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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 was accessible to the vast majority of students and seemed to be of an appropriate length. There were a few non-attempts in questions 9 and 10 but these were generally restricted to students who performed less well across the paper as a whole.
The calculations in the paper were accessible to most students with the more able students performing well in all calculations.

Question 1

Over half of the students provided a good description of what was meant by a superconductor. It was still relatively common to see statements that suggested superconductors have almost no resistance below the critical temperature; this lack of exactness along with failure to use technical vocabulary to describe the critical temperature were common reasons for students to lose marks. It was concerning that a significant number of students had no knowledge of superconductors or their applications.
It was rare to see good examples of current applications of superconductors. Many suggested applications were too vague with many students suggesting that they are used in the National Grid or for long distance power transmission.

Question 2

The overwhelming majority of students were able to answer parts (i) and (ii) correctly. Fewer knew that radiation of wavelength 0.03 m is in the microwave section of the electromagnetic spectrum.

Question 3

Many students' answers lacked sufficient detail. Quite often students would leave out a step in their explanations or fail to follow points through in a convincing way. There were many instances of poor or limited use of appropriate technical language. Many of the students who used the term impulse used it incorrectly by suggesting that impulse was reduced.
There were some excellent answers in which students presented their explanation in a thorough, coherent manner. These answers incorporated appropriate physics and were presented in a structured way.

Question 4

This was a straightforward question with most students being able to carry out the calculations in both parts. Part (b) posed slightly more problems with a good number of students failing to correctly convert seconds into hours. Some students failed to select an appropriate formula to use or substituted incorrectly by mixing up energy and power.

Question 5

Good definitions of resistance were rare. Many students attempted a description of the causes of resistance or gave general statements such as resistance is the opposition to the flow of charge.
In part (b)(i) many students were unable to draw a correct *I-V* graph for the filament lamp with most wrong answers opting for representing the *I-V* relationship as Ohmic. In some cases where the correct curve was attempted the draughtsmanship let students down by the drawn line remaining linear for too long or plateauing or dipping at higher values of current.
Part (b) (ii) was challenging for most students with less than 30% achieving 2 marks or better. Of those who recognised that resistance increased many did not communicate the idea of increased vibration providing a larger target. Instead they limited their response to larger current led to increased collisions. Many students incorrectly stated that the resistance would decrease and attempted an n.t.c. thermistor type answer.

Question 6

The setting out of students' working in part (a) was generally quite limited. Students gained credit for attempting to determine the area under the graph and most managed to do this with a fair degree of accuracy. Students had to adopt an approach that would lead to an answer inside the range given in the mark scheme; there was no credit for simply stating that the area under the graph was the distance or approximating this area to one large triangle.
A significant proportion of students failed to score any marks by attempting to use either *speed = distance / time* or an equation of motion.

The QoWC question in part (b) was set on an accessible topic with the vast majority of students making an attempt at an answer but on the whole answers lacked detail and the use of technical language was not of the level expected of students at this level. Many students confused forces with acceleration or velocity. The descriptions often lacked detail with students discussing the initial and final conditions with no attempt to describe the intermediate stage. The aspect of the motion when the parachutist's acceleration decreased was either missing or incorrectly dealt with. Statements that showed a lack of understanding of the situation were common, examples of this include: weight increases, parachutist stops and then increases in speed again.

Question 7

Few students were able to state the principle of flotation. Instead, most students either stated Archimedes' principle or made some general remark about less dense objects floating in more dense fluids.
Part (b) (i) was a straightforward calculation and most students managed it easily. Part(b) (ii) posed more difficulty but still almost two-thirds of students managed to obtain at least 2 marks here. Many students calculated the volume of the displaced water, 2.4×10^{-5} m^3, and stopped there. This was either due to not knowing how to proceed or not paying enough attention to the question that has been asked.
Most students obtained 1 mark in part (b) (ii). They were able to state that the volume of the block that was submerged would decrease but were unable to explain in sufficient detail why this was the case. Often students confined themselves to a description of the relationship between volume and density without relating the displaced volume to the same upthrust or the weight of the ice block.

Question 8

This question posed the greatest problems for students with less than half presenting work in a convincing manner. Many students failed to deal with the perpendicular nature of the horizontal and vertical velocities.
In part (a) a significant number of students were unsure how to tackle this problem. Many assumed that the initial vertical velocity was 18 ms^{-1}. These students also failed to realise that the ball had undergone a vertical displacement of 1.51 m on reaching the net.
Part (b) proved to be an excellent discriminator with under half of the students showing an understanding of the situation and demonstrating the knowledge and mathematical skills required. Again in part (b) (i) students failed to realise that the initial vertical velocity was zero. In part (b) (ii) many students attempted to use equations of motion showing little awareness of how to solve this type of problem.
Correct calculations were well organised with equations and processing being arranged in a logical manner.

Question 9

Part (a) (i) was well done by most students but surprisingly part (b) (ii) posed more problems for students. Part (b) (ii)'s description of why step-up transformers are used was poorly answered with most students unable to relate this to decreased current and reduced heating effects.
Part (b) presented a challenge for most students. In part (b) (i) many attempted to use the equation for maximum power available from the wind but then didn't know how to proceed towards the required answer. In (b) (ii) most students were able to use either a formula for the kinetic energy or the power available from the wind but failed to apply this to the wind farm.
Most students were successful in part (c) (i) with many students producing a correct, well laid out calculation. This was not the case in part (c) (ii); although many students obtained a correct answer the quality of the working produced in support of the answer was often unconvincing. Students need to

be aware of the need to produce convincing working in support of their answer in “show that” questions.

Most students achieved 2 marks in part (d) (i) but considerably fewer calculated the power loss in the cables in part (d) (ii).Common errors in part (d) (i) included use of $V=IR$ with incorrect values for V and mishandling powers of ten. The most common mistake in part (d) (ii) was to take 150 kV as the voltage dropped across the cables.

Question 10

Most students performed well in part (a) with many examples of well laid out calculations in part (a) (ii).

Part (b) again provided a good discriminator which challenged students’ understanding of the situation and looked for detailed analysis of the situation.
Many students correctly identified that the hook would have a lower speed but often the supporting explanation was superficial and lacked the rigour expected at this level.
Best examples used a knowledge of physics to support explanations through thorough use of equations and coherent multi-staged arguments.

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