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General Certificate of Secondary Education

Additional Science 4463 / Physics 4451

PHY2H Unit Physics 2

Report on the Examination

2010 examination – June 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 by the vast majority of candidates. There was no evidence of candidates being unable to complete the paper in the time allocation. The majority of questions were well answered by the better prepared candidates. There was less evidence than in previous years of candidates having been entered for an inappropriate tier. However, there was some evidence of centre dependent areas of strength and weakness, in particular with regard to Question 4 on Nuclear Physics. Questions that required straight recall eg the frequency of the mains electricity supply and the fissionable isotopes, pose a problem for a large number of candidates.

Question 1 ***(Standard Demand)***

(a) (i) This question discriminated well. The majority of candidates completed the calculation successfully but less than half could provide the correct unit. Those who did were much more likely to get (a)(ii) correct.

(a) (ii) Far too many candidates selected numbers, apparently, at random. If students acquired the habit of grouping zeros in threes there might be fewer slips, as there were many instances where candidates gave correct substitution but an incorrect final answer.

(b) (i) Only about two thirds of candidates drew the force arrow in the correct direction.

(b) (ii) Many candidates forgot to carry forward the information from the stem and consequently too few students recognised that the skier's speed was increasing so made vague, insufficient, points about kinetic energy. There were also some excellent, succinct answers, and some impressive responses going well beyond that required for full marks.

(c) Less than one fifth of candidates gained this mark. Most candidates merely restated the stem, or explained why a helmet cushions a blow, with reference to change in momentum without addressing the question asked. Again there were some excellent responses from a small minority of candidates.

Question 2 ***(Standard Demand)***

(a) (i) Common mistakes on this section, accounting for nearly one fifth of the candidates, included the inability to add, presumably without a calculator, or missing the 0.01 mSv.

(a) (ii) Many candidates scored this mark.

(b) (i) About two thirds of candidates gave correct responses with a good spread of answers between: other factors, other radiation and unsure of the cause. A small number of candidates argued the reverse and suggested that the number could have been greater due to deaths caused by radon that were attributed to other causes.

(b) (ii) There were a number of answers that simply repeated the first sentence of the stem. A common error was to state that measurements over 3 months would make the answer more accurate and a few candidates argued for 'getting rid of anomalies', failing to understand the random nature of decay and the way in which readings could vary. Many candidates gained a mark for the concept of reliability.

(b) (iii) Nearly half of the candidates gained one mark, for either generally mentioning 'higher levels', or for picking out higher average or higher maximum levels. A large number of candidates tried to argue that a larger sample from areas C and D, with a smaller number of homes 'balanced out' the small sample from a large number of homes in areas A and B. Relatively few candidates gave answers that seemed not to have made some use of the information given.

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

(a) (i) Over half of the candidates scored full marks here and were very concise in their explanations. 'Electrons' was the key word in this answer and candidates who mentioned negative charge as an alternative were only able to obtain one mark. However, there were a significant number of candidates who mentioned either positive electrons or electrons transferring to the rod and making it positive. As in previous years there were candidates who wrote about negatively charged atoms or ions.

(a) (ii) This part was done very well with just under three quarters of candidates scoring both marks. Some answers were too long and the marks would have been obtained even if there was only half the writing. Some candidates penalised themselves by not using the word 'attraction' but 'attaches' or 'sticks'. A few candidates were too vague in their first sentence and wrote about the TV becoming static instead of charged. Candidates sometimes talked about the dust just 'sticking' to the TV or gave answers along the lines of 'rubbing with a cloth shifts the dust into the air and it just comes back down to land on the screen again', showing a lack of appreciation of what the question was about.

(b) (i) Nearly two fifths of candidates gained full marks with the spread over the other mark allocations being roughly equal.

