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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 - June series

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Dr Michael Cresswell Director General.

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

General Comments

The performance of candidates was variable and many were unable to maintain a reasonable standard across the range of topics tested. Perhaps not unexpectedly, candidates had particular difficulties in questions on topics that have not been in recent specifications and which have been included because of their relevance to energy production and use. It was encouraging to see many candidates making a good effort to try to answer explanations questions even when they were uncertain of the physics and there were many instances where a candidate was on the right track but could not quite get to the point required. Straightforward calculations were frequently done well, but candidates had more trouble with those that required a little 'problem solving'. Both the numerical questions that required application of trigonometry showed that many candidates were poor in this aspect.

Presentation was usually satisfactory, but the tiny handwriting of a small minority was difficult to read and sometimes impossible to decipher.

There was some evidence, from an increase in the proportion of non attempts in later parts of the paper, that the paper was a little too long for the time allowed, particularly for the less able candidates. This was unclear however, as it could be that unfamiliarity with the topic was the cause of the non attempts.

Question 1

Part (i) was correctly answered by about three quarters of the candidates.

About half of the candidates correctly answered part (ii).

Question 2

This question was not done well. Candidates needed to recall that as a consequence of Newton's law of cooling the **difference** in temperature between that of the cooling body and the surroundings falls by the same fraction in a given time interval. In this case, the **temperature difference** halves in the given time interval of 480 s so it must halve in the next 480 s. The most common answer was 10°C, assuming a linear change so that the fall in temperature in the second 480 s would be the same as in the first. Others appreciated the need to use ratios but forgot to subtract 10°C.

Question 3

Solution to this question required candidates to find the vertical component of the tension from 610 cos 20 and realisation that the sum of the upward forces produced by the rope and reaction force is equal to the weight. There was a good proportion of completely correct answers but some who could do the resolution correctly did not realise what the next step should be. Some candidates overcomplicated the problem by trying to calculate the reaction force shown on the diagram.

Question 4

A majority of the candidates appreciated the need to use an inverse square law but only the more able candidates dealt successfully with the algebra. Many correctly substituted using the new data but were unable to finish it all to arrive at 12*I*.

Question 5

Part (i) was not done well. Most candidates stated Archimedes' principle and a smaller number stated that the upthrust must equal the weight or that the density of the object must be less than the density of the water.

In part (ii), a majority of the candidates appreciated that the melting would produce no change in the water level but providing a coherent explanation proved difficult. Some candidates thought the level would rise by the amount of the water in the iceberg that is above the water level when it is floating. Some tried to explain the lack of any change when the iceberg melts by equating the displaced volume to the weight of the iceberg and others introduced confusion by stating that the density of the iceberg was equal to that of the water, presumably trying to say that when it had melted this would be the case. It was noticeable that a significant minority of the candidates made no distinction between volume and area.

Question 6

Many hedged their bets on whether the superconductor has any resistance in part (i). Of those who appreciated the lack of resistance, only half referred to a critical or transition temperature.

There were some very good responses to part (ii), with a few candidates commenting on the problems experienced at CERN. The reduction in loss of energy through heating was appreciated by most and an appropriate application was given. Some answers were too vague and simply stated, for example, 'in scanners' or 'in the LHC' without stating what they are used for. Those who appreciated the use in magnets rarely commented on the ability of superconductors to allow high currents which produce stronger magnetic fields.

Question 7

Many candidates answered part (i) correctly. Errors included use of 7.5^2 instead of 7.5^3 and an incorrect blade length. This was a 'show that' question, so a substitution in the appropriate equation needed to be seen in a clear layout.

Part (ii) was successfully completed by a large majority of the candidates.

Question 8

Most candidates successfully completed part (a) (i).

Part (ii) was also successfully completed by a majority of the candidates.

The use of the equation for uniform decelerated motion was inappropriate in part (iii). Only a minority of the candidates appreciated that the work done had to be equated to the gravitational potential energy that had been transferred to forms other than to kinetic energy.

Only a small minority did not gain some credit in part (iv) and most stated friction and air resistance. A significant proportion of these did not identify where the friction was occurring. Vague answers such as between the skier and the ground were not accepted.

