# Examiners' Report
# Principal Examiner Feedback

## Summer 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 eight of the questions but there were a few blanks for the last part of question 8. It wasn't always clear whether this was due to candidates running out of time or other factors. The paper had a friendly start with the both the first two questions being well answered. Questions 3 and 6 seemed to present the greatest challenge where there were a significant number of zero scores. There were some excellent scripts but there was also a substantial number where the standard of presentation 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(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

In part (a), candidates who chose to use the impulse-momentum equation for $Q$ had the most success and most were able to achieve the required answer. There were a few sign errors and some made mistakes when collecting terms. However, a significant number used conservation of momentum and whilst this was usually correct, they were only able to get $v$ in terms of $k$ and $u$. A surprising number left the answer in this form even when they had found a value for $k$ so ended up with no marks.

In the second part, those who had found an expression for $v$ in terms of $u$ in part (a) mostly used it correctly in either the CLM equation or in the impulse-momentum equation for $P$. A few did part (b) first, using the impulse on $P$, then used their $k$ value in CLM to answer part (a).

## Question 2

In part (a), a common error was to add the two vectors or subtract them the wrong way round and a few even forgot to divide by three. A small minority of students made basic arithmetical errors when subtracting a negative and the A mark was occasionally lost due to leaving the answer in column vector form.

A significant number, in part (b), failed to realise that they needed to 'work backwards' to find the position vector at $t = 0$, and made little progress. Of those that did, some lost the A mark for not putting their answer into the required form and others made arithmetical slips when subtracting a negative.

The final part was a good discriminator and whilst many scored well, a large proportion of candidates achieved no marks in this part as they thought that the bearing was the angle $AOB$. Where students identified **AB** ($-5\mathbf{i} - 12\mathbf{j}$) as the key vector, they usually went on to score some marks. However, having found a relevant angle, some couldn't then go on to find the correct bearing or failed to give the answer to the nearest degree. Some used incorrect answers from part (b) to obtain the position vector of $A$ at $t = 5$ instead of the given $10\mathbf{i} + 4\mathbf{j}$ so lost the last mark. It is also worth noting that those candidates who did appreciate the need to find **AB** often spent time finding a general expression before substituting in $t = 5$ rather than finding the position vector of $B$ and using the given position of $A$ at $t = 5$ to then calculate **AB** (or **BA**) numerically.

**Question 3**

In part (a), the majority of candidates used an appropriate *suvat* method to find the value of $U$, the initial speed of projection. The most direct method was to use $s = ut + \frac{1}{2}at^2$ for the whole motion. A common error was in not taking account of the fact that the particle landed 12 m *below* the starting point leading to inconsistent signs in the equation and an incorrect answer of $U$ =22.6. Since $U$ was defined as a speed (i.e. positive) in the question, it was important that it was used correctly in the equation(s) to gain all the marks. A small but not insignificant number treated the two parts of the motion, up and down, separately forming algebraic equations in the time/displacement to the highest point and then back to the ground, sometimes leading to a quadratic equation in $U$. While these were often correct, candidates should consider that a 3 mark question is unlikely to need this amount of work and there is likely to be a much simpler approach.

In part (b), although most candidates adopted a valid approach to finding the speed with which the particle hit the ground, they sometimes carried forward an incorrect $U$ value to their equation and so only achieved the method mark; it was possible to find the required speed using $s = vt - \frac{1}{2}at^2$ without reference to $U$. The most common methods were to use $v^2 = u^2 + 2as$ or $v = u + at$ for the whole motion and those with a correct part (a) often gained all of the marks here.

Part (c) required a sketch of a speed-time graph for the whole motion. A minority drew a velocity-time graph with many good attempts at a 'V' shape. The first mark also required the second line to be longer than the first reflecting the fact that the speed at which the stone hits the ground must be greater than $U$. Those with incorrect answers for the speeds sometimes had the second line shorter although this was not possible. Most realised that the acceleration was constant throughout and drew lines with gradients of roughly equal magnitude. The second mark was awarded for labelling the graph with the values for speeds from previous working and the given $t$ = 4. Occasionally one was omitted, most likely the $t$ value. A solid vertical line drawn at $t$ = 4 was penalised but it was only seen very rarely.

