Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

January 2025

Pearson Edexcel International Advanced Subsidiary Level In Physics (WPH13)
Paper 01 Practical Skills in Physics I

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Introduction

The Pearson Edexcel International AS-level paper WPH13, Practical Skills in Physics I is worth 50 marks and consists of four questions, which enable students of all abilities to apply their knowledge and skills to a variety of styles of question.

Each question assesses the student's knowledge and understanding of the skills developed while completing practical investigations.

A student's understanding of the 8 core practical tasks will be assessed by the WPH11 and WPH12 papers. As such, the practical contexts met in the WPH13 paper may be less familiar but are like practical investigations students may complete during their AS Physics studies. Students who do little practical work will find this paper more difficult as many questions rely on applying their learning to unfamiliar, as well as other standard experiments.

The scenarios outlined will be related to content taught during the study of WPH11 and WPH12. However, the focus of WPH13 is the assessment of the practical skills the students have developed, during the completion of the required core practical tasks and other experiments, as applied to the physics context described in the question.

There will be questions that are familiar to students who have revised using the earlier series of WPH03 and WPH13 papers, but some performances would suggest some students were unfamiliar with the practical skills outlined in the specification for Unit 3.

At all ability levels, there were some questions which students answered with generic and pre-learned responses, rather than being specific to the scenario as described in the question. Additionally, understanding the meaning of the standard command words (such as deduce and determine) proved a challenge to students at the lower end of the ability range.

Question 1(a)

Appendix 10 of the physics specification defines the uncertainty of a single measurement to be “half the resolution”

For this question, in (a) students were required to recognise the smallest measuring interval in the digital caliper display shown was 0.1 mm.

One common error seen was to use the full resolution in the percentage uncertaintly calculation, however this was rarely seen. Most students are now well prepared to calculate percentage uncertainty, and scored both marks.

Question 1(b)

For this question, in (b)(i) students were expected to use all 5 values when calculating the mean. There was no clear anomaly, though some students did choose to disregard 45.2 ms.

Appendix 10 of the physics specification defines the uncertainty of a set of repeated measurements to be “half the range”.

In part (ii), any students who had disregarded 45.2 ms could still access both marks for a correct calculation based on the new range.

As with 1(a), most students were well prepared and completed the two calculations correctly, with 4 being the most common mark awarded for 1(b).

Question 1(c)

Many students were unfamiliar with the use of a light gate, so misunderstood the time recorded by the data logger. Few students understood how the time measured allowed the calculation of the final velocity (v).

It was common to see students using the time for the car to move along the ramp with either v = u + at, or s = ut + ½ at2.

Both methods would require an additional equipment (eg a second light gate & timing device, which students were not instructed to add). As such, many students scored 0, although most students did score at least 1 mark.

Question 2(a)

The photograph shows a labelled concrete beam held up by 2 supports. It was deliberately left unclear whether these supports rested on a table or were held in some form of clamp.

In part (i), students were left with many options for applying a force to the beam. Most added masses to the top of the beam, some hung masses below the beam. A small number pulled downwards with a forcemeter.

A small number of students misinterpreted the scenario, so described stacking the beams until the supports failed. Although their method would not give valid results, these students were still credited for adding mass until beam failure.

In part (ii), most students gave a valid health and safety suggestion, but were often vague when describing the health and safety issue (eg a falling mass is not by itself a safety issue, if there is no risk of it injuring someone)

Question 2(b)

In (b)(i) students were asked a question that has appeared many times in similary ways on previous papers. Students are now well prepared for such questions, with most scoring at least 1 mark and the majority scoring both marks,

For (b)(ii) it was rare for students to be able to describe how to demonstrate proportionality. Many described drawing a graph with a straight line of best fit, but it was rarer for this to be described as passing through the origin.

It was even rarer for students to correctly describe this graph. A graph of maximum force and mass of fibre (the data in the table) would not be proportional (0 g of mass is not linked to 0 N of force).

Very few students decribed the correct graph, one where the increase in maximum force was plotted. As such, very few students scored any marks.

Question 3(a)

For part (i), most students could correctly suggest a method to control background light.

Students who have studied previous WPH13 papers have seen questions where the solar panel was rotated.

In the scenario described in the question introduction, the solar panel was fixed (as it would be on a roof or on a mount) and the lamp was moved (as the sun would move) to different angles. As such, the angle of the solar panel was not accepted as a valid control variable in part (ii).

Some students suggested controlling the distance between the panel and the stand. These students did not consider the fact the lamp was changing height, which would still change the distance from the lamp to the panel (affecting intensity). However, most students scored at least 1 mark.

Question 3(b)

For part (i), students needed to carry out two linked calculations. They were also expected to follow the standard conventions for rounding calculated data (eg round their answer to the same number of significant figures as the least number of significant figures in the original data). The vast majority of students (over 85%) were awarded all 4 marks.

However, in part (ii), it was clear many students did not understand that a line of best fit can be a curve, with maximum efficiency being the peak of that curve. It was common to see mutiple straight lines of best fit or multiple curves crossing.

