Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2025

Pearson Edexcel International Advanced Level
In Mechanics M2 (WME02) Paper 01A

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General

The majority of candidates were able to attempt all questions with question 1 proving to be the most accessible and a good introduction to this paper. The degree of challenge did increase throughout the paper with question 5 proving to be particularly challenging. There were many very good scripts which were well presented displaying well-structured and clear arguments. However, there were scripts which were almost illegible making it very hard for examiners to follow and then 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 2(a), 6(a) and 7(a) 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

This proved to be a very good introductory question for this paper with good access to all three parts.

In part (a), the vast majority of candidates successfully differentiated the expression for x to form an expression for their velocity and then went onto clearly substitute t=2 to obtain zero. An alternative successful approach was to equate their expression for v to zero and then to solve for t, listing all solutions of t and then highlighting the required solution of t=2. Very few errors were noted in this part, but these were mainly careless arithmetic ones.

In part (b), candidates who recognised that there would be a change in the direction of motion at t=2, were very successful. These candidates found the distance travelled in the first two seconds and added this to the magnitude of the change in positions at t=2 and t=3. Occasional unchecked arithmetical errors did cost a few the last mark. For those who did not realise the importance of the motion changing direction at t=2 lead to a zero score in this section. Other errors including trying to employ *suvat* equations.

In part (c), nearly all candidates differentiated their v expression correctly to obtain an expression for the acceleration. A substitution of t=1.5, then occurred achieving the value of (-27). Many stopped at this point, not realising that the magnitude of the acceleration was required to get to 27.

Question 2

In part (a), most candidates decided to take moments about the line *AD* and were successful here. This required candidates to realise that the centre of mass of a uniform, semicircular lamina from its diameter is $\left(\frac{4a}{3\pi}\right)$. The formula is available in the Formula booklet. Most candidates split the shape into 3 sections, although some combined the' rectangle and removed semicircle'. A moments equation was formed, and with careful use of algebra the required form of the answer was achieved. Marks were lot when algebra was carelessly applied and when incorrect areas of semicircles and when the distance of the attached semicircle was applied. A few used the correct formula but used degrees.

Part (b) proved more challenging than the first part. Successful candidates formed two equations using moments and/or vertical resolution. Candidates then carefully solved these equations to reach the expected exact value of k. Many candidates formed only one of these equations. An alternative valid solution involved combining the W and kW masses into a single mass W+kW at position $\frac{\bar{x}}{k+1}$ and then forming a moments equation and solving for k.

It was noticeable that errors in algebraic manipulation were frequent.

Some candidates failed to plan carefully and tried to find the position of the centre of mass from *AB* which was not required.

Question 3

In part (a), the vast majority of candidates were successful. Most took a one stage *suvat* approach using $v^2 = u^2 + 2as$ achieving the maximum height as 10m. Others produced a complete method in two stages, calculating time to top of trajectory with another *suvat* equation to get to 10m. Error were mainly due to incorrect signs or the use of an incorrect value of *g* such as 9.81 m s^{-2} rather than 9.8 m s^{-2} .

In part (b), most candidates found the vertical component of *v* at t=2.4. Successful candidates then applied Pythagoras to find the speed to 2 or 3 sf. But there were many scripts where the Pythagoras part was not attempted.

Part (c) was well answered with most applying most direct method involved using $s = ut + \frac{1}{2}at^2$ to find the time to a height of 3m followed by horizontally multiplying this time by 8 to find the distance *A*. Other successful methods included finding the time to the top of trajectory, followed by finding the time to drop 7m to a height of three. These two times were then added to find total time for this motion. Common errors included using incorrect signs, miscalculating the height of the drop and some thinking that the total time was twice the time to the top. Other correct methods using the equation of the trajectory and Energy methods were also seen.

Question 4

In part (a), almost all candidates scored full marks after applying the two stages of firstly, Newton's second Law, and secondly, the Power formula. Errors were few and included sign and extra weight term in $F=ma$ or an extra *g* in $F=ma$

In part (b), the vast majority of candidates realised that an energy equation involving Kinetic Energy, work done against the resistance and a change in Potential Energy was required. Most candidates produced a correct term for Kinetic Energy when v=8 or 5 for one mark and showed that the work done against resistance was 250×30 for the second mark. Most candidates then formed an energy equation involving the four required parts and occasionally made a sign error. If one of the four parts was omitted, then no marks were awarded for the Energy equation. Successful candidates formed the correct equation and found the change in vertical height as

13m or 12.9m to 2 or 3 sf. A strange error was for candidates to write the change in KE as $\frac{1}{2} \times 70 \times 3^2$ instead of $\frac{1}{2}\times 70\times 8^2 - \frac{1}{2}\times 70\times 5^2$. This led to the loss of 4 out of 5 marks.

