Examiners' Report
Principal Examiner Feedback

October 2018

Pearson Edexcel
International Advanced Subsidiary Level
In Physics (WPH02)
Paper 01 Physics at Work

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October 2018
Publications Code WPH02_01_1810_ER

General comment

This paper assessed learners on their knowledge of d.c. circuits and waves with a range of contexts in which to apply their physics.

Short answer questions were generally answered well and it was pleasing to see that learners are learning definitions. However, sometimes it is clear that, learners have learnt by rote and do not understand what they have learnt and are unable to apply this. In some questions learners found the contexts difficult and failed to apply the physics that they know correctly in the unfamiliar situation.

Longer written answers demand not only the application of physics but also require the learners to explain their reasoning, using appropriate language, and to write a clear and concise answer. For example, in Q19(a), even those learners who had a good understanding of d.c. circuits, often failed to write a reasonable argument to arrive at a conclusion.

Short calculations were generally answered well, as were longer calculations although there was a tendency by some learners to stop half way through thinking that they had finished. Looking back at the question before moving on would help to prevent this.

Section A – Multiple Choice

	subject	% scoring correct answer	Common incorrect response
1	Units	93	-
2	Pulse-echo	80	A
3	Doppler effect	50	A,D
4	Energy levels	61	C
5	Total internal reflection	37	C,D
6	Displacement-time graph	65	A,C
7	Efficiency	62	C
8	Definition of potential difference	74	C
9	Potential divider circuit with a thermistor	15	B,C
10	Reflection of wave at an interface	35	A,D

Section B

Q11(a)
This is a standard question that has been on previous papers. It was generally answered well. The most common missing point was the idea that the waves are travelling in opposite directions. The incorrect word superIMpose did appear occasionally though not as frequently as seen in previous series.

Q11(b)
This question was answered well.

Q12(a)
A straightforward calculation, generally scoring well, but did need the correct choice of values. Mistakes included not distinguishing between load resistance and internal resistance. Some learners used the equation E=V+Ir but of these there was some confusion between E and V.

Q12(b)
Generally answered well with learners using a correct power equation. Learners needed to realise that they were calculating the power of the torch bulb – a common mistake was using the value for emf instead of the terminal p.d. Also incorrect conversion of mA to A was evident, either with no attempt to convert, or using the incorrect value of 2.8.

Q13(a)
This is a question that has appeared on previous papers and it was evident that learners had seen this before. There seemed to be more learners using the "planes" route than previously although MP3, especially in the planes route, caused a problem, and it was clear that they do not really understand what this means. Of those who did not score well there was confusion over distinguishing between the vibrational movement and the wave motion. This needs to be clear in order to answer this question satisfactorily.

Q13(b)
Not well answered, with few learners understanding what was happening. Many thought that the light in A was absorbed by the polarising filter, so the light from inside the car could not be seen. Those that did understand that the polarising filter removed the reflection of photograph B, generally failed to give the detail required to earn more than MP2. There were many who thought that the filter polarised the light missing the key fact that the light was polarised on reflection and that it is this polarised reflected light that is absorbed by the filter.

Q14
Most learners recognised this as a longitudinal wave with compressions and rarefactions. For MP4 very few candidates described a compression or rarefaction in terms of displacement or pressure. Of those scoring MP4 the example of a soundwave was common. In the description of a wavelength it is important that learners show that they appreciate that wavelength is the distance between *adjacent* compressions/rarefactions.

Q15(a)
A good number managed to calculate the wavelength using the speed of light. Some learners who clearly understood that this was diffraction then failed to score MP2 as they talked about diffraction at a gap which was not relevent to this situation.

Q15(b)
Generally scored well. Mistakes included: omission of units or giving watts as the unit for energy, dividing flux by area rather than multiplying it, incorrect calculation of the number of seconds in an hour and not realising that, having calculated the power, they then needed to calculate the energy.

Q15(c)
Learners found this question challenging with a lack of understanding that this was to do with photon energy. The question tells them that the amount of energy of the waves is the same so failure to mention photons indicated that the learner had not made this link. However, two marks could still be obtained with a comparison of the frequency and the ionisation power of UV and radio waves. Few learners mentioned ionisation but gave insufficient answers relating to cancer or damage to cells.

