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Examiner's Report
Principal Examiner Feedback

October 2019

Pearson Edexcel International A Level
In Mechanics M1 (WME01/01)

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October 2019
Publications Code: WME01_01_1910_ER

General

The majority of candidates seemed to find the paper to be of a suitable length, but there was some evidence of a significant number of candidates not finishing the final question. The paper was found to be challenging and seemed to be a good discriminator at all levels. The last two questions proved to be by far the most challenging with 44% of candidates scoring the modal mark of zero on question 7. In the case of question 8, the final question, it wasn't clear whether candidates were running out of ideas or running out of time. Question 5 proved to be the most successful with almost 43% of candidates scoring full marks. Candidates who used large and clearly labelled diagrams and who employed clear, systematic and concise methods were the most successful.

In calculations the numerical value of g which should be used is 9.8, as advised in the rubric on the front of the question paper. Final answers should then be given to 2 (or 3) significant figures – more accurate answers will be penalised, including fractions but simple exact multiples of g are usually accepted.

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. This was especially true in both parts of question 4.

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 and correct answers without working may not score all, or indeed, any of the marks available.

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

This impulse-momentum question proved to be a nice starter for many, with 36% of candidates scoring the modal mark of 6/6. However, 19% of them scoring nothing at all. In part (a), most used the conservation of momentum principle, but a significant number didn't realise that the two particles would be moving with the same speed in the same direction immediately after the string goes taut. The most common error in the second part was a sign error. A few forgot that the speed and the magnitude of the impulse had to be positive.

Question 2

This question was poorly answered, especially the second part. In part (a), many candidates were able to score the first 3 marks by a whole variety of methods, depending on whether they found a time first or the speed just before the first bounce first. The second two marks were more difficult to come by with sign errors often playing a part or else rounding errors leading to an incorrect final answer of 5.72. Candidate are advised, in questions where $g = 9.8$ has been used, to always give their final answer to two significant figures. The problem in the second part was usually miscounting the number of bounces with many candidates using a speed of 7 ms^{-1} instead of 3.5 ms^{-1} to find the required height.

Question 3

For those who were able to identify correctly all the forces which were acting, this proved to be a quick and easy seven marks and 43.5% of all candidates scored all seven. However, there were many who omitted forces or had them acting in the wrong direction or on the wrong part of the system. The most common and successful method was to write down the equation of motion for the trailer and obtain the acceleration and then use it in the equation for the car to find the value of D. Some used the equation for the whole system. The most common mistake was omission of the weight components which, if done consistently, fortuitously led to a correct value of D but this received no credit due to the missing terms in the two equations.

Question 4

This question was quite well-answered with a mean mark of 7 out of the available 12. In part (a), many candidates were able to correctly write down two correct resolutions, parallel and perpendicular to the plane, and then use $F = \mu R$ to obtain an expression for μ. However, relatively few were then able to show sufficient working to earn the last 3 marks for obtaining the given answer. This involved cancelling mg, for one M mark, and then clearly dividing the *top and bottom* of their expression, by $\cos\theta$ for the other M mark before finally using $\tan\theta = \dfrac{\sin\theta}{\cos\theta}$ to obtain the given answer and the final A1. In the second part, few realised that the statement $\mu > 0$, (or $F > 0$) was needed to start their deduction. Some showed that $\mu = 0$ when $k = 1$ and $\theta = 45°$ and earned only the first mark. There were few completely correct solutions making use of an inequality throughout.

Question 5

In the first part, many candidates did not realise that the tension in the rope at A would be zero when M was at its largest value. This resulted in some very long-winded work which led nowhere. Also a few mistakenly thought that $T_A = T_B$. The most successful candidates took moments about C and quickly obtained $M = 14$. A few resolved vertically to obtain $T_C = 12g + Mg$, then took moments and then substituted for T_C to get an equation in M only. Very few successfully formed two moments equations. Part (b) was generally well done with the most successful candidates resolving vertically and then taking moments about A or B. Common mistakes were mainly sign errors or distance errors with 3.5 m often being mistaken for 3 m.

Question 6

The first part was very well answered, with just a few candidates losing the first mark for having a solid vertical line at the end of their sketch. In part (b), most candidates made use of the gradient to obtain a correct result, with a few candidates making use of the area to obtain the alternative result. Very few incorrect solutions were seen. For the third part, successful solutions were equally split between using a trapezium and using a triangle plus a rectangle to find the area under the graph. Those who used $V = 0.8T$ usually managed to derive the correct equation, those who used the alternative and did not realise that $V = 0.8T$ tried to substitute $V = 400/(60 - T)$ into their trapezium equation and ended up with 200 = 200. In part (d), those who had the correct equation went on to solve it, sometimes using the quadratic formula rather than factorising. The vast majority found the two roots but some failed to explain clearly why they were rejecting 50. Candidates need to be reminded to show working when solving quadratics as those who had not derived the correct equation sometimes just wrote down an incorrect answer and received no credit for solving. For the final part, relatively few correct solutions were seen. Candidates need to appreciate that the question refers to ‘the model’ and the model is clearly described in the second paragraph of the question. Hence only modifications to that model received credit.

Question 7

Candidates found this question very challenging and the mean mark was only 2.4 out of 7. Very few seemed to understand how vectors are added. Some did not even draw a diagram and for many of those who did, their diagram did not have their vectors ‘top to tail’, which meant they used 120° in the cosine rule. This received no credit. A significant number thought the magnitude would be 14, i.e. (2x4) + 6. Successful candidates either applied the cosine rule to a triangle with sides 6 and 8 and included angle of 60° or resolved in two perpendicular directions and applied Pythagoras to find the magnitude of **P**. For part (ii), successful candidates applied the sine rule or cosine rule to the same triangle, using their answer for the magnitude of **P** or used tan on their two components. This angle then needed to be interpreted as a bearing. A number did not seem to understand the significance of the 2 in 2**F**.

Question 8

This was the most poorly answered question on the paper with a mean mark of 4.4 out of 14 and just over a third of the candidates scoring zero. There were many completely blank responses although this may have been due to time pressure. In part (a), some found the components correctly but had a sign error, some used a unit vector, forgetting that the magnitude was 40, whilst others just used 40**i** or 40**j**. In the second part, the first two marks were more often gained although some had a sign error. The B mark was almost always scored as it was a follow through on their answer from part (a). A decent diagram would have helped with the above. A significant number stopped at this point or at least stopped earning marks. In the third part, some did not realise that **r** - **s** had to be found and instead equated their **r** and **s**. There were often missing brackets, leading to sign errors, or errors when removing the brackets. A significant number used **r** - **s** = 60**i** and found *t* by equating **i** components. Those who got as far as Pythagoras often scored the next three marks as long as they had found **r** - **s**, but some just squared individual components of **r** and **s**, some left out the **i**’s and **j**’s and just squared **r** and **s**, whilst others equated the square root to 3600 or the square equal to 60. Several then managed to pick up a mark because they had obtained a quadratic but scored no more marks. Those who managed to get this far with a correct quadratic usually scored the next mark but not the last – they stopped at 12/7 or 103 mins, presumably thinking that this was what was required. Only 30% of the candidates scored more than 6 marks.

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