In part (c), the cyclist is now described as traveling up a hill at a constant speed. Many candidates realised that there would be no change in Kinetic Energy. An Energy equation was formed with terms for change in Potential Energy and the work done against t. he resistance. The majority of candidates formed the correct equation and reached a value but failed to round their final answer to 2 or 3 sf as 18000(J). Other errors included the omission of 200.

Question 5

This was probably the most challenging of the questions on this paper with many candidates only being rewarded with 2 or 3 marks out of 8. There were some fully correct solutions, but these were in the minority. There were various methods of solution.

The most direct method was to form an expression for the velocity after the Impulse had been applied, using the fact that the velocity had been deflected through 45°, as either $\mathbf{v} = (v\cos 45°)\mathbf{i} \pm (v\sin 45°)\mathbf{j}$ or $\mathbf{v} = \lambda\mathbf{i} \pm \lambda\mathbf{j}$. But many solutions only dealt with one of these either + or −, thereby losing one of the first two marks. Candidates that sketched out a small diagram seemed to appreciate better how the two different velocities related to each other.

The next stage was for candidates to apply the Impulse-Momentum formula for two marks. This was the only successful part for most candidates. The third stage for successful candidates was to apply Pythagoras with the two components of the Impulse and equate to the given magnitude of the Impulse. The equation needed to be in one unknown. This proved a challenge for many. The remaining marks were for the two answers.

An alternative approach was to work with the Impulse ($a\mathbf{i}+b\mathbf{j}$) in this case the initial **v** needed to be found and then Pythagoras in one unknown, say *a* became $a^2 + (a+3)^2 = \frac{9}{2}$.

Many candidates found it hard to make a meaningful start apart from using $\boldsymbol{I}=m\mathbf{v}-m\mathbf{u}$.

A common error was to use ($a\mathbf{i}+b\mathbf{j}$) as a velocity.

Question 6

In part (a), many candidates achieved full marks. Successful candidates formed a moments equation about the point A. with the moment of Tension T either being worked out as $2dT\cos\beta$, where β was angle ABC or $2dT\sin\alpha$,where α is angle ACB. Combing this with the values for the trigonometric functions using the lengths in triangle ABC. Successful candidates were careful to show all stages of working before reaching the given expression for the tension. An alternative solution was for the moment of the tension about A was to work out perpendicular distance from A to the line BC using the perpendicular distance as $0.8d\cos\beta$ or $0.8\sin\alpha$. Common errors were misapplication of the surds in the trigonometric values. Other errors included taking moments about other points and omitting the reaction forces at A.

In part (b), many candidates were able to form two equations of resolution, one vertical and one horizontal, for four marks, but then found it difficult to use these in an equation in k only using $\tan\theta = \frac{1}{8}$.

The final correct value was achieved by a minority of candidates.

Alternative methods included forming two moments equations, one about C and one about D. This is a more direct method but was rarely used.

The components for the Reaction at A were expressed by candidates in a variety of ways e.g. X **and** Y, or $R\cos\theta$ **and** $R\sin\theta$, and sometimes using the $\tan\theta$ value as $R\frac{8}{\sqrt{65}}$ **and** $R\frac{1}{\sqrt{65}}$.

Another successful approach was to use sin rule to a three-force problem of mg, T and reaction R. In the latter stages of this question careless errors over surds and algebra resulted in loss of marks.

Question 7

Throughout this question there were inconsistent sign issues over directions of travel of the particles. Those who used diagrams were more successful in this respect than those who did not use diagrams.

In part (a), most candidates were successful in forming an equation using Conservation of Linear Momentum and another one using Newton's Experimental Law. In the CLM equation the correct pairings of mass and speed were expected for the M mark. Candidates then solved these two equations in stages to arrive at the required form of an expression for the speed of *Q* after he first collision. Common errors included incorrect signs, and some tried to include masses in their NEL equations

In part (b), most were able to gain 2 out of three marks by forming an equation in their *v*, the speed of *P*, *e* and u. Successful candidates then looked at an inequality and found the bounding value of $\frac{2}{3}$ for *e* but were unable to create a fully correct solution. Knowledge that the upper bound of *e* is 1 was rarely shown.

In part (c), the majority of candidates applied the Impulse-momentum principal to form a correct equation, this is a 'show that' question and so stages of working were expected to be seen to earn the final mark. Candidates who went directly to $e = \frac{4}{5}$ could not earn the last mark. Again, algebraic errors were seen in rearranging their expression.

In part (d), the challenge increased and only a minority of candidates gained full marks. Successful candidates found the speed of *P* for one mark

This was followed by candidates applying CLM and NEL to the second collision to form two equations, and the to solve for the speed of *Q* after the second collision. Sign issues and careless algebra caused many to falter at his stage. Finally, a direct comparison of the speeds of *P* and *Q* was required, direction had been implied by their equations, followed by a conclusion that another collision between *P* and *Q* would occur.

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