Q16(a)
Even for learners who understand phase this question was worded in such a way that learners were expected to consider their understanding in a new way. They knew what a phase change of 180° looks like but were not able to explain what it means. The most common mark achieved was for the mention of "antiphase". Many learners then went on to repeat the question. There was a difficulty with using the terms and understanding the difference between path and phase difference, and antiphase and out-of-phase.

Q16(b)(i)
This question was well answered with the majority of learners achieving full marks.

Q16(b)(ii)
A tough question which tested the learners' understanding of path and phase difference. Many learners correctly performed a calculation of the path difference to achieve MP1 and 2 but this was rarely linked to the phase change for MP3, leaving learners confused and incorrectly referring to destructive interference, meaning they scored no further

marks. Often MP4 and 5 were achieved by chance or by using some logic about why yellow could be seen and not the other colours, as opposed to fully understanding the situation.

Q17(a)
Most learners achieved some credit here with MP1 more frequently awarded. Where MP2 was not awarded this was due to not referring to the work function. Some learners wrote in terms of frequency as opposed to energy.

Q17(b)(i)
Most recognised that they needed to calculate a gradient. When calculating a gradient learners should remember to use at least half the graph. Also, in this case, a significant number of learners ignored the fact that the graph did not go through the origin.

Q17(b)(ii)
A number of learners did not state that this is the threshold frequency but did give a reasonable description of threshold frequency.

Q17(b)(iii)
Generally well answered even by those who struggled with the earlier parts of the question.

Q18(a)
This scored well. A main problem was the unit for resistivity, with Ω and Ω m^{-1} frequently seen. It was pleasing to see fewer incidents of confusing resistance and resistivity which results in an incorrect arrangement of the equation, compared to previous series.

Q18(b)
In order to answer this question the learner needed to link a change in resistivity to a named layer, hence linking values of resistivity from the graph with the layers named on the sketch. A learner who simply described the change in resistivity with no mention of the layers was unlikely to gain credit. As an "explain" question, merit was given in MP3 for an attempt to explain the change in resistivity. Some learners had the idea of the water decreasing resistivity but very few learners made the connection beween the gradual/rapid change in resistivity with the slope of the layer.

Q18(c)(i)
An answer of 3V was regularly seen but learners were unable to explain the reasoning behind their calculation in terms of the relationships between length, resistance and potential difference.

Q18(c)(ii)
Not many learners realised that this was linked to the effects of having a shorter length. Common incorrect answers were descibing repeats and accuracy.

Q19(a)
This question highlighted some poor understanding of d.c. circuits with many learners thinking that, after C was added, A and B were still in series and therefore the same brightness as each other. Some thought B would get dimmer. Learners were often quick to state what would happen to A, B and C and then tried to use physics to justify this. It is often better to discuss the physics first and then to arrive at a conclusion.

19(b)(i)
Most learners drew a curve. Whilst it is taken into account that learners are drawing this freehand, it is important that care is taken when making a sketch of a graph. Common reasons for not awarding marks included the addition of hooks or plateaus, none or incorrect labelling of the axes, lack of symmetry.

19(b)(ii)
Some had seen a similar question from previous examinations and even if they did not quite get it right they did use the correct kind of language. Most recognised that this was linked to temperature and that this caused an increase in vibrations although some referred to electrons vibrating. Those learners who referred to collisions, and so heading towards MP3, did not get the mark because they failed to mention the increase in *frequency* of collisions. There was a failure among many to look back at their graph in (b)(i). Even a learner who drew a perfect graph could then refer to a decreasing current which their graph clearly did not show.

Paper Summary

Based on their performance on this paper, learners are offered the following advice:

- Make sure questions involving multi-step calculations are completed such that the final answer corresponds with the quantity asked for in the question.

- Read the information given in the question carefully so that repetition or contradiction with the given detail is avoided. The information given in the question is aimed to be a help in answering the question.

- In questions requiring a conclusion, work through the physics before forming a conclusion. Avoid trying to "fit" the physics to a conclusion.

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