Examiners' Report/
Principal Examiner Feedback

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

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General introduction

This paper included some questions that candidates found challenging, but the majority of candidates did offer solutions to all seven questions. The better candidates worked through the questions offering precise and concise solutions that confirmed the breadth and depth of their understanding; they were confident in applying their knowledge in unfamiliar questions. Some candidates confined themselves to answering only things they had seen before. The questions on energy continue to present difficulties, and many candidates did not cope well with the vector format of the projectile question.

The best work is usually accompanied by tidy and clearly annotated diagrams. All candidates should be encouraged to draw diagrams, which usually assist and rarely detract from a solution.

Candidates need to be reminded to take care over the level of accuracy in their final answers; despite comments on this in all recent reports, candidates continue to lose marks through giving final answers to more than 3 significant figures following the use of an approximate value for g. When the answer is given in the question, candidates should be aware that they need to provide full working to demonstrate how they have arrived at the given answer – if essential steps in the working are missing then full marks will not be awarded.

Question 1

(a) The majority of candidates were able to form a correct equation connecting momentum and impulse. Having found the impulse, some candidates did not go on to find the magnitude of the impulse. A minority of candidates started by finding the magnitude of the momentum of P before and after the impulse, and did not score any marks.

(b) There were many correct answers to this part of the question, but some candidates did not look for the correct angle, and some diagrams indicated confusion over the direction of the two velocities and the impulse. Those candidates with clear diagrams were more likely to succeed.

Question 2

(a) Candidates made a confident start to this question, and the acceleration found was usually correct. A small minority of candidates were confused about the relationship between acceleration, velocity and displacement, and started by integrating v to find a.

(b) Most candidates integrated correctly to find an expression for the displacement, but many of these went on to find the displacement from the initial position rather than the distance travelled in the first three seconds. Having been given v in factorised form, they should have realised that P changes direction when $t = 2$ (and when $t = \frac{10}{3}$).

(c) Many candidates tackled this by attempting to find the values of t when P is at O. Some simply stated the cubic equation and then said that it had no solutions for $t > 0$. The question tells them this, so they needed to demonstrate that the equation has no positive roots. The alternative approach of considering the displacement when $t = \frac{10}{3}$ was also popular, but candidates following this route were often unclear in explaining how their work demonstrated that P would never return to O.

Question 3

(a) Most candidates were successful in forming two equations in P and R using the information given in the question, and they went on to solve the pair of simultaneous equations. Some candidates made algebraic slips in this process, but the most common error was to give more than 3 significant figures in the answers.

(b) Some candidates omitted the resistance when forming their equation of motion, and some included a component of the weight of the car, but most were successful in forming a correct equation using their R. Large numbers of candidates left the final answer as a fraction, which is not appropriate following the use of a decimal approximation for g.

Question 4

Some candidates could not see how to approach this question, with a significant proportion scoring no marks. Having been given the answer to part (a), they should have been able to solve part (b), but many offered no attempt.

(a) Most candidates formed a correct equation for the position of the centre of mass of the lamina. Having been given the value of h, they needed to go on to solve the equation in h, or to verify that the given solution fits the equation. Many candidates stated the answer without ever substituting the given value or forming a simplified quadratic in h, and lost marks as a consequence.

(b) A large number of candidates attempted to find F by resolving, and made no useful progress. They need to use moments, and to avoid the need to find the force acting at A they need to take moments about A. Several of these equations did not involve $4F$, indicating confusion (sometimes confirmed by a diagram) about what it meant for AB to be vertical and the force to act horizontally. Correct answers were usually associated with clear diagrams showing W and F acting in the correct directions.

Question 5

(a) The given answer to this part of the question enabled the majority of candidates to score all three marks, but there were several candidates who offered no attempt.

(b) Those candidates who tackled this part of the question by taking moments about C usually obtained a correct expression for the normal reaction. There were also candidates who resolved forces parallel and perpendicular to the ground who completed the question correctly. Resolving forces was a common approach, but many of these candidates made an incorrect assumption about the direction of CD and did not offer any correct equations.

(c) Most of those candidates who had an expression for the normal reaction went on to use it correctly to find the value of the coefficient of friction.

Question 6

(a) The two common approaches to this question were to form an equation connecting the kinetic energy at O and at A, or to equate the potential energy gained to the kinetic energy lost. Candidates who reached a correct equation in v usually went on to solve it correctly. The most common errors in this part of the question were due to confusion between vector and scalar quantities – it was common to see expressions for the kinetic energy in terms of the vectors $\mathbf{i}$ and $\mathbf{j}$. Some candidates ignored the horizontal component of the velocity when attempting to calculate the kinetic energy of the ball at O and at A.

(b) There were several approaches to this part of the question. Some used the symmetry of the trajectory and the speed of the ball at B. Others considered the time to the maximum height, or to reach the ground again, and then used the symmetry. Slightly more complicated, but equally successful was to find the height of A about the ground and form a quadratic equation in T.

Question 7

(a) Most candidates were successful in forming equations using conservation of momentum and the impact law to find the velocities of A and B after their collision. Only a very small number considered the speeds, as requested in the question. Some candidates go directly from their equations to write down solutions for the velocities – they need to be aware that if they show no working then they risk losing all of the marks for that stage.

(b) In order to find the set of values for e, the candidates needed to form two inequalities. The first related to the direction of motion of A, and needed to be set up correctly following the assumption made about direction in part (a). For the second, many candidates assumed that C needed to be moving faster than B, overlooking the fact that they could also be moving with the same speed. It was quite common to see candidates considering only one of the two conditions.

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