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Physics B: Physics in Context PHYB2

(Specification 2455)

Unit 2: Physics keeps us going

Report on the Examination

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GCE Physics, Specification B: Physics in Context, PHYB2, Physics Keeps Us Going

General Comments

The paper seemed to be quite accessible to all candidates. Questions 1 and 6 posed the most problems due to some candidates not having the appropriate mathematical techniques at their disposal. There were some part questions that were not attempted by a minority of candidates. The paper seemed not to present any time related difficulties.

In a lot of cases, mathematical parts of questions generated correct answers. Some candidates organised their mathematical work extremely well with equations, data and processing being logically arranged and easy to follow. Candidates should realise that well organised work can help them avoid errors and even gain compensatory marks if they do make a mistake. There were several complicated calculations, in which less able candidates lost out through their inability to set their work out clearly. Use of significant figures has improved recently. For example, the practice of writing down all of the string of figures from a calculator display seems to have ended. However, candidates should be aware that the use of only one significant figure is inadvisable in many circumstances. Its lack of precision may leave candidates outside the permitted range for numerical answers.

Standards of explanation varied considerably. Less able candidates tended to rely on general statements rather than scientific ones. The same candidates also used technical vocabulary incorrectly, demonstrating their lack of understanding of the topic under discussion.

Question 1

Only a minority of candidates attempted to find the acceleration of the cyclist by determining the gradient of the graph. Of these, some determined the gradient at an arbitrary time rather than at $t = 0$. The most common technique used was to divide change in velocity by time taken for a short section at the start of the graph. This is a poor technique but did receive some credit. Most candidates showed a performance enhanced in terms of acceleration and final speed for the cyclist having taken performance enhancing drugs. Few were able to say how the drugs helped the athlete, for example in the production of enhanced muscle mass or strength. Adverse effects of the use of performance enhancing drugs were often speculative or very general.

Question 2

Most candidates realised that they should determine the area under the graph. Techniques for doing this varied, but square counting tended to be most accurate and less prone to error. The standard of setting out of working was generally poor.

Question 3

Many candidates were able to draw a sufficiently accurate graph to illustrate the behaviour of superconductors. A significant number of candidates confused absolute and Celsius temperatures. Standards of draughtsmanship tended to be poor. Only a minority knew typical critical temperatures for high temperature superconductors. The range of values given was from negative absolute temperatures to many thousands of Kelvin.

Question 4

There many completely correct solutions to this question. The most frequent error was to assume that the change in momentum was equivalent to the initial momentum, although there were some who thought that there was no change in momentum as the initial and final speeds were the same. Many knew, or could work out, the appropriate unit.

In part (b) some used an approach based on the average acceleration of the ball. This approach was accepted although; having calculated the change in momentum, a consideration of impulse was the most straightforward way to proceed.

Question 5

Complete, careful and accurate diagrams of forces were rare. Despite being reminded in the question, many candidates seemed to make no attempt to indicate the comparative magnitudes of forces by the sizes of the arrows. More frequently than not, forces seemed not to be acting on the aircraft but to be suspended in mid-air. There were many redundant forces, for example normal reaction and friction, which, at the instant of take-off would both be zero. Lift was frequently labelled upthrust or normal reaction.

Question 6

Part (a)(i) was correctly answered by many candidates. Frequent errors were to label the air resistance force as friction despite being instructed to assume that friction was zero, and to label the normal reaction force as lift, perhaps as a carry-over from the previous question. The word 'reaction' by itself was accepted for **Q**. Many candidates omitted the word 'normal'. Candidates should be encouraged to label the forces fully and accurately. On another occasion, they may be penalised for their omission.

In part (a)(ii), some candidates made loose statements about balanced forces. At this level, candidates should be able to be precise about conditions for equilibrium. A simple statement that there would be no resultant force was all that was required.

There were many correct scale diagrams in part (b), but there were also a great number of candidates who had no idea how to proceed. Despite being asked to find the force using a scale diagram, quite a few candidates opted for a trigonometrical solution. They were given a limited amount of credit for this. Candidates should be advised to read questions carefully and to follow instructions.

