Examiners' Report
Principal Examiner Feedback

January 2025

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

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General

The vast majority of candidates were able to make attempts at all seven of the questions but there were a few blanks for the last part of question 7. It wasn't always clear whether this was due to candidates running out of time or running out of ideas. The paper had a friendly start with the modal mark on both of the first two questions being full marks, and 52.6% scored full marks on question 1. Surprisingly, question 4 on moments was the best answered question with 63.6% scoring 10 out of 10. The modal mark was full marks on each of the first six questions. The final question was by the far the most demanding, with a modal mark of 0, and there was a significant number of incomplete attempts at the final part. There were some excellent scripts but there was also a substantial number where the standard of presentation left a lot to be desired. This, in some cases, made it very difficult for examiners to follow the working and award marks accordingly.

In calculations the numerical value of g which should be used is 9.8 m s^{-2}, as stated 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.

N.B. If there is a given or printed answer to show, e.g. as in 6(b), 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 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

In part (a), the vast majority knew to sum the three forces to find the resultant. Following this, the most common method was to use Newton's 2nd Law first to get $\mathbf{F} = 2.5\mathbf{a}$ and then apply

Pythagoras to find the magnitude of the acceleration. Others found the magnitude of the resultant force first and then used $F = 2.5a$ to obtain the answer. The most common error was to leave the answer as a vector instead of finding the magnitude. An incorrect method seen in a small number of attempts was to find the magnitude of each of the forces before adding to find the resultant and this gained no credit. A number of candidates misread 18 for 8 at various stages throughout the question. Occasionally an extra force was added e.g. the weight ($2.5g$) in the **j** direction.

In the second part, most candidates were able to score the first mark by finding the resultant force and collecting the **i**'s and **j**'s. Many then went on to successfully find $p = -30$ by either using a correct ratio in p or by equating the resultant to $\lambda(7\mathbf{i} + 2\mathbf{j})$ and eliminating λ. A relatively small proportion of candidates simply equated the resultant to $(7\mathbf{i} + 2\mathbf{j})$ and ended up, incorrectly, with $p = 19$ and $q = -16$.

Question 2

In part (a), successful candidates drew the correct shape for the graph, labelled T_1 and T_1+T_2 on the time axis and entered V and 5 at the appropriate places on the speed axis. A few candidates added a solid vertical line and lost a mark.

Successful candidates in part (b) either applied a *suvat* approach or used the areas under the graph and equated these to 132 and 136 respectively. Candidates then rearranged the equations to form expressions for T_1 and T_2 in V only.

Part (c) required candidates to use $T_1+T_2 = 28$, and their answers to part (b), to form an equation in V only, leading to $V = 17$ only. A small number failed to reject the other root of the quadratic and lost the A mark.

In the final part, candidates either used the gradient of their graph or a *suvat* method, together with their value of V, to find the deceleration. A substantial number gave a negative answer and lost a mark.

Special case: It was noticed that many candidates treated the total time for the two motions together as T_2. In such cases, where this happened consistently throughout an entire solution, the first two B marks for the graph were lost but candidates could then score the remainder of marks if applied consistently. Candidates would be well advised to read the question carefully. They would also be advised to reflect on their answers as many gave answers for T_2 which were bigger than 28.

Question 3

In part (a), almost all candidates were able to find λ using impulse-momentum. Occasionally either 3 or m was missing and -15m was also seen.

Part (b) proved to be much more challenging. Many correctly used $v^2 = u^2 + 2as$ but often 0 instead of 5 was used for the value of u. The next two marks were usually gained but there were often errors in the use of $F = ma$ with some candidates including the impulse $15m$ from part (a) whilst others used $3m$ on one side of the equation and m on the other. The work-energy approach, although seen very rarely since it is not on the specification for this paper, was usually completed successfully.

In the final part, there were many correct solutions, with just a few using $v = 5$ instead of 2.5. The vast majority used conservation of momentum but a few chose instead to equate the magnitudes of the two impulses.

Question 4

There was some confusion generally over tensions in the strings with tensions from different parts of the question being used. Unsuccessful candidates would have benefited by drawing diagrams, especially in parts (b) and (c).

Part (a) was well answered with the majority of candidates taking moments about A. Very few used two equations but of those that did, it was usually a vertical resolution and moments about B. They were mostly successful, but errors were more likely with the algebra. As the answer was given there was the occasional fudge.

