Pearson

Examiners' Report
Principal Examiner Feedback

October 2017

Pearson Edexcel International Advanced Level
Physics (WPH05)
Unit 5: Physics from Creation to Collapse

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General 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.

This paper gave students 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 Q11, Q12b, Q14, Q16d, Q17bi, ii, Q17c, Q18b, Q18c and Q19e tended to be clustered at the lower end of the scale.

Calculation and 'show that' questions gave students 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. Occasionally in calculation questions students made a unit error. This was usually by omitting the unit, but was sometimes due to the addition of a unit for a dimensionless quantity as in Q16c.

Students 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 students recognised the importance of showing all stages in their working in this type of question.

Once again there were examples of students disadvantaging themselves by not expressing themselves using suitably precise language. This was particularly the case in questions such as Q11, Q15b, Q17c and Q19e where students sometimes had knowledge of the topic, but could not express it accurately and succinctly. Compared with previous examination series, there seems to be more evidence in this examination of correct physics being written that is not gaining credit because it doesn't answer the question. Students could most improve by ensuring they describe all aspects in sufficient detail and always use appropriate specialist terminology when giving descriptive answers.

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

Section A – Multiple Choice

The response to the multiple-choice questions was acceptable, with 7 of the questions having 50 % or more correct answers. However, the percentage of students selecting the correct response was lower across the full range of multiple choice questions.
In order of highest percentage correct they were Q1 (71%), Q9 (69%), Q2 (66%), Q4 and Q10 (59%), Q7 (56%), Q6 (53%), Q8 (47%), Q5 (41%), and Q3 (39%).

Q3 involved a ratio, which students often find difficult. In Q5 many students forgot about the vector nature of gravitational field strength. Q8 required students to interpret graphical information which makes the question relatively challenging. The stronger students scored well on each of these items, indicating that the low overall success rate resulted from the level of challenge presented by these items.

There was some evidence of students learning previous mark schemes in the expectation of earning marks. Students 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 B

Question 11:
In general this question was very poorly answered. Many students misread the question and thought that they were required to give the conditions for simple harmonic motion.
The most common way to gain credit was by saying that the centre is the equilibrium position of the oscillation, although few went beyond this statement to explain why this would be the best place to use as a reference point.

Question 12:
(a) Some very good responses to this question were seen, with most students realising that they were required to outline the parallax method for determining the distances to nearby stars.

Many students scored 2 or 3 marks on this question, either from a good description or from a good diagram. However, a minority of students outlined the use of standard candles. Some gave less obvious incorrect alternatives such as sending out electromagnetic waves and measuring the time for them to return, or by using the Doppler Effect and Hubble’s Law.

(b) Overall the responses seen to this question were disappointing. There was evidence of considerable confusion between luminosity and brightness. Some students tried to use the Stefan Boltzmann law to incorrectly justify their answer.

Those students who realised that the radiation flux equation could be used often missed out on marks as a result of writing out the equation without defining terms.

Question 13:
(a) This is a straightforward application of the specific heat capacity equation and most students were awarded full marks. Those who missed out on all 3 marks did so by making arithmetical errors or, in some cases, by not completing the calculation and instead just working out the energy.

(b) Most students gained credit for MP1 by referring to an appropriate energy transfer. A bald statement of energy loss was not enough to gain this mark, although if the statement was qualified by making reference to the surroundings then this was acceptable for this mark.

Those students who went on to consider how the energy transfer would affect the calculated power of the heater seemed to divide evenly between those who thought that the actual power would be higher and those who thought that it would be lower. Sometimes the language used by students made it hard to determine if they were referring to the actual power or the calculated power.

Question 14:
This was a challenging question, which only students at the top end of the grade range made significant progress with. The question is very similar to the question about light bulbs and collisions from the summer and a lot of students have clearly learned that mark scheme and tried to modify it to apply it to this question.

A surprising number of students were not sure what a vacuum pump does. Some thought that it makes the molecules vibrate, others thought that it increases the temperature, and a considerable minority thought that it increases the number of molecules in the balloon.

In the best responses seen work was set out clearly and logically either by following the sequence given in the mark scheme, or by reversing this sequence.

Question 15:
(a)(i) Many students gained full marks for this question. Common ways in which students did not obtain the correct answer were by only using 1 neutron others or by carrying out the J to MeV conversion incorrectly.

(a)(ii) Most students gained credit for MP1, but fewer were awarded MP2. This was either because the reason stated was poorly expressed, or because no justification was given at all. Note that because both nuclei consist of 3 nucleons references to either binding energy, or binding energy per nucleon were both accepted for MP1.

