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General Certificate of Education

Physics 1450

Specification A

PHYA2 Mechanics, Materials and Waves

Report on the Examination

2009 examination - June series

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GCE Physics, Specification A, PHYA2, Mechanics, Materials and Waves

General Comments

In general, candidates over a wide range of abilities scored highly on the calculations but tended to drop marks on the more extended prose answers. The key errors for many candidates were the failure to calculate weight from the mass given in question 2 and an inability to fully explain the motion of the ball in question 3.

In general, far too many candidates are still using a blue pen or a pencil with which to write, despite the instruction on the cover that states that a black pen should be used. With all the scripts being marked online, it is very important that all candidates use a black pen for writing.

Question 1

Part (a) (i) was straightforward and was answered very well.

Again, part (a) (ii) proved to be a particularly accessible question and candidates performed well.

In part (a) (iii), most grasped the concept that energy was wasted but less able candidates did not realise that the cyclist did work, believing it to be a simple transfer of potential energy to kinetic energy. Many candidates perhaps did not realise that marks could be gained by performing the relevant calculation.

In part (b) (i), a surprising number of candidates used time=distance/speed = 160/16 = 10 s. They did not appreciate that the situation involved uniform deceleration and therefore a kinematics equation should be used.

Part (b) (ii) was generally done well, with most calculating the acceleration and then using $F=ma$. It was possible to gain full marks even with the use of an incorrect answer from the previous question.

Question 2

A surprisingly large number of candidates divided the mass by four to get a 'weight' of 5500 kg in part (a) (i). Many also forgot to divide by four in what should have been a fairly uncomplicated question.

In part (a) (ii), many candidates simply multiplied the mass of 22000 kg by 32, indicating a surprising confusion between weight and mass. For the unit mark there were many common errors such as N, NM, Nm^{-1}, Nm^{-2}, J, nm, kg and Nkg^{-1}.

A very easy mark for mentioning the 'counterweight' was picked up by most candidates in part (a) (iii). However, not many went on to discuss the 'anticlockwise moment' that this provides.

Most picked up the first two marks to part (b) (i), some as a result of the ecf for the tension. Many candidates used wrong units; pa, PA, Nm^{-1}, being common rather than Pa.

Those with an ecf in (b) (i) generally failed to get both marks to part (b) (ii) because they did not arrive at 17 mm. This may have given some candidates a clue that one of their previous

answers was incorrect. The candidates who were successful on the first parts of the question invariably scored both marks here.

Question 3

Part (a) (i) was answered well. Candidates immediately recognised a 'suvat' question and performed the calculation with no difficulty.

It was a similar story in part (a) (ii) with most candidates having no trouble in gaining both marks.

The responses to part (b) were, in general, a little disappointing. Responses that simply indicated that the ball decelerated and that balanced forces caused terminal velocity could achieve a maximum of four marks. For the higher marks (five or six), candidates needed to explain that the deceleration was decreasing and the drag force decreased as the ball slowed down. These more sophisticated answers discussing the forces acting were rare.

Some candidates compared different quantities, eg 'acceleration balanced out the weight'. Some clearly thought that the graph showed acceleration not velocity.

Unfortunately, almost every candidate felt the need to describe the motion of the ball before it entered the liquid before embarking on answering the question. In many cases half or more of the answer space was used up before any marks were scored. Perhaps many candidates felt this was a suitable introduction to their answer. However, as a general rule, marks will not be awarded for correct physics statements that do not address the question. Inclusion of irrelevant detail in this case resulted in an excessive number of candidates requiring additional sheets to complete their answers.

Question 4

Most scored very well on parts (a) (i) and (ii), which were fairly straightforward questions, though occasionally the answers to (a) (i) and (a) (ii) were given the wrong way round.

In part (b) Quality of Written Communication was assessment. Many candidates did not specify a distance measuring instrument (a ruler); perhaps failing to state the obvious.

Very few recognised the need to specify a suitable number of different loads over the complete range. This would be important in order to obtain the true shape of the curve; six marks were only awarded if the candidate specified seven or more loads.

Many candidates forgot to include the unloading of the rubber cord in their answers and would have benefited greatly from re-reading the question and their answer here.

Candidates in a few centres appeared to use mnemonics to remember the elements necessary in answering this type of question; this seemed to work quite well.

Question 5

Most picked up full marks to parts (a)(i) and (ii).

Candidates tended to successfully state the phase difference and the unit to part (iii). A few confused path difference with phase difference and gave an answer as a number of wavelengths.

Part (b) should have been a fairly easy question, but was quite poorly answered by many candidates. There was much confusion over the meaning of displacement. Many thought point Y goes down then up. Few stated that a positive peak is reached after ¼ period. Many referred to wavelength rather than period or think that this is a stationary wave and the 'node' would not move. Many believed point Y would move horizontally.

Question 6

It was very pleasing to see how well the calculations to parts (a)(i) and (iii) were done by candidates of all abilities. Part (a)(ii) also presented little difficulty to the vast majority.

The majority of candidates managed to pick up a mark and many the second mark to part (b). This seems to have been universally well learnt by candidates who often referred to 'preventing crossover' and the issue of signal security.

Question 7

There were common mistakes to part (a)(i), such as failing to put n = 2. Some candidates thought n was the refractive index and for this reason put n = 1. A significant number did not convert from nm to m.

Part (a)(ii) was done very well by the majority of candidates, either by substituting in 90° or n = 3.

Most were successful in finding the wavelength to part (b).

Mark Ranges and Award of Grades

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