Examiners' Report
Principal Examiner Feedback

January 2021

Pearson Edexcel International A Level
In Mechanics 2 (WME02)
Paper: WME02/01

January 2021
Publications Code WME02_01_2101_ER

General

The candidates found some questions on this paper very accessible, and other questions proved to be more challenging. Many candidates did offer attempts to answer all eight questions, so the blank responses to questions suggest that some candidates had not prepared all of the topics, rather than that they were short of time.

A significant number of candidates are clearly using the substitution $g = 9.81$ rather than $g = 9.8$. These candidates who do not follow the rubric on the paper risk losing an accuracy mark in each question affected. Similarly, after the use of $g = 9.8$, many candidates lose accuracy marks for giving an over-specified final answer.

When checking their work, candidates should ensure that their response answers the question. It was common for candidates to lose the final mark in Question 4 because they did not give their answer to the nearest degree and to lose two marks in Question 5(b) because they did not find the magnitude of the acceleration.

Candidates should consider the legibility of their response. It is often difficult to distinguish numerals, and some handwriting is so small that it is barely legible, even after magnification.

Report on individual questions

Question 1

This was a familiar topic and, for many, an approachable opening question. Almost all candidates used a vector algebra approach and there were very few attempts using vector triangles. The most common errors were to attempt to use speed in place of velocity in the impulse-momentum equation, or to make statements involving a mixture of vector terms and scalar terms. Several candidates used v in place of $v\mathbf{i}$ and were not able to make any progress.

Question 2

Those candidates who recognised the presence of the right angle triangle $5a$, $12a$, $13a$ and remembered that the centre of mass of the isosceles triangular lamina lies at a point of trisection of the perpendicular from A to BC were often able to score full marks very easily.

However, many candidates constructed quite complicated solutions: some attempted to use $\left(\frac{x_1+x_2+x_3}{3}, \frac{y_1+y_2+y_3}{3}\right)$ which could have provided the required information quite quickly, but was very dependent on the frame of reference they were using for their coordinates. Some used similar triangles, which again could be straightforward or could be made quite complicated. Having located the centre of mass of the triangle, all that was needed was to consider the moments of the forces acting about an axis through A.

Some candidates misunderstood the task and attempted to treat this as a lamina with a particle added at point B.

Question 3

Most candidates showed a good understanding of this topic and a high proportion of responses gained full marks. Some candidates stated the value of R but did not find P. Other common errors were sign errors in the equations of motion and using the acceleration $0.2\,\text{ms}^{-2}$ in the equation for motion up the hill. For a few candidates, the use of a generic force F for different driving forces caused difficulty; the use of F_1 and F_2 would avoid confusion. A small number of candidates formed the two equations but did not appear to know the relationship between power and driving force.

Question 4

The candidates adopted a wide range of approaches to this task. All of the points on the diagram were used as the centre for measuring coordinates, and some candidates selected points off the framework to use as the origin. In many responses the two moments equations were combined, using a vector approach. The majority of candidates adopted a correct method, but there were several slips in locating the centres of mass of the rods. Some candidates preferred to work with five rods. A minority of candidates attempted to split the figure into triangular laminas.
The distances given were in terms of a and the co-ordinates used should therefore also have been expressed in terms of a. A small number of candidates assumed that the three rods had equal masses. Some candidates did not state the axes being used for their moments equations; this created problems for examiners, and there were a minority of attempts to find the angle where it seemed that candidates had forgotten the origin of their original co-ordinate system.
Several candidates lost the final mark because they did not state the answer to the nearest degree.

Question 5

Many candidates scored full marks for this question. Most were confident working in vectors, and they gave concise accurate answers. A small number of candidates attempted to answer parts of the question using *suvat* equations.
(a) Some candidates did not associate the direction of motion with the velocity of the particle - many started by finding the position vector and attempted to use that. Some candidates started by trying to equate the velocity to $\mathbf{i}+\mathbf{j}$ or trying to equate at least one component to 1.
(b) Almost all candidates obtained the correct vector for the acceleration, but some did not go on to find its magnitude.
(c) The small number of errors were usually due to slips in the integration or errors in the arithmetic.

Question 6

The key to solving this problem was often a clearly labelled diagram, easily achieved by annotating the diagram given in the question. Several candidates embarked on the question with no indication of what their forces represented. Some candidates included friction at B, and several candidates used the same name for more than one force.

(a) The standard approach when solving this type of question is to resolve vertically and horizontally and then take moments. In this case, using an axis through A is the most efficient approach. Candidates who attempted to take moments about B often omitted part of the force acting at A. Many of those producing complete accurate solutions lost a mark by leaving the final answer to more than three significant figures when $g = 9.8$ had been used.
Several candidates assumed that the question required only the vertical component of the force acting at A, despite the fact that there were six marks available.

(b) Candidates who had given incomplete solutions to part (a) often gave a fully correct response here. The question asks for a distance from A, so the most efficient approach is to consider moments about A. Those candidates who used moments about B were more likely to omit a term from their equation and often did not go on to find the distance from A.

(c) Many responses related to the ladder being modelled as uniform whereas the question asks about modelling the ladder as a rod. Only a minority of candidates gave the expected answer - that the ladder was rigid / did not bend.

Question 7

(a) For those candidates who followed the instruction to consider energy, this was a straightforward opening to the question. Some omitted the initial kinetic energy term and several gave their final answer to more than three significant figures. Several candidates ignored the instruction and attempted to use the *suvat* equations and received no credit.

There was an error in the information given in the question. Those candidates who followed the expected methods in parts (b) and (c) were not affected. Those candidates who followed alternative routes were all considered individually and given credit for valid methods.
(b) Most candidates appreciated that the minimum speed was associated with the horizontal component of the velocity and obtained the correct answer. The incorrect answer, zero, was the most common error. Several candidates offered no response.
(c) This is always a discriminating task, and there were several blank responses. The most efficient method was to work with the vertical component of the speed, $6\,\text{ms}^{-1}$, but several students were successful in forming a quadratic equation in t using the maximum height. Many candidates misinterpreted the question and gave the time interval for which the speed was less than 10 m s^{-1}.

Question 8

(a) This is a familiar topic, but many candidates lost accuracy marks because they did not take due notice of the information given about the directions of motion of the two particles. A diagram summarising the information given would have been helpful. The speeds of the particles before their first impact can be found by solving two impulse-momentum equations, but several solutions began by writing down the three basic equations and attempting to solve these equations simultaneously, often resulting in a long and unnecessarily complex solution.
After a long period when candidates appeared to understand the impact law, this time there were a number of instances of candidates using the incorrect version: $(\text{speed of approach}) = e \times (\text{speed of separation})$.

(b) This was a familiar scenario and many correct solutions were seen. It was relatively straightforward since the initial motion and speeds are given in the question and many candidates adopted a clearly structured approach. Many of the errors seen could have been avoided by working from a clear diagram.

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom