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Mathematics MM1B

(Specification 6360)

Mechanics 1B

Report on the Examination

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General

The candidates found the paper quite accessible with most questions being attempted by a high proportion of candidates. The early questions were more accessible, with the later questions providing more challenge to differentiate the higher levels of performance.

Question 1

This question was done well by many candidates. There were a few minor slips in part (a). Part (b) was a little more challenging. The most common errors were to omit one force, typically the weight leading to an answer of $160\ \text{N}$, or to make a sign error, for example $800g - T = 800 \times 0.2$ leading to a final answer of $7680\ \text{N}$.

Question 2

Parts (a), (b) and (c) were completed well by the majority of candidates and most of the errors were to be found in part (d). In part (a), some candidates made errors such as omitting arrowheads or using inappropriate labels, such as $4\ \text{kg}$ instead of $4g$. In part (d), although there were many correct answers, the candidates produced a wide range of incorrect answers. Common errors included candidates' dividing either the $30\ \text{N}$ (from the question) or $11.76\ \text{N}$ (the friction) by the mass; other candidates calculated the resultant force and not the acceleration.

Question 3

Part (a) was usually done correctly. Part (b) saw more errors from candidates, with some failing to subtract the 400 from the 2000 and using $2000\ \text{metres}$ in their calculations. A few also simply divided their distance by 18 rather than using a constant acceleration equation. In part (c), many candidates drew a graph with the correct shape, but many did not label the required speeds and times clearly on the axes. In many cases, a scale (for example 4, 8, 12, 16,…) had been put on the axis, rather than just indicating the initial and final speeds. Part (d) was generally done very well, but a few candidates did take the mean of 18 and 32 rather than using the total distance divided by the total time.

Question 4

There were many correct solutions to this question. There were some candidates who were unable to form the required equations, although a few could write down a correct vector equation but could not extract equations from it to find the two unknowns. There were also candidates who wrote down correct equations and made algebraic or arithmetic errors when solving them. In addition, there were a few errors due to incorrect signs.

Question 5

Parts (a), (b) and (c) of this question were done very well. In part (a), almost all candidates used an equation of motion for each particle and there were very few 'single equation' solutions. In part (c), some candidates stated one incorrect assumption, for example one about the peg rather than the string. In part (d), a few candidates took the acceleration to be equal to g rather than the value obtained in the question.

Question 6

This question was more demanding and candidates sometimes confused the horizontal and vertical aspects of the motion, for example by including the 250 horizontal component of velocity in an equation for the vertical motion. However, part (a) was generally done well. In part (b), the confusion between the horizontal and vertical components of the motion was

most apparent, with expressions like $s = 250 \times 4 + \frac{1}{2} \times 9.8 \times 4^2$ being seen. Candidates who took this approach in part (b) then often made little progress in the later parts of the question. Similar problems were evident in part (c) when candidates tried to calculate the vertical component of the velocity. In part (d), some candidates used distances rather than components of the velocity to calculate the angle. In some cases there was a mixture of a velocity and a distance!

Question 7

In part (a), many candidates produced correct answers, but some stopped when they had obtained the velocity and did not go on to find the speed as requested. Part (b) was generally done well, but a few candidates did not give their final answer to the nearest degree. Part (c) was very much more demanding. A significant number of candidates mixed scalar and vector quantities in an attempt to answer the question. Statements like $500 = \frac{1}{2}(0.5\mathbf{i} + 0.375\mathbf{j})t^2$ were quite common and there were some similar ones that also included an initial velocity. The successful candidates used a variety of approaches, which can be seen in the mark scheme. The key difference between those who were successful and those who were not was the ability to connect the scalar distance of 500 to the position vector in a meaningful way.

Question 8

While there were a number of good solutions to this question, there were also a very significant number of weak attempts. In part (a), many candidates could write down either a correct horizontal or vertical equation, but then were unable to derive the required answer correctly. Some could get one equation but not the other. In some cases the equations were confused, for example containing both a and g in the same equation. In part (b), there were again a number of correct solutions. The most common error here was to work on the assumption that P would also be zero. The candidates who answered correctly produced a variety of solutions, which included finding an expression for Q and starting again as if there was only one string.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results statistics page of the AQA Website. UMS conversion calculator www.aqa.org.uk/umsconversion