GCE
MATHEMATICS

MM2B Mechanics 2 Option B
Report on the Examination

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General

The early questions proved to be a pleasing introduction to the paper with most students achieving good marks for questions 1, 2, 3 and 5.
The differential equation in question 6 part (a) was given on the question paper to enable students to proceed onto the next part. This equation was "obtained" by virtually all students despite some of their working bearing no real relation to the required result.

Question 1

Nearly all students answered this question well.

Question 2

This question was answered successfully by virtually all students.

Question 3

This question was also answered well by the vast majority of students, who showed that they knew the techniques involved in this question. In part (a) the majority of students integrated to find the velocity of the particle but a common error was to forget the + $\mathbf{c}$ term and thus to ignore the initial position vector. Some found the + $\mathbf{c}$ incorrectly, assuming that $\mathbf{c}$ was $6\mathbf{i} - 5e^{-4}\mathbf{j}$ without completing the necessary calculation.
Another common error was seen whereby students did not integrate the e^{-4t} term correctly.
In part (b) a number of students found the initial velocity, $-15\mathbf{i} - 5\mathbf{j}$, but did not find the initial speed.

Question 4

Part (a) of this question was usually answered well. There were many correct solutions to part (b) but a few students tried to use the tensions found in part (a) forgetting that there was now an additional particle at B. A significant number of students did not include g in their calculations involving the particle of mass m kg and hence did not take the moment of a force.

Question 5

This question was answered well by most students. A few students were concerned that the mass of the particle was not given in the question even though the 'm's cancelled in the equation which the students were required to use.

Question 6

Most students answered part (a) correctly but some did not replace their a by $\frac{\mathrm{d}v}{\mathrm{d}t}$. In part (b) students were expected to use $\int\frac{1}{100-v}\mathrm{d}v=-\int\frac{1}{40}\mathrm{d}t$; some incorrectly split $\int\frac{1}{100-v}\mathrm{d}v$ into $\int\frac{1}{100}-\frac{1}{v}\mathrm{d}v$, whilst others incorrectly used $\int(100-v)\mathrm{d}v=-\int\frac{1}{40}\mathrm{d}t$.

A common error was in forgetting the minus sign in the evaluation of $\int\frac{1}{100-v}\mathrm{d}v$. Most students attempted to find the '+ c' term in the solution of the differential equation.

Question 7

Most students knew many of the techniques required to answer this problem. However many of them had not understood the theory behind these techniques. They tried to use specific formulae which could answer similar questions and frequently omitted minus signs. The safest approach was to find the driving force exerted by the engine and then to take away the resistance force, this gave the accelerating force on the train.

Question 8

In part (a) most students considered the kinetic energy at the lowest point and the highest point together with the difference in the potential energy. Unfortunately many forgot that in their kinetic energies, the velocities were $2u$ and $5u$, so the kinetic energies were $\frac{1}{2}m(2u)^2$ and $\frac{1}{2}m(5u)^2$.

Many incorrectly used $\frac{1}{2}m2u^2$ and $\frac{1}{2}m5u^2$, only inserting the brackets when they found that they had obtained an incorrect answer.

In part (b) a significant number of students did not attempt to find the two equations needed, one considering energy and the other considering forces. For those who did attempt to use these two equations, common errors shown were:

in the conservation of energy equation $\frac{1}{2}m(5u)^2=\frac{1}{2}mv^2+mga(1+\cos 60)$ where the 'height difference' was incorrect or where $\frac{1}{2}mu^2$ was used instead of $\frac{1}{2}m(2u)^2$ or $\frac{1}{2}m(5u)^2$ and in the resolving equation $\pm R+=mg\cos 60+\frac{mv^2}{r}$, where the components were often incorrect.

Question 9

This question was designed to discriminate between grades A and A* and it was common for students who scored very well in the rest of the paper to find this question challenging.
Many students were successful in part (a) but some students considered the initial Elastic Potential Energy in the string rather than the initial tension. Part (b) was also completed well by many students although a number forgot the square in their elastic potential energy term.
To solve part (c) of this question, students needed to consider four terms, which were the initial elastic potential energy, the work done by friction, the change in potential energy of particle B and the final elastic potential energy. Many students forgot that the string had a non-zero elastic potential energy when particle B was at rest.
Relatively few students considered the work done by the frictional force which was the friction acting on particle A (31.36N) multiplied by the distance A had moved (0.46m). A few students incorrectly used $v^2 = u^2 + 2as$, ignoring the fact that constant acceleration formulae cannot be used with elastic strings.

Mark Ranges and Award of Grades

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

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UMS conversion calculator www.aqa.org.uk/umsconversion