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Examiners' Report/ Principal Examiner Feedback

Summer 2016

Pearson Edexcel International A Level in Mechanics M2 (WME02) Paper 01

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General

The vast majority of candidates seemed to find the paper to be of a suitable length, but some candidates failed to complete the last question and it wasn't always clear whether they were running out of time or running out of ideas. Candidates found some aspects of the paper very challenging, in particular, questions 4(b), 6(b) and 6(c) and to a lesser extent question 5. The best source of marks was question 2 followed by question 1. The paper discriminated well at all levels including at the top end, and there were some impressive, fully correct solutions seen to all questions. Generally, candidates who used large and clearly labelled diagrams and who employed clear, systematic and concise methods were the most successful.

As clearly stated on the front of the question paper, in calculations the numerical value of g which should be used is 9.8 and final answers should then be given to 2 or 3 significant figures – more accurate answers will be penalised, including fractions.

If there is a printed answer to show then candidates need to ensure that they show sufficient detail in their working to warrant being awarded all of the marks available.

In all cases, as stated on the front of the question paper, candidates should show sufficient working to make their methods clear to the Examiner.

If a candidate runs out of space in which to give his/her answer than he/she is advised to use a supplementary sheet – if a centre is reluctant to supply extra paper then it is crucial for the candidate to say whereabouts in the script the extra working is going to be done.

Question 1

In part (a) most marks were lost because candidates only found the vector form for **v** and failed to find the speed. More marks were lost in part (a) because of this than in part (b) which, on the whole, was quite well done, with most candidates appreciating the need to find the difference in the two kinetic energies. Interestingly, many of those who had not found the speed in part (a) went on to successfully find it and use it in part (b). A few candidates lost the final 3 marks by working in vectors, although many who started in this way managed to correct themselves and produce an appropriate solution.

Question 2

Almost all got full marks in part (a) with the most common answer being 217, although many gave it as $650/3$ or 216.7. A few lost the last A mark for truncating the answer to 216.6. The second part was also done well, with most arriving at an answer of 8. However, many did not show their method for solving the quadratic equation and just gave 8 as the answer, presumably after using their calculator. This is fine if they get the correct answer but it should be noted that if the answer is incorrect then the method mark is also automatically lost. However, many simplified the equation to $V^2 + 42V - 400 = 0$ and factorised it. There were very few who had the correct equation but failed to solve it correctly and use of $12/V$ instead of $12000/V$ was rarely seen.

Question 3

In part (a) many used a correct method with full working. However, a few tried to work out the tension in the string and include that in their formula or to include kinetic energy. In contrast, candidates found the second part much more demanding. Many realised that they needed to include KE, PE and work done against friction (by multiplying 3/5 mg by d) but a common error was to omit the KE of one of the particles or just to write ½ mv^2 without indicating which mass they were using. Many didn't realise that they could use their answer from part (a) and gave two separate terms to calculate the loss in PE. If they had the correct number of terms, then they usually went on to get full marks in part (b) although there were the occasional sign errors. Most gave the answer as a fraction although a few stated it as $0.64gd$. Many candidates did not score any marks for part (c) as it was common to see use of $s = vt$ or to use an acceleration of g. However, some did pick up the M mark for using their incorrect answer from part (a) in a correct equation.

Question 4

Part (a) was generally well done, although some worked out the centre of mass of the triangle incorrectly. Almost all knew to set up a moments equation about AE but quite a few also found $\overline{y}$ unnecessarily. In contrast, many scored no marks for the second part. Some started well and worked out F from a correct equation but then stopped, thinking that they had answered the question. Some took the distance of the line of action of F from A to be $3a$ instead of $6a$. However, very few realised that they needed to find the vertical and horizontal components of the reaction force at A and use Pythagoras to find the magnitude and fully correct answers were rare. Many candidates thought that they needed to work out an angle for part (b) as this is what they are usually required to do. Some knew that they needed to take moments but did not appreciate that AB was horizontal and so they tried to use trigonometry to find the distance to the lines of action of F and the weight.

Question 5

This question was well answered by strong candidates but weaker candidates made a variety of mistakes ranging from slips to a fundamental misunderstanding of the forces involved. In part (a) most candidates attempted a moments equation about A, without always announcing it as such. A few split the T into vertical and horizontal components before taking moments; unfortunately some then used just one of the components in the moments equation. Many candidates showed in answering part (b) that they were very unclear about the directions of a number of the forces involved, especially the normal reaction and friction. These confusions led to the use of many incorrect angles in the resolving equations. Those who found values for the normal reaction and frictional force usually scored at least the M1 for use of $F = \mu R$, and the M1 in part (c) for using arctan (F/R). Sadly, even good candidates who had everything else correct often lost the final A1 for not specifying the direction adequately - it was very common to see just an angle given, with no indication of what it was the angle with, nor whether it was up or down. In part (b) most tried to resolve horizontally and vertically; a few resolved parallel and perpendicular to the rod, but the resulting equations were much harder to solve for μ. Many candidates lost final accuracy marks, for either over specifying their result in part (a) or giving an inaccurate answer to part (b), having prematurely rounded their value in part (a).

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Question 6

Part (a) was almost universally well done with a high proportion of candidates scoring full marks. However, the second part was generally poorly done, with many candidates trying to find the direction of motion using the displacement vector rather than using the velocity vector. A number found the displacement vector then realised that they needed the velocity, and used $v^2 = u^2 + 2as$ to find the vertical component, but without subsequently explaining why they needed the negative value. As in question 5(c), many lost the final mark for not specifying the direction adequately. The final part provided some more discrimination. More able candidates used the path equation to attempt an equation in λ or T (or occasionally in x or very occasionally in y, but this was realised to be equal to λ). The equation was usually solved reliably and a value found for T. As with quadratics elsewhere in the paper, there was rarely very convincing working shown in solving their equations, which led to the loss of method marks when the wrong answer was found.

Question 7

Part (a) was routine and well done; almost all candidates came up with a momentum equation and a restitution equation then solved simultaneously to find v and w. There was usually sufficient working shown to justify the given answer. In the second part the majority of candidates who made any progress at all dealt with events step by step as they happened, using the alternative method. Most scored the B1M1A1, but having found a distance many then stopped, failing to realise that this was not the required distance. Those progressing from there seemed to be split between the alternative method and an attempt at the ratio approach. This was often rearranged with the fractions moved around, but close inspection generally revealed everything to be the correct way up. Unfortunately there were many candidates who did not progress beyond the first B1 mark, seemingly overwhelmed by the complexity of the question.

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