Examiners' Report
Principal Examiner Feedback

October 2020

Pearson Edexcel Advanced Subsidiary Level
In Physics (8PH0_02)
Paper 2: Core Physics II

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General Comment

This paper assessed topic 4 materials and topic 5 waves and particle nature of light. Section A, a total of 56 marks, consisted of 8 multiple-choice questions and questions of differing style and length, drawing on a range of different concepts. Section B, a total of 24 marks, consisted of two synoptic questions drawing on content from the whole of the AS specification.

This paper provided students with the opportunity to consolidate their knowledge at the end of the first year of the AL qualification and students were able to demonstrate progression from GCSE. It was evident that, even after a difficult year, they had prepared for this exam.

There was a range of mathematical skills assessed, in both short calculations and in longer calculations requiring many steps. Similarly, written answer varied from short answers to longer written answers that required application of their knowledge. Prior knowledge of the core practicals as well as general practical techniques were assessed

Section A

Multiple Choice

Question	Comment
1	Recognising SI base units
2	Core practical 4
3	Intensity = power per unit area
4	Core Practical 7
5	Diffraction of electrons
6	Interpretating displacement-distance graph of a longitudinal wave
7	Equation for the de-Broglie wavelength and for momentum
8	Uncertainty of results

Question 9

Candidates were familiar with how to indentify a polarised wave using a polarisation filter. MP3 requiring an explanation of why the screen appears different created a challenge in wording their answer clearly.

Question 10

This question assessed the candidates knowledge of a core practical so prior knowledge was expected. The question asked how the data should be used but this was missed by some who described the apparatus and method instead. Candidates need to remember the equation for the area of a circle. The easiest way to achieve MP3 and 4 was to sketch a graph which was suggested in the question.

Question 11(a)
The description of transverse waves needs to be revised. Answers demonstrated little knowledge of a transverse wave as an electromagnetic wave consisting of oscillations of electric and magnetic fields.

Question 11(b)
Candidates knew that the wave spreads out but need to apply Huygens law clearly to explain why, using appropriate terminology for secondary wavelets.

Question 12(a)
Most candidates were familiar with the value of the spring constant being the gradient of the graph.

Question 12(b)
Two approaches to answer this question were accepted – using the area of the graph or using the appropriate equation with values from the graph. Most candidates were able to tackle this question well.

Question 12(c)
Some answers were left blank but, of those who attemped this, it was answered well.

Question 13(a)
A question requiring candidates to deduce a value for the work function and then compare with the given values to make a conclusion. It was pleasing to see candates tackle this style of question well.

Question 13(b)
The graph could have been used as a starting point for candidates by connecting the intensity of UV with the altitude and then giving a reason.
The remaining points are all an explanation of the photoelectric effect. The rate at which the aeroplane charges depends on the rate at which electrons are released from the spacecraft which in turn depends on the rate of the incident photons.
Most candidates scored some marks. By making better use of the graph, and with more thorough application of ideas from the photoelectric effect, candidates could have scored more marks.

Question 14(a)
This question expected candidates to use their knowledge of stationary waves in an unfamiliar context. The emphasis, different to questions on previous papers, is on the amplitude of the wave and not on how the nodes and antinodes are formed. A common mistake was thinking that the piles were formed at the antinodes.

Question 14(b)
Candidates were able to select the correct equation but mistakes occurred in not realising that the 0.5 m mentioned in the question covered 5 gaps or 2.5 wavelengths. Some thought that it covered 6 gaps, counting the number of piles and not the spacings, and so using an incorrect value for wavelength. Some thought that the distance between neighbouring piles was one wavelength indicating a lack of application of stationary waves.

Question 15(a)
A challenging multi-layer calculation. Most candidates were able to pick up some marks but achieving the correct final answer was rare. It was evident that candidates knew they needed to use the thin lens formula but they failed to recognise the difference between the

quantities of object distance (5.0 cm) and image width (3.5.mm). These two values cannot be used in the same magnification equation.
The magnification is first calculated using the object width (0.2 mm) and the image width (3.5 mm). Then this magnification is used with the object distance (5.0 cm) to calculate the image distance. Then the thin lens formula can be used to determine f and P.