## Question 4

In part (a), almost all candidates realised that they needed to equate the components, perpendicular to the motion of the barge, of the tensions exerted by the two ropes and reached a correct unsimplified equation in the unknown angle, α. A few candidates confused sin with cos while setting up the equation and some failed to give their final answer to an appropriate degree of accuracy. A small proportion of candidates used either the sine or cosine rule on a vector triangle to tackle this part of the question. Those who did usually scored all marks.

In the second part, most candidates were able to set up a correct unsimplified equation of motion with all relevant terms. The mark scheme enabled any who had obtained an incorrect value for the angle α in (a) to be awarded the accuracy marks.

Common errors were sin/cos confusion and failure to convert to tonnes (although the vast majority of candidates did carry out this conversion successfully). Other errors involved using 800N and 500N with no resolution, including extra terms in their equation of motion (e.g. 15000g) or omitting terms (usually 750N).

Some otherwise correct solutions lost the last accuracy mark for not rounding the final answer correctly to 2 or 3 sf. Many gave the answer as 0.02.

## Question 5

The majority of candidates took moments about *A* and *C*, the two points about which the rod tilted.. Those that chose other points and/or a resolution were rarely successful at solving their equations.

For the first case, most could successfully take moments to gain M1 but a few lost the A1 for incorrect distances or inclusion of *g*.

In the second case there was more confusion with distance than in the first and those who had included *g* in the first case did so again here losing all A marks. 1.5*P* was seen quite frequently despite 1.25*P* appearing on their diagram.

It was striking how difficult a large number of candidates found solving their equations for *d* in terms of *a*. A good number did not manage it; a fair few were able to get there because they switched to decimals; a fair number did stay with fractions and solved correctly.

Some gave $a$ in terms of $d$ rather than $d$ in terms of $a$.

Some candidates who attempted a solution created reaction forces at each of the labelled points and tried to find multiple ways over several pages to solve moments and vertical resolution equations with no luck

**Question 6**

Part (a) was a 'show that' question and all steps in the working needed to be shown. Too often an inadequate amount of working was written, with candidates taking short cuts and losing marks as a result.

However, the 'show that' aspect of the question certainly helped some candidates, by allowing them to make corrections to their solutions. It was pleasing to see these corrections being generally tracked back through previous lines of working allowing the method to be complete. Generally, most candidates scored at least the first 3 marks for showing how friction was calculated with even the least successful candidates able to resolve at right angles to the plane correctly. The equation of motion was done well and sign errors were rare. A good number of candidates were able to complete the question and supply a convincing argument that the deceleration was $\frac{4}{5}g$ , as required.

In part (b), the vast majority were able to find the value of $U$, using $v^2 = u^2 + 2as$, although quite a few left $U$ as a surd, following use of $g = 9.8$, and lost a mark.

Part (c) proved to be more challenging. The main error here was to have the friction acting in the wrong direction. Other common errors were not acknowledging that the acceleration was now zero or having an extra force ($R$) in the equation. A few gave their correct value of $X$ as an exact fraction, following use of $g = 9.8$, and sometimes lost a mark depending on whether they had already been penalised for this type of error earlier in the question.

## Question 7

Part (a) of the question was answered well by the majority of candidates and most scored M1A1. However, some correctly identified the acceleration vector but didn't use Pythagoras to find the magnitude, so scored M0. A score of M1A0 was rare.

Some candidates worked out the acceleration by using two different values for **v**, before applying Pythagoras. A small proportion of candidates used calculus before calculating the magnitude of **a**, usually with good outcomes.

In part (b), most candidates scored both marks here although a few divided by the wrong time. A small number left their answers in column vector form and so lost the A mark.