Most candidates completed part (b) (i) successfully.

Part (ii) was also done well by the majority of the candidates.

Question 9

Many were unable to identify which resistors were in the circuit for different switch settings and then calculate the total resistance in part (a). The $2R$ value was most easily identified but only about 20% of the candidates obtained credit for the other switch settings. Some could correctly write down the equations for calculating resistors in parallel but then got no further.

Part (b) was not done well. Few appreciated that they need to use V^2/R and not $I^2 R$ because potential difference was the common factor for each setting and not current.

Part (c) exposed many misconceptions about charge flow through conducting material. Many thought thermal energy to be produced by electrons bumping into each other or that they excite atoms which then release the energy as heat. Some thought the nuclei of atoms in the conducting material to be involved.

In part (d) a good proportion of the candidates appreciated that the thermal energy output would be decreased and, although there were some very good answers, many went on to give a partial explanation of why this would happen in terms of the reduced pd across the load or a reduced load current.

There were many correct answers to part (e) (i), but it was disappointing that a quarter of the candidates were unable to make any progress with the calculation.

A majority could give at least one sensible property in part (e) (ii), but many candidates had clearly confused the rod with the resistance wire so gave properties that were ‘opposite’ to those needed or irrelevant properties. Some gave contradictory properties such as ‘it must have a low resistivity and be a good conductor’.

Question 10

A majority of the candidates were successful with the calculation in part (a). Those who were unsuccessful could usually not determine the time from the data provided. Although it was stated clearly in the question that the equation gave the power in kW some still thought it to be in W so lost a mark for an answer of 0.499 kW or 0.500 kW.

There were very few high quality graphs seen in part (b) with the correct curvature and detail that showed an inverse square relationship and the correct value at 4 m. Many (about half) were unable to sketch a graph with the correct curvature.

There were relatively few answers to part (c) that provided adequate discussion of the topic. Good explanations of the origin of wave energy were rare. To gain the higher marks, candidates were required to include an explanation of how the energy in the waves can be traced back to the Sun. Many were satisfied with very basic statements such as ‘there will always be wind’ or ‘there will always be water’ or that ‘wave energy comes from the Sun’ without further detail. Many answers confused wave energy with tidal energy. Discussions of advantages and disadvantages were better and enabled a good proportion of the candidates to access the middle range marks but again many responses tended to be very superficial and avoided use of physics. Few made any comparisons with other energy options when discussing, for example, visual impact. Some good answers included quantitatively the relative output from waves of different height. Many of the poorer accounts included little more than one vaguely expressed advantage and one disadvantage.

Question 11

Only a minority of the candidates made progress with part (a) (i). The working in many responses did not convey a correct physics approach to the problem. Multiplying the peak force by half the time did not show that the aim was to determine the area, but rather that the aim was to find a number that fitted that given in the question. It would help demonstration of a correct approach to a problem, and in particular to ‘show that’ questions, if candidates were to include a subject for the formula and/or numerical substitution.

Candidates were generally more successful in part (a) (ii), almost half the candidates gaining both marks.

In part (b), candidates either coped very well or not at all with the straightforward task of finding the resultant magnitude and direction of the vector addition of horizontal and vertical velocities, both of which were given in the question. Many were unsuccessful because they could not successfully use Pythagoras’ rule or identify the appropriate relationship to find the angle.

Question 12

Many approached part (a) (i) from the equation for the rate of heat transfer through a material rather than being a property that enables the rate of heat transfer to be determined. This meant that the *U* -value was stated to depend on the rate of heat transfer, temperature difference and area.

Part (a) (ii) was a straightforward question that yielded relatively few correct responses, which was disappointing. Candidates could gain two marks for arriving at 43°C, by substitution of data that was given in the question in the formula for the heat transfer. Remembering to **add** three to the difference was the only complication. Only about a fifth of the candidates gained two or more marks and of these only half achieved the correct answer.

In part (b), a good proportion of the candidates could give one sensible reason (usually the existence of draughts or gaps in the structure) but few could provide two.

Mark Ranges and Award of Grades

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