Examiners' Report/
Principal Examiner Feedback

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Pearson Edexcel International Advanced Level in Physics (WPH06) Paper 01

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General comments

The paper WPH06 is closely tied to the Internal Assessment unit 6PH06 for UK centres. It assesses the skills associated with practical work in physics and addresses the skills of planning, data analysis and evaluation. Set in a wide variety of contexts the questions will be more accessible to those candidates who have, themselves, carried out a range of practicals in the laboratory and a plan at this level will consist of several stages. There are questions concerning choice of apparatus, and the use of that apparatus, that will be immediately familiar to those with the practice they have done.

The paper for January 2015 was in the same format as previous years and with much the same content although this appeared in different questions. The topics and contexts are new each time and it is this aspect that is likely to cause difficulties for candidates who do little practical work for themselves.

Generally, the candidates were well prepared and seemed familiar with all that was asked of them, and again this year it was the planning question, question 2 that they found difficult; the context of a radioactivity practical was clearly one that very few had studied. The data handling question, question 4 also spreads out the candidates.

This document should be read in conjunction with the question paper and the mark scheme which are available at
http://qualifications.pearson.com/en/qualifications/edexcel-international-advanced-levels/physics.coursematerials.html#filterQuery=category:Pearson-UK:Category%2FExam-materials

Question 1

This question used some measurements to test the candidates' ability to calculate values for properties of materials – this year the glass in a microscope slide. They are then asked to consider the uncertainties and to conclude whether the glass was Crown glass.

(a)
Candidates are asked to choose instruments to make the measurements and quote the uncertainty introduced by using those instruments. The aim is to select an instrument that will give a reading to 3 significant figures so it was odd to see the suggestion of a metre rule. Callipers and a micrometer are the appropriate instruments and can be used in both measurements.

(b)
We accepted answers correct to 1 or 2 SF (significant figures) and based on either the whole range or half the range of readings. There was a surprising number of errors involving powers of ten, calculating a percentage from a fraction is a skill that candidates might usefully practise.

(c)(i)
Usually all numerical data is to 3 SF so that readings, calculated values and all aspects of graph work are expected to be quoted to 3 SF. A large number of candidates rounded the measurements to 1 SF and then calculated the volume to 1 SF, despite the suggestion in part (a). An even greater number quote 4, 5 and 6 SF, the calculated value should reflect the SF quoted in the data which here was 3 SF.

(c)(ii)
Candidates did well on this part with nearly all scoring both marks. Many candidates included the percentage uncertainty (%U) for the width in their calculation which was not asked for and so was not penalised.

(c)(iii)
This part expects candidates to use one of two methods. They can either use the %U from part (ii) to calculate the maximum value of their calculated density or they can calculate the percentage difference (%D) between their value and the 'book' value. The second mark is for drawing a correct conclusion from their calculations – interestingly, this year either conclusion was possible depending on which numbers had been used. Candidates who say that their calculated value of 2460 lies outside the range of the 'book' value gained no marks, candidates must use their %U from (ii). Some candidates calculated the %U in the book value and compared this with their %U – a conclusion based on this is not valid. When calculating a %D with a known or 'book' value the %D should use the book value as the denominator, not the mean value.

(d)
A 'better value' is one that is more accurate – close to the true value – or more precise. The basis for this method is that the measured value is larger and hence the precision is improved as is the percentage uncertainty also a mean of 10 slides is found.

Question 2

In this question there are 3 marks for standard technique when using radioactive sources, 3 marks for the measurement techniques and 3 marks for the way the measurements are used to draw a conclusion. Credit was given to candidates for each piece of good physics in their answer, based on either a range method or an absorption method.
Crucially candidates were expected to take account of background radiation and explain what they would expect to find as the range (or thickness of absorber) increased. They were also expected to describe methods that followed a sequence and then use their expected evidence to validate the labels. Thus no change at short range (or with the insertion of paper) would indicate the absence of alpha radiation and the reduction to background at around 25 cm (or with the insertion of not thin aluminium) would show the absence of gamma and the range of the emissions, which can be confirmed as beta. Remarkably few candidates included a Geiger-Muller tube and counter in their answer – standard equipment should be well known by candidates at this level.
Methods including cloud chambers or deflection in electric fields were marked in accordance with the scheme but were usually extremely vague which is always a fault in planning an A level practical.

Generally candidates scored the mark for (a) but were poor in discussing the precautions and method in (c) and (e) – precautions were often bizarre including the use of lead coats. In practice the use of handling tongs in order to keep the experimenter at a distance from the source is a basic precaution. There were many good answers about technique and interpretation but very few candidates were able to produce a coherent plan. This question scored poorly with a mean mark of just over 3, this is probably due to the topic which seemed largely unfamiliar to candidates.

Question 3

This question asks candidates to draw a line of best fit through some data plots on a graph, this has been a feature for some time on this paper and the graph is almost never expecting a straight line. The topic is electrical resonance which is very similar to mechanical resonance and part of the specification. The candidate's line should not extend beyond the plotted data since this is outside the range of the experiment – here the origin should not be included. Their line should also enable interpolation by being smooth. There is a peak value between 20 and 25 kz and it will be higher than 27 mV.

Disappointingly nearly 20% of candidates scored zero on this question but 10% scored all five marks. Few mistakes were made taking readings from their graph either with the scale or the units. Curve drawing is a skill that repays practice and there was a strong clue in the use of the word 'resonance' in the stem.

Question 4

This question was based on a standard damping experiment that requires virtually no apparatus but there was little evidence in part (a) that candidates had done this experiment where they had to consider the measuring technique required. The remaining data handling sections separated out the candidates, the successful ones took more care over their work and looked as though they had practised the techniques required by this sort of exercise.

(a)(i)
When the question says that candidates 'should add to the diagram' they are unlikely to be able to score any marks if they do not do so. Over half the candidates either failed to draw anything or drew something inappropriate such as a mass without a cone. Candidates were expected to draw a displaced mass and cone with some means of taking a vertical reading down on to the rule. This is most easily achieved by drawing an eye symbol looking vertically down past the edge of the cone and this can be shown by drawing a vertical dotted line.

(a)(ii)
There is a huge uncertainty in reading the rule from a height past a cone that is only stationary for an instant, it will certainly be greater than the precision of the rule which was the answer a large number of candidates gave. Candidates who carry out practical work will be able to more easily appreciate how to answer questions such as this.

(b)
Candidates should show the log expansion of the equation and $y = mx + c$ the equation of a straight line. They also need to identify the gradient m as being k which they are told is a constant and hence the line is straight.

(c)
The standard label for a log variable on an axis is ln(variable/unit), so here ln(A/cm) is expected. Similarly it is often a mistake to include the origin on the graph which is to display the data across much of the grid. Scales that are difficult to use to interpolate – such as multiples of 3 – are usually heavily penalised, here a vertical scale rising from 2.4 in 1 unit for every heavy line (2 cm) provides a suitable scale that is very easy to plot and read; a surprisingly high number candidates lost the scale mark. 3 SF are expected to be used to plot the data, take measurements of a gradient triangle and for the final answer. A large number of candidates quoted their answer for k to 2 SF.

Conclusion

Many candidates are learning the techniques required and becoming skilled at employing them in planning, analysing and evaluating. Many candidates also show a lack of fairly basic knowledge which, at A level, i slightly surprising. As a test of practical skill the obvious element of carrying out an experiment is missing but all the other aspects of practical work are here assessed and those who carry out real experiment for themselves must inevitably score higher marks. As shown on this paper, the practicals do not necessarily require complex or expensive apparatus.

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