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Examiners' Report
October 2025

International Advanced Level in Mechanics M1

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General Comments

The majority of learners were able to attempt all seven questions but there were a few blanks for the last part of question 7; it wasn't always clear whether this was due to learners running out of time or for other reasons. The paper had a friendly start with the modal mark on the first three questions being full marks with almost 40% of learners scoring full marks on question 1 and 31% on question 2. Question 3 produced a large spread of marks but here only 17% scored all of the marks. Question 4 presented by far the toughest challenge while the level of success on the remaining questions were very similar. The best answered, by a small margin, was question 5. There were some excellent scripts but there was also a substantial number where the standard of presentation could be improved amongst learner responses.

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 1(a) and 3(c), then learners 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, learners should show sufficient working to make their methods clear to the examiner and correct answers, without workings shown, learners may not score all, or indeed, any of the marks available.

If a learner runs out of space in which to give their answer than they are advised to use a supplementary sheet, if this is not used then it is crucial for the learners to say whereabouts in the script the extra working is going to be done.

Question 1

Part (a)

Successful learners generally had two approaches. Most took the direct approach and took moments about D and then solved the algebra to reach $x = 2/3$. Others resolved vertically to find the force at C (150 N) and then formed a moments equation about another point to reach the required conclusion. This part was well answered with many learners gaining all three marks. Common errors included using incorrect distances in moments equations, making the force at C equal to 90 N and taking the weight of the beam as $240g$ N rather 240 N.

Part (b)

Part (b) proved to be more challenging than part (a). The most successful learners took moments about D, using the value of x as 2/3 and183 N as the tension at C, to give an equation in W only. Others reached a correct equation in W by resolving forces vertically to find the tension at D (81 N) and then used this value in a moments equation about another point, usually B. Some chose to form two moments equations to find the tension at D and then formed a single equation in W only. Some learners worked correctly using inequalities and then argued that the maximum value was 24. Leaving the answer as an inequality meant that the maximum mark available was three out of four. Common errors included using incorrect distances in moments equations or wrongly assuming that the tensions in the strings were still the values found in part (a). Some learners wrongly made the two tensions equal or used one tension as zero.

Question 2

Part (a)

Part (a) was very well attempted with many gaining 2 or 3 marks. To be successful, learners needed to form an impulse-momentum equation using the $3m$ particle. A significant number attempted use conservation of momentum or impulse-momentum for the $7m$ mass. Both of these were insufficient to solve the problem and gained no credit. Common errors here were to have sign errors or omit some u's in their equations.

Part (b)

To gain full marks in part (b), learners needed to realise that the direction of P's velocity after the collision could be either towards or away from Q. Successful learners then formed two equations in w, using either conservation of momentum or impulse-momentum for the $7m$ mass. Many gained three out of the five available marks here by only considering one of the possibilities for the direction of w. Sign errors were very common and incorrect mass-velocity pairings occurred, including using mu instead of $3mu$. Some learners obtained one answer correctly as 7/12 and assumed wrongly that the other value must be -7/12.

Question 3

Part (a)

Learners realised that they needed to find the sum of the two forces and then apply $\mathbf{F} = m\mathbf{a}$ to give the acceleration in vector form. This part was extremely well answered although a small number subtracted the forces instead of adding them. Some learners went on to find the magnitude of the acceleration but this was not penalised.

Part (b)

Successful learners found the velocity at $t = 3$ using $\mathbf{v} = \mathbf{u} + \mathbf{a}t$ and then applied Pythagoras to find the speed but a significant number lost 2 marks by not proceeding to find the magnitude of their vector. Some learners failed to score any marks in this section as they failed to understand the vector nature of velocity.

Part (c)

Responses to part (c) were well answered with successful learners forming an expression for the sum of the three vectors $(2+b)\mathbf{i}+(5+c)\mathbf{j}$ and then using the direction to form an equation in b and c to proceed to the required expression. Many used $2+b = \lambda$ and $5+c = \lambda$ and then eliminated λ. The common error was to equate $(2+b)\mathbf{i} + (5+c)\mathbf{j}$ to $\mathbf{i} + \mathbf{j}$ and this received no credit.

