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General Certificate of Secondary Education

Additional Science 4463 / Physics 4451

PHY2H Unit Physics 2

Report on the Examination

2011 examination – January series

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Science B / Physics
Higher Tier PHY2H

General

Questions 1 to 3 were standard demand, targeting grades C and D. Questions 4 to 7 were high demand, targeting grades A* to B.

Candidates were able to access all questions with very few items not attempted. This was true even on the longer questions, such as 7(c). There was no evidence of candidates being unable to complete the paper in the time allocation. The vast majority of questions were well answered by the better candidates. However, there was some evidence of candidates having been entered for an inappropriate tier, but this was not widespread. Mathematical questions remain a strength for many candidates.

Question 1 *(Standard Demand)*

(a) (i) This was very well answered with most candidates scoring the mark.

(a) (ii) This was less well answered, with just over two-thirds of candidates scoring the mark. Weaker candidates completed a variety of mathematical operations, including addition and multiplication to achieve incorrect answers.

(a) (iii) Descriptions of changing forces were not well made, with the use of every day language resulting in inaccurate statements. There were many examples of decreased drag and the swimmer becoming stationary. Only one-tenth of candidates gained all three marks, giving the impression that few candidates seemed to be trying to link three points to match the mark allocation.

(b) (i) It was surprising that only two-fifths of candidates were able to identify the dependent variable from information in the stem of the question and from the axes of the graph, the most common error being to state the gender of the swimmers or the distance over which the readings were taken.

(b) (ii) Many candidates made indiscriminate use of the words ‘reliable’, ‘precise’ and ‘accurate’, and only the better candidates appeared to appreciate that this was not a direct repetition of the same result being taken.

(b) (iii) The majority of candidates gave a correct difference between the data, although a surprising number misread the question and described the way that the data on the graph was displayed, ie crosses and dots.

(b) (iv) Just over four-fifths of candidates provided a correct answer to this question. Those failing to gain credit gave responses which ignored the request in the stem to consider only the data supplied, and referred to issues such as body mass or shape, improved exercise and training regimes, etc.

Question 2 *(Standard Demand)*

(a) Over three-quarters of candidates chose the correct response, the most popular incorrect response being ‘the negative charge in the water is attracted by the rod and the positive charge is repelled’.

(b) (i) The stem of this part question clearly stated that the movement of the plastic bottles on the conveyor belt had caused the bottles to become charged so it was disappointing that there were so many responses which attributed the charge to having come from some process involving the ionised air. Reference to positive electrons still loses many candidates' marks. It was most common for candidates to miss out any reference to rubbing or friction.

(b) (ii) The correct description of an ion is not well known, with less than one-fifth of candidates scoring this mark.

(b) (iii) Those candidates that gained a mark usually did so by realising that the belt was rubber / an insulator. A considerable number of candidates did not appreciate that the earth wire would, if effective, remove charge as it was built up. Many candidates wrote about the wire not stopping the friction, etc.

Question 3 ***(Standard Demand)***

(a) (i) Surprisingly only three-fifths of candidates answered this question correctly. A significant number of candidates incorrectly suggested various electromagnetic waves such as infra red or ultraviolet, with quite a few candidates naming microwaves.

(a) (ii) Again surprisingly few candidates (less than two-fifths) gave a correct answer to this part question. The most common incorrect answers were radiation types: 'alpha', 'beta', 'gamma'. Candidates should be made aware that a CT head scan uses X-rays, and as such this was not an acceptable answer. As in part (a)(i) too many candidates named parts of the electromagnetic spectrum.

(a) (iii) Almost half of the candidates gave the correct answer to this question. A common mistake was to discuss the change to the mass number (or neutron number) in addition to the change in the proton number, leading to confusion over which aspect caused the formation of a new element. For some candidates, it appeared as if they were simply describing alpha-emission (ie 'X has 2 fewer protons and two fewer neutrons') which is the answer to a question they were asked in a previous paper but is not the answer to this question.

(b) Over three-quarters of candidates scored both marks for this question. Many of the candidates not scoring both marks lost the opportunity to gain one compensation mark by ignoring the instruction 'Show how you work out your answer'.

(c) (i) Virtually all candidates scored this mark.

(c) (ii) The vast majority of candidates answered correctly. A fairly common error was the answer: 'even' taken to mean an even number: 2, 4, 6 in each group, but not necessarily the same number in each group. A few candidates had not read the question (which was about the *number* of people) and made suggestions about *the people* instead.

