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# Examiners' Report

## Summer 2014

## Pearson Edexcel GCE Physics (6PH05)
## Paper 01R

## Physics-Creation/Collapse

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Summer 2014
Publications Code UA039727

## General Comments

The assessment structure of unit 5 mirrors that of other units in the specification. The examination consists of ten multiple choice questions, a number of short answer questions and some longer, less structured questions with synoptic elements incorporated throughout.

This paper gave candidates the opportunity to demonstrate their understanding of a wide range of topics from this unit, with all of the questions eliciting responses across the range of marks. However, marks for questions Q12(a), Q12(b), Q14(b)(i), Q15(a), Q18(a) and Q19(a) tended to be clustered at the lower end of the scale.

In general, 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 solutions which were well crafted, clearly set out and accurate.

Occasionally, in calculation questions the final mark was lost due to a missing unit. Most candidates understood the convention that in the "show that" question it was necessary to give the final answer to at least one more significant figure than the value quoted in the question.

Scientific terminology was used imprecisely and incorrectly in a number of responses seen on this paper. There was confusion demonstrated between atoms, molecules, nuclei and particles. At A2 level it is to be expected that, where candidates use such terms, they do so with accuracy.

Once again, there were examples of candidates disadvantaging themselves by not expressing themselves using suitably precise language. This was particularly the case in extended answer questions such as Q13(a), Q18(b)(iii) and Q19(a), where candidates had knowledge of the topic, but were sometimes unable to express it accurately and succinctly.

Some candidates did not spend enough time reading the question before they started to write their answer. Some responses to question Q12(a)(ii) focused on the conditions for fusion rather than considering the technical difficulties.

The space allowed for responses was usually sufficient. However, candidates should be encouraged to consider the number of marks available for a question, and to use this to inform their response.

Responses to the multiple choice questions were generally good with 7 of the questions having 70 % or more correct answers.

In order of highest percentage correct they were:

Q8 (95%), Q1 & Q6 (86%), Q4 & Q9 (79%), Q10 (74%), Q5 (71%), Q2 (51%), Q7 (31%), and Q3 (23%).

**Question 3**

Question 3 had the lowest percentage of correct answers attracted a range of the distractors which indicates that many candidates were unsure of the correct answer. Perhaps the use of the word ‘indefinitely’ mislead some candidates into thinking that D could not be the correct answer.

**Question 7**

Question 7 is based around a context that has not been used in this topic area before.

**Question 11**

Some very good answers were seen for this question. Candidates identified this situation as an example of resonance, and the effect of damping when the mass was made to oscillate in water was clearly understood.

The two marking points causing the most difficulty for candidates both related to energy. Some responses referred to a large transfer of energy at resonance, although this doesn’t necessarily mean that the energy transfer is a maximum. Similarly, references to energy transfer from the mass-spring system didn’t always convey the idea that energy is not able to be returned.

Some weak responses described the two curves without offering very much explanation of the key features and differences.

**Question 12ai**

This was poorly answered, with many references to atoms, particles and even molecules. At this level it is expected that candidates will refer to nuclei rather than atoms. Many responses did little more than to say that nuclei joined together, with little detail on how close nuclei have to be for this to occur. Marking point 2 was awarded more frequently than marking point 1, although some candidates missed out on this mark too by referring to a larger nucleus being produced and not specifying that it was the mass that was larger.

**Question 12aii**

Many responses concentrated on the reasons why extreme conditions are required (to overcome the electrostatic forces between nuclei, to maintain a sufficiently high collision rate, etc) rather than to focus on the technical difficulties as required by the question.

**Question 12b**

On the whole this was well answered, although those responses which referred to binding energy often omitted to say that it is the binding energy per nucleon that is important. Further to this some responses indicated confusion between which nuclei had the higher binding energy per nucleon. Candidates were aware that binding energy is energy released in the fusion process, but seemed to conclude that the binding energy per nucleon should decrease as a result of this.