In the final part, some applied Pythagoras to find the magnitude of the sum of their three forces, $(2+b)\mathbf{i} + (5+c)\mathbf{j}$, and equated it to 200 to give an equation in b and c. This was then used, together with the given result from part (c), to find either b or c. This result then needed interpreting to find the two possible forms of the required force. A popular alternative method was to work with $\lambda(\mathbf{i} + \mathbf{j})$ to get to $\lambda^2 + \lambda^2 = 200$. This led to $\lambda = \pm 10$ and then to the two forms of the required force.

Question 4

Part (a)

Many learners answered very successfully on this question. Most learners took a direct approach using $v^2 = u^2 + 2as$ and then correctly gave the answer to 2 or 3 sf. Others found the time to the top and then used this to find the distance above the starting point. Errors occurred in not giving the final answer to 2 or 3 sf or by

adding 10 to the answer and actually finding the height above the ground. A few learners used $g = 9.81$ rather than 9.8 and lost a mark.

Part (b)

Part (b) proved to be very challenging with few gaining full marks. Most gained one or two out of four, however zero marks was not uncommon. Most learners were able to use $s = ut + \frac{1}{2}at^2$ for one of the particles t seconds after projection. However, few were then able to write down a correct equation for the second particle, using the correct time. Many failed to appreciate that T was given in the question and needed to be used appropriately. An alternative method was to find the position and speed of the first particle at $t = 1$ which then allowed the same time to be used in the equations.

Part (c)

Part (c) was much more accessible than (b). Learners who progressed to this stage generally understood the requirement to use the time found in the previous part to calculate the required velocity and then give a positive answer for the speed.

Question 5

Part (a)

Successful learners resolved forces vertically and horizontally forming two equations. These two equations were then used to form an equation in P only, from which a value for P was found. Common errors included omitting one of the forces in the vertical equation e.g. using $R = 4g$, not giving the final answer to 2 or 3 sf and using $g = 9.81$. A few failed to appreciate that the box was on the point of sliding along the surface and introduced, in error, an acceleration.

Part (b)

Learners needed to realise, in part (b), that the value of P was now 25 and that the box now had an acceleration. Successful learners formed an equation for a vertical resolution and then formed an equation of motion. These equations were then solved and the acceleration was found to 2 or 3 sf. Errors included changing the mass of the particle to $4m$ and making sign errors when solving their equations, particularly when removing brackets.

In some responses, learners used their value from part (a) and added 25 to it to get 46.8. i.e. they increased P **by** 25 instead of increasing it t**o** 25. This was treated as a misread as it did not alter the nature nor intent of the remainder of the question in parts (b) and (c). Learners who made this error but proceeded correctly could score all the remaining marks except for two accuracy marks.

Part (c)

In part (c), successful learners applied a *suvat* method to arrive at the correct value of the speed after travelling 1.5 m. Many learners gained the first method mark but only a correct final answer gained the accuracy mark as well. Some learners wrote down incorrect *suvat* formulae which meant they were using an incorrect method and scored no marks.

Question 6

Part (a)

Learners were required to use gradients or *suvat* methods to arrive at two **positive** answers (i) 3 and (ii) 6. The second answer was often left as negative (-6) which is not the value of the deceleration. Some learners offered incorrect methods involving areas and some learners gave the reciprocal of the expected answer.

Part (b)

There were many correct sketches of the graphs, in part (b), with all the correct labelling. Errors included wrong shaped graphs, omitting one of the labels on the axes and adding solid vertical lines

Part (c)

In part (c), successful learners used the area under the given graph to find the distance travelled in the first 35 seconds. Other successful methods included using *suvat* for each of the three sections of the motion and most learners gained the two marks available here. Errors were mainly made through not checking calculations or forgetting the ½ in an area of a triangle or trapezium method.

Part (d)

Careful reading of part (d) should have led learners to realise that the distance covered by the car (450m) was only for the first 20 seconds of its motion. This proved to be a challenge for many learners. Successful learners needed to find the distance travelled by the car in the first 20 seconds of its motion and the distance travelled by the motorcycle in the first 15 seconds of its motion. This distance could be found using *suvat* or by areas i.e. $\frac{1}{2}A15^2$ or $\frac{1}{2}15V$. The two distances then needed to be equated to form an equation in A only and then solved. Sometimes learners also needed to use $V(60) = 15A$. The most common error here was to use an incorrect distance travelled by car but there were also those that assumed that at the point where the motorcycle catches up with the car, the motorcycle had a speed of 30 ms^{-1}.