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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Physics 1450

Specification A

PHYA1 Particles, Quantum Phenomena and Electricity

Report on the Examination

2009 examination - June series

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Dr Michael Cresswell Director General.

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

General Comments

Candidates' performance in this unit was generally consistent and there was convincing evidence of careful preparation in a significant proportion of centres. Candidates seemed as confident with the quantum phenomena questions as they were with the electricity questions, which was not the case in the January examination. Candidates once again had problems when a circuit contained cells with an appreciable internal resistance.

Questions 2 (b) (i), 5 (b) (ii) and 7 (a) were particularly discriminating and not many candidates scored full marks. To balance this, questions 3 and 6 (a) (ii) and (iii) were answered well by the majority of the candidates.

Presentation was acceptable for the most part but there were instances where more than the allotted space was used when answering questions. Some candidates used ink that did not scan well, making their answers difficult to read. It would be a good idea to remind candidates that they should use black ink or a black ball-point pen.

The dedicated marks for units and significant figures did not present candidates with too many problems although knowledge for the unit of resistivity seemed a little variable. For the most part candidates set out their work clearly and certainly seemed better at this than was the case in January. This was particularly noticeable in question 1 (b) (iii) where a logical approach clearly helped candidates arrive at the correct answer.

There were two questions used to assess the Quality of Written Communication and the majority of candidates attempted both questions.

Question 1

Part (a) was answered well and the majority of candidates seemed to have a clear idea of the meaning of the term *isotope*.

Part (b) did require some careful analysis by candidates and this was particularly true in parts (iii) and (iv). The unit for specific charge is generally well known and the majority of candidates were able to access this mark. The number of protons surprisingly caught out a significant minority of candidates and this is in contrast to the many correct responses to part (a). The last two parts of this question were quite discriminating and the more successful candidates did well because they structured their answer in a logical way. Common errors were to not include the masses of both nucleons in the calculation and to try and include the mass of electrons when the question clearly referred to the specific charge of a nucleus.

Question 2

Candidates usually find questions involving a description of the formation of line spectra difficult. This proved to be the case this time and many candidates were very confused in their answers to part (a). A common error was to mix up this effect with the photoelectric effect even though the question mentioned the emission of photons. Many less able candidates talked about photons being absorbed rather than electron collisions and the idea of discrete energy levels and their relationship to the frequency of characteristic photons did not seem well understood. This question assessed the Quality of Written Communication and candidates tended to fail to gain marks because there was not a logical structure in the physics used in their explanations.

Part (b) (i) was not done well and many candidates confused the incident electrons with the orbital electrons and made statements such as 'one of the electrons is excited and loses energy while the other one is in its ground state'. Candidates in the main, did not link this with part (a).

Part (b) (i) and (ii) proved to be much more accessible and full marks were common. The only common error was to use 9.0 eV instead of 8.0 eV as the energy of the photon.

Question 3

This question was answered well with a number of candidates obtaining high marks. Quark structure and the application of conservation laws seemed to be particularly well understood.

Question 4

Part (a) was answered reasonably well and candidates seemed to appreciate the effects of changing the frequency and changing the intensity of the incident light. In the legacy specification, this topic has often confused candidates and it was pleasing to see many confident responses. A minority of less able candidates did confuse the meaning of frequency, taking it to mean the rate of photon arrival rather than the frequency of individual photons.

Part (b) (iv) assessed How Science Works and candidates answered this question well, demonstrating that the idea of validated evidence is well understood.

The calculation in part (c) was, for the most part, done well and identifying the unit for the work function did not really cause many problems. The only common error occurred in part (c) (ii) when the maximum kinetic energy was calculated by equating it to the photon energy and ignoring the work function in spite of the fact that this had been successfully calculated in part (c) (i).

Question 5

The circuit diagrams drawn by candidates in part (a) (i) were generally not done well. Many did not include a means of varying the potential difference across the diode and the inclusion of a load resistor was rare. Less able candidates also confused the positioning of the voltmeter. There were very few occasions where a potential divider was used even though this is best practice for obtaining the full characteristics for the diode.

The descriptions of experimental procedure required for part (a) (ii) were generally thorough but some did suffer from a poor structure and this had an impact on the assessment of the Quality of Written Communication. Many candidates did not mention anything about reverse characteristics and it was noticeable that a significant minority did not appreciate that it was important to obtain readings with a potential difference of less than 1.0 V.

The calculation in part (b) (i) was done well and full marks were the norm. Part (b) (ii) proved to be not so straightforward and it was common to see candidates divide the potential difference across the diode by the resistance of the resistor. This proved to be one of the most discriminating questions on the paper.

Question 6

In part (a) (i) the majority of candidates were able to relate the time-base setting to time period and from this determine the frequency. Many however, did not use the whole trace and did not recognise that there were one and half cycles across the ten divisions. Instead, they tried to judge the number of divisions occupied by one cycle and consequently obtained a value for frequency of less than 100 Hz.

Part (a) (ii) & (iii) were answered very well with only a minority of candidates confusing peak voltage with peak to peak voltage.

Part (b) was less well done and it was rare for candidates to score full marks. It was not uncommon for candidates to state that two horizontal lines were produced when the time base is switched off. Some also confused this situation with what would occur if a source of direct current had been used and stated that the trace or spot is deflected upwards.

Question 7

Part (a) caused similar problems to the question on emf and internal resistance in the January examination. A common, incorrect approach was to calculate the potential difference across the internal resistance and quote this as the value of terminal pd.

Part (b) proved to be much more accessible and the calculation only caused a few candidates problems. The unit for resistivity does confuse a significant proportion of candidates and this is often quoted as $\Omega\,m^{-1}$ or Ω/m.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results statistics page of the AQA Website.