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General Certificate of Education

Physics 1456

Specification B: Physics in Context

PHYB1 Harmony and Structure in the Universe

Report on the Examination

2010 examination - January series

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GCE Physics, Specification B: Physics in Context, PHYB1, Harmony and Structure in the Universe

General Comments

Each question on the paper produced some good answers. Some of the explanations were done well by only a few. It seemed that many candidates had a passing familiarity with some topics but they did not know them in sufficient depth or detail. In many cases, technical vocabulary was not used and questions were answered with general terms. Many candidates had more success with calculations, but even here, the setting out of calculations was often poor. It is very clear that those candidates that adopt a rigorous and consistent layout for calculations make far fewer mistakes and, when they do, they are more likely to gain partial credit for their work.

At this stage, some topics are still relatively new and it would not be surprising to see some candidates who are relatively poorly prepared. What is more surprising it to see evidence of under-preparation in topic areas with which centres have been traditionally familiar, for example radioactive decay. One indicator of this is the number of candidates who do not attempt particular parts of questions. This did not occur significantly in section A, but it did occur in some part questions in section B. Such part questions were not grouped at the end of the section and there was no indication that time had presented a problem to candidates.

Question 1

In part (a), many candidates showed that they knew what was meant by the fundamental and the overtone but there were many others whose inaccurate drawing failed to convince that they did understand. Others chose the wrong numbers of nodes and antinodes.

Part (b) was answered poorly. Some candidates recognised that the first diagram represented a louder sound but many relied on stating that it had a lower intensity. Since this was given in the question, it was not acceptable. A very few realised that the tone or quality of the notes differed. Many interpreted the graphs as being of intensity against time and wrote about how the sound varied throughout that time. In particular, they commented on the ‘attack’ of the note.

The notion of synthesising sound by adding different frequency signals of appropriate amplitudes in order to copy the characteristic waveform of an instrument was not well grasped. Many candidates wrote of recording a note of the instrument and others thought that this was a question about digitising signals.

Question 2

Many candidates answered this question well. The most common error was to use the value for the number of lines per mm as the grating spacing. Otherwise, a few candidates had their calculators set in radians rather than degrees. Significant figures were coped with well.

Question 3

In both halves of this question, candidates demonstrated their lack of confidence. Often answers were changed or reversed and frequently the mechanism was wrong but the type of radio signal was correct or vice versa.

Question 4

In part (a), candidates often did not give any detail of the mechanism is understood. In particular, they did not mention that the exchange particle moves between the interacting particles.

Part (b) was answered well by many candidates. However, it seemed to be a complete mystery to a few.

Question 5

This was well answered by most candidates. A few quoted the answer in °C without subtracting 273.

Question 6

In (a)(i), a surprising number of candidates did not know how to complete this standard block diagram. More candidates identified the loudspeaker correctly than identified the microphone. Candidates should be advised to make answers clear; full words should be used rather than abbreviations. In particular, in the context of sound recording, the word 'speaker' is not unambiguous. In part (ii), the function of a mixer was not known well and those who realised that it concerned the adding of signals often did not specify that the relative strengths of the signals were adjusted. When discussing amplification in (iii) candidates tended to be very vague with few stating that the amplifier worked on the electrical signal. Many used answers such as 'boosting the sound'.

Candidates answered part (b) better. Sampling was often referred to but the less able candidates did not mention that this involved measuring the signal voltage.

Many candidates correctly answered (c)(i) and many more either used the correct relationship for *T* or realised that they needed twice the quoted frequency. Many candidates also did part (ii) correctly but some still concerned themselves with further doubling or halving of the frequencies.

Question 7

It was surprising to see that fewer than half of the candidates could complete an alpha decay equation and work out the appropriate proton and nucleon numbers. In fact a significant number may no attempt on this part. Many did not no the numbers for an alpha particle. Others introduced other particles in addition and/or placed the alpha particle on the left hand side of the decay equation. In part (ii), standards of draftsmanship were very poor. It was often difficult to interpret candidates' intentions. Candidates seemed to have little notion of drawing a smooth curve. The directions of their particle tracks were often unusual, bearing little relationship to electrostatic repulsion.

Part (b) was done well by many candidates. Most people gained marks for knowing the observations and the outcome but few could explain the logical links between the two. As is often the case, the standards of expression varied from excellent, lucid descriptions to unstructured and misspelt answers.

Part (c)(i) gave candidates more difficulty than part (a)(i). As beta decay involves a wider range of particles there was more opportunity for error. Typical errors were similar to those made in the alpha decay question. Only a minority of candidates had an idea of how to explain the beta energy spectrum. The mention of conservation of energy was rare and few candidates realised that each decay involved the same overall energy change.

Question 8

A few candidates chose simply to describe the place of a main sequence star in the Hertzsprung-Russell diagram. Otherwise, most of the candidates gained at least partial credit for their answers. The most common omission was an acceptable explanation of why the temperature of the material goes up.

In part (b) candidates were more successful, mostly because there was a greater range of acceptable responses. However, clear and lucid descriptions were rare but impressive when seen.

Question 9

Many candidates found the calculations in part (a) to be accessible. However, candidates should be aware that simply getting the correct answer in not sufficient when they have been asked to 'show that'. In these cases they must be clear with their selection of equations, manipulation, substitution and in dealing with powers of ten. They should also quote their answer to a greater degree of provision than number mentioned in the question in order to demonstrate that they have performed the calculation completely. There were a surprising number of candidates that did not attempt this part of the question.

Answers to part (b) were poor. It seems that candidates were familiar with the effect but they were not able to articulate the logic of why it demonstrates that light, in this case, is not acting as a wave.

Question 10

Part (a) was answered well. Nearly all candidates got some credit. A few chose to give symbols when they had clearly been asked to name the particles. Once again, candidates should be advised that they should avoid sloppy answers in examinations.

In part (b), the majority of candidates correctly identified that charge was not conserved in the reaction. Many also demonstrated this clearly but many struggled with the explanation, particularly when they did not choose to set out the conservation equations in a formal way. Candidates were obviously more comfortable with the conservation of charge than they were with the other properties.

Most candidates had an idea of what would happen in this circumstance but some were again let down by unclear use of language; 'the particles cancel each other out' is not the same as 'annihilation occurs'.

Mark Ranges and Award of Grades

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