(b) (ii) This was generally well answered by the majority of candidates. Most correct answers were scored by candidates who recycled the wording in the previous question ie 'to melt the toner so it sticks to the paper'. A significant number of candidates did try to answer in terms of electrostatic attraction between the toner and the paper, although they did not always mention charges; some just answered in terms of attraction. A small number of candidates tried to answer in terms of increasing the rate of the 'reaction' as the particles of toner, being hotter, would move more quickly etc.

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

(a) This mark was scored by over three quarters of candidates, the common incorrect answers were 'isomers', 'allotropes' and ions.

(b) There were many correct answers, with relatively few candidates getting only one of the numbers correct.

(c) (i) There was the usual illegible and poor spelling of 'fission' where it was difficult to see if the candidate had written a u or an i. Many of the candidates gained the mark.

(c) (ii) Only just over half of candidates were able to recall this, with nucleus and electron being common incorrect answers.

(d) Just over half of candidates were able to correctly identify plutonium, although the spelling was often incorrect. Polonium was a common incorrect answer along with potassium. The 'acceptable' answer of MOX was rarely seen.

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

(a) (i) While many candidates answered this well, many let themselves down by a poor choice of language or ambiguous statements such as 'the driver took longer to brake' which could mean that the braking action occurred over a longer time or that the driver took longer to apply the brakes. Incorrect use of technical terms negated some otherwise correct answers. A minority of candidates also confused the time to see the incident with the time to react to the incident.

(a) (ii) About three quarters of candidates gained this mark. Again a lack of precision in responses led to ambiguity which lost the mark: mentioning deceleration without specifying that velocity reached zero, stating that they both started from 15 m/s without saying they stopped, and vague statements that the 'lines were the same' without quoting gradient, slope or angle. Some candidates demonstrated an inability to take times from the graph with wildly inaccurate values quoted from 1.2 s to 'nearly 30 s'.

(a) (iii) Few candidates recognised that they only needed to calculate the distance car B travelled in the extra thinking time part of the graph [(1.4-0.6)x15]. The majority of candidates knew that the area under the graph represents the distance travelled and gained marks accordingly. However, calculating these for both cars proved difficult due to the number of calculations involved and errors in obtaining the correct times from the graph. Many candidates did obtain two marks for completing only one of these calculations correctly. About two fifths of candidates failed to gain any marks.

(b) Some very good answers scored two marks but these were from less than a tenth of the candidates and were usually gained for explaining why X and/or Y were not suitable, rather than why Z is suitable. Most candidates scored one mark for correctly choosing Z but failed to give an acceptable reason. Many candidates clearly did not understand what a sensor was, describing it as a safety device that helped protect people in collisions by counteracting the forces they experienced rather than a device for measuring forces. Some candidates believed the resistance was some sort of resistance to collision, rather than electrical resistance, and made comments such as 'Z would be better as impact time would be increased' or 'the increased resistance would reduce the effect of the collision'.

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

(a) Less than one fifth of candidates were able to complete both the calculation and give the correct unit. Many candidates did not calculate the time period correctly or gave the time period as their final answer.

Those who scored one mark usually scored this from part of the calculation, as the unit was not well known. Nearly a third of candidates scored zero.

(b) Less than half of the candidates were able to recall this, the most frequent incorrect response being 230 (V).

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

(a) Many candidates were able to give a brief, correct response that current is the movement of electrons or charges. A smaller number of candidates gave the answer that current is the rate of flow of charge. The most common reason for failing to score the mark was to be imprecise or incorrect about what it is that flows, for example 'the flow of electricity', or 'the flow of energy'.

(b) Only just over a quarter of candidates were able to present a clear calculation arriving at the correct numerical answer with the correct units. Many other candidates gained some credit for showing correct calculation steps, such as transposing the equation and substituting correct data. Common reasons for loss of a mark were misreading the power value from the graph, putting values into an incorrect re-arrangement of the equation, usually 230/1.6 or 1600 or failing to convert 1.6 kW to 1600 W.
A surprising number of candidates gave the wrong unit or omitted it. Incorrect units seen included coulombs, ohms or a combination of units such as kW/V.

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