Question 15(b)(i)
Candidates selected the correct equation but having calculated the angle of refraction candidates did not then complete the question.
Candidates were required to deduce whether it is possible to distinguish between the two angles using the protractor. The difference between the two angles needs to be greater than 0.5° - the uncertainty in the measurement using the protractor. As a deduce question a conclusion was needed that compared their answer to the uncertainty of the protractor.

Question 15(b)(ii)
A question in which candidates needed to calculate the critical angle and to compare this value with the angle of incidence given in the question to conclude whether the light is refracted or totally internally reflected. This question was generally well tackled.

Question 16(a)
An unfamiliar context introduced by the passage but with a fairly familiar markscheme. The first sentence in the passage lead candidates to the context of energy levels which should have helped candidates score MP2. Photons were not mentioned in the passage and some did not mention photons in their answer. There was less appreciation of the significance of the difference in the energy levels as leading to the energy of the photon that is emitted, and in turn to the frequency of the photon.

Question 16(b)
This proved a challenge for some and answers were left blank. It links the energy that is absorbed by the atom to the wavelength of the emitted photon. Some failed to use a value of 3.0×10^8 for the speed of the radiation.

Question 16(c)
Answers showed a good understanding of monochromatic radiation as having a small range in wavelengths, and many appreciated the effect this would have in diffraction experiments.

Question 17(a)
A familiar pulse-echo question. Most common mistake was in forgetting the factor of 2. In this case, the time given in the question is the time taken for the pulse to travel there and back, so either this, or the calculated distance needed to be halved. Overall this question was well handled

Question 17(b)
Velocity is a vector and so both magnitude and direction need to be calculated, as shown by the answer lines. Magnitude is calculated using pythagoras and most candidates were confident with this.
Many also confidently used trigonometry to calculate the direction using an angle. Unfortunately of these candidates many failed to show clearly which angle they had calculated, and so, although having calculated a correct value they failed to score MP4. The arrow on the exam paper showing the direction of north was an aid to candidates. An acceptable answer could describe which angle was calculated with respect to north or south. Alternatively, the angle could have been clearly drawn on the diagram in the exam paper.

Question 17(c)(i)

A multistep calculation drawing on knowledge of the forces acting on a sphere falling through a fluid at constant velocity. The forces on the sphere are balanced. The names of the three forces are given on the paper and candidates needed to use the correct mathematical relationships for these.

Both the formulae for weight and for viscous drag are given in the formulae sheet. Upthrust can be determined from the 'weight of fluid displaced' using both the equation for density and the volume of a sphere.

Upthrust in air is usually so small as to be negligible when compared to the other two forces. It is therefore reasonable not to include it in the calculation for the resultant force in this instance. However, candidates who chose to do this needed to state this assumption rather than just 'missing it out' especially since it was named in the question.

Altogether it was pleasing to see many candidates have a valid attempt at this question, with marks awarded.

Question 17(c)(i)

Stokes law applies only in laminar flow. Some gained a mark by mentioning Stoke's law for MP2 but few candidates related this to turbulent flow.

Summary

Candidate responses indicate that they had prepared well for this exam after a difficult year. Based on their performance on this paper, students should:

- consider a range of applications for each area of physics to give candidates confidence in applying their knowledge in unfamiliar contexts.
- revise the photoelectric effect to explain the effect of altering the intensity of the radiation
- explain the significance of the difference in the energy levels with respect to the energy and frequency/wavelength of the emitted photon
- memorise the formulae for the area of a circle and the volume of a sphere, and use them with both a radius and a diameter.
- practise longer, multi-step calculations and develop strategies to help them work through the problem, including showing clear working at each stage.
- Practise writing a full description of how data should be used following experimental procedures.

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