Examiners' Report
Principal Examiner Feedback

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Pearson Edexcel International Mathematics
In Mechanics A Level (WME02)

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IAL Mathematics Unit Mechanics 2

Specification WME02/01

General Intoduction

This paper proved to be very straightforward for many students. Most students offered solutions to all eight questions, and the general standard of the work seen was very good.

Clarity of presentation continues to be an issue - some students write down equations without saying what they represent; a little more focus on what they were trying to do might prevent students from writing down dimensionally inconsistent equations. Energy equations often contain a term which is just a force, and distances are often missing in moments equations.

Some students lose marks through inappropriate accuracy in their answers. The rubric to the paper states that students substituting a value for g are expected to use 9.8 (not 9.81), and, as mentioned in previous reports, following the use of an approximate value for g the answer should be given to 2 or 3 significant figures.

When checking their work, students should read the question very carefully to ensure that their response actually answers the question.

Question 1.

Many students scored full marks for this question. The most common reasons for marks to be lost were either arithmetic errors in finding the vector **I**, or not going on to calculate the magnitude of **I**. A small number of students found the sum rather than the difference of the two velocities, and some worked with the change in speed rather than the change in velocity.

Question 2.

Most students recognised the processes they needed to use, and applied them correctly. A small number of students did not read the question carefully enough and used the acceleration found in part (a) in forming the equation of motion in part (b). A significant number of students did not score full marks because they left their final answer as 39.12 kW (which is inappropriate following the use of 9.8 for g).

Question 3.

Part (a) was answered well, with most students applying a valid method of finding the friction, and little evidence of sine/cosine confusion. They then went on to find the work done. The only common error was to over-specify the answer, usually with 4 significant figures.

There were several fully correct answers to part (b), but there were some sign errors in forming the work-energy equation, and some students omitted either the work done or the change in gravitational potential energy.

Question 4.

(a) Those students who attempted to take moments about A usually reached the correct answer, but some did not consider the particle attached to the rod at B. Several students attempted to take moments about other points on the rod, but they usually considered only part of the force acting on the rod at the wall.

(b) Most students formed a correct equation for horizontal resolution of the forces acting on the rod and almost all obtained an answer that followed correctly from their answer to part (a). There was evidence of sine/cosine confusion in some solutions.

(c) Some students stated that the reaction at A was $2mg$, but the majority resolved vertically and formed an equation for the friction. It was common for students to assume that the friction acted upwards, but most eventually realised that μ should be positive. A small number of students were confused between friction and normal reaction, and used the incorrect formula $\mu F = R$ at the end.

Most students resolved horizontally and vertically, but those who resolved parallel and perpendicular to the rod usually reached the correct conclusions.

Question 5.

(a) Most students knew that a moments equation was required, but the solutions were often inaccurate due to problems finding the area of the triangle and the distance of the centre of mass of the triangle from its base. A few students also made errors with the circle. Those students who set out their working in a table before forming an equation made it far easier to award marks for the elements they completed correctly.

Many students simply wrote down a vector equation without saying where their values came from, and never gave a separate equation for the vertical distance; some reached a correct final conclusion, but some never made a correct final statement.

(b) The majority of students found the tangent of a relevant angle and reached a correct answer, but they did not always round this to the nearest degree, as requested in the question.

Question 6.

Many students gave fully correct solutions to this question.

(a) The majority of solutions were fully correct, with just a few arithmetic errors.

(b) Most students found the critical values of *t* correctly and integrated correctly. Although the values of 1 and 2 had already been found, a significant number of students used limits 0 and 1, then 1 and 2, before adding their two values. Most students recognised that the final answer should be positive. A small number of students attempted to use the *suvat* equations, but usually after they had scored the marks for finding the correct values of *t*.

Question 7.

(a) There were many correct solutions. A small number of students used *suvat* equations rather than following the instruction to consider the energy of *P*.

(b) The need to resolve the speed into horizontal and vertical components was appreciated and correctly managed by most. There were some concise solutions, but some students took the longer route of finding the value of *t* to the highest point first and completing this part of the task in two steps rather than one. Some students lost an accuracy mark through premature approximation: they rounded their answer for the height reached above *A* to 3 significant figures before adding the 47.5 leaving them with a final answer of 51.63 which they did not then round to 3 significant figures.

(c) Although similar questions have been asked in the past, a large number of students overlooked the horizontal component of the velocity and stated that the minimum speed was zero.

(d) The students adopted a variety of approaches to this question, with many completing it successfully. Amongst students with a correct strategy, the most common cause of loss of marks was inaccurate working or over-specification of the final answer. A particular problem here was using a rounded value 4.16 as their time so that the required horizontal distance became 49.9 to 3 significant figures. A common error in this part of the question was to use the initial (or, depending on their approach, final) speed without resolving it to find the vertical component of the speed.

Question 8.

(a) The majority of students started this question by considering the conservation of linear momentum and the impact law. Some students - usually those without diagrams - made sign errors in their equations and were not consistent in the signs used in their two equations. There were many correct solutions, possibly because careful reading of the question told students that the speed of *B* should be $\frac{u}{5}(3e-2)$ rather than $\frac{u}{5}(2-3e)$, but some students did use modulus brackets to remove any doubt.

(b) Several students formed appropriate inequalities based on their work from part (a), although there was often incorrect manipulation of these inequalities to arrive at the given answer. Several students tried to answer the question by setting up and solving equations for the second collision, apparently not realising that this was not necessary. The explanation of $e > \frac{2}{3}$ was often omitted in otherwise correct solutions.

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