Quite a few candidates did not attempt part (c)(i). Those that did were usually successful. In part (c)(ii) there were many answers that demonstrated misunderstanding of mechanics in general. For example, statements such as 'deceleration decreases until it is equal to the forward momentum of the skier' were common. Quite a few candidates referred to the deceleration 'slowing', an ambiguous usage that is not to be recommended.

Question 7

Part (a) was done well by many candidates. Of the less successful ones, the commonest errors were to use the value of the radius of the wire as if it were the area or miscalculate the area by omitting to square the radius.

Part (b) was also well done by many. In this case, the most common error was to add an additional value of 5.6 Ω once the total resistance had been correctly calculated.

Question 8

Almost all of the candidates correctly calculated the power of a headlight lamp. A very few extracted an incorrect value of resistance from the table. In part (a)(ii), candidates made the usual errors of using the resistors in series formula instead of resistors in parallel. Others omitted to invert their answer once they had calculated the sum of the reciprocals of the five resistors. In part (a)(iii), some candidates revisited their part (a)(i) type calculations to find the powers of all of the lamps, rather than using the overall resistance value that they had just calculated.

In part (b), most candidates realised that, in this circumstance, lamps of lower resistance ought to be used. Candidates' justifications were not always convincing. The best answers referred to the equation relating power to voltage and resistance. Some argued that lower resistances should be used so that the current would increase, this was acceptable. What was not acceptable was the argument that it was necessary to restore the current to its previous value.

Question 9

Most of the candidates identified the correct formula to use in order to determine the intensity of the solar radiation. Common errors were forgetting to square the radius and mistakes with power of ten. Some candidates opted to work in km, finding a final answer in W km^{-2}; this was acceptable.

In part (b), most candidates were able to make general comments about the relative suitability of the UK climate, compared with that of Spain, for the generation of electricity form solar power. Only a few gave reasonable, physics based accounts of why the intensity of radiation was greater in Spain. Many candidates mentioned alternatives that were more suited to the UK climate. Once again, the level of detail about these alternatives varied greatly. There were also some strange ideas expressed. For example, many candidates thought that, as Spain was closer to the equator, it was also closer to the Sun and so gave a greater intensity with reference to the equation form the previous part. The best answers included accounts of absorption of radiation by the atmosphere and gave good levels of explanation about how wind, wave, tidal or hydroelectric power could be used and would be better suited to the UK.

Question 10

There were many good answers to part (a). In particular, natural convection was often well described. However, some candidates confused their explanations with reference to particles. The worst of these had particles being heated and expanding. Another fairly common error was the idea that forced convection related to convection that was driven by something that had been heated by man such as a radiator, as opposed to something that was heated naturally, for example by the Sun.

Part (b)(i) was well done by most candidates. The most common error was to find the time taken for the temperature to fall to 35°C instead of the time taken for the temperature difference between the object and the room to halve. Those that recognised that they could use the idea of the time for temperature difference to halve in order to determine the time taken for the temperature to fall to 23°C, found the final part of the question to be very easy. Others mostly attempted to use Newton's Law of Cooling to find the answer. It seems that, when candidates are unsure of how to proceed, the quality of their mathematical work suffers to the point that they find it difficult to access compensatory marks for partly correct approaches to problems.

Question 11

Part (a) was generally answered well. The best answers mentioned or explained the greenhouse effect and were specific about the gases that are responsible and how human activity produces these gases. In a minority of cases candidates were still demonstrating confusion between the greenhouse effect, acid rain and depletion of the ozone layer.

There were also many excellent answers to part (b), highlighting the developed world's reliance on electrical energy and oil-based transport. Such answers went on to describe the vulnerability of the developing nations and their lack of the financial resources that would be needed to cope with the effects of global warming. However, a large minority of candidates were under the impression that the developed world no longer contributed to the greenhouse effect as, so they erroneously thought, energy use has shifted to renewable, none carbon dioxide producing technologies. Typically, they thought that the developing nations were too poor and too lacking in education to use such technologies.

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