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General Certificate of Education

Physics 1456

Specification B: Physics in Context

PHYB2 Physics Keeps Us Going

Report on the Examination

2010 examination - June series

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

General Comments

More able candidates were able to produce a consistent performance across the range of topics tested. They demonstrated a sound understanding of the principles and coped well in applying the principles to the contexts in which the questions were set.

Presentation of responses from some candidates was poor. Working was often hard to follow and explanations and descriptive work was often poorly written as well as lacking relevant detail. It was clear from some responses that candidates had not read the question carefully enough and taken care to note the various units and prefixes for the data given. Knowledge of what prefixes mean and conversion of, for example, minutes to seconds are basic requirements at this level. In calculations candidate should also be aware that it is usually not appropriate to rounding off derived data early in a question. Consideration of the appropriate number of significant figures should be left until deciding on what to give for the final answer.

Candidates generally found Section A more accessible than in the corresponding examination last year. In Section B marks were generally harder to come by but competent candidates coped very well with the demand. In Section B the electricity questions were generally not done as well as expected and the poor understanding shown by many candidates in such questions was disappointing.

Question 1

The common errors in this question were incorrect resolution of the tension, failing to take account of both ropes and giving the final answer to three significant figures whereas all the data used was given to only two significant figures.

Question 2

Most candidates coped well with part (a). Some, having identified the light output of the filament lamp as 3 W, did not know what to do next.

In part (b), for one mark candidates could or identify higher heat loss in the TFL as the cause of higher inefficiency or express their appreciation of what efficiency meant, so one mark was common. A significant number stated that there would be more output power in the CFL for a lower input power without specifying that the relevant output power was the light or useful output. Relatively few stated that the higher rate of loss of heat was due to the filament lamp operating at a higher temperature.

Question 3

Fewer than half the candidates identified the correct part of the spectrum in part (a).

Part (b) was generally done well, but powers of 10 caused problems for less able candidates so responses often contained ‘fudge factors’ to arrive at the correct order of magnitude. A number of candidates were clearly interpreting the unit of the Wien constant, m K (metre Kelvin), as mK (millikelvin).

Question 4

More than half of the candidates answered part (a) correctly and most gained some credit for making some progress with the question. Incorrectly converting 40 minutes to seconds was common. A significant proportion did not appreciate the difference between mass and weight. The weight was given in N but many multiplied this by *g* in there working.

The unit prefix again presented problems for many when attempting to convert 15 mm to mm in part (b) and 10^6 was not uncommon. The vast majority divided 750 by 15 or 15×10^{-3} but then gave an inconsistent unit.

Question 5

There were a high proportion of correct answers but arithmetical errors were common. Most were able to calculate one heat transfer correctly or appreciated that the difference between the two heat transfers was needed gaining one mark.

Question 6

Part (a) (i) was generally done well. A small minority went on to add or subtract 1.8 m after having arrived at 3.6 m correctly. A common error was failure to square the velocity when carrying out the arithmetic after identifying the correct algebraic equation.

Most realised that something had to be done with 0.9 m in part (a) (ii) but some subtracted rather than added it to the (a) (i) answer.

There were very few responses to part (b) (i) worthy of three marks. Explanations were often lacking is detail. The poorest responses referred only to energy losses to other forms, or due to heat and sound, with no further explanation. Many referred to the KE due to horizontal velocity necessary to clear the bar. Those who referred to the effect of air resistance did not add that this was the air resistance experienced when moving upwards. The clarification was essential as many candidates did not read the question carefully enough and referred to this and other energy losses during the run up rather than during the jump itself. That not all the energy stored in the pole when it bends could be returned was often given as a reason but most candidates do not appreciate that when the pole behaves elastically all the energy is returned. This aspect was treated leniently.

Few were able to provide convincing responses to part (b) (ii). Candidates had to realise that to pass over a higher bar either a technique adopted by the jumper had to take the body over the bar without increasing the height reached by the centre of gravity or energy in addition to the ke acquired in the run up was needed. The first point was given by a good proportion for the candidates and many also appreciated at least one way in which the athlete could provide energy by jumping at take off or by pulling and/or pushing on the pole during the jump. Many did not read the question carefully and referred to changes that would increase their speed at take off.

