Examiners' Report
Principal Examiner Feedback

October 2022

Pearson Edexcel International Advanced Level
In Physics (WPH15) Paper 01

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Introduction

The assessment structure of WPH15 mirrors that of WPH14. It consists of 10 multiple choice questions, a number of short answer questions and some longer, less structured questions. As it is an A2 assessment unit, synoptic elements are incorporated into this paper. There is overlap with circular motion and exponential variation in Unit 4, but also overlap with some of the AS content from Units 1 and 2.

The paper includes the use of specific command words as detailed in the specification, Appendix 9: Taxonomy. It is recommended that centres ensure that their students understand what is required when responding to such questions. In this paper where the command word was deduced, evaluated, or assessed, the final mark could sometimes not be awarded on otherwise good responses because a final appropriate comment was missing.

Some of the questions on this paper required candidates to analyse graphical data to inform their response. This was often done incompletely, and sometimes ignored completely. Candidates should be aware that the context of the physics in which the question is set and all supplementary information provided are essential for a complete response that could gain full marks.

Candidates should be encouraged to read questions carefully to ensure that their responses take into account all the relevant information.

The space allowed for responses was usually sufficient. Candidates should be encouraged to consider the number of marks available for a question, and to use this to inform their response. If candidates either need more space or want to replace an answer, they should indicate clearly where that response is to be found.

Candidates should be encouraged to work with mark schemes in preparation for their exam. However, it is important that they understand that mark schemes are written for examiners, and so sometimes refer to what examiners expect to see rather than giving a complete answer.

SECTION A: Multiple Choice Questions

In general candidates’ performance in this section of the paper was similar to candidates’ performance in previous series.

In Q7 careful substitution of values into the gravitational potential equation was required.

Q9 relied upon candidates being able to deal with ratios confidently. This is a skill that candidates often struggle with.

SECTION B

Q11

This question was well answered, with a variety of different methods being used by candidates to come to the correct conclusion. However, there was still a number of candidates who got to the end of the calculation but failed to make a suitable comment to address the command 'Deduce'.

Candidates should be aware that when a temperature difference is needed, conversion to Kelvin is not required. Some candidates added 273 to the temperature difference, giving an incorrect final answer.

Some candidates could not manage to determine the correct mass of water used in the shower

Q12

This question was challenging, as the mass of a single molecule was given but not the total number of molecules in the gas. Many creative but flawed attempts were seen to use what might be a molar mass with *R* or *k* in the ideal gas equation. In most cases candidates gave that up and just used the mass of a single molecule in the density equation. The best solutions obtained an expression for *V* in terms of *N*, then used that in the equation for density so that the unknown N cancelled out.

Q13

This question required candidates to produce a coherent and logically structured answer. Out of the total of 6 marks, 4 marks may be awarded for physics content and 2 marks may be awarded for the degree of structure seen in the response.

The responses seen indicate that many candidates' understanding of this topic is quite superficial. Many responses were seen in which reference was made to the intensity of the galaxy rather than a standard candle in the galaxy. Similarly, references were often made to "a star" without making it clear that a standard candle was being referred to.

A popular idea was that the diameter of a star could be determined in order to use the Stefan Boltzmann rule.

Those candidates who knew something about Cepheid variable stars were often able to score 3 marks, even if the rest of their description didn't hit any of the indicative content points.

Q14 (a)

Most candidates were able to determine the time period although disappointingly this was often from a single period.

Q14 (b)

Many candidates recognised this as an example of resonance. However, many descriptions were given in quite general terms, and so MP1 was often not awarded.

Amongst the incorrect answer seen here were some odd ideas about the Moon getting closer to and further away from the Earth over 12 hours, and some said that the Bay of Fundy was closer to the Moon than the rest of the Earth!

Q15 (a)

Although this should have been a straightforward calculation, too many candidates did not seem to understand the Doppler shift equation. These candidates were not aware that $\Delta\lambda$ means a difference in wavelength.

Q15 (b)

For those that could do the conversion from light years to metres the most common error was to omit the x 10^9 when they read a value for d from the graph. An alarming number of candidates were content to multiply the speed of light by the red shift to obtain a value larger than 3×10^8 m s^{-1} for the sped of the radiation.

