Pearson Edexcel

# Examiners' Report
# Principal Examiner Feedback

## January 2019

Pearson Edexcel International Advanced
In Physics (WPH05) Paper 1
Physics from Creation to Collapse

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**Introduction**

The assessment structure of WPH05 mirrors that of other units in the specification. It consists of 10 multiple choice questions, a number of short answer questions and some longer, less structured questions. As 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 tested candidates' understanding of a wide range of topics from this unit. All of the questions elicited responses across the range of marks. However, marks for questions Q14b, Q15b, Q16, Q17, Q18ci, Q18cii, Q19ab, Q19ci, Q19dii, and Q19diii tended to be clustered at the lower end of the scale.

Calculation and 'show that' questions gave candidates an opportunity to demonstrate their problem-solving skills to good effect. Some very good responses were seen for such questions, with accurate solutions which were clearly set out. Candidates understood the convention that in the "show that" questions it was necessary to give the final answer to at least one more significant figure than the value quoted in the question. Not all candidates recognised the importance of showing all stages in their working in this type of question.

Once again there were examples of candidates disadvantaging themselves by not expressing themselves using suitably precise language. This was particularly the case in questions such as Q16, Q17, Q18ci, Q19ab, and Q19di-ii, where candidates sometimes had knowledge of the topic, but could not express it accurately and succinctly.

There was evidence in this examination of candidates' responses not gaining credit because the response didn't answer the question, as in Q16. Candidates should be encouraged to read the question carefully before they start to write down their response.

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.

The response to the multiple-choice questions was good, with 5 of the questions having 70 % or more candidates selecting the correct response. In order of highest percentage correct they were Q1 (94%), Q9 (88%), Q2 (82%), Q6 (75%), Q10 (73%), Q7 (68%), Q5 (67%), Q3 & Q8 (63%), and Q4 (53%).

Q4 tested ideas about energy in oscillations, and involved finding a ratio. Ratios are often challenging for candidates, although grade 'A' candidates scored well on this item.

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.

**Question 11**

This was generally well answered, although some candidates calculated the decay constant in day−1 rather than s−1, so they missed out on the mark for the final answer.

Other candidates seemed unaware of the equation relation activity to the number of unstable nuclei. Hence in some candidates calculated a value for the decay constant and then attempted to use the exponential decay equation.

**Question 12 (a)**

This question was generally answered well, with full marks being quite common. The most common reason for a response gaining less than full marks was an incorrect value for the Boltzmann constant or an incorrect attempt to use pV = nRT (which is not on this specification).

**Question 12 (b)**

This seemingly straightforward question cause a number of candidates some difficulty. Most knew that the internal energy depended upon the temperature in some way, but some didn’t appreciate the need to convert the temperature to kelvin.

The essential starting point for this calculation is the understanding that the internal energy is directly proportional to the absolute temperature. Those candidates who realised this were usually able to make good progress with the calculation and obtain full marks for a correct answer.

**Question 13 (a)**

This question was straightforward for most candidates, with the vast majority scoring full marks.

**Question 13 (b) (i)**

This was straightforward for most candidates, although some made an unnecessary conversion of temperature to kelvin and made an error in their calculation as a result of this.

**Question 13 (b) (ii)**

Although many good responses to this question were seen, a number of responses seen simply referred to an energy loss. A bald statement of energy loss was not enough to gain this mark, although if the statement was qualified by making reference to the loss being to the surroundings then this was acceptable for this mark. Some candidates made vague references to energy transfer. At this level it is expected that candidates will be specific about the details of the energy transfer.

**Question 14 (a)**

Calculating the missing values from the table should have been straightforward, but some candidates made calculation errors, and some gave their answers to more than 2 significant figures. Graph scales were usually suitable, although some candidates chose awkward scales. Scales that go up in units of 1, 2, or 5 (or multiples of these numbers) are expected. Axes were not always labelled as in the table headings, and best fit lines were sometimes poorly drawn. In this example it was necessary to assess whether or not the line went through the origin, so extending the line to the axis was expected. Many candidates forced their line of best fit to pass through the origin.

**Question 14 (b)**

Candidates who drew their best fit line to pass through the origin often stated that this showed that the data supported Boyle’s law. However, they missed out the important reasoning, that if two quantities are directly proportional a graph of the quantities would be a straight line passing through the origin. Some candidates were satisfied that a straight line was evidence of a direct proportionality, although statements that the intercept indicated that a systematic error was present were rarely seen.

**Question 15 (a)**

The usual responses to this question were seen, with many candidates giving correct definitions, but others omitting to specify where the displacement is measured from. Other referred to displacement from equilibrium, but displacements are measured from a position or point and so the mark was not awarded unless this was clear from the candidates’ response.

**Question 15 (b) (i)**

It should have been straightforward for candidates to read displacement and time period values from the graph, but this was surprisingly challenging. Some candidates gave an answer that was twice the amplitude, and some just seemed to misread the scales completely. The horizontal axis was labelled “time of day”, and it was though that this would be clear to candidates. However, too many candidates interpreted the *x*-axis values as times in days or seconds.

