Examiners' Report
Principal Examiner Feedback

Summer 2025

Pearson Edexcel International Advanced Level
In Mechanics M3 (WME03) Paper 01

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General

Overall candidates were able to access all seven questions on this paper and time did not appear to be a limiting factor. Candidates were able to recall and use standard formulae and were familiar with the context given in most questions. This was evident in question 1 on Hooke's Law and in question 2 on horizontal circular motion, where many weak candidates were able to earn most of the marks available. The final question presented an appropriate level of challenge and high achievers were able to demonstrate their mechanical understanding and mathematical communication.

Although the presentation was generally good, there were many occasions when handwriting and letters were difficult to read. Examiners reported difficulties distinguishing between π, x and t and cases of wandering square roots when manipulating surds. Candidates are advised to present solutions vertically down the page, using all the space available, and to avoid using arrows to direct examiners around their solution.

If there is a given or 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 and in the case of a printed answer that they end up with *exactly* what is printed on the question paper.

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 their answer than they are 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

Candidates at all levels were able to achieve full marks on the opening question to this paper. The majority made a confident start, taking moments about A and quickly establishing the correct tension. Some candidates who failed to take moments, lost all marks in part (a) but used Hooke's Law correctly to earn 3 out of 4 marks in part (b). Others lost marks in part (a) due to processing errors, choosing to replace trigonometric functions rather than cancel common factors.

Question 2

Performing best on the paper, this question on horizontal circular motion was accessible to candidates across the grades. Although unstructured, most candidates recognised the familiar format and promptly established a vertical equilibrium equation, and a suitable horizontal equation for N2L, before solving to find the magnitude of the contact force and earn all 7 marks.

Those who lost marks often missed out a term in the vertical equation or used the length of the string as the radius of circular motion. Aware that the $a\cos\theta$ term would cancel, some well-rehearsed candidates wrote the equation of motion without the trig components on either side of the equation. Although acceptable in this question, if the answer had been given, it is likely that candidates would be required to write down the initial equations in full to 'show' where the result had come from.

Question 3

This question presented candidates with the first major challenge of the paper and whilst the vast majority earned the first three marks in part (a), many did not consider the constraint on *x* and could not progress to earn all marks in part (b). In part (a), candidates were able to establish the correct differential equation, integrate correctly and find the constant of integration to reach $v^2 = 4x^2 - 4x + 1$. In general, only high achievers recognised that this could be written as $(2x-1)^2$ and also took the square root correctly to obtain $v = 1 - 2x$.

It was incredibly rare for much progress to be made in part (b) if the answer to part (a) had not been reduced to a linear expression. Those who were sufficiently skilled, established a relevant differential equation, integrated correctly, found the constant of integration and rearranged to find an expression for *v* in terms of *t*.

Question 4

Part (a) provided a very accessible opening to this question on elastic potential energy and the work-energy principle. The vast majority found the length *AD* correctly and produced sufficient working to show the difference in two GPE terms was equal to $\frac{1}{2}mga$ as required. Whether considering the problem as a whole string or two half strings, candidates were equally successful.

The scaffolding provided by part (a) supported a strong entry into part (b) for many who earned the marks for the GPE term and for establishing a dimensionally correct work-energy equation with all required terms. Well-rehearsed candidates did so with ease, using the answer to part (a) and " Loss = Gain + Work Done" to complete part (b) in just a few lines of neat working. Those with less confidence did not use their answer to part (a) and chose to identify the required terms separately using "Initial – Final = Work Done". The latter technique was more prone to sign errors, losing 2 marks out of 5. However, candidates using the latter technique were also more likely to forget a term completely which is a very costly mistake.

Some candidates scored just 1 out of 5 for identifying the correct GPE term only, having forgotten to include both KE terms in their work-energy equation. Candidates should be advised to check carefully whether all required terms are present in an energy equation.

Question 5

All three parts to this question required a 'show that' proof and many candidates were able to use the given answer as a guide to find sign errors and correct their own solution.

The result in part (a) is standard bookwork and almost all candidates achieved all marks in just a few lines. To gain all 3 marks, there must be sufficient working and the solution must be free from errors. Candidates must take care to correct errors and slips throughout their solution, rather than just the final line, and they should avoid writing over the top of their own work, which may be illegible to an examiner.