(b) Most have some idea of what happens in the fission process, but a general lack accuracy in their descriptions meant that many students scored less than they should have. For example, it was common to see references to large nuclei and smaller nuclei. At this level students should qualify their use of such words by referring to mass. Some students did not refer to the graph at all. A few students confused fission with fusion, and others thought that the uranium splits into individual nucleons.

Question 16:

(a) Most students were awarded full marks here. Occasionally this item was left blank.

(b) Most have the correct idea but some are only giving 1 condition. Some students referred to the containment issues experienced when trying to establish a practical fusion reactor on the Earth.

(c) Most students knew that they needed to use the Stefan Boltzmann law to work this out, and quite a few scored all 3 marks.
Common reasons for not obtaining the correct answer included forgetting to change the temperature to kelvin, and omitting the square or the fourth power in the calculation. Quite a large proportion of students left the ratio as a fraction. Where a calculation is specified the final answer must be fully worked out. Some candidate's added units, which counted as a unit error a ratio of similar quantities has no units.

(d) It was common to see responses scoring marks for MP3 & MP4, but less common for MP1 & MP2. Even those students who referred to gravitational forces for MP1 often did not link this to the core density for MP2.
Some students thought that as the star has more hydrogen it will take longer before it is used up and hence agreed with the statement.

Question 17:
(a) Responses to this question generally scored full marks. A common reason not to score full marks was to mix up *A* and *Z* for the β^- particle.

(b)(i) Most students read the word 'decay' in the question and assumed that it meant a normal exponential decrease. Students have to relate their answers to the context in which the question is set.

(b)(ii) Very few students' responses were awarded this mark, although it was more likely to be awarded to students at the top end of the grade range.
A common incorrect response seen was that all the uranium has been converted so no more neptunium is being produced.

(b)(iii) Many students scored full mark here, although some were calculating a value for the decay constant but then attempting to use the exponential decay equation.

(c) This is another example of where students could have scored more marks by reading the question carefully. Most students referred to beta radiation, missing the point that the question refers to a 6 m thickness of concrete. Many students just did not give enough relevant detail, so responses such as "to prevent radiation from escaping" were relatively common.

Question 18:

(a) The vast majority of students scored full marks for this question. For some reason a few students attempted to use the method of dimensions to prove that the formula is dimensionally correct.

(b) A significant minority of students wrote nothing for this question. Those students who did attempt the question seemed to either not understand the topic or they did not understand the question. Typical incorrect responses referred to centripetal force, recessional speed, and the frequency of radiation.
A minority of students argued the situation backwards from the equation to explain why the mass must increase and suggest it comes from dark matter. MP1 and MP2 were the marks most commonly awarded.

(c) This question was not well answered. Many students missed out on marks because they didn't refer to density. Some thought that dark matter would affect the critical mass density of the universe. Others compared the mass (rather than the density) of the universe to the critical density.
Many students gave all 3 possibilities for the future of the universe, but they did not always relate these to the question. Vague statements such as "the amount of dark matter is uncertain, so the density is uncertain and hence the fate of the universe is uncertain" were seen too often.

Question 19:

(a) This is a standard definition that has been tested many times on this specification. However, less than 30% of students scored full marks, and a sizeable proportion of students (38%) scored just 1 mark. This was usually because they gave enough detail for MP2 to be awarded, but did not state the <u>position</u> from which displacement is measured (necessary for MP1).

(b) A large proportion of students were awarded full marks for this question. Most of those that didn't score 3 marks calculated ω incorrectly or forgot to square ω in the calculation.

(c) Quite a variety of responses were seen to this question ranging from some excellent sketches to some that bore no resemblance to the original.
Some students drew a minus sine curve, for which partial credit could be given. Others drew a minus cosine graph for which no marks were awarded.

(d) Responses to this question were often poorly expressed. The best responses see made good reference to resonance, maximum energy transfer and large amplitude vibrations. However, there was often some confusion between the loudspeaker cone and the casing.
Responses seen all too frequently were often vague and referred to loudness or clarity of the sound produced together with general statements about oscillations that included little that matched the mark scheme

(e) Although some students expressed the idea of energy being removed from the oscillation they then usually went on to state that the amplitude reduces with time rather the removal of energy preventing an increase in amplitude.

Some students referred to a change in frequency of the output. As in Q19(d) there was confusion between the loudspeaker cone and the casing.

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