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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Physics 1456

Specification B: Physics in Context

PHYB2 Physics Keeps Us Going

Report on the Examination

2009 examination - January series

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

General Comments

The proportion of candidates omitting parts toward the end of the paper suggested that some candidates were pressed for time rather than the questions being inaccessible.

Question 1

The majority of candidates correctly used the data to obtain a correct value but many quoted the answer to too many significant figures. Some candidates appeared to think they needed to find a new force (perhaps confusing force and power). These candidates made no use of the distance moved and used 1500 N as ΔW in the formula $F = \frac{\Delta W}{\Delta t}$.

Question 2

The majority of candidates produced correct and clearly set out answers to part (a). Not showing adequate detail in the manipulation cost some candidates a mark. Less able candidates tended to approach the problem using average speed.

Part (b) (i) was successfully completed by just over half the candidates.

Very few answers gave sufficient detail to part (b) (ii). Candidates often referred to upthrust and/or friction without any indication that upthrust was due to displaced water and the friction force occurred between the water and the diver. Some included air resistance in this part.

Question 3

The common error in part (a) was to multiply the frictional force by cos 20 instead of dividing. Had candidates written the equation in the form *F* cos 20 = 2800 first, many more could have been successful.

In part (b), the majority multiplied the value from (a) by the distance moved forgetting that the distance moved is the force × distance moved **in the direction of the force.**

Question 4

Those who gained one mark usually had the first line correct. Those who gained two marks usually forgot the gravitational PE in the second line.

Question 5

Only a few candidates appreciated that the inverse square law was relevant, and of these, few could use it successfully.

Question 6

About one third of the candidates understood the increase in conduction electrons at the higher temperature. Many of these were unable to provide any further detail.

Question 7

The correct magnitude of the resistivity was determined by the majority of the candidates. The correct unit was provided by far fewer and many made no attempt to provide a unit in spite of the specific instruction in the question.

Question 8

In part (a), some simply stated that the sprinter did not start at the time the gun was fired but gave no reason for this. A mention of reaction time or thinking time was required.

Part (b) was answered well. The majority of the candidates appreciated that a tangent at 3.5 s was needed and many did this accurately. The unit was well known.

Although many appreciated that the area under the graph was needed in part (c), relatively few could convert this knowledge into an accurate distance. Some treated the area as a triangle and some tried applying an equation of uniform accelerated motion.

There were many vague and/or impracticable ideas in part (d). Comments such as use a computer or attach a speedometer to the runner were not uncommon. Some answers stated the data needed (distance and time) but not how it would be obtained or how the velocity data would be obtained from it.

Question 9

A large number of candidates had not grasped the concept of the independence of motion in two directions at right angles.

In part (a) (i), many candidates had difficulties resolving velocities. The use of cos 30 or tan 30 rather than sin 30 was common.

For part (a) (ii), many used the projected speed of $22\,\text{m}\,\text{s}^{-1}$ rather than the resolved speed in the equation of motion. Only a small minority of the candidates calculated the time to reach the maximum height and then doubled it. Some quoted $u = at$ so $22 = 9.8t$. This gave the correct outcome for the wrong reason.

The most common answer to part (a) (iii) was to use $22\,\text{m}\,\text{s}^{-1}$ as the horizontal velocity. Some candidates introduced gravitational acceleration into the solution of this part.

Few candidates were able to make significant progress with their explanations in part (b) (i). The majority appreciated the lower momentum and/or kinetic energy of the ball on leaving the bat but going on to explain how the effect of air resistance on the object leads to a lower range proved too difficult for most candidates. Answers frequently illustrated conceptual difficulties between energy and force, e.g. more kinetic energy means there is more force driving the ball, or the ball with a lower momentum loses its forward force quicker.

Consideration of the force acting on a ball was often related to the force exerted by the bat which was nor relevant in the context of the question. A few mentioned the decelerating force of the air and appreciated that for the same resistive force produced by air resistance the ball would have a greater

There were few carefully thought out diagrams in part (iii). The quality of drawing varied considerably. It was common for the path to be shown unchanged to almost maximum height before deviating. Attempts to show an asymmetrical path were rare

Question 10

Part (a) was successfully completed by a very high proportion of the candidates.

A majority of the candidates determined the new energy loss and/or the energy saved in part (b) but many of these were unable to convert this into a cost saving.

Most were able to provide sensible ways as required in part (c), but responses were often unconvincing when explaining how they reduced carbon emission.

Question 11

There were a few of pitfalls in part (a) (i). Some ignored the efficiency factor altogether and others used the factor of 5 the wrong way round. Many had problems handling the kW hour unit. Failure to convert W to kW was another common error. Many with the right idea stopped at the saving per hour.

Again, in part (a) (ii), many candidates had problems handling the prefix in the unit.

In part (b) (i), few appreciated that a greater emf was the advantage of the series connection.

For part (b) (ii), most gave the advantage gained should one cell fail but fewer appreciated the ability of the cells to provide a greater output current (or higher terminal pd) due to the effective internal resistance of the combination being reduced.

That conditions may arise when there is no wind or sunshine was appreciated by about half the candidates in part (c) and many of these went on to say that using a connection to the national grid could provide the back up power. Some suggested that the village should have a further alternative supply and almost every possible alternative power source was mentioned by candidates including a nuclear power station and tidal barrage. Relatively few suggested a suitable way of using surplus electrical energy in a storage system which could regenerate electrical energy when the other two systems were unproductive.

Question 12

Few candidates failed to make any progress with part (a) and the vast majority produced correct responses.

There were many correct answers to part (b). Some who obtained the correct answer in seconds did not convert to minutes successfully.

There were a number of misconceptions about currents in circuits in responses to part (c). Some suggested that current or power is used up as it travels through the battery before it can get to the external circuit. Others suggested that emf **caused** internal resistance and a significant proportion suggested that resistance is brought about by a current rather than being a property of the materials from which the cell is made. More able candidates recognised this and were able to go on to discuss ‘lost volts’ or explain the energy loss due to the dissipation of energy inside the cell due to the current in the internal resistance.

Mark Ranges and Award of Grades

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