Many students did not add a line of best fit, so chose the highest plot.

Question 3(c)

Many students assume that data points should be taken evenly when plotting a graph. This question aimed to identify those students who understand that collecting more data at key points on the graph allow values detemined from the graph to be more accurate.

Since students were told to explain how collecting more data would increase accuracy, we needed the answer to be specific about that data (eg smaller angle increments and around the peak).

Most students did not consider the scenario as presented, giving a generic “repeat and calculate the mean” answer – which would not help identify the peak (which is between two measured angles).

Question 3(d)

During their study of WPH12, students lean that light intensity is defined as the power transferred per unit area (I = P/A) where that area is measured on a plane perpendicular to the direction of propagation of the light.

So, maximum power would be output (for any given light intensity) when the light is incident perpendicular to the surface area. However, very few were awarded this mark. It was common to see more poor descriptions (eg above, up, vertical).

For part (ii) students need to link this concept to the Sun moving across the sky, so by tracking the Sun, the panel would remain perpendicular to the light during the day, maintaining maximum power for a longer time.

This question was designed to be challenging, to identify more able students, but most students scored at least 1 mark for part (ii), with many scoring 2 or 3 marks.

Question 4(a)

Graphs remain a challenge to students, but this is one area where a little more time spent on practice would significantly benefit students.

There are 5 marks available for plotting a graph on WPH13. This makes up 10% of the marks available, so a well-drawn graph could increase a student's achievement by a grade.

The standard expectations of a well-drawn graph are:

- Labelled axes – the quantity and unit separated by a / eg f / MHz and sinθ (which is unitless)
- Scales chosen that maximise the size of the used portion of the graph, while still being an easily interpreted scale. The graph paper provided is divided into 10 small squares every 2 cm, so we expect a scale with increments on the 2 cm lines that go up in 1, 2 or 5 if we ignore powers of 10 – this makes the smaller squares a sensible increment.

  eg on the y-axis increments of MHz every 2 cm and on the x-axis increments of 0.5 $\times$ 10–3 every 2 cm

- Data points that are plotted accurately to within 1 mm (half a square) in both directions. This means large or unclear plots cannot be checked for accuracy, eg students should be advised that large bullet-point style plots will not be credited as their accurage cannot be judged. Small neat plots (eg $\times$) are expected.
- A well-balanced line of best fit that follows closely the trend of the plots.

The marks awarded to students show an even spread of performance, indicating that the graph question remains a good discriminator. But, with a mean mark of 4 out of 7, there remains scope for students to gain additional marks with continued practice of their graph skills, which will be assessed on WPH16.

Question 4(b)

Students are generally well-practised with this type of question. Often these questions ask students to link a quantity in the formula to the gradient.

In the scenario presented to students, the equation would need to be re-arranged to be in $y = mx + c$ format.

The majority scored 2 marks, but a sizeable minority (one third) scored 0, as their either did not re-arrange the equaiton or made an algebra error whilst doing so.

Question 4(c)

Most students correctly linked the gradient to the wavelength and wave speed. Others used data from the graph or table, with the equation given. In either case, most were able to score at least 2 marks.

The most common errors were;

- Using data from the table that did not lie on the line of best fit.
- Using too small a range of data for the gradient calculation.

In part (ii), most students now understand that a “deduce” question requires them to calculate evidence, compare and form a conclusion.

Overall performance on this style of question is improving over time, with a third of students scoring maximum marks (5 out of 5) for 4(c), with the majority scoring at least 4 out of 5.

Summary

Students will be more successful if they routinely carry out and plan practical activities for themselves using a wide variety of techniques.

These can be simple experiments that do not require expensive, specialist equipment.

They should make measurements on simple objects, using vernier calipers and micrometer screw gauges, and complete all the Core Practical experiments given in the specification.

In addition, the following advice should help to improve the performance on this paper.

- Learn what is expected from different command words, in particular the difference between describe and explain.
- Be able to describe how to measure lengths, angles, force, time, potential difference and current using appropriate apparatus and techniques.
- Refer to random or systematic errors when explaining techniques.
- Practise writing experimental methods including identifying safety issues specific to that experiment.
- Show working in all calculations and give answers using appropriate significant figures and a unit.
- Choose graph scales that are sensible, i.e. the value of the smallest square is 1, 2 or 5 and their powers of ten only, so that at least **half** the page is used. It is **not** necessary to use the entire grid if this results in an awkward scale, e.g. 0.25, 3, 4 or 7.
- Plot data using neat crosses (× or +), and check any points that lie far from the best-fit line.
- Use a one piece, 30 cm ruler to draw straight best-fit lines. Ensure there are data points on both sides of the line, and the line cannot be rotated. Using a pencil will allow for the line to be changed if needed.
- Draw a large triangle that covers at least **half** of the plotted data using sensible points. Drawing the triangle on the graph often avoids mistakes in data extraction.
- Learn the definitions of the terms used in practical work and standard techniques for analysing uncertainties at AS level. These are given in Unit 3 and Appendix 10 of the IAL specification.

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