**Question 15 (b) (ii)**

Most candidates answered this question successfully by using their values for $T$ and $A$ with appropriate equations to calculate $v_{max}$. It was acceptable to draw a tangent to the graph at its steepest pint and to calculate the gradient, although this was seen less often than anticipated. Some candidates just read values from the graph and calculated a rate of change from these values.

**Question 15 (b) (iii)**

This was a difficult curve to add to the graph, but some candidates drew excellent sinusoidal curves that led the displacement variation by one quarter of a cycle. It was common for curves to vary in amplitude and time period, and many were drawn in antiphase to the displacement variation.

**Question 16**

This question took standard specification content and gave it a twist by requiring candidates to make a comparison between the viability of fusion in the core of stars and the attempts at fusion on Earth. Many candidates had learnt the conditions for fusion, although their descriptions often missed out vital detail. For example, although a very high temperature was often stated as a requirement to overcome the electrostatic forces between nuclei, many candidates omitted to state that very high temperatures gave high kinetic energy to nuclei and that this was the key to overcoming the electrostatic forces.

Only a minority of candidates considered why the core of stars were ideal, with very little mention of the huge gravitational forces acting in the interior of stars. Most candidates were aware of the containment problems in achieving viable fusion on the earth, although many gave incomplete descriptions of what might happen if the fusing plasma were not contained.

**Question 17 (a)**

Although many candidates stated that the distance should be small because alpha particles are absorbed by a few cm of air, few considered why the distance should be fixed.

**Question 17 (b)**

Many candidates were aware that taking account of background radiation was an important modification. Responses that explained that the count rate was higher because of background radiation were fewer in number. Similarly, many candidates referred to "recording the background radiation", rather than making a specific reference to the background count rate.

Many candidates realised that increasing the counting time, or repeating counts and calculating an average was an important modification. Most related this to the general situation of taking a measurement, rather than the specific instance in this question of the random nature of radioactive decay.

**Question 18 (a)**

A large number of candidates were able to obtain a value for the frequency that was in the required range. However, some did this by measuring the time period over a single cycle, and some who repeated measurements over more than one cycle omitted to calculate an average value. A minority of candidates tried to fiddle their answer to lie in the correct range, often by calculating a time period from an inaccurate measurement from the graph and giving this time period units of Hz.

**Question 18 (b) (i)**

Most candidates were able to obtain the correct answer, although some candidates used their value for the frequency of rotation from (a) rather than the 0.8 Hz specified in the question.

**Question 18 (b) (ii)**

The vast majority of candidates recognised that this speed exceeded the speed of light. However, some expressed this quite ambiguously, by stating that the frequency was too high.

**Question 18 (c) (i)**

Most candidates were aware that a Doppler shift was taking place, but responses were often unclear as to whether the wavelength of the light received from A (or B) was longer or shorter. General statements such as "the wavelength of light received on Earth is longer as the source is moving away" did not specify whether the source being referred to was A or B. In addition, some candidates missed up what was happening with ideas about red shift due to the Sun moving away from the Earth, and some referred to an accelerating source rather than a source with relative motion to the Earth.

**Question 18 (c) (ii)**

This should have been a straightforward application of the Doppler equation. However, although many candidates obtained the correct answer for the wavelength shift from A or B, but then didn't go on to double this to calculate the difference in the wavelength of light received from A and B.

**Question 19 (a)**

It is clear from the responses to this question that the vast majority of candidates are aware what parallax is. However some candidates answered the question by stating that this was a method of determining stellar distances.

**Question 19 (b)**

In many responses to this question it was stated that the parallax angle for A would be less than that for B. Candidates should be aware that when numerical values are given in the question, full marks will depend upon a numerical answer being given. As the question states that star A is **twice** as far away from the earth as star B, then the second mark was for stating that the parallax angle for A would be (about) **half** of the parallax angle for B.

**Question 19 (c) (i)**

In answering this question many candidates were able to able to read values of binding energy (per nucleon) from the graph correctly, but were unsure whether energy is required or released in the process of forming/splitting a nucleus. As a result, it was common for the first but not the second marking point to be given credit.

**Summary**

This paper provided learners with a wide range of contexts from which their knowledge and understanding of the physics contained within this unit could be tested.

A greater understanding of the context and question being asked would have helped many learners. In addition learners should read the question carefully and ensure that they answer what is asked.

For descriptive questions, it is often helpful to try to base the answer around a specific equation which is quoted. In calculation questions learners should show all of their working. This is particularly important in a "show that" question.

Based on their performance on this paper, some learners could benefit from more teaching time and extra practice on the following concepts and skills:

- Choose graph axes suitably and ensure that all plotting of points is accurate.
- Thinking through complex explanations such as the conditions for fusion to ensure that they understand why each conditions is important.
- Practise standard definitions, such as the conditions for simple harmonic motion and the description of the Doppler effect. Answers in previous mark schemes are useful reference points for *standard descriptions* such as these.

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