



General Certificate of Education

Physics 6451

Specification A

PHA9/W Electronics

Report on the Examination

2007 examination - June series

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Dr Michael Cresswell Director General.

General Comments

All five questions on this paper proved to be accessible to the candidates. All the marking points were awarded. Most of the answers to sections where marks for the Quality of Written Communication were being awarded were answered, but the examiners were conscious that more candidates than usual gained only one mark for the quality of their answer.

Question 1

In part (a), few candidates were able to give a concise statement of the meaning of the decay constant. Most candidates referred to the number of nuclei rather than the fraction or proportion of the nuclei that decay in a given time. Candidates quoted the equation for activity in terms of the number of nuclei often did not define their symbols. In describing two differences, many candidates realised that X has a shorter half life than Y and then went on to write about the differences in terms of the relative numbers of nuclei of X and Y, rather than the activity or the count rate or total count from each source. Candidates who compared their emissions often did not specify if they were comparing the total emissions or the emissions in a given time. Many answers were marred by ambiguities and repetition.

Part (b) (i), saw a good number of candidates score full marks, although a significant number of candidates did not correctly read the logarithmic scale for activity. Candidates who read the time scale for an activity of 100 Bq often made an arithmetical error in reading the time scale.

Most candidates in (b) (ii) scored both marks, although some candidates did not give the answer in days and thereby lost a relatively easy mark.

Many neat solutions were seen in (b) (iii). However, some candidates gave an unnecessarily lengthy calculation as a result of not using the value of the initial activity directly.

Question 2

Part (a) was expected to be a question which all candidates should do well, but few candidates managed to gain all three marks. The drawings were often careless and common mistakes included a gradual breakdown at -3.9V , a non-zero current in the section between 0V and 0.7V and many labelling the forward voltage as 3.9V .

The calculation in part (b) was understood poorly by many candidates who took the voltage across the resistor to be 6V . Other candidates, who were able to work out the total current correctly, then added 10mA to this current to get the wrong answer.

Question 3

In part (a), most candidates were able to recognise this as a summing amplifier circuit.

The majority of candidates were also able to gain the mark in part (b) by substituting the correct values in the equation from the data sheet.

Many candidates calculated the correct values of the output voltage and drew the correct graph in part (c). However, some candidates ignored the fact that the positive input voltages produced negative output voltages and thus could not find the correct total output voltages.

Question 4

Candidates found it difficult to articulate their answers to the written parts of this question; many answers lacking either precision or the correct terminology. In (i), although most candidates had some idea of what was meant by negative feedback, they did not gain marks either because they did not say that it was part of the output which was fed back to the input or because they did not state that this was 180° out of phase with the input. Many expected these points to be clear from a statement such as 'the output is connected to the negative input', but this gained no marks.

The majority of candidates were able to gain the mark in (ii) for saying that negative feedback provided increased stability of the output signal.

It was startling to see so many answers where the candidates could not express accurately the answer either in terms of voltage or power output.

Surprisingly, candidates who did not gain the mark for (iii) were able to gain the marks for (iv). Equally, there were candidates who answered part (iii) correctly, but then did not show the same answer on this diagram. Marks were also lost because of careless drawing and lack of indication as to the range of frequencies involved.

Question 5

In part (a) (i), many candidates understood the need to measure the time period and then use $f = 1/T$, but too few candidates explained how the time base value and the correct measured distance from the trace could be used to calculate the period of the wave.

Part (ii) was perhaps the most disappointing part of the paper in terms of the answers seen. Although candidates had been asked in the stem of (a) to state the readings to be taken and explain how they would be used, the majority of candidates ignored this instruction and suggested the use of the equation $X = 1/2\pi fC$. Of those candidates who tried to use readings of current and voltage, few were able to realise that the milliammeter measured rms current and the oscilloscope trace gave a peak voltage and thus a conversion was needed to make both readings either rms or peak values.

The shape of the graph was known well in part (b) and most candidates gained this mark.

Nearly all candidates managed the calculation in part (c) which proved to be the easiest part of the paper, although some candidates did lose a mark for quoting the wrong unit.

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