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General Certificate of Secondary Education

Additional Science 4463 / Physics 4451

PHY2H Unit Physics 2

Report on the Examination

2010 examination - January series

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Additional Science / Physics
Higher Tier PHY2H

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.

Candidates were generally able to attempt all questions and there was no evidence that timing posed any problems. It is also clear that much of the information in the specification that is expected recall is not being learnt by many candidates.

There were fewer candidates this year giving incorrect basic units eg, n for Newton rather than N.

Question 1 (Standard Demand)

(a) Nearly half of the candidates obtained the correct answer; 96 N. A common mistake of some candidates was to note that the unit for acceleration contained second squared and to square 1.2 to obtain the answer 115.2.

(b) (i) Although the majority of candidates wrote 'direction', it is still surprising that just over a third gave an incorrect answer. Not learning this factual information costs some candidates many marks. Common incorrect answers were 'mass', 'time', 'acceleration' and 'distance'.

(b) (ii) Just over half of the candidates correctly wrote 'the data is continuous'. The most common error was to refer to only one of the variables.

(b) (iii) The majority of candidates obtained full marks here with a correct statement about the velocity not changing and some reference to the lengths of the arrows or the forces being equal. A few candidates called the forward force the resultant force or speed.

Question 2 (Standard Demand)

(a) (i) Many candidates answered in terms of atoms (and, more rarely, molecules or particles) rather than nuclei, despite being asked for a description of **nuclear** fusion. A lot of answers used the word **fuse** or **fusion** without explaining that it meant joining. A substantial minority gave clear, concise answers that gained both marks. There were many descriptions of fission.

(a) (ii) Just over half of the candidates gave a correct answer. Common incorrect answers included volcanoes and the atmosphere. A small number of candidates gave a biological response to **fusion** and answered in terms of sexual reproduction.

(b) (i) Most candidates did as asked and gave an answer that used the information given in the question. A majority correctly chose 'uses more energy than it produces'. A smaller number gave an answer in terms of not lasting long enough, but quite often scored no mark because they did not say that it is the reaction that does not last long enough. Those candidates giving good answers usually quoted directly from the information given, or slightly paraphrased it. Those candidates giving responses that were not creditworthy often tried to give an interpretation or explanation of the information in the question.

(b) (ii) This was a poorly answered question. Many candidates continued from part (b)(i), suggesting that we want to make the reactions last long enough to be useful or produce more energy than they consume, and so did not address this question. Others gave only vague suggestions about fusion being better for the environment or saving fossil fuels, merely stating that fusion will give a lot of energy was not enough for the idea of an unlimited supply. The most popular correct answers were that fusion gives an extra energy source and there is reduced radioactive waste (compared to fission reactors).

(c) (i) This question which assessed candidates ability to comprehend issues from 'How Science Works' was poorly answered. The majority of the responses dwelled on either experimental conditions or reporting issues rather than the failure of science community to be able to replicate the claimed creation of 'cold fusion' described in the question stem.

(c) (ii) This part question was answered well by most candidates. Answers were usually in terms of the credibility of the journal and its authors rather than the perceived bias or lack of validity of articles in daily newspapers, and the motives of their writers.

Question 3 (Standard / High Demand)

(a) (i) Most candidates gave a correct answer. The most common incorrect pair was **K** & **M**.

(a) (ii) Again many correct responses were given. Weaker candidates were often unsure of difference between protons and neutrons.

(b) (i) & (ii) About three-quarters of the candidates gave correct answers to both parts. Incorrect responses usually involved the two answers being in the wrong order.

(c) The majority of candidates scored at least 1 mark. Quite a few responses were seen where the candidate selected a type of radiation (often alpha) but could not explain why. Some referred to the alpha particle emitting radiation. The most common correct response was the loss of 2 p and 2 n, followed by the change in mass / atomic number. A number of candidates managed to introduce the participation of electrons, but often still gained a mark for a correct reference to protons and neutrons.

Question 4 (Standard / High Demand)

(a) (i) Surprisingly only just over half of the candidates correctly identified the component as an LDR. Again, this shows that many candidates need to spend time learning some of the basic information contained within the specification. Common errors included; LED, light sensitive resistor, bulb and diode.

(a) (ii) Most candidates were able to read off 25 from the graph within the tolerance of the mark scheme.

(a) (iii) Most candidates managed to use the equation, however common errors were to use 25 instead of 25000 or failing to convert kilohms to ohms successfully. A small minority of candidates used 20 (from 20 lux) instead of the resistance from part (a)(ii). Less than half of the candidates scored both marks.

(b) (i) This question was poorly answered. Candidates did not seem to put together the information in the circuit diagram with this part of the question and recognise that the maximum voltage available for the circuit was the 6 V supply. The most common scale was 0 to 15 V, which was acceptable for credit.

(b) (ii) Few candidates demonstrated a good understanding of the operation of the circuit. Many candidates drew a positive gradient line. Comments above for maximum voltage also apply for the line sketched. Of the few candidates who drew a negative gradient line, many lost 1 mark by taking the line above 6 V. However, some candidates scored both marks for the line even though their answer to part (a)(iii) was incorrect.

(c) (i) Just over half of the candidates managed to calculate the correct value. Common mistakes were to use the wrong values from earlier in the question – using their calculated values of voltage from part (a)(iii) or using the 20 from 20 lux.

(c) (ii) Very few candidates managed to obtain full marks. Precision and accuracy were confused by some candidates; many candidates using 'it' lost marks by failing to specify that it was the measurements /values / light intensity that was inaccurate.

Question 5 (High Demand)

(a) This question was poorly answered with a small majority of the candidates scoring no marks. In some cases this was due to a lack of knowledge or understanding eg, candidates refer to the attraction of the (positive) boy's body to the negative dome or to the movement of positive charge / protons / positive electrons.
In many instances, a lack of precision in the use of English prevented candidates gaining marks, especially in respect of the second mark point where responses were left at hairs repelling without further explanation. Some candidates referred to hair standing on end as a result of the person getting a shock and others because the charge was trying to escape from the body.

(b) Under a quarter of the candidates scored 2 marks for a correct calculation. A significant number of candidates scored 1 mark for answers of either 2 or 0.002 as they had not converted the kV or mJ correctly, despite the information in the stem.
A number of candidates did not seem to have access to a calculator and had done calculations around the text, sometimes making errors which deprived them of full marks. Of those who did not gain marks, this was evenly spread between those who did not transform the equation correctly and those who did not transform values properly. At this level it is disappointing that over a third of the entry simply multiplied the given numbers; with or without an attempted conversion.

(c) Only half of the candidates gave the correct answer.

Question 6 (High Demand)

(a) (i) There was much confusion throughout this question between momentum and energy. Clearly a large number of candidates consider them to be the same. Less than half of the candidates gave a correct answer. Those that did often scored the mark with a simple statement such as 'momentum before = momentum after'.

(a) (ii) Very few candidates answered this correctly. Incorrect answers often talked about elastic and inelastic collisions in terms of energy conservation. There were also a lot of references to crumple zones, walls, immovable objects etc. Those candidates gaining credit often simply stated an 'external force acts'.

(b) (i) Many candidates scored 1 mark for calculating the momentum of the car either before or after. However, many candidates failed to develop the idea and subtract the two numbers. Units proved troublesome; far too often it was given as kg/m/s or kgm/s^2, occasionally answers were given as N.

(b) (ii) The better, well prepared candidates scored both marks. However, the incorrect answer 10 – 2 = 8 m/s was very common. Too few candidates seemed able to write down 'momentum before = momentum after' and hence obtain the answer.

Mark Ranges and Award of Grades

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