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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 - June series

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

General Comments

Although some candidates were thoroughly well prepared for the paper, many had gaps in the required knowledge. This was evident by the numbers of parts that were not attempted by significant numbers of candidates. These parts were not grouped towards the end of the paper. In other words, there was no indication that parts were not attempted due to time pressure. Some topics are clearly not well understood by candidates. Candidates were not able to explain how to do a standard experiment.

In general, candidates were insufficiently precise in their explanations. Often it seemed that they were loosely familiar with a topic but had not managed to learn the detail that was required. Quality of Written Communication it is not directly assessed in most questions but the poor use of language is indicative of some candidate's immature approach. At this level, candidates should be able to organise their thoughts clearly and communicate them reasonably grammatically and legibly.

Many candidates would also benefit from using more rigour with mathematical work. In two questions, limited ability to rearrange equations caused many candidates difficulty. In this paper, knowledge and use of units were not specifically tested. In one question, candidates were required to give an answer to an appropriate number of significant figures, having taken data from a graph. Most were able to do so but a significant number still struggle with this.

Question 1

Most of the candidates correctly identified decibel, sometimes with the correct spelling. Few knew the approximate quantitative effect of reducing the sound level by 3 dB. In part (b), candidate's graphs were as likely to be below the given curve as above it and details of relative insensitivity at high frequencies were rare. Most of the candidates could give an acceptable reason for the deterioration of hearing. Candidates should be advised to be specific in their answers; general answers, such as 'illness' may not be sufficiently precise.

Question 2

Most of the candidates correctly commented about increasing the sample rate and many had an idea about using more levels of quantisation, but they had difficulty in expressing this idea well. Similarly, although candidates knew something about compression they often did not express the clear idea that the required data could be transmitted in a shorter time. Answers involving bandwidth sometimes were not convincing although, potentially, this is an excellent approach.

Question 3

Most of the candidates identified the formula connecting intensity with power and area but went on to divide by the area instead of multiply. Another common mistake was poor extraction of data from the graph. Candidates should able to recognise when a curve does not go through a grid point and interpolate when necessary. Some candidates also quoted their answers to too many significant figures.

Question 4

Over 10% of candidates did not attempt this question. Most of the candidates could not recall what the acronym 'quasar' stood for. Most candidates correctly identified at least one property of quasars.

Question 5

The calculation was done well by most candidates. Few could explain about graded index fibres. Candidates should have been able to say that the refractive index decreases towards the outside of the fibre. There were, however, some excellent answers that, not only described this, but also explained why it was useful.

Question 6

In part (a), the majority of candidates could name the parts of the satellite dish correctly but a surprisingly large number could not.

The first part of part (b) was done quite well but candidates showed some uncertainty about whether to use 600 or 1200 as the appropriate distance. Some candidates introduced an arbitrary factor of ½ in order to get to the required answer. Some candidates set out their calculations in a very convincing way but, unhappily, this is not the norm. Most of the candidates gained some credit for their diffraction pattern but well drawn sketches showing the first minimum at the appropriate distance and evidence of subsequent minima of appropriate size and distribution were rare. A significant number of candidates did not attempt part (b) (iii). Those that did tended to be reasonably successful. Candidates who started with the diffraction grating equation were penalised but were allowed some credit. In part (b) (iv), almost half of the candidates thought that a larger footprint would be achieved with a consequent reduction in signal strength, rather than vice versa. Disadvantage pertaining to expense and size of dish were permitted.

Question 7

Most candidates did the calculation well. Those that did not usually did not correctly rearrange the equation. Once again, those who set out calculations well tend to be more successful than who are untidy or who miss out steps. Candidate's drawings of the oscillation tended to be correct. A few got it wrong because they could not identify the correct oscillation but more lost the mark because their loops were obviously far from equal in size. Candidates should be advised to take care with their answers. Measuring the sixes of loops would not be inappropriate. Few candidates answered part (a) (iii) well. Stopping was mentioned and allowed even when the candidates did not indicate that this should be done lightly.

Part (b) was extremely badly done. There were some diagrams that showed more or less appropriate experimental apparatus but more that showed unfamiliarity with any sensible experiment. Candidates tended not to know the names of apparatus such as oscillators or signal generators. Very few mentioned that the length of the vibrating string should be measured using a metre rule or suitable alternative. Those that mentioned that a graph should be drawn almost always failed to suggest an appropriate graph that would yield a straight line. When describing experiments, candidates should be aware of the need to state the measurements that should be made; the measuring equipment used; which variables to control and how; how to display the results in a straight line graph.

Question 8

There were some admirable precise and concise answers to part (a), describing Brownian motion, explaining the deductions about kinetic theory that could be made and describing the mechanism by which air molecules cause the motion of smoke particles. Such excellent answers were rare. Candidate's vocabulary was often unclear. For example, most referred to air particles rather than air molecules. Momentum was usually ignored when describing collisions between air molecules and smoke particles. Many candidates did not comment on the mass disparity between the two and the consequent deduction about the speed of the air molecules. Some candidates thought that the air molecules were bigger than the smoke particles. A very common error was to confuse diffusion with Brownian motion. Many candidates lacked the language skills to write a cogent account of what they knew.

In part (b), many candidates did (ii) either completely or partly right. Candidates should be advised to complete the analysis for each fundamental particle rather than simply stating, for example, that a meson would have a baryon number of zero. The other two parts were omitted by many and answered incorrectly by more. Many did not know about the deep inelastic scattering of high energy electrons. Some described the analogous alpha scattering experiment. In part (iii), most of the candidates were unaware that strangeness is not conserved in reactions that involve only the weak interaction. Some did not mention that this was just that sort of reaction.

Question 9

Part (a) was done better, by those candidates that attempted it, than other parts of the paper. All subsections of part (a) were omitted by a significant numbers of candidates. Most of the candidates who attempted it got part (i) right although some made arithmetic errors or omitted the minus sign. Those who had a clear idea of how to proceed with part (ii) did well but some tried a variety of arithmetic processes until they got something approaching the right answer. This was rarely successful and it again noteworthy that the more successful candidates had clearly set out answers. Many did part (iii) well. A common error was to choose the de Broglie equation. Candidates who started correctly sometimes made errors in rearrangement of equations particularly when their work was untidy. Many knew the answer to part (iv). Surprisingly, some candidates knew the answer without having correctly done the calculation.

In part (b), candidates tended to know something about the importance of the absorption spectrum for making deductions about stars. They tended to have some idea about how they were produced but their accounts were often either contradictory or not detailed enough.

Question 10

Most candidates gained credit for their answer to part (a). Candidates were a little unclear about the sources emitting radiation that is red shifted. Planets and stars were common ideas. A frequent omission was the idea that it is significant with distant objects, usually galaxies.

The first part of (b) was answered very poorly. Many candidates confused dark matter with black holes and anti-matter. Others had difficulty in describing what they half knew. Candidates were expected to know that dark matter is difficult to detect. Very few candidates gave examples of the sorts of particles that constitute dark matter. In part (ii), many candidates knew that the mass or density of the universe would control its fate. Fewer went on to say that sufficient mass or density would result in the collapse of the universe. Those that used the idea of critical density often got the argument the wrong way around.

Mark Ranges and Award of Grades

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