Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

January 2025

Pearson Edexcel International Advanced Subsidiary Level In Physics (WPH12)
Paper 01 Waves and Electricity

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Q11

This was answered very well with the majority of candidates scoring full marks. Some candidates divided Planck's constant by velocity rather than mass x velocity and scored zero. Other mistakes were the use of electron charge instead of electron mass or the omission of a unit in the final answer.

Q12

Well over half of candidates scored full marks in this question. It was pleasing to see how many correctly converted cm^2 into m^2 for the calculation although some who didn't do this correctly often ended up with 48W instead of 0.48W, resulting in a different but valid conclusion. The most common route to this was the power calculation but quite a few did the intensity comparison. The comparison of areas was the least attempted route

Q13(a)

More than half of candidates did not score any marks in this question. A significant number were clearly thinking of a different question here, as many described the process taking place in a thermistor. This usually resulted in their complete answer being the opposite way round to what was expected. Many spoke of increased temperature causing the number of conduction electrons to increase. Others who did the right description were often vague about their answers, discussing particles rather than atoms/ions/lattice/electrons, and the collisions discussed were often between electron and electron, or atom and atom. Many therefore correctly stated that resistance increased but failed to score MP3 due to the dependency.

Q13(b)

Questions on resistivity are common in this paper and it was pleasing to see that there has been an improvement in candidate responses in recent series. The vast majority of candidates were awarded 2 or 3 marks here. One issue was that the unit for resistivity was either missing or incorrect. Fewer candidates confused resistance and resistivity in the equation as has previously been the case but incorrect calculations of area often remain problematic.

Q14(a)

Given that this question was also asked in the previous paper it was a surprise to see that fewer than half the responses were awarded the mark. If there is no mention of oscillations or vibrations then the response cannot be given credit. It is also necessary to discuss the direction of travel, energy transfer or propagation of the wave. Statements simply referring to direction of wave or wave motion are not detailed enough for the mark.

Q14(b)(i)

This question required the use of trigonometry for the first marking point, but it was common for candidates to confuse tan with sin which meant that this mark was not awarded. It is true that the sin and tan of the angle are similar values but it was important that the correct one was used. The second marking point could be awarded even if an incorrect value for sin had been calculated, however, a number of candidates confused the values for n and d and could not score further marks. It was common to award the third marking point as the reciprocal of any d value was accepted but if this was the incorrect d value then obviously the fourth marking point could not be achieved. It is important to note here that some candidates attempted to answer this question by using the Young double slit equation, which is not on this specification. Responses using this equation cannot be awarded any marks. The double slit experiment results in the interference of two coherent waves and the single slit experiment results in diffraction from a single aperture. The double slit experiment calculates fringe spacing and

not the slit width. There are other differences which could be addressed but it is not appropriate to do so here.

Q14(b)(ii)

Only around ten percent of candidates scored full marks here with the vast majority only being awarded the third marking point. The question asked how the first order maximum was produced but a considerable number of candidates discussed the central maximum. Many candidates just wrote generic comments about both constructive and destructive interference without ever explaining what was happening at the first order maxima. Fewer responses than in previous series confused path difference with phase difference. In all questions it is important to keep your responses in context.

Q15(a)

Around half of the responses to this part scored full marks but many candidates could only be awarded the first two marking points as there was confusion in the use of the parallel formula equation. Most read off the current correctly, although there were a few misreads of the scale. It is important to note that a value of current from the graph of 0.48A leads to a calculated value for resistance of exactly 5 ohms. As this is a show that question it was necessary to add an additional significant figure to the value in the question but many failed to do this.

Q15(b)

A quarter of candidates scored full marks but around half scored only the second marking point for the use of a power equation. As is often the case with circuits, there are a number of ways of solving this problem so it is worth investing some time in practice. Interestingly there were quite a few completely wrong methods that ended up with the right answer but no credit was given. Many candidates put some quite random values for current, resistance or potential difference into the equations.

Q16(a)

This proved to be a poorly remembered definition as only a third of candidates were awarded the mark. Any mention of voltage in the response is unlikely to gain credit.

Q16(b)

As is often the case, there was a wide range of marks awarded in this indicative content question. However, a quarter of candidates were not awarded any marks. It was rare to award the first indicative content mark although the second and third were common. The biggest issue was the contradictions that revolved around indicative content marks five and 6. Quite a few stated that the p.d. across the internal resistance increased, but thought that this was actually the voltmeter reading. Consequentially many of those candidates then stated that the voltmeter reading also increased (even when they had said that the p.d. across the LDR decreased).

