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Examiners' Report
Principal Examiner Feedback

Summer 2017

Pearson Edexcel International Mathematics
In Mechanics A-Level (WME02)

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General Introduction

The vast majority of students seemed to find the paper to be of a suitable length, with no evidence of students running out of time. Students found the paper accessible, with all students able to make substantial progress on all questions. The paper was well-structured with 73% of the students scoring full marks on question 1, 59% achieving full marks on question 2 and 44% achieving a maximum score on question 3. Thereafter the questions became more demanding and the students were less successful. The paper discriminated well at all levels including at the top end, and there were some impressive, fully correct solutions seen to all questions. The last two parts of question 5 and the last parts of questions 6 and 7 provided stretch and challenge for the more able students. Those who used large and clearly labelled diagrams and who employed clear, systematic and concise methods were the most successful. In question 4(c), it became evident that many students (incorrectly) think that μ has to take a value less than 1.

If a question specifies a particular method of solution, as in question 5(a), then no credit will be given for any other method, even if it leads to a correct answer.

In calculations the numerical value of g which should be used is 9.8, as advised 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 exact multiples of g are usually accepted.

If there is a printed answer to show then students 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, students 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 student 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 student to say whereabouts in the script the extra working is going to be done.

Reports on Individual Questions

Question 1
This question proved to be a nice starter and the vast majority found the velocity correctly, though failure to go on and find the speed was common. Those who did go on to find the speed were usually correct. There were occasional sign errors in the impulse-momentum equation and a few tried to use speeds.

Question 2
Students were generally successful when answering this question, although in part (a) some simply found the driving force, some tried to use energy and a few had sin/cos errors. In part (b) common errors were omission of the component of the weight from the equation of motion, using 140 for the driving force or leaving out the acceleration. Some still ignore the instructions regarding use of $g = 9.8$ and gave answers as fractions (e.g. $a = {}^{11}/_{15}$) which lost the final A mark.

Question 3
A significant number tried to use the *suvat* formulae, but most integrated correctly and went on to find the constant. Substituting $t = 1$ to verify that $v = 0$ and then factorising was generally done well, although many had to resort to using the formula to find $t = 3$ instead of realising that one factor was $(t - 1)$. If they integrated in part (a), they nearly always integrated again in part (b), but many did not realise the connection with part (a) and so simply integrated between $t = 1$ and $t = 4$. Those who sketched the velocity–time graph answered part (b) particularly well. A significant number of students tried to find the distance travelled between $t = 0$ and $t = 4$.

Question 4
In the first part, most attempted to take moments about *A*, but students often failed to resolve *T* and/or had the associated length missing which resulted in a substantial loss of marks. Several tried to resolve without including all the forces and some took moments about *D* or *B* and included a contribution from *T* in their equation. In part (b), most opted to resolve to find the normal reaction and friction, but few found both. Of those who did, not many then combined them to find the magnitude as required. Very few tackled this part by taking moments, despite it being much easier. In the final part, there was a lot of confusion about which forces should be considered to find the range of possible values of μ. Those who had found the total reaction at *A* often used this in "$F = \mu R$". If they were using the correct forces, it was often in an equation or upside down. Many did not like the fact that μ was greater than 1, with a few even stating it was not possible, whilst others, having obtained a value greater than 1 proceeded to cross out their work and use the formula the wrong way up and lost both marks as a result.

Question 5
In part (a), the majority used energy as instructed and correctly obtained $u = 9.8$ but some had signs confused in their energy equation and some ignored energy altogether (which received no credit). For part (b)(i), many started completely from scratch and treated it as a projectile question, with a significant number splitting the motion, firstly to the maximum height and then from there to the ground. This obviously introduced lots of potential errors in components and distances used and in combining the final vertical and horizontal components to get the final velocity. Very few realised, due to conservation of energy, that w had to be the same as u. Most of those who obtained $w = 9.8$ did so from projectile methods. Some tried to use *suvat* incorrectly. Following on from difficulties in finding w, many struggled to find the correct angle in part (b)(ii). Many students understood how to do part (c), but were hampered because of earlier errors. A time was often found in part (b) and used in part (c), usually correctly, but in both part (b) and part (c) there was a significant number who used 9.8 as the initial speed of projection.

Question 6
Most students had been well-schooled in using areas/ mass ratios and in finding the centre of mass of the separate parts but there was some confusion over the "y" distances, and $8a/3$ and $-10a/3$ were quite common incorrect answers. Some students needed to show more working as they were finding a given answer in part (a). However, overall both part (a) and part (b) were well done. Many did not attempt part (c) but of those that did, by first finding the centre of mass of the new system, those who used distances from *BC* usually failed to find ($6a$ – their distance) before equating to the distance from *AB*. Those who tried to take moments about *A* were often unable to find the required distances. Some were successful numerically but did not have clear explanations or diagrams, so were in danger of losing marks. However, there were a few very elegant answers using intersecting lines and clear diagrams which were a delight to mark.

Question 7
Part (a) was usually correctly done with sufficiently detailed working to warrant all the marks, although inevitably when the answer is given, there were the usual fudges where a few tried to fiddle the answer after, for example, an inverted impact law equation. In the second part, most tried to find initial and final energies but very few found the energy lost. Using the total mass of $10m$ was quite common. Many of those who did find the KE lost did not then go on to find the fraction lost. In part (c) many failed to find the new v_B. and even if they did, they often tried to use $v_B < v_C$ rather than $v_B \geq 1.6u$. Those who did understand the scenario often used a strict inequality or else did not include $0 \leq e$ or did not manipulate their inequality correctly.

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