Q15 (c)

It was unusual to see a response in which the earlier part of the question about red shift was linked to this context. All sorts of irrelevant and/or incorrect statements about infra-red radiation were seen, and it was common for candidates to state that the radiation was emitted by distant galaxies in the infra-red part of the spectrum.

Q16a

This was usually well answered. Most candidates read the value of fmax from the graph and then converted the frequency to a wavelength and used Wien's law. As this was a "show that" question it was possible to work backwards from the value of 3000 K given in the question. This was seen occasionally, although this method usually went astray somewhere in the middle of the solution.

Q16b

Although formulae for areas and volumes are not provided in the equation list, A level physics students should know that the equation for the surface area of a sphere is $A = 4\pi r^2$. However many incorrect substitutions were seen ranging from 1 through to $\frac{4}{3}\pi r^3$. The most common error was to use πr^2. The most common approach was to calculate a value for *L*, but some candidates calculated a value for *T*.

It was expected that candidates would provide a unit for their value of *L* (or *T*), otherwise a valid comparison cannot be justified. However, a unit was not always seen.

Some strange methods were seen to determine a value for 10% of the luminosity of the Sun, including determining a value for 90% then subtracting from 100%. Candidates need to think about the calculations that they are performing.

Q17(a)(i)

This was well answered.

Q17 (a)(ii)

Most candidates scored well on this question, but by a variety of routes. It was thought that candidates would use their answer to (i) here, but a number of candidates ignored the value of *F* from (i) and started the calculation from first principles. This included carrying out a derivation of the Kepler equation from first principles.

Q17 (b)

Many candidates produced good solutions to this question. However, simple errors such as using 9.8 for G, using the mass of the Sun instead of the mass of Ceres, and an inability to calculate 5% were seen.

Q18 (a)(i)

It was expected that candidates would identify X as a neutron, but a number of random alternatives were seen. This may be an indication that candidates were relying upon GCSE knowledge to answer the question.

Q18 (a)(ii)

Most candidates were able to work through to a final correct answer. It was rare to see MP2 explicitly stated, but many arrived at the right answer, so gained full credit. The few who got in a mess with the mass difference perhaps lacked sufficient practice with this kind of calculation. The unit GeV/c^2 is generally less familiar than u or kg which are sometimes used in similar calculation.

Q18 (b)

The context was not understood by a significant minority. Maybe the word 'diagnose' was a barrier, but perhaps candidates didn't read that sentence. Responses were often referring to treatment, killing cancer cells etc. Many candidates did not realise that a positron would annihilate with an electron inside the body and so it is gamma radiation that is being detected.

Q19a

This question has been asked in various ways over the lifetime of this specification. The key points that candidates often omitted were that displacement is measured from the equilibrium position. There are a number of ways in which this can be expressed, but it is never enough to refer to displacement from equilibrium.

Q19 (b)(i)

Far too many candidates treated the space on the question paper as space for rough working. If candidates are performing calculations to obtain pertinent values, then it is expected that their work should be set out clearly. In a mathematics exam candidates are often encourages to leave answers in terms of π and/or fractions. In physics we are dealing with real data, and so we would expect values to be worked out in full.

A surprising number of candidates got in a muddle with frequency and time period, e.g. T = 4.5 Hz

Q19 (b)(ii)

This often scored full marks, although there may have been e.c.f. credit given for incorrect values calculated in (i).

Q19 (b)(iii)

This should have been a straightforward question, if candidates had thought about the context. However, most candidates came up with a standard wrong answer, citing energy lost to the surroundings in their response.

Q20 (a)

A minority of candidates muddled fission and fusion. Those that did know what they were trying to describe often used imprecise wording.

Q20 (b)(i)

Most candidates scored 2 marks on this question. However, in some responses the proton and nucleon numbers were confused.

Q20 (b)(ii)

Most candidates were aware that momentum conservation was important. They often had more difficulty in expressing why this would lead to a range of β particle energies.

Q20 (c)(i)

Most candidates calculated a value for the decay constant. However, they found it more challenging to work out how to get N.

Most candidates who realised the equation to use, could proceed to get 5 or 6 marks.

Q20 (c)(ii)

This was often left blank. However, those candidates who attempted it often scored full marks. The main issue for these candidates was deciding upon the

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