In part (b), with the unknown length being measured from A, there was a strong hint to take moments about A again and this was the method used by most candidates and invariably led to a correct solution. Resolving vertically and taking moments about any other point was much less successful with candidates often making errors with the distances e.g. $(1.5 - d)$ or $(2.1 - d)$.

In the final part, a significant number of candidates clearly did not understand the significance of *on the point of tilting*. This part was less successful than the other two but most of the successful candidates took moments about C. The majority of unsuccessful candidates took moments about A but with the tension at C still 600N or the particle P still attached. A very small number of candidates used X as a mass.

Question 5

Part (a) was generally well done with most candidates realising that they needed to use a value of 8 rather than 9 for the time. A significant number found the correct velocity but went on to find the speed, for which there was no penalty, but it does highlight the need to read the question carefully. Some candidates chose a non-vector approach and were unable to score any marks.

Part (b) was found to be more challenging, but successful candidates first used their $\mathbf{v}$ from part (a) to calculate the position of the ball at $t = 7$, either by using the position at $t = 1$ and adding on $6\mathbf{v}$ or by first finding the position at $t = 0$ and then adding on $7\mathbf{v}$. A few worked back from $t = 9$. The distance from the target then needed to be calculated by using Pythagoras on the difference between their position vector and $(13\mathbf{i} - 5\mathbf{j})$. This method mark was only available if a sensible method had been used to find the position of B at $t = 7$.

Question 6

Part (a) was generally well answered but a few candidates did not appear to understand what was required and failed to write down an expression for the friction. However, in part (b) they were often able to successfully resolve parallel to the plane and complete that part. A few candidates used 0.75 instead of $0.75mg$ for the tension, with others leaving the tension as T. A few who used $F = \mu R$ did not replace μ with ½, R was occasionally given instead of F and a few candidates set the difference equal to ma but did not then set $a = 0$.

In part (b), the reaction R was generally correctly found and then most substituted for F and R in $F = \frac{1}{2}R$. The most common error was to use $R = mg\cos\alpha$, ignoring the fact that the tension in the string will affect the reaction. This was a 'show that' question and candidates needed to make clear use of $\tan\alpha = \frac{\sin\alpha}{\cos\alpha}$ and correctly obtain the given answer to earn all the marks.

Part (c) was a good discriminator and was sometimes omitted. A significant number of candidates wrote an 'essay' with no calculations to explain their conclusion. Others still had a two term expression for friction with the string still attached. The alternatives on the mark scheme were rarely seen. Finding a value for 'a' using $F = ma$ was often seen rather than a direct comparison of the friction and the weight component parallel to the plane. A few candidates did well here despite scoring zero in part (b). The final mark was often lost by candidates who clearly did not understand limiting friction and thought that the friction would move the box up the plane.

Question 7

In part (a), the equation of motion for the whole system was rarely seen or used. Most candidates wrote down an equation of motion for each particle and then either solved them directly for T or else found a first and then used it to find T. There were some examples of poor algebraic manipulation to find T or a with a few candidates finding a but not T. Some of the most common errors were using m instead of $2m$ and/or $3m$, omitting g from the weight term and including g in the 'ma' term. $T - 2mg = 3mg - T$ was also often seen. A number of candidates substituted 9.8 for g whilst trying to solve for T and ended up with a two term expression rather than the single correct answer.

When students found the correct acceleration in part (a) they often went on to gain full marks in part (b). A common error (scoring no marks) was to use g for the acceleration. Some found the time first using $v = u + at$ which was useful for part (c). Only a handful gave $\frac{7}{5}$ as their answer instead of a decimal and a few left v as an algebraic expression without turning it into a decimal. The g was also occasionally lost during calculations, giving $a = 0.2$. This then had a knock-on effect.

The final part proved challenging for many candidates. A large number failed to realise that there are two parts to the motion and so made no progress, using only one equation for the whole of the motion. Those who realised that there were two parts usually found the first time accurately but 0.56 s or even 1.06 s was often seen. Use of $v = u + at$ to find the first time was quite common. A significant number correctly solved the quadratic for the second stage but occasionally chose the wrong root. Very occasionally the total time was left as a surd. There were a few who lost the final mark(s) due to rounding errors.

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