Examiners' Report
Principal Examiner Feedback

October 2019

Pearson Edexcel International Advanced Subsidiary Level
In Chemistry (WPH05)
Paper 01 Physics from Creation to Collapse

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October 2019
Publications Code WPH05_01_1910_ER

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 Q12a, Q13c, Q14bi, Q14bii, Q15a, Q15b, Q16c, Q17a, Q18b, Q19bi and Q19biii tended to be clustered at the lower end of the scale.

Calculation and 'show that' questions gave candidates an opportunity to demonstrate good problem-solving skills. Some very good responses were seen for such questions, with accurate solutions which were clearly set out, but 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 Q15a, Q15b, Q16c, and Q17a, 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 Q18b. 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 not answered as well as in previous series, with only one of the questions having 75 % or more candidates selecting the correct response. However, overall performance seemed to be influenced by a number of candidates at the lower end of the mark range scoring poorly on these items.

In order of highest percentage correct, the items are Q2 (90%), Q5 (70%), Q10 (64%), Q8 & Q9 (62%), Q7 (57%), Q3 (56%), Q1 (51%), Q4 (40%) and Q6 (30%).

Q4 tested knowledge of experimental techniques in a radioactivity context. In answering questions about radioactive decay experiments candidates should understand that a longer counting time decreases the percentage uncertainty in the count (and hence the rate) for a given source activity.

Q6 was an application of resonance in which candidates were required to consider the relationship between the damping forces and the amplitude of the oscillation. However, grade 'A' candidates scored better on both of these items.

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 rather than students.

Question 11

This question was poorly done by a sizeable number of candidates. Many did not seem to think it was necessary to draw a best fit line and, of those that did, many failed to draw it with sufficient care to obtain an answer within range. Those candidates who did not attempt to draw a line read the co-ordinates of a point on the graph and then went straight to a calculation. A few candidates attempted an unnecessary unit conversion.

Question 12 (a)

A number of candidates misread the question and just described the part of the process when the water is heating up, rather than what happens at the boiling point.

A good number of candidates thought that the molecular kinetic energy increases. Of those that did manage to say that KE is constant and PE increases, many didn't actually say what happens to the internal energy.

Question 12 (b)

This question was answered well by most candidates. Where errors were made, they were most frequently regarding the temperature difference. Either candidates misinterpreted the question and used the difference between the coffee and milk or didn't calculate a difference at all and just used a fixed temperature.

Some unnecessary conversions to absolute temperatures were seen, which sometimes led to arithmetic errors and an incorrect final answer.

Question 13 (a)

Wien's law was generally applied correctly to obtain a correct answer. However, the unit for Wien's constant included in the equation (m K) seemed to encourage some candidates to apply a factor of 10^{-3} (or sometimes 10^{3}) as a "conversion" to their answer.

Question 13 (b)

Many candidates realised that they needed to use Stefan's law, and this was usually managed successfully. However, when performing the calculation some candidates forgot to raise the temperature to the power of 4.

Question 13 (c)

This question was very poorly answered. Many candidates gave a generic response related to thermal energy or radiation being transferred to the surroundings, despite this being the point of the question. Very few candidates commented on thermal energy being absorbed as well as emitted.

It was very rare to see a reference to the temperature variation over the body and rarer still to see a candidate note that the surface area of the human was an estimate.

Question 14(a)(i)

On the whole, this question was well-answered. Some errors occurred where candidates attempted to recall Kepler's Third Law and then used it incorrectly, meaning they could score no marks. Remembering the steps leading to the final equation is a more useful approach.

Question 14(b)(i)
This is a standard derivation from the specification, and most candidates were able to score full marks here. Given that it is a derivation, a convincing attempt at algebra leading to the final expression was expected, rather than simply writing down the two starting equations and then giving the answer. Although candidates should be very well-prepared for this derivation, some candidates just quoted the relationship they were supposed to derive.

Question 14 (b)(ii)
The majority of responses scored full marks here. Some very odd units were seen for the final answer in some responses, and sometimes no units were given. The mark for the final answer is only awarded if correct units are given.

Question 15 (a)
The different approach to this question on stellar parallax seemed to have caught many candidates out. However, most candidates scored the first mark, for a reference to one star moving in the field of view over 6 months. The other three marks were much more difficult to score, although a smaller number of candidates managed a detailed explanation of exactly what was happening.
It's clear that some candidates did not understand what 'particular field of view' means, and many candidates showed that they did not know what parallax is. Some gave generic responses which, in some cases, would still not have been sufficient even for a more general question, and others did not recognise it as a parallax question at all.
Incorrect physics was often used to attempt to explain what is shown by the three images. Responses that referred to stars orbiting the Sun with a period of one year, and even stars orbiting the Earth were seen.