Question 7

Part (a) was very poorly answered by most candidates and highlighted many misconceptions about the operation of electrical circuits. The relevance of the high resistance of the voltmeter was often appreciated but relatively few could go on to explain why. Some candidates made some progress with an approach using either the potential divider formula or $E = IR + Ir$.

Part (b) (i) was done well but one significant figure answers were penalised. Some from their working seemed to have made a positive decision to convert 0.309 to 0.3 A as their answer and considered this to be a two significant figure response.

The correct working was rewarded in part (b) (ii) although using the approach via $E = IR + Ir$ and a current of 0.3 A yielded an internal resistance of 30 Ω (rather that ≈ 16 Ω) and this would give a terminal pd that significantly different from the 14.5 V given. The obvious approach was from lost volts = 0.5 V and then $r = 0.5/0.31$. Many spoilt their attempt using $E = IR + Ir$ by associating E with the terminal pd.

Question 8

In part (a), few than half the candidates identified this as potential divider circuit.

There were many correct responses to part (b) fairly straightforward question. A small minority gave the answers the wrong way round. Some knew that 12 V was likely to be the maximum without knowing when this would occur and some knew the resistor setting but were unable to calculate the voltages.

It was disappointing that more than half of the candidates were unable to complete the circuit in part (c) (i) correctly.

Few could make progress with part (c) (ii). Many thought that the circuit in Figure 6 would only enable the amplitude of one speaker to be changed. They did not appreciate that the voltage could not be made zero in the left hand loudspeaker or that the range of voltages available would be different in the two loudspeakers. Using the potentiometer both loudspeakers have the same range of voltages from zero to the maximum.

Question 9

Although there were many correct responses to part (a), a significant number of candidates were unable to correctly read the coordinates of the peak. Many ignored the prefix in the mW value or interpreted it incorrectly.

Prefixes caused problems in part (b) too when finding the area of the solar cell but the majority gained some credit for recognising some aspects of the correct method.

There were a good proportion of correct responses to part (c) and a majority of the candidates gained at least one mark. There were, however, many vague responses that referred only to the intensity of the sun being lower at other times of the day with no reference to the relevant intensity being that at the solar cell or why the intensity varies. Some thought the intensity falls because the Sun closest to the Earth at noon and moves further away in the evening. Few could establish a clear link between the angle at which radiation fell on the cell and the lower output.

Question 10

Part (a) (i) was done well by about half the candidates. Many did not determine the weight of the 1200 kg car.

There were many correct answers to part (a) (ii). The direction of the resistive force was sometimes expressed too vaguely.

A good proportion of the candidates successfully completed part (b). However, only half were able to gain any credit for making some progress although there were three easy marks available for demonstrating some understanding of the correct process.

In part (c), most candidates were able to communicate in a reasonably coherent style and with relatively few grammatical and spelling errors and there were many good responses. Unfortunately, some who were able to write fluently had insufficient knowledge and understanding of physics and how it is applied in this situation to capitalise on their ability to communicate.

More able candidates usually began by demonstrating that reducing momentum to zero over a longer time interval required a smaller force for the same change in momentum and went on to show how the physics affected design features. Relatively few, however, applied the physics clearly to the passengers in the vehicle. Most did not distinguish between the momentum of the car and that of a passenger and consequently did not refer to the force acting on the passengers as they decelerated to rest as being the important issue in terms of passenger safety. Many only referred to the car and the force required to bring the car to rest. The force acting on the passengers was most often assumed to be identical as that on the car.

The functions of the different safety features were also very vaguely understood and design features were often very loosely related to the physics. Less able candidates usually simply mentioned that a 'longer time' was needed without linking it to any force and assumed that all safety features were involved in increasing the time for the passenger to come to rest. There was confusion amongst a significant proportion of candidates between force and impulse. Increasing the time was often stated as producing a reduction in the impulse on the passengers.

Mark Ranges and Award of Grades

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