Examiners' Report/ Principal Examiner Feedback

January 2016

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

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January 2016
Publications Code IA043296

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The majority of candidates for this paper offered responses to all seven questions. Much of the work seen was of a high standard, and weaker candidates found that they could make progress with some aspects of all questions. The presentation of solutions was generally good, with most candidates giving an indication of what they were trying to do at each step.

Candidates should be advised to take note of the rubric on the front cover of the paper, particularly the part which refers to the expected accuracy of their answers and the use of $g = 9.8\ \text{m s}^{-2}$: candidates who do not follow the instructions, either by using $g = 9.81\ \text{m s}^{-2}$ or by giving answers to more than three significant figures, will lose accuracy marks. Similarly, candidates who give an incorrect answer without showing any working will gain no credit for the part of the question affected.

As part of their checking at the end of the exam, candidates should make sure that they have found what the question actually asked for.

Question 1

Most candidates demonstrated a good understanding of work and power, but many lost at least one accuracy mark through giving answers to more than three significant figures or by giving an answer for *P* in watts rather than in kilowatts.

In part (a) some candidates considered only the work done against the resistance to motion or only the work done to increase the potential energy. Another common error involved using $10\ \text{m}$ or $14\ \text{m}$ as the distance travelled.

Question 2

The majority of candidates scored the first four marks in part (a). Some candidates made no further progress, or stopped work when they had found an expression for the velocity of *Q*. Many did realise that *P* must be following *Q* after the collision and formed an appropriate inequality by considering the velocity of *P*.

There were many correct answers to part (b), with the majority of responses considering the change of momentum of particle *Q*.

Question 3

Parts (b) and (c) of this question proved to be accessible to most candidates. Part (a) proved to be more challenging. Some candidates tried to compare $\mathbf{v} = \lambda(\mathbf{i} + \mathbf{j})$ with the position vector of the particle rather than with the velocity of the particle. Some equated the **i** and **j** components of the two expressions for **v** but did not realise that the two components of **v** must be equal and could not see how to make further progress. Some candidates gave the answer $T = 2$ but provided no evidence that their solution was anything more than a lucky guess.

In part (b) some candidates did more work than necessary, giving the magnitude of the acceleration in addition to expressing acceleration as a vector.

In part (c) some candidates who had found the vector $\overrightarrow{OA}$ correctly did not go on to find the distance.

Although parts (b) and (c) were a good source of marks for many, some candidates attempted to apply equations for motion with constant acceleration and scored no marks at all.

Question 4

Most candidates scored some marks in part (a) of this question. A few used $\sin\alpha$ in place of $\cos\alpha$, but the most common error was to find the total work done, rather than just the work done against friction.

The wording in part (b) refers to the whole system, but many candidates considered only the potential energy gained by *P*. Some candidates who did consider both particles had them both gaining or both losing potential energy - this suggests a very limited understanding of the physical model described in the question.

Again in part (c), many candidates considered just one particle rather than the whole system. It was only in rare cases that a candidate considering only one particle found the tension in the string and included the work done by the tension in their work-energy equation. Some candidates did achieve a "correct" answer by using an incorrect method and making sign errors - they scored no marks.

A few candidates ignored the instruction to use the work-energy principle and attempted to find the speed of *P* using equations for motion with constant acceleration. Some of these obtained the correct answer but scored no marks because they had not used the method required.

Question 5

Unusually for a question on this topic, this question does not take the candidate step by step through the problem. Most candidates showed a good understanding of the key steps required to tackle the question.

The most straightforward (and quickest) method of considering the complete system as two rectangle each of mass $\frac{1}{2}M$, with the particle of mass kM, and then using A as the reference point was not often seen.

The lamina in this question is a much simpler shape than some in recent papers, but several candidates managed to make slips, often in the vertical distances of the centres of mass of the individual rectangles from their chosen horizontal reference point.

Some candidates are so accustomed to using area ratios for the ratio of masses of the elements of the lamina that they overlooked the given mass in this question. This led to solutions involving a mixture of mass and mass ratio. In only a handful of cases did the candidate introduce a variable for the density per unit area and thus achieve dimensionally correct equations.

Some candidates misread the question and worked with two rectangles each of mass M, and some candidates took no account of the particle attached to the lamina at E.

The majority of candidates who had measured all of their distances relative to axes through F were able to adapt their results for axes through A.

Several candidates made incorrect assumptions in attempting to find the value of k, usually thinking that the line AE would be vertical when the lamina and particle were suspended from A, and/or that the centre of mass of the system lay on the line AE.

Question 6

Most candidates reached the given result in part (a) from correct working, but some needed several attempts before they found the correct method.

In part (b) many candidates followed the instruction in the question to work parallel and perpendicular to the rod. There were some errors in the trigonometry and some sign slips, but several candidates found correct expressions for the two components of **R**.

In part (c) only a few candidates realised that if **R** acts upwards at an angle greater than θ then the component of **R** perpendicular to the rod must be positive (if measured upwards).

Those candidates who misinterpreted the instruction in part (b) and found the horizontal and vertical components of **R** often did this correctly, but they then had more work to do in order to find the range of possible values of b, and usually offered no attempt.

Question 7

Most candidates started part (a) by considering the horizontal and vertical components of the initial velocity. The equation for the horizontal component was usually correct, but there was commonly a sign error in the equation for the vertical velocity using an upward component of $6\sin 45$ at *A* rather than $-6\sin 45$. Most candidates used their equations correctly to find θ.

Parts (b) and (c) do not require the candidate to have values for *u* and θ, so full marks in the rest of the question were available to those candidates who were not successful in completing part (a).

In part (b) many candidates used the horizontal component of speed correctly and reached the correct answer. The most common error was to assume that the kinetic energy at the highest point would be zero.

There are several approaches to part (c). All of them require the candidate to realise that the speed of *P* will also be 6 m s^{-1} at a point on the upward path of *P*. Many candidates found a correct approach and reached the correct answer if they avoided arithmetic and algebraic slips. Some candidates gave a range of values for *t* as the final answer, e.g. $1.13 < t < 2$ rather than find the value of *T*. The most common error was to confuse the speed and the vertical component of the speed.

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