Questions matter

A-level

Further Mathematics

7367/3M Paper 3 Mechanics

Report on the Examination

7367
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Version: 1.0

General Comments
The early questions on this paper were found to be accessible by a good proportion of students. Several parts of later questions offered a good level of challenge for students aiming for higher grades.

Question 1
The vast majority of students selected the correct response. The most frequent incorrect response was 8**j**.

Question 2
The vast majority of students selected the correct response. The most frequent incorrect response was 1.8 N s.

Question 3
The vast majority of students selected the correct response. The most frequent incorrect response was $T\cos\theta = mr\omega^2$.

Question 4
This question was done very well by the vast majority of students with many fully correct responses. In part (a), some students found ω first and then the acceleration. A few students used incorrect formulae.

Part (b) was also done well, but some students tried to include the weight of the particle or gave its weight as their answer.

Part (c) was also done well, but some students did not give their final answer as 48 rpm as requested, leaving answers such as 47.7 rpm. Some students were not able to complete their argument, stopping at, for example, 5 rad s^{-1} or 300 rad/ min.

Question 5
This question was generally done well. The main issues were using incorrect dimensions for one of the quantities involved or omitting the dimensions of k. Only a very small number of students used units rather than dimensions and they were able to score the second M1 mark only.

Question 6
There were many good responses to the first few parts of this question, but part (d) proved to be much more demanding.

In part (a), the majority of students found the correct elastic potential energy, but a few used incorrect formulae, such as $\frac{1}{2}ke^2$ or ke, not realising that they had been given the modulus of elasticity, rather than the stiffness.

Part (b) was done well, but a few students tried to use their elastic potential energy from part (a).

Part (c) was also done well, but some students did not realise that they should give their answer correct to two significant figures to match the value of g that they were using. Some also did not state units: whilst the omission of units is often condoned, students should always state them for answers in context. A very small number of students tried to use constant acceleration equations.

Part (d) was much more challenging with many students trying to use energy methods, often to try to find a speed for the particle at *C*. There were a few rare cases where students used energy methods to provide a convincing argument, for example by considering the speed just above and just below *C* or looking at the rate of change of the kinetic energy. Students who considered the forces acting on the particle at *C* found it relatively easy to produce a good argument. Some students used ideas of simple harmonic motion to reach a correct conclusion, by finding the length of the string in the equilibrium position.

Question 7
Students found parts (a)(i) and (a)(ii) the most accessible and a good number of students were able to complete these parts. Students often made errors when resolving, using the wrong trigonometric function consistently, or even forgetting to resolve one or both velocities.

Part (a)(ii) was usually done well by students who had completed part (a)(i) successfully. Some students had found the angle as part of their solution to part (a)(i) and were simply able to state this. Some students who had made no progress in part (a)(i) were able to recall and use the formula $\tan\beta = e\tan\alpha$ to obtain the correct angle.

Part (c), as with many questions about impulse, was found to be more difficult. The main issues were using velocities that had not been resolved or using velocities with incorrect signs. A few students used a vector approach and were often able to obtain the correct impulse from this, but did more work than was necessary.

Part (d) was found to be very challenging with few good solutions. Students were often imprecise, rarely mentioning the components of the impulse parallel and perpendicular to the wall.

Question 8
This question proved to be more challenging, except for part (b), where the vast majority of students gave a correct response.

In part (a) some students formed incorrect integrals, for example as if they were finding the centre of mass of a uniform lamina. Some students did not include π or ρ in their working. Some students obtained $\frac{15}{4}$ but did not then include a conclusion that the position of the centre of mass is independent of k and could not score the final R1 mark.

Part (a)(ii) was generally answered well and some students benefitted from the follow through mark that was available here. However, some students incorrectly stated the value that they had obtained in part (a). A few students used the formula for the height of the centre of mass listed in the formulae booklet.

Part (d) was completed well by some students. A few obtained $\tan\theta = 0.8$ by considering the case of sliding, but far fewer could deal with the condition for toppling. Several students obtained $\tan\theta = \frac{k}{4}$ rather than $\tan\theta = 4k$. Many students did not identify the correct distances to use in their solutions.

Question 9

A single issue dominated attempts at this question. This was not to consider the forces on the sphere at the point *C* and just use an energy approach based on the assumption that the speed of the sphere at *C* was zero. Those students who did consider the forces at *C* usually obtained a complete solution.

Interestingly there were some good answers to part (b) from students who had made little or no progress with part (a). A very large proportion of students identified air resistance as the issue. However, a significant number of these then stated $U^2 < \frac{ag}{2}\left(4 + 3\sqrt{3}\right)$ arguing incorrectly that air resistance would decrease the required initial speed.

Mark Ranges and Award of Grades

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