Q17(a)

Around twenty percent of candidates were not awarded this mark as they could not distinguish between a node **and an antinode.**

Q17(b)

There was a spread of marks in the responses as many candidates attempted an answer that did not apply the formation of a standing wave in the context of the question. In order to achieve the second marking point it was necessary to describe what the wave was reflecting from, for example, the pulley, support, stand or vibration generator.

Q17(c)(i)

The first two marking point were often awarded but for the third the comparison with the equation for a straight line was often missing. In some responses candidates automatically replaced lambda squared with 4L squared with no explanation, and were not given credit.

Q17(c)(ii)

Around a quarter of candidates did not score anything which was surprising as the graph provided was not used. Common errors were the omission of units in the answer line or squaring the value of f^2 from the y axis.

Q18(a)

Half of the response scored full marks with the majority of the remaining responses scoring only the second marking point as the wrong angle of incidence was used.

Q18(b)

This was well attempted but there were some common mistakes. It was expected that candidates would have used the first version of the mark scheme and this turned out to be the case. It is worth noting, however, that use of the second alternative of the mark scheme required the result of the calculation to be shown, in this case 1.06. It was not enough to state that a correct value could not be calculated. Just a small number of candidates did the correct calculation but made the wrong conclusion that TIR did not occur. We were not insistent, on this occasion, to see all 3 words of total internal reflection as this had been given in the question?

Q18(c)

Candidates had difficulty in answering this question in a logical way and the responses often appeared confused. A significant number of responses were not sufficiently expressed to gain credit. Despite the apparent difficulty of this question there were a number of details to be taken from the diagram. The question described the light entering the cable as a pulse and that the pulse consisted of rays; three of which were shown. It should have been evident from the diagram that all three rays followed different paths through the cable. Mention of this would have scored the first marking point. Following on from this it should have been clear that some rays would take longer to travel through the cable and this would have scored the second marking point. One of the rays was shown to refract out of the cable close to the point of entry and stating this would have scored the fourth marking point. Although the order of the marks in the mark scheme did not affect the scoring of responses it would have been better to have swapped the third and fourth marking points as it would have explained the context more clearly. The consequence of the rays following different paths should have led to the idea that the pulse (which contained the rays) would have taken longer to pass through the other end of the cable and that the intensity would be less, as not all rays that entered the cable left it at the end. Most of the responses never distinguished between the rays and the pulse and many candidates simply focussed on the three rays as entities separate from the pulse.

Q18(d)

Poorly answered as most candidates did not recognise that a non-air/vacuum material must have a refractive index value greater than 1. Most responses just compared the refractive index of glass with that of cladding without saying much more.

Q19(a)

The majority of candidates scored no more than the first marking point in this question. The work function is a fixed property of the metal, so all electrons require at least this same minimum energy to

escape. However, the range of kinetic energies arises due to differences in the initial energy of the electrons within the metal. Inside the metal, electrons are distributed across different energy levels so some electrons need to use more of the absorbed photon energy to escape and have less kinetic energy upon release as a consequence. Many candidates answered this question by suggesting that different electrons had different work functions.

Q19(b)

This was poorly attempted with most responses containing copious discussions of threshold frequency and work function, which did not gain any credit. Most commonly seen were the third and fifth marking points with the others rarely mentioned.

White light (low intensity) → No current

- White light consists of a range of frequencies. No current means that **none of the photons in the white light has enough energy to eject electrons**.
- This contradicts the wave theory of light, which predicts that electrons will be ejected at any intensity

  This is addressed by the first two marking points

White light (high intensity) → No current

- Increasing intensity means **more photons** are hitting the surface, but since **each individual photon still has too little energy**, electrons are **not ejected**.
- This further confirms that the photoelectric effect depends on the **energy of individual photons**, not the intensity.

  This is addressed by the third and fourth marking points

Ultraviolet light (low intensity) → Current produced

- Ultraviolet (UV) light has a **higher frequency** than visible light, meaning its photons have **more energy**.
- Even at **low intensity** (fewer photons), some photons still have enough energy to eject photoelectrons, causing a current.

  This covers the fifth marking point

  We would clearly not expect the level of detail above but I have broken the context down to explain that no mention of threshold frequency or work function is needed to answer this question.

Q19(c)

Generally, well answered with most doing the first and second comparisons of the fifth marking point. Quite a few just scored the first and second marking points as they were just showing that the photon energy was greater than the work function to conclude that there would be a current.

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