General Certificate of Education

Mathematics 6360

MM2B Mechanics 2B

Report on the Examination

2010 examination – June series

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General

Candidates found the first few questions a good introduction to the paper, with the majority scoring full marks in questions 1, 2 and 3. Questions 5 to 9 caused problems to many candidates, but large numbers of candidates could complete at least one of these later questions well. Questions involving the resolving of forces caused major problems. In general, algebraic skills were quite good, although unusual problems proved challenging, such as the requirement in question 5 to find v from the equation $v^{\frac{5}{4}} = u^{\frac{5}{4}} - \frac{5}{4}\lambda t$.

Question 1

This question was answered well; a few candidates had difficulty in the differentiation of $3\cos 4t$.

Question 2

Candidates also answered this question well. Virtually all candidates considered energy as required, although, in part (c)(i), some subtracted the initial kinetic energy from the change in potential energy. Others ignored part (c)(i), and only answered part (c)(ii). Most candidates gave an appropriate answer in part (d), stating either that the rock is a particle or that there is no air resistance.

Question 3

In part (a), a number of candidates tried to explain why the centre of mass is on the line AB by discussing uniform laminas; the required answer was based on symmetry. Part (b) was completed well, although a number of candidates when taking moments about B used 6 cm as the distance of the centre of mass of the smaller circular lamina from B, rather than 8 cm. Some candidates considered areas rather than masses, assuming that the two laminas had the same density. On this occasion, this method was condoned.

Question 4

Virtually all candidates answered part (a) correctly. The common problem in part (b) was in the integration of $400\cos\frac{\pi}{2}t$. Apart from this, answers to part (b) were good, and most correctly found $t = 2$ in part (c). The majority of candidates also found correctly that the speed of the particle was 3, with only a few finishing with the velocity of the particle being -3 or $-3\mathbf{i}$.

Question 5

The majority of candidates used $\frac{\mathrm{d}v}{\mathrm{d}t} = -\frac{\lambda}{v^{\frac{1}{4}}}$ and then solved this by using $\int v^{\frac{1}{4}}\mathrm{d}v = \int -\lambda\,\mathrm{d}t$.

Some used $a = \frac{\mathrm{d}v}{\mathrm{d}t}$, together with $v = u + at$, so that $v = u - \frac{\lambda}{v^{\frac{1}{4}}}t$ was often seen.

Many candidates found $\frac{4}{5}v^{\frac{5}{4}} = -\lambda t + \frac{4}{5}u^{\frac{5}{4}}$, but the solution for v was not often found correctly.

A common result was "$v^{\frac{5}{4}} = u^{\frac{5}{4}} - \frac{5}{4}\lambda t \Rightarrow v = u - \left(\frac{5}{4}\lambda t\right)^{\frac{4}{5}}$".

Question 6

In part (a), the majority of candidates showed that the power was $30 \times 48 \times 48$, giving the answer of 69120 W. Part (b) proved more demanding with relatively few candidates finding the accelerating force to be 1728 (the maximum force exerted by the engine) – 1200 (the resistance force). In part (c), many candidates considered the car to be accelerating, rather than being at its maximum possible constant speed with the acceleration hence being zero. A few incorrectly used the gravitational force to be another resistance force rather than noting that the car was travelling down the slope.

Question 7

Many candidates showed an incorrect force diagram in part (a). Often no friction at C was shown, whereas some included friction at A. In the required moment equations, distance or angle considerations were often omitted. Candidates were more successful in part (d), usually gaining follow through marks.

Question 8

In part (a), most candidates attempted to use conservation of energy. Frequently accuracy was lost through truncation or premature rounding. This led to common incorrect answers of 1.4, 1.41 or even $\sqrt{2}$, whereas 1.42 was the required answer. In part (b), most candidates resolved vertically at Q, obtaining $T\cos 15 = mg$. This ignored the transverse acceleration. Hence resolving radially was required, and this produced the correct result of $T = mg\cos 15$.

Question 9

Some candidates assumed that energy needed to be considered. Those who did equate tension to be $m\frac{v^2}{r}$ sometimes found $m\frac{v^2}{r} = \frac{\lambda x}{1.2}$ but then often failed to notice that $r = 1.2 + x$, which reduced their equation to one with only one unknown.

Mark Ranges and Award of Grades

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