Question 15 (b)
In general, this question was not well answered. Many candidates made no reference to locating a standard candle in the galaxy, and there was also confusion between luminosity and brightness. Some candidates quoted the expression for radiation flux but did not define symbols. In this context it is essential to identify F as the radiation flux and L as the luminosity.
Candidates were often not specific about which flux they were measuring (the star), and some candidates thought that flux was calculated rather than measured. Some candidates were unclear on what is meant by the term "standard candle", with a few thinking that it was a light source on Earth that is compared with a star.

Question 16 (a)
Despite this being a frequent question on this unit, many candidates are still missing the clear reference to equilibrium 'position'. Confusingly, some of these candidates will use it correctly in one sentence, and then refer to 'equilibrium' in the other.

Question 16 (b)
Surprisingly, this question was poorly answered, as many candidates took the amplitude as 3mm. Another common error was to calculate the time period or frequency incorrectly, or forgetting to square ω.

Question 16 (c)
Many candidates assumed that this question was about resonance, and gave a standard response related to driving frequency matching a natural frequency. However, this is not specifically an example of resonance. Very few candidates got the idea that the volume of air was causing the loudness of sound, and so the final mark was only rarely awarded.

Question 17 (a)
Most candidates had the right idea with regards to the diagrams, commenting on the presence of red giants/white dwarfs/main sequence stars. Marks were often missed, however, for not relating this clearly to the ages of the clusters.
Good candidates who read the question carefully were able to give a succinct answer that scored full marks. However, some seemed to misunderstand what the diagrams actually show, with their answers suggesting that they described an individual star, a whole galaxy, or the whole universe, rather than a cluster of stars.

Question 17 (b)
Most candidates recognised that they had to apply the Stefan-Boltzmann equation in this question, but responses were often not detailed enough. Many candidates missed out of the second mark, as they omitted to state that the luminosity of the stars was the same. The final mark was often given, but sometimes not because there was no specific reference to the comparative temperatures of Rigel or Betelgeuse

Question 18 (a)(i)
This rather standard 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 or missing conversion of temperature from Celsius to Kelvin.

Question 18 (a)(ii)
This was a “show that” question, but very few candidates showed anything clearly. Some responses considered the number of molecules, some the pressure in the tyre with one canister, some the volume in the tyre with one canister. However, very few candidates showed clearly what they were thinking or what they were attempting to do.

Question 18 (a)(iii)
The mark was commonly awarded, usually for a response related to gas escaping.

Question 18 (b)
This question was poorly answered, with a number of candidates writing nothing of relevance. Many candidates didn’t understand that the question is about how the pressure decreases over time, and these candidates just tried to explain why the pressure exerted by nitrogen might be less than the pressure exerted by oxygen.
A few candidates expressed the idea of it being ‘easier’ for oxygen molecules to escape but didn’t link this to a rate of decrease.

Question 19 (a)(i) and (ii)
These items were well answered by most candidates, and it was common for full marks to be awarded.

Question 19 (a)(iii)
In general, this question was well answered with a number of candidates scoring full marks. However, although most candidates scored the first mark for attempting a mass difference calculation, this was also the most common source of error, as an incorrect mass difference leads to an incorrect final answer. A surprising number of responses were seen in which no conversion from u to kg was made.

Question 19 (b)(i)
A large majority of candidates scored well on this question even though it is a graph that they may not have seen before. Most candidates identified that the 390 mg cm^{-2} was relevant, even in incorrect answers. Some errors were due to incorrectly re-arranging the equation.

Question 19 (b)(ii)
The majority of candidates scored this mark, usually for a reference to background radiation.

Question 19 (b)(iii)
Most candidates had not paid sufficient attention to the command word in this question and stated or described rather than explained. The most commonly awarded mark was for commenting on the use of tongs. However, candidates who identified the need to use tongs often did not go on to explain that this is important because the intensity of radiation decreases with distance. Unfortunately, lots of answers that were about shielding were seen, despite the instruction given in the question.

Question 19 (c)(i)
This question was generally well-answered. As common error was to attempt to use the exponential decay equation after calculating the decay constant. The activity equation is often overlooked by candidates.

Question 19 (c)(ii)
This question was also well-answered in general, but some candidates didn't realise that this was where they needed to use the exponential equation.

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