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Physics B: Physics in Context PHYB1

(Specification 2455)

Unit 1: Harmony and structure in the universe

Report on the Examination

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GCE Physics, Specification B: Physics in Context, PHYB1, Harmony and structure in the universe

General Comments

This paper provided opportunities for candidates of varying abilities to demonstrate their knowledge and application of the subject content for the unit. Although there were parts of questions that were not attempted by some candidates, these were spread throughout the paper and it appears that candidates had sufficient time to complete the paper.

There were some good answers and many candidates demonstrated a developing understanding of key concepts. Some of the explanations were done well, but only a few. Unfortunately, candidates were often unable to capitalise on the knowledge they had due to a lack of rigour in presenting calculations and descriptions. Often the technical language lacked the level of sophistication required of an AS candidate.

There were many instances where candidates demonstrated a limited grasp of the subject content rather than the detailed knowledge and understanding required.

Question 1

Many candidates were able to obtain full marks for this calculation. The two most common errors made were the lack of substitution for the mass of the electron and a calculator error involving the order in which the calculation was performed. This calculation error meant that candidates performed $(h \div m) \times v$.

Question 2

This question demonstrated many candidates lack of familiarity with specification content. Very few candidates achieved full credit.

Question 3

In part (a) a large number of candidates thought that part X was the cladding.

Part (b) was answered well, with many candidates correctly using the formula and laying out their working in a structured manner. The most common error seen was due to candidates confusing n_2 and n_1. This resulted in an answer of 1.85 for part Y's refractive index.

Part (c) was answered poorly, with many candidates being unsure of dispersion. Some candidates tried to describe graded index fibres and how these reduced dispersion rather than answering the question.

Question 4

Many candidates confused apparent magnitude with the luminosity of a star. Candidates were unable to correctly use technical vocabulary and instead of describing brightness, used terms such as size and luminosity in their descriptions.

Question 5

Many candidates did not get any credit for this question, with a significant number not attempting it at all. It was obvious that many candidates were unfamiliar with strangeness and those who were frequently mixed up their answers to parts (i) and (ii).

Question 6

Most candidates scored at least one mark in part (a), but getting both in the correct order was less common. Those candidates who had difficulty with part (a) tried to describe analogue to digital conversion rather than the required stages in an analogue recording chain.

Part (b) was answered very well, with most candidates achieving full marks. Those who lost marks attempted to convert the frequency into a period and tended to get lost in the process.

Question 7

Candidates found this explanation challenging and many did not score any marks. A common error was to describe expansion of the Universe, red shift and the density parameter.

Question 8

In part (a) there was an error in the numerical data provided on the question paper. The Earth–Moon distance was quoted as 3.8×10^8 km instead of 3.8×10^8 m.

Candidates who used 3.8×10^8 m for this distance achieving a value of 7.7×10^5 m for the diameter of the footprint achieved full credit. Those candidates who correctly dealt with the data as presented and achieved an answer of 7.7×10^8 m also achieved full credit.

Many candidates were unable to proceed through the entire calculation but most were able to receive some credit for calculating the wavelength or calculating the angular position of the footprint edge. However, many were unable to use trigonometry to calculate the radius of the footprint. This demonstrated the candidates' lack of maturity in the skills required to carry out structured calculations. Candidates who made a quick sketch of the situation and presented their work in a rigorous manner made far fewer mistakes.

Part (b) was answered well, with most candidates presenting credit-worthy answers. It was less common to see candidates who linked the outcome to the process that produced it.

In part (c) (i), most candidates were able to relate the observed change in frequency to the Doppler effect. However, fewer were able to correctly relate it to the situation presented in the question.

The calculation in part (c) (ii) was difficult for many candidates. Most were able to achieve some marks but few achieved full credit. Many candidates did not recognise that they had been provided with Δf and instead tried to find this value by subtracting Δf from the transmission frequency.

The assessment of the ability of the candidates to use significant figures was treated as an independent mark in the mark scheme. That is any numerical answer to three significant figures that was achieved from workings was awarded the mark. Candidates are expected to quote numerical answers to a number of significant figures that is consistent with the significant figures of the data used in the calculation.

Question 9

A significant number of candidates did not attempt part (a) and a large number achieved no marks. Candidates were not able to relate the phase difference of the rays to their path difference in this situation.

In part (b), many candidates were unable to recall properties of the light required to produce an observable interference pattern.

Part (c) was answered very well, with most candidates produced credit worthy responses.

Question 10

Part (a) was answered well with most candidates achieving full marks.

Part (b) required candidates to describe Chadwick's experiment and then explain how he had concluded that the particles were neutrons. A large number of candidates did not know this experiment and instead chose to describe the alpha scattering experiment. This demonstrated that a significant number of candidates were insufficiently prepared for the exam. They did not know the specification content to the level of detail required at AS level. Candidates who knew the experiment were able either to describe the experiment or to describe Chadwick's conclusions but few were able to do both. Simple statements were common without linking these statements to detail or appropriate explanations.

Part (c)(i) was answered poorly, with many candidates stating the name of the particle as an antielectron neutrino. This exemplified the lack of rigour demonstrated by candidates in their use of technical vocabulary.

Parts (c)(ii) and (c)(iii) were answered well, with most candidates gaining credit here.

Question 11

Many candidates were unable to answer part (a) with sufficient detail. Often these candidates did not include that this is a surface phenomenon and were penalised.

The calculation in part (b)(i) was performed well with most candidates achieving full credit. The most common error made by those who attempted the calculation was an incorrect conversion of the wavelength for nm to m.

In part (b)(ii), many candidates were unable to correctly convert 2.3 eV into joules or made no attempt to convert the work function but then compared $5.2(3) \times 10^{-19}$ J with 2.3 eV.

Part (c) was answered poorly, with many candidates stating that there were no electrons left or that the photoelectric effect can only occur when the emitting surface is negative. Very few candidates were able to explain the lack of photoelectrons from an energy perspective.

Question 12

Candidates made surprisingly hard work of part (a) with many not taking into account that time was measured in ms and others reading off the graph with insufficient regard to the position of the peaks.

Part (b)(i) was answered well, although some candidates had difficulty expressing their answer in the form that the question required.

Parts (b)(ii) and (iii) were answered poorly. A significant amount of the candidates who correctly determined the sound intensity ratio in part (b)(i), had difficulty recognising this as a 6 dB change in the sound intensity level. Part (b)(iii) was answered correctly by very few candidates. Most candidates had made an attempt at this part but on the whole these candidates attempted to use a speed, distance, time approach rather than an inverse square law approach.

Mark Ranges and Award of Grades

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