Most candidates scored full marks in the third part. A few set up a correct unsimplified equation but made a slip, e.g. a sign error, when solving and so ended up with an incorrect value for one component. Only a few gave the answer in column vector form. Some did not appreciate that they needed to use their answer to (b) and work backwards but instead used $t = 0$ in their equation.

Only a small proportion of candidates managed to produce fully correct solution to part (d). Although many wrote expressions for the two velocities they did not collect the **i** and **j** components and tried to solve for $t$ by equating components. However, many did gain the first M mark for simplified equations seen in part (e).

Many failed to appreciate that the question required them to consider the magnitude of the two velocity vectors. Those who did realise that they needed to use Pythagoras usually set up a correct equation and solved it correctly, although those who had made errors in (b) or (c) only gained the M1A1ft.

A small proportion of the candidates who had successfully applied Pythagoras and reached a correct quadratic equation, lost the last accuracy mark because they gave their final answer to 2 or 3 s.f./d.p., rather than in exact form.

Part (e) was generally answered better than (d) and many scored full marks. Those who had incorrect answers to (b) and (c) were usually able to gain the M1A1ft. Some candidates made errors when carrying out the algebraic manipulation and so ended up with an incorrect value, e.g. the coefficient of $T^2$, in their final answer.

**Question 8**

The first few parts of this pulley question were generally done well but full marks were fairly rare for the whole question. It is possible that time was an issue for some but often candidates found the later parts challenging.

(a) Most candidates wrote down a valid equation of motion for $P$ using the given acceleration. The most common mistake was in not putting this acceleration in the same direction as the motion of $P$ (upwards) leading to a sign error. A few seemed uncertain about what constituted an equation of motion and attempted a *suvat* equation or left this part blank; however, such instances were comparatively rare.

Those who wrote down a correct equation of motion for $Q$ in part (b) generally proceeded to find a correct value for $k$. A few adopted a whole system approach to produce an equation of motion. This was acceptable but the requirement to use a combined mass in the '*ma*' term ruled out some attempts.

Part (c) proved more challenging. Although most used the given mass in one of their equations of motion to find the tension, not all realised that the total force acting on the pulley was $2T$. Of those who did, a significant number lost the final mark by giving their answer as 23.52. Following the use of $g = 9.8 \text{ m s}^{-2}$, answers should be rounded to 2 or 3 significant figures (although such 'over-accuracy' is only penalised once per complete question). An answer in terms of $g$ was also acceptable here. Incorrect approaches included just adding the weights, leaving the answer as $T$ or using $\sqrt{T^2 + T^2}$.

Only a minority of candidates achieved all the available marks in part (d). Many recognised that, to find the magnitude of the impulse received by $Q$ as it hits the ground, the speed immediately before impact was required and used an appropriate *suvat* method to find it. However, there was sometimes confusion evident with either the acceleration used as $g$ or somehow including 0.4 (the speed after impact) in the *suvat* equation. Most who attempted to find the impulse knew the correct formula but often did not take account of the change in direction, resulting in a sign error. and occasionally one of the velocities was assumed to be zero. The final answer was required to be positive (magnitude) and to be given to 2 or 3 significant figures following the use of $g = 9.8 \text{ m s}^{-2}$.

Again, not many fully correct solutions were seen to part (e) which required the times for the two stages of the motion to be found and added together. Some candidates had given up by this point but, nevertheless, a fair number were able to find one relevant time. Similarly to part (d), the use of $v = 0.4$ was occasionally seen in one or both of their equations showing a lack of understanding of the situation. Some candidates who failed to find $v = \sqrt{g}$ in part (d) calculated it correctly here. The most common error was to only find the time before *Q* hit the ground and not consider the subsequent motion of *P* freely under gravity. Some candidates recognised that the total time taken was $\frac{v}{a} + \frac{v}{g}$ with $a = \frac{g}{5}$, and so solved the problem very efficiently.

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