(c) (iii) Only about a quarter of candidates responded correctly. Most candidates who answered incorrectly, answered with a variation of the following, 'See if the group who were X-rayed got cancer'. The question asked 'what *data* was compared?' so there needed to be a reference to both groups so candidates needed to focus on this with their answer. Common incorrect vague answers included reference to 'medical history'.

(c) (iv) The vast majority of candidates gave correct answers; most incorrect answers involved the candidate circling 'Yes' and then providing an answer that would be valid if the 'No' option had been circled. Candidates should be made aware that they need to provide more information than is given in the question, for example: 'There is a 1 in 10,000 chance of getting cancer from a CT head scan' is worth zero, but 'There is only a 1 in 10,000 chance of getting cancer from a CT head scan and so the risk is small' is worth a mark. The candidate needs to interpret and emphasise details contained in the stimulus material.

Question 4 ***(High Demand)***

(a) Nearly four-fifths of candidates scored both marks for this part question. Where errors occurred they were often slips – removing or adding a 0 from the working out to the answer line, stating 12 squared in the working out but not carrying out the function on the calculator. Other candidates divided the correct answer by 20 or chose to convert kilograms to grams.

(b) Candidates did not seem to understand the need for some quantitative detail, with many simply referring to a greater or more area. Many candidates considered the actual area of the blades rather than the area swept out by the blades.

Question 5 ***(High Demand)***

(a) Considering that there are only three I-V graphs that candidates need to be able to identify it was surprising that under half of candidates gained this mark.

(b) Half of the candidates scored zero for this question. Centres might well consider issuing symbol diagrams photocopied from the specification and encouraging candidates to copy them accurately. Many candidates were able to salvage some marks by correctly drawing a voltmeter in parallel with whatever device they did select, although there were also a large number of short circuits drawn.

(c) (i) Only two-fifths of candidates were able to read the graph correctly. Some misreadings were quite inexplicable.

(c) (ii) Even those candidates who had not scored a mark in part (c)(i) frequently picked up these two marks by accurately manipulating the equation and pushing the right calculator buttons. It was pleasing to see that most candidates were able to transform an equation. The importance of significant figures was also widely recognised. The commonest mistakes were either inverting the sum or multiplying instead of dividing.

Question 6 ***(High Demand)***

(a) (i) Less than a quarter of candidates applied the rule for current in a series circuit to arrive at the answer 0.25 A. The vast majority of candidates multiplied the series current by the number of lamps to arrive at an incorrect answer of 5 A.

(a) (ii) Just under two-thirds of candidates used the equation correctly to gain both calculation marks. About three-tenths of candidates lost one mark because they failed to convert the time from minutes into seconds. Only just over a third of candidates knew that the unit of charge is the coulomb. A substantial number failed to give any unit or offered one of a range of other electrical units.

(b) Many candidates showed a good understanding of why a piece of aluminium foil is not an appropriate replacement for a fuse, and they could use good scientific language to explain their ideas and gain full marks. Some candidates got sidetracked too far into describing how a fuse functions in a faulty circuit without then going on to say why the aluminium foil presents a danger. Many of the poorer answers were long and rambling, with wrong physics such as 'too much voltage goes through the foil', and 'explosions' in many of the responses scoring zero. In contrast, some of the best responses covered all four of the possible mark points in a succinct sentence or two.

Question 7 ***(High Demand)***

(a) It was surprising that only a quarter of the candidates correctly answered 'direction' with 'velocity in m/s' a very common response. A small minority of candidates did not attempt this part question. It may be that many of these candidates did not look at the page carefully enough to realise there was a question at the top.

(b) Generally this question was well answered by the majority of students, with just over two-thirds scoring full marks. However, a large minority of students couldn't substitute values from the text into a given equation correctly, often confusing time and speed. Some candidates didn't recognise that the standard unit for mass is the kg and needlessly changed mass from kg into g, losing marks.

(c) Many candidates concentrated on the details of operation of airbags rather than the explanation of how they reduce risk of injury. There was little mention of 'momentum' from many candidates, and over two-fifths scored zero. Some candidates answered in terms of conservation of momentum, indicating that they had learned some physics but were not aware when to apply it. Of those that did give creditworthy answers there was often confusion over 'reducing momentum' and 'reducing the rate of change of momentum'.

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