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General Certificate of Education

Mathematics 6360

MM2B Mechanics 2B

Report on the Examination

2010 examination – January series

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General

The early questions proved to be a pleasing introduction to the paper with most candidates achieving full marks for questions 1, 2 and 3. Unfortunately, candidates found difficulty with questions which required any form of resolving so questions 6 and 7 were often answered badly. A number of answers were given on the question paper to enable candidates to proceed to the next part of a question. Some of these printed answers were arrived at by candidates, despite their working bearing no real relation to the candidates' working.

For example, in question 7, part (a), the working should show;
$\frac{1}{2}mv^2 + mga\cos\theta = \frac{1}{2}mu^2 + mga$ or $\frac{1}{2}mv^2 = \frac{1}{2}mu^2 + mga(1-\cos\theta)$ but all too often $\frac{1}{2}mv^2 + mga\cos\theta = \frac{1}{2}mu^2 + mga(1-\cos\theta)$ was used and this was manipulated into the given result.

Question 1

Most candidates answered this question well, with only a few using Fs or $Fs\sin\theta$ instead of $Fs\cos\theta$.

Question 2

This question was also answered well by most candidates. However, a significant number of candidates ignored the lamina in their solutions. A small number of candidates made arithmetical errors.

Question 3

Many candidates completed this question correctly. A common error occurred in part (a) where some candidates did not show, on their diagram, that the two vertical reactions on the plank were different. Creative algebra by a number of candidates was seen in part (b), particularly in the insertion of 'g' in the final answer.

Question 4

Most candidates showed that they knew the techniques involved in answering this question. In part (a) the majority of students integrated to find the position vector but a common error was to forget the '+ $\boldsymbol{c}$' term and thus to ignore the initial position vector. Candidates generally answered part (b) correctly.

Part (c) was also answered well, although a number forgot to insert the square root in their result, ie $\{(12t^2-12)^2+64\}^{\frac{1}{2}}$, and some wrote $\{(12t^2-12)^2+64\}^{\frac{1}{2}}$ as $\{(12t^2)^2+(12)^2+64\}^{\frac{1}{2}}$.

Candidates who ignored the instruction not to simplify their answer often made serious algebraic errors in their working. These candidates were not penalised in part (c), but inevitably found part (d) more difficult. Often candidates looked at $(12t^2-12)^2+64$ and instead of just writing down $t=1$ or $t=\pm 1$, they equated this magnitude to be zero. Naturally they could not solve the resulting equation.

In part (e) almost all candidates used $F = ma$ but some did not appreciate that it was the magnitude of F that was required.

Question 5

Most candidates started from $F = ma$ and answered part (a) correctly. Others were penalised for ignoring the m term or ignoring the minus sign. There were many good answers to part (b), although some used inventive algebra. The solution to part (c) was usually correct, although candidates often forgot to obtain ± 1, for the square root of v, when they found the square-root of the equation obtained in part (b).

In part (d) candidates who integrated v to find the distance travelled often forgot the $+ d$ term which was required to be shown to be equal to zero.

Those who used integration with limits commonly used $\int_{16}^{1} (4 - 0.1t)^2 \, dt$ forgetting that the integral was with respect to t so that $\int_{0}^{30} (4 - 0.1t)^2 dt$ was required. A considerable number of candidates, in part (d), tried to use equations for motion with constant acceleration.

Question 6

Part (a) was usually answered well. However a significant proportion of candidates did not resolve in part (b) and hence were unable to find θ.

Question 7

In part (a) most candidates used two kinetic energy terms and either one or two potential energy terms. Unfortunately those who used two potential energy terms often started with $\frac{1}{2}mv^2 + mga = \frac{1}{2}mu^2 + mga(1 - \cos\theta)$ instead of $\frac{1}{2}mv^2 + mga\cos\theta = \frac{1}{2}mu^2 + mga$. Naturally all candidates obtained the printed result!

In part (b) candidates appreciated that the reaction between the hemisphere and the particle was zero when the particle left the surface of the hemisphere. Unfortunately relatively few candidates resolved in the correct direction and the required equation of $mg\cos\theta = \frac{mv^2}{a}$ was therefore not found.

Question 8

Most candidates appreciated that they needed to consider kinetic energy, gravitational potential energy and elastic potential energy. However the extension in the cord was not equal to the height dropped by the bungee jumper and this caused difficulty to many candidates.

In part (b) most candidates gave a reasonable explanation why x had to be greater than 22.

In part (c) most candidates knew that $v = 0$ when x had a maximum value, but only the better candidates appreciated that, since x had to be greater than 22, x had to be the larger of their two solutions. This statement was required for full credit to be given.

In part (d) (i) the extension x when the speed is at a maximum was found either by maximising $5v^2$ or by using $T = mg$, and candidates used these two approaches in equal numbers with equal success. Part (d) (ii) was answered well.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the **Results statistics** page of the AQA Website.