**Question 13**

This was a well answered question with a good awareness displayed of the similarities and differences between the two types of field. Some candidates stated that gravitational fields have a larger range than electric fields, possibly from the notion that gravitational forces shape the universe over a large scale.

**Question 14ai**

This was reasonably well answered, with marking point 1 being awarded slightly more frequently than marking point 2.

**Question 14aii**

On the whole candidates seemed to understand the effect that smoke particles would have on the ionisation process.

**Question 14bi**

The meaning of random and spontaneous were generally well understood, although in applying them to this context it was expected that candidates would refer to nuclei and not atoms or particles. This was sometimes the reason for marks not being awarded.

**Question 14bii**

This question was very well answered with marks being dropped only occasionally.

**Question 15a**

Some candidates were able to gain the mark, although many descriptions were based around the tea particles rather than the water temperature.

**Question 15bi**

This calculation was well done with most candidates aware that they needed to give their answer to at least three significant figures. Candidates sometimes tried to convert temperatures from $^{0}$C to K, and occasionally they did so incorrectly by adding 273 (K) to the temperature difference.

**Question 15bii**

The calculation tended to be well done here, with some candidates using the show that value in preference to their own calculated value from part (i). Most candidates who dropped marks here did so by referring to energy being lost. Candidates should be aware that energy is never lost, although there is often a transfer of energy to the surroundings which, unless taken into account, may lead to discrepancies in calculated values.

**Question 15biii**

This question tended to be well answered by most, although some candidates were unclear when they made the comparison.

**Question 16a**

Some candidates expressed the activity as the number of counts per second. Although this may be how we would estimate the activity in an experiment it is not a definition of activity.

**Question 16b**

The radioactive decay constant equation was used successfully by most candidates, and they were then able to calculate a correct value for N.

**Question 16ci**

This was well answered by the vast majority of candidates. Some candidates made an incorrect conversion between seconds and years, but the exponential function was handled well.

**Question 16cii**

Most candidates recognised that the time given was a very long time, although they often went on to say that this would be a good thing, without indicating why this would be so.

**Question 17ai**

This question was generally well answered, although some candidates missed marking point 2 by not showing clearly how the field strength expression is obtained.

**Question 17aii**

Many candidates seem to have learnt this derivation and so full marks were quite common for this question.

**Question 17b**

A common correct answer was to state that the satellite must rotate with the Earth, although some candidates repeated the stem of question and said that the satellites must remain at a point above the earth's surface at all times.

**Question 18a**

This is a fairly standard definition, and most candidates were able to include the essential features in their answer. The most common error was to omit a reference to the equilibrium position when referring to the displacement. Candidates should understand that because displacement does not have to have a central datum point they must refer to the "equilibrium" or "rest" position.

**Question 18b**

This was a well answered question, although in part (ii) there was a tendency for some candidates to refer either to kinetic or to potential energy changes.

**Question 18c**

This was a synoptic calculation from unit 2 which most candidates were able to complete well to obtain the correct answer.

**Question 19a**

This was a poorly answered question. Most candidates described what they could see mathematically, rather than in terms of star groupings. There was little evidence that candidates were aware that such diagrams can give evidence for the evolutionary paths of stars. Marks were most frequently awarded for marking point 1, marking point 4 and marking point 5, although rarely in the same script.

**Question 19b**

Most candidates answered this question well. In part (ii) some candidates selected an inappropriate trig function.

**Question 19c**

This question was well answered, with only a small fraction of candidates selecting the wrong value for $\lambda$max and most candidates making substitutions into Wien's equation to obtain the correct answer. In a small number of responses the decay constant equation, $\lambda = \ln 2 / t_{1/2}$, was used. This tends to suggest that not all candidates are familiar with the equations provided in the question paper.

## Final Comments

In order to improve their performance candidates should:

- Ensure they have a thorough knowledge of the physics for this unit.
- Read the question and answer what is asked.
- Make a note of the marks for descriptive questions and include that number of different physics points.
- Show all their workings in calculations.
- Try to base the answer for descriptive questions around a specific equation which is quoted.

**Grade Boundaries**

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