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General Certificate of Education (A-level)
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Physics A PHYA1

(Specification 2450)

Unit 1: Particles, quantum phenomena and electricity

Report on the Examination

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GCE Physics, Specification A, PHYA1, Particles, Quantum Phenomena and Electricity

General Comments

Students generally performed well in this unit and there was strong evidence of careful preparation in a significant proportion of centres. Students were assured in their answers to questions on particles and seemed to approach the questions involving circuit calculations with a greater confidence than was the case in January. The questions involving quantum phenomena such as electron capture and the photoelectric effect caused more problems and proved to be quite discriminating.

The majority of students attempted all questions and answers were in the main well set out. This was particularly noticeable in questions 2 (a)(iii) and 2 (b)(ii) where a logical approach clearly helped students give correct answers.
The question assessing quality of written communications generated many good responses although it was clear that a minority of students were unfamiliar with the oscilloscope.

Questions 3(c)(i), 4(a)(ii) and 6 (c)(ii) proved to be the most discriminating whilst 2(a) and 3(b) were answered impressively by the majority of students.

Question 1

Students seemed quite familiar with the quark structure of mesons and were able to deduce the quarks found in the K^- meson successfully. The questions relating to the Feynman Diagram were well answered and full marks were quite frequently awarded. A significant minority however, did have problems interpreting the information given to produce a correct equation of the decay as required in part (b)(iii).

Question 2

This proved to be one of the most accessible questions on the paper with many students securing full marks. The majority of explanations of nucleon number, proton number and isotope were clear although a minority did confuse number of neutrons with number of protons in there definition of isotope. The calculations and deductions pertaining to the nucleus and one of its isotopes were in the main well set out and in many cases this helped generate correct answers. A minority, as has been the case in previous sessions, did include the mass of electrons in the specific charge calculation even though the question clearly refers to a nucleus.

Question 3

The quark structure of the proton was well remembered but this was not the case with interactions and their associated exchange particles. A surprising number of students were unable to provide two consistent examples. Mixtures such as strong interaction and W^+ were relatively common. It was also clear that a significant proportion of students were unfamiliar with the process of electron capture. A common problem seemed to be a misunderstanding of where the electron in the interaction comes from. The Feynman diagram proved to be quite discriminating but students who took a bit of care were generally more successful.

Question 4

Students have found questions on the photoelectric effect quite challenging in previous series. In view of this it was pleasing to see more confident answers this time around. The explanation of work function and the calculation were well answered by a significant proportion of students. Explanations of the range of kinetic energies were less sound and as has been the case in the past there was frequent confusion between the photoelectric effect and excitation of electrons from discrete energy levels. The idea of validated evidence which was required in part (b), seems now to be well understood.

Question 5

Part (a) required students to describe the use of an oscilloscope to measure peak voltage and frequency of an alternating current supply. This was answered well by a good proportion of students and many were confident in their description of the use of the time base to determine frequency and the y-gain to measure peak voltage. In a number of good quality answers students mentioned switching off the time base and measuring peak to peak voltage so as to find an accurate rms voltage. It was evident however, that a minority of students were unfamiliar with the use of an oscilloscope and consequently gave very vague answers which scored few marks.
The calculation of rms and peak current were well done with the only common error occurring when students assumed that the 12 V quoted in the question referred to peak voltage. Those doing this were not heavily penalised as their answers were carried forward in the subsequent calculations.

Question 6

The quantitative parts of this question were well answered but as is often case, students found the qualitative aspect the much more challenging. The calculations of current and resistance caused few problems and the majority of students were able to explain the effect of an appreciable internal resistance. Part (c) caused far more problems and a significant proportion could not convincingly explain why the lamps were not at normal brightness when connected in series. They seemed not to appreciate that the voltage of the 12 V battery was divided between the lamps or that the circuit resistance is higher when the lamps are in series. They also found it very difficult to explain which lamp was brighter – many incorrectly assuming that it was lamp P as it had a higher power rating.

Question 7

The majority of students were able to analyse the circuit correctly although surprisingly a significant minority had problems with (a)(i) because they did not appreciate that the pd across R_2 was 4.0 V. This did not affect their subsequent responses however, as the answer they gave was carried forward to subsequent calculations. As was the case in question 6, the qualitative aspect of the question presented students with a greater challenge. Many incorrectly stated that the voltmeter reading would decrease as the thermistor resistance falls seemingly forgetting that the voltmeter was connected across R_1.

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