advised to consider whether their answer is physically possible for instance giving the radius as 4 m.

In part (c) the idea of synchronous behaviour (however expressed) was most frequent correct response. Students who suggested 24 hour availability without explanation failed to gain credit.

Question 11

Part (a) was intended to be an easy introduction into the question, but surprisingly over a third of students failed to gain a mark. Commonly the correct answers were reversed.

The calculation in part (b) was better answered with over 60 % gaining two or more marks. Students, however, should be reminded of the need to work in seconds and for correct units (A not mA and C not A hr).

Part (c) was also well answered; nearly 75% of students gained some credit. Many students linked the movement into the shade to a reduction in the amount of energy available.

Some students did mention a lower current but very few referred to the power equation.

It was unfortunate that some students missing out on the second mark by repeating part of the stem e.g. the charging time was longer because the power was less.

Question 12

On the whole, students made good attempts at all parts of (a). In (ai), good knowledge of background radiation sources was shown, with just a few students who gave MP 1 twice, e.g. rocks and radon. Unrewarded responses include alpha, gamma and microwaves.

Part (aii) was also high scoring with many students demonstrating their understanding of the need to take readings with and without the source and to subtract the values correctly. However, the marks gained often depended on the clarity and precision of their answer.

Some students wanted to subtract the wrong way round, others got confused and referred to measuring count rates with and without background radiation present and most often students just stated that they would 'measure the background radiation' with no reference to count rate thereby not adding anything to what they were told in the stem. Some students thought that it was acceptable to measure the corrected count rate and the uncorrected count rate and subtract in order to find the background count.

In parts (aiii-iv) many totally correct graphs were seen. Most graphs occupied at least half the grid. The axes labels proved far more problematic with 'corrected' and 'counts (/minute)' often missed out, the unit 'becquerel' occasionally used and the time shown as 'time in m'. Some students plotted all the uncorrected count rates although some did a mixture of the two. A few dot to dot 'curves' were seen and rejected but most students drew smooth, thin curves through the points. Only a few students used incorrect scales so as to achieve a straight line. A significant number of students failed to show any evidence of graph use but still often gave a value of half-life within range. Several students seemed to think that half the initial corrected count rate was 300 rather than 315. Some students gave an answer of 50, i.e. half the 'life of the experiment'. These were predominantly students who got the axes back to front. A few students went a stage further by reading off the corrected count rate at 50 min and stating this value as the half-life!

Part (b) was not well answered by most students and showed evidence of being centre dependant. Only one third of students gained any credit for this recall of knowledge question.

In contrast, students were able to demonstrate good knowledge of the risks and precautions needed when working with radioactive sources in part (c). Marks were commonly lost by omitting to mention ionisation in (ci) and by giving the ‘shielding’ idea more than once in (cii).

Question 13

This question was targeted at the higher grades and so it was not surprising that many candidates failed to make good progress in this question.
In the calculation, few students scored partial marks. The essential key was to realise this was essentially a Boyle’s law ($p_1V_1 = p_2V_2$) calculation to get the volume and then common sense to further calculate the time. The main difficulty for those using the correct equation appeared to be realising that 'normal atmospheric pressure' meant that p_2 was 1 (atmosphere).

Most students found the other parts of this question also difficult. In (aii) the most common correct answers seen mentioned temperature or expansion due to decrease in pressure due to a decrease in depth. Only a very few students mentioned a relevant equation. Commonly, students discussed the composition of the exhaled gases.
In (bi), less than a third of students gained any marks. The displacement method was often seen, but frequently students made this method much

more complicated that it warranted, a simple ‘completely’ or ‘fully’ could have been used more often to describe how well the balloon was immersed. Students who decided to find the volume by other methods often suggested oddities e.g. taking measurements as if the balloon were a rectangular box; measuring its surface area; filling the balloon with water or multiplying the number of pump strokes taken to inflate the balloon by the volume of air delivered by each pump stroke.

In (bii), surprisingly, most students tended to describe inaccuracies rather than errors in creating a fair test. Leakages during transfer or changes in force used featured frequently while comparatively few students referred to a change in volume or temperature. Less than 20% of students gained any credit in this part.

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
- Be familiar with the equations listed in the specification and be able to use them confidently
- Show all working, so that some credit can still be given for answers that are only partly correct
- Describe experiments in reasonable detail and be ready to comment on experimental data and methods
- Recall the units given in the specification and use them appropriately, for instance when calculating quantities
- Take care to follow the instructions in the question, for instance when requested to ‘explain’ some form of causal link should be provided e.g.’ and so’ or ‘this means that’
- Take advantage of opportunities to draw labelled diagram as well as or instead of written answers.
- Allow time at the end of the examination to check answers carefully for meaning in order to correct basic slips in wording or calculation

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