Although some candidates made no further progress in the question, the well-prepared ones usually recognised the familiar format of part (b) and established an equation of motion directed towards the centre, with the correct form of circular acceleration, and use part (a) to replace v^2. Although it was common for R to feature in the equation of motion, most were able to recognise and use $R = 0$ to obtain the given answer.

The final part challenged the understanding of many as the circular motion progressed to projectile motion. The presentation in part (c) was often chaotic and the letter formation was difficult to read as candidates attempted to correct their own work to obtain the given answer by any means. With 7 marks available, candidates should recognise that a problem-solving approach is required and think through their strategy rather than start and abandon multiple attempts. The most efficient, successful solutions usually included a simple diagram and a line of working to find the exact trig values, before bringing two expressions together to form a relevant trig expression.

Despite the level of difficulty in this part, high achievers rarely made sin/cos errors in their speed components and quickly found the required horizontal component. Whether using energy or $v^2 = u^2 + 2as$, they usually established a correct equation that could lead to the given answer. Whilst many progressed directly to $\cos\theta$, those who correctly found $\sin\theta$ or $\tan\theta$ first, almost always produced the required result in the following step.

Question 6

Candidates are typically well-rehearsed using integration to find the centre of mass as required in part (a) of this question. In this case candidates were expected to use the equation of a circle with the limits from 0 to *a*, and most did so with great success. Occasionally *r* was used instead of *a* which was condoned throughout the working but needed to be correctly written as *a* for the final mark. Surprisingly many candidates ignored the given volume of a hemisphere and chose to use integration here as well. Candidates should be advised that in an exam, the phrase '*You may assume that …*' permits use of the equation or formula without proof.

Part (b) was well understood and most organised the mass ratios and distances in a table before arriving at the correct moments equation. Perpendicular distances were almost always taken from *O* which led to the answer very quickly. When answers are given in the question paper, candidates are advised to show at least one line of working to demonstrate how the given answer is reached.

Without a given answer, far fewer candidates had success in part (c), and there were many blank responses, or 0 marks awarded. Some with good exam technique, knew that a second relevant distance was required, earning the first 2 marks without recognising how to complete the question. Those with fully correct solutions usually produced a simple neat triangle on the given figure, showing once again that a good diagram can provide clarity when problem-solving.

Question 7

Simple Harmonic Motion presents a significant challenge to some candidates with a few making no attempt to answer this question. Solutions were often very difficult to read with many examiners referencing poor formation of π and untidy surd manipulation leading to errors and lost marks.

High attainers progressed quickly through part (a) reaching the required result and earning all available marks. Well-prepared candidates understand that the result must be written in the form $\ddot{x} = -\omega^2 x$, using $\ddot{x}$ for acceleration and conclude '$\therefore$ SHM' to achieve all marks. Some candidates do not appreciate that a represents amplitude in SHM and therefore should not be used for acceleration.

There were many correct solutions to part (a) from candidates who were less confident and used the space around their diagram to check the order of their terms and the expected cancelling. It was pleasing to see that their efforts revising, combined with good exam technique, led to a well-presented solution in the main body of the page.

Candidates are advised to check that their equation of motion has all required terms, has tensions at a general position and is dimensionally correct. The most costly method errors stemmed from incorrect extensions in Hooke's Law such as ($0.5L$), which gives a constant tension, or $\left(0.5 - x\right)$ which is not dimensionally correct.

Part (b) was the most successful, demonstrating confident recall of SHM formulae. Even those who struggled in part (a) were able to earn all 3 marks in part (b) as they worked backwards from the given period, to find ω and then combined it correctly with $0.5L$ to find the maximum speed.

Those who attempted part (c) were usually able to earn the first 2 marks by recalling and substituting into relevant SHM formulae. The most popular approach used $v^2 = \omega^2\left(a^2 - x^2\right)$ to find x and then $x = \pm a\cos\omega t$ or $x = \pm a\sin\omega t$ to find a relevant time. Whilst some candidates found multiple values for t and then sought to combine them, the most successful usually found one value for t and considered its significance before giving the required time.

Despite the level of challenge in this question, it was pleasing to see many well-presented and efficient solutions.

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