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General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1H Unit Physics 1

Report on the Examination

2011 Examination – June series

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Science B / Physics
Higher Tier PHY1H

General

Questions 1, 2 and 3 were standard demand targeting grades C and D; questions 4, 5 and 6 were high demand targeting grades A* to B.
There were many pleasing instances where candidates were able to demonstrate their knowledge of physics. However, candidates often failed to gain credit because of insufficient detail, or the use of general terms rather than subject-specific ones, an example being the use of 'environmentally friendly'. In some cases candidates seemed to know the answer, but omitted a word or wrote a wrong word; errors which might be avoided if they had read through their answers.

Question 1 *(Standard Demand)*

(a) (i) Approximately three quarters of the candidates answered correctly, with the most common wrong answer being 'conduction'.

(a) (ii) Just over half of the candidates gained one mark for saying that the black surface was a better absorber but just over a tenth of candidates went on to say that the consequence of this would be the water heating more quickly. There was a significant number of 'absolute' answers, stating that black surfaces absorb the radiation but white surfaces do not.

(b) (i) Approximately three quarters of the candidates gave the correct answer.
A common mistake was thinking that 1.2 hours was 1 hour 20 minutes.

(b) (ii) It was encouraging to see that nearly all candidates gave the correct answer. The most common mistakes were that the temperature increased at a constant rate or that the temperature dropped as time progressed.

(c) (i) The majority of candidates were able to gain at least one mark here. The most common error was in changing a feature of the bags themselves, eg shade or colour, thickness of plastic etc, rather than factors they could control.

(c) (ii) Just under two thirds of candidates were able to draw a correct line for the second bag.

Question 2 *(Standard Demand)*

(a) (i) Just over half of answers were correct; 'decontaminating' was the most popular wrong response.

(a) (ii) About two thirds of answers gained at least one mark, usually for stating that the level of radiation from the isotope would have reduced. However, the consequence of this, that it would be less dangerous for the workers, was often not stated.

A significant number of 'absolute' answers stated that the radiation would have reduced to zero, posing no risk at all. Answers indicating that the isotope would have 'died' were not uncommon.

(b) (i) It was pleasing to see nearly all of the candidates gave a correct answer. Common mistakes were merely quoting figures rather than describing the trend, or stating 'it increased' without defining 'it'.

(b) (ii) About a half of candidates picked up a mark here. A large number of candidates referred to 'bias', however, a significant number did not explain in what way the bias may have occurred.

(b) (iii) Over half of answers scored this mark. Common errors were to say that nuclear energy was renewable, or to use terms like 'more environmentally friendly' without being specific.

(c) Nearly all answers were correct. As in 2(a)(i), if asked to put a tick in 'the' box, ticking more than one box, even if one of these is correct, does not gain credit.

Question 3 *(Standard Demand)*

(a) (i) About half of the answers were correct with the most common wrong answer being 'radio waves'.

(a) (ii) This was answered correctly by three quarters of the candidates. However, it would benefit candidates to draw diagrams carefully, using a ruler.

(a) (iii) This question was answered correctly by just over half of the candidates. Candidates who use correct physics terms such as 'interference' are more likely to score than those who have the correct idea but use terms like 'fuzzy' or 'dirty'.

(b) The majority of candidates were able to transform the equation, substitute the given numbers and work this out, so most candidates scored at least one mark. Just under a fifth of candidates gained full credit. Failure to convert 15 cm correctly to 0.15 m was the most common mistake. Despite the question asking candidates to 'give the unit', a large number gave no unit at all, indicating that perhaps they had not read the question carefully.

(c) (i) About two-thirds of answers were correct with the most common incorrect answers being ultraviolet or radio waves.

(c) (ii) Only about a third of candidates realised that the signals sent via a satellite link had a further distance to travel. Many thought that the signals in the optical fibre travelled faster or that the atmosphere absorbed or distorted the signals travelling to and from the satellite. It would benefit candidates to read and think about the sense of their answers. Statements indicating that the optical fibres or satellites were travelling, rather than the signals, were not uncommon.

Question 4 *(High Demand)*

(a) (i) Less than half of the candidates answered this correctly. Many were unable to transpose the equation correctly.

(a) (ii) Only about a third of candidates were able to draw something resembling a Sankey diagram and label it appropriately. Whilst the majority of candidates obviously had some idea that a Sankey diagram had some arrows going in

different directions, some drew a picture of solar cells, and over a tenth did not attempt the question.

(a) (iii) This was answered reasonably well, with over three quarters of candidates gaining at least one of the two marks, usually for realising that a change in intensity of the sunlight would affect the time taken to charge the battery. However, less than half of these went on to score the second mark by giving a factor which would change the intensity.

(b) This question was correctly answered by the majority of candidates. However, many seem to have a dim view of company scientists, indicating that they would lie or falsify results.

(c) Nearly all candidates gained at least one mark, with more than half scoring both. The most common answers were that the Sun is a renewable resource and that solar cells do not produce pollutant gases.

Question 5 *(High Demand)*

(a) (i) About a third of candidates answered this question correctly. Questions in previous years have referred to satellite telescopes detecting waves which were unable to pass through the atmosphere; perhaps that is the reason for a large number of incorrect answers indicating that low frequency radio waves could not pass through the atmosphere. Answers often seemed to indicate that the radio waves were emanating from the Earth rather than from space.

(a) (ii) Many candidates referred to interference; about two fifths realised correctly that digital signals are easier to process with a computer.

(b) (i) Despite this being a fairly frequently asked question, less than a third of candidates scored the mark. The main error was to say that the distant galaxies themselves were moving to the red end of the spectrum. If candidates were to answer in terms of a change in wavelength or frequency of the waves, they would be more likely to avoid such errors.

(b) (ii) Less than a third of answers were correct. Candidates should realise that repeating words given in the question is unlikely to gain them credit, eg ‘the telescope is 20 times more sensitive’ is not a suitable answer to explain the meaning of ‘a sensitivity 20 times greater’.

(b) (iii) This question was answered quite well, with three quarters of candidates gaining at least one mark. Despite the word ‘Universe’ being referred to in the question, a large number of candidates indicated that the big bang theory was related to the creation of Earth, and that the Earth itself is expanding.

(c) Many candidates did not realise that the LOFAR super-computer was being used for different investigations, and referred to many scientists analysing data from the LOFAR telescope.

Question 6 *(High Demand)*

(a) (i) About half of the candidates gained both of the available marks. Many of the wrong answers indicated that candidates knew there was a connection to numbers of sub-atomic particles, but got them the wrong way round.

(a) (ii) Less than a third of candidates correctly identified a beta particle as an electron from the nucleus. Whilst a large number of candidates knew that the beta particle was an electron, the majority thought it was emitted from the electron shells.

(b) Nearly four fifths of answers failed to score this mark. Some candidates realised that the carbon-14 was decaying, but failed to equate this to the rate of production. Others referred to the carbon-14 being 'used up' but did not elaborate on the way in which this was happening.

(c) (i) Fewer than half of candidates answered this correctly. Whilst some candidates found difficulty in understanding the question, others used the graph in the correct way, but mis-read one or other of the axes.

(c) (ii) More than a tenth of candidates did not attempt this question, either because they ran out of time or because they found it too difficult. Under half of candidates gained at least one mark, for obtaining an adjusted age from the carbon dating age; a common mistake was to use the axes the wrong way round. Only about half of those who scored the first mark subsequently added 50 years to obtain their final answer.

Mark Ranges and Award of Grades
Grade boundaries and cumulative percentage grades are available on the **Results statistics** page of the AQA Website.

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