OXFORD
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AQA EXAMINATIONS

INTERNATIONAL A-LEVEL PHYSICS

PH01 Paper 1

Report on the examination

June 2018

REPORT ON EXAMINATION: INTERNATIONAL A-LEVEL PHYSICS PH01 UNIT 1 JUNE 2018

GENERAL

Most of the paper was accessible to the majority of students. There was a broad range of total marks awarded, with some strong performances.

Answering questions framed in an experimental context proved to be a challenge for many students. Students seemed comfortable with basic data analysis skills such as plotting points on a graph and drawing a best fit line (10.2) but struggled with obtaining and using that data in their calculations (10.3, 11.3). Additionally, questions that related to the planning and carrying out of experiments drew few good responses (11.1, 11.4).

Students tended to be successful with direct, single stage calculations but found multi-stage calculations where different topic areas were addressed in sequence more challenging. In questions with the "show that" command, answers must be given to an extra significant figure compared to the numerical result given in the question. The numerical result given in the question, on its own, does not gain any marks as this is merely repeating information given in the question.

Question 11 proved to be a particularly challenging part of the paper. Students appeared unfamiliar with the practical aspect of radioactivity. Question 5, also a contextual radioactivity question, was not well answered either. Students seemed to struggle with questions set in an experimental context. As a general rule, students should try to refer to measurable quantities when answering questions set in an experimental context.

Students were more successful than previous series in those questions that required an extended description or explanation, for example in 03.2, a four-mark question about annihilation, and 04.3, a comparison of the properties of two different steels.

Many students seemed to find questions requiring brief definitions of quantities challenging (04.1, 06.1, 09.1).

QUESTION 01

This question was not answered well, with only around half of students calculating each unit conversion correctly. Common errors included power of ten errors.

QUESTION 02

Most students answered 02.1 correctly, a straightforward speed calculation. However the rest of the question was not well answered, with many students uncomfortable with the different procedures for calculating scalar and vector quantities in a context where motion is not in a straight line.

QUESTION 03

This question was well attempted by most students. For the calculations in 03.1, over half scored at least one mark, while some students confused antiprotons and electrons, and others did not specify the sign for the charge. 03.2, a description of the process of annihilation, was well attempted, with 40% of students scoring at least three marks out of four.

QUESTION 04

04.1 was not well answered; students found questions requiring a brief definition of a quantity challenging. An answer written only in symbols will not score any marks if the symbols have not been defined by the student.

04.2 was well answered, showing that students were confident interpreting a graph in this case.

There were some good responses to 04.3, with around half scoring at least two of three marks. Many students were able to make brief comparisons between properties of the two steels, but to attain full marks, some reference to the use of the steel in this context was required, ie some reference to the relevance of those properties for a brake cable. As a general rule, if a question refers directly to the context, some reference to the context is required in the response.

QUESTION 05

In 05.1, the majority of students identified some sort of neutrino; for two marks, the neutrino needed to be specified as an electron-neutrino.

Most students scored the first mark in 05.2, a non-standard half-life question, by indicating that the fluorine nuclei had quartered in number. However, only about a fifth of students calculated the new ratio of nuclei numbers correctly.

05.3 was very poorly answered. At this level, a vague comment about the half-life being short is insufficient; as a question in a practical context, some reference to directly-measurable quantities is required. In this case, a comparison between the diminished count rate and the background count rate was required.

QUESTION 06

This question drew mixed responses. Under half of students recalled the definition of a couple correctly.

Around half completed the moment calculation in 06.2 correctly, but most struggled with the uncertainties calculation. The errors made were either not combining the two uncertainties correctly, or not calculating the percentage uncertainty in the distance correctly.

QUESTION 07

07.1 was generally well answered, with most students scoring at least two of the three marks. Most students could convert MeV to J, and even more showed they were able to rearrange and substitute into the kinetic energy equation. The final answer must be given to an extra significant figure (in this case three significant figures), as merely repeating a number given in the question cannot score a mark.

07.2 was not as well answered; many students did not identify that this question required the application of conservation of momentum. At this level, we require students to identify that considerations of momentum are required for collision questions without extra guidance.

07.3 was generally not well answered. A small minority of students gave some very well-worded responses and showed an impressive understanding of the context, the discovery of the neutrino. However the majority of students did not provide a response with enough detail to score more than one mark out of three. While most students did identify that the undiscovered particle was a neutrino, this fact alone was insufficient for any marks; the marking point that was most commonly accessed was the fact that the third particle carried some energy and momentum. Most students did not address both bullet points, and so limited the number of marks they could be awarded.

QUESTION 08

08.1 was well answered, with two thirds of students scoring full marks. Students seemed confident with resolving vectors and using the speed equation in this instance.

08.2, another vector-resolution question, was also well answered – again, around two thirds of students scored the mark. As mentioned previously, students should provide an answer to an extra significant figure to the solution given in the question.

08.3 proved more challenging; while most students were able to use an appropriate equation of uniform motion correctly, they seemed less comfortable relating their calculated distance to the final answer. It may be helpful, in contexts such as these where several lengths and distances are involved, to encourage students to annotate the diagram with quantities they have calculated.

QUESTION 09

This question was not well answered by the majority of students. In spite of 9.1 referring to work done, and the reference to energy considerations in 9.3, many students incorrectly attempted to use the equations of uniform motion which are not helpful in this context. However, students who understood to use the energy considerations approach were successful and there were some strong responses.

QUESTION 10

10.1 and 10.2 were well answered, with around three quarters of students calculating means correctly to the correct number of decimal places, and either plotting the points correctly, drawing the line of best fit correctly, or both.

However, 10.3 was not well answered, with around a third of students calculating the gradient correctly. Many students also made power of ten errors. For gradient calculations, students must annotate the graph to evidence how they have attained their answer.

10.4 was well answered; again, the most common error was in powers of ten.

QUESTION 11

This question overall was poorly answered by a majority of students. Many students seemed unfamiliar with the practical aspect of radioactivity.

11.1 was not well-answered, with many students making unrealistic suggestions such as lead screens or lead-lined coats, which are not appropriate in this context. Students are required to be familiar with the procedures for handling radioactive sources in a school-laboratory context.

11.2 and 11.3 were poorly answered. Many students seemed comfortable with halving the count rate and reading off a time accordingly, but in both question parts, under a third showed they understood the relevance of a graph of uncorrected count rate.

11.4 was also poorly answered, again showing that students were unfamiliar with experimental procedures in the context of radioactivity. The marking point that was most commonly accessed was taking several values and calculating a mean.

SECTION C

In general, students seemed to do better in the multiple choice questions than in the rest of this paper. A majority were successful in the more straightforward numerical calculations across topic areas, such as in questions 14, 21 and 22. Question 12 was also answered successfully by the majority. Students were less successful in questions requiring manipulation of quantities in algebra, with no numbers given, ie questions 23 and 25. Questions 15, the estimation question, and question 24, about the Rutherford Scattering experiment, were also not well answered. It may be helpful to encourage students to make annotations to their paper when attempting the multiple choice section; while these will not be marked, it was seen that students who did do this were less likely to make mistakes in their calculations.

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