Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

January 2019

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

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January 2019
Publications Code WME01_01_1901_ER

General

The vast majority of candidates seemed to find the paper to be of a suitable length, with no evidence of candidates running out of time. Overall the paper seemed to be a good discriminator at all levels, with no question, apart from question 1, found to be entirely straightforward but with all candidates able to make some progress on all questions. Question 1 proved to be a very good choice for a starter as it was by far the most successfully answered question, with 66% of the candidates scoring full marks. On the other hand, questions 2, 3 and 4 proved to be by far the most challenging questions with 31% of candidates scoring no marks at all on question 4. Candidates who used large and clearly labelled diagrams and who employed clear, systematic and concise methods tended to be the most successful.

In calculations the value of g which should be used is $9.8\ \text{m s}^{-2}$, 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, as in question7(a). 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

Part(i) of this question was generally done well. Virtually all candidates produced a conservation of linear momentum equation with the correct structure. There were occasional sign errors through not taking account of the stated directions and the odd arithmetic slip when solving to find the unknown speed, but nevertheless much entirely correct working was seen. Those who chose a positive direction which led to a negative answer for the velocity mostly gave the speed as $(+)2u$ as required. Again, in part (ii), most knew and used the correct definition of impulse in terms of difference of momenta for one particle. It was possible to consider either particle but it made more sense to use A since this did not depend on carrying through a possibly incorrect value from previous working. The answer was almost always given as positive as required for a 'magnitude'. Some dropped the m or u (or both) at some stage during their working and, following a correct initial equation, the magnitude was sometimes stated as '9' rather than '$9mu$'. Those who did not take account of the change in direction in their impulse expression lost the two available accuracy marks but such instances were in the minority.

Question 2

Although many candidates in the first part realised that the velocity vector defined the direction of motion, a significant minority attempted to use a position vector and gained no credit. Those who correctly identified a relevant angle did not always convert it to a bearing successfully, and some failed to round to the nearest degree as specified in the question. In part (b) most wrote down position vectors of the form $\mathbf{r} = \mathbf{r}_0 + \mathbf{v}t$ for A and B, substituted $t = 4$ and simplified appropriately. However, the next step of interpreting the information of B being south west of A eluded many candidates. Some common errors included equating the ratio of the $\mathbf{i}$ and $\mathbf{j}$ coefficients for A with those for B, equating the $\mathbf{i}$ coefficient with the $\mathbf{j}$ coefficient for just B, or equating $\mathbf{i}$ and $\mathbf{j}$ coefficients for A and B separately. The minority who realised that subtraction of the position vectors was required generally proceeded to find a correct value for p. Many candidates who found a value for p from an incorrect method achieved the final two method marks by substituting to find the velocity of B and then finding the magnitude to give a value for the speed.

Question 3

In part (a), the equation of motion, for the person only, was found correctly by the majority of candidates although a few failed to substitute 560 or 1.4 or both at this stage but then went on to successfully find m in part (c). In the second part, a majority of candidates gave the equation of motion for the whole system instead of for the lift only, as was required, and scored no marks for part (b). Those who did attempt the equation for the lift only often had the reaction missing or had a sign error. In the final part, those candidates who had stated the whole system equation in part (b) usually obtained all three marks for this part.

Question 4

Part (a) was generally done well with most candidates identifying a valid method for calculating the distance the boy could walk without the plank tilting. The most popular (and straightforward) method was to take moments about R although the method of vertical resolution and moments about another point was also often completed successfully. There were occasional slips in distances or signs of terms but many correct answers were seen. A minority of candidates failed to realise the implication of 'tilting' and had a non-zero reaction at P (surprisingly often having equal reactions at P and R); they could make no valid progress and achieved no credit. In the second part the significance of the box being modelled as a particle was that the weight acts exactly **at *Q***; those who just wrote that the weight acts at a point did not gain the mark. In general, when a question asks "how have you used..." it is important that the answer refers specifically to the scenario being considered rather than just stating a general modelling definition. In part (c) not so many realised that, because the smallest possible mass of the rock to maintain equilibrium was required, the reaction at P was again zero. Those who appreciated this condition generally managed to use a valid method to find an equation in M, with 'moments about R' again being the most popular option and a fair number of entirely correct solutions were seen. Again, those attempts with a non-zero reaction gained no credit as they showed a lack of understanding of the mechanics of the situation and the equations could not lead to a solution (despite the best efforts of some candidates).

Question 5

This question involved the equilibrium of a particle under the action of three forces (tensions in two strings and weight). In order to solve the problem it was necessary to calculate a relevant angle. This should have been a relatively short calculation with a realisation that the angle BP makes with the vertical is part of a right-angled triangle with opposite and adjacent sides of 1.5 m and 2 m respectively. Some used the cosine rule to find the hypotenuse (BP) of this triangle, generally successfully but with more working and consequently a greater chance of error. The majority of candidates then attempted to resolve the forces horizontally and vertically giving two equations in the unknown tensions. Those who assumed the tensions were equal achieved no credit. Alternative methods such as triangle of forces or 'Lami's Theorem' were seen and often used successfully. If an incorrect angle was used consistently then marks could still be achieved for the resolution equations (or equivalent). However, the assumption that both strings made angles of 45° with the vertical resulted in the loss of all accuracy marks for these equations. Some errors were evident in the solution of the simultaneous equations and a rounded value for the angle sometimes led to at least one inaccurate answer for a tension. Only correct answers given to 2 or 3 significant figures were acceptable following the use of $g = 9.8\text{ms}^{-2}$.

Question 6

In part (a) the majority of candidates produced the correct shape for the graph. A few made the mistake of having solid vertical lines included and lost a mark, but most candidates labelled it correctly and a few left out relevant delineators or incorrect times. There were some misinterpretations of the information in the question. In the second part, candidates were generally successful and used the area under the graph to find the correct value for V. Those who failed to obtain the correct value often had incorrect labelling in part (a). Very few candidates attempted to solve using *suvat* equations. In part (c), the majority of candidates managed to gain full marks for a correct value of T. A significant number of candidates, however, managed to solve for a relevant time but then failed to add the initial 60 seconds to give their final answer for T. A few attempted to use a single *suvat* equation to solve for time which received no credit. The first part of (d) was answered well with most candidates able to score full marks for $T_1 = 15$. However, finding the second value presented more of a challenge and a significant number of candidates found a relevant time, usually 7.5 or 22.5, but then added 7.5 to 240 or subtracted 22.5 from 270.

Question 7

Part (a) was generally answered well with most candidates forming correct equations and attempting to solve. A few lost the T or F in the equation of motion parallel to the plane. There were very few sin/cos confusion errors and also very few missing or extra g's. Most errors lay in the algebraic manipulation and final stages of solving for T. A few candidates made the mistake of assuming that there was no acceleration and so their equations were incorrect. A few candidates incorrectly cancelled or lost m from their equations in the final stages of their solutions. There were many completely correct solutions with a similar number just losing the final mark due to algebraic errors. Very few gained the mark in the second part. Often acceleration was mentioned with or instead of tension. A precise correct statement was needed and just saying "tension same" was not enough for the mark. Many just ignored this part. Part (c) proved to be the most challenging part of this question with the majority of candidates becoming confused over angles and a significant number did not attempt it. There were a variety of methods used, with those using the cosine rule being the most successful. Rounding errors were common and often m was lost in their calculations.

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