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Examiners' Report
Principal Examiner Feedback

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General

This paper tested all areas of the specification giving all students the opportunity to demonstrate their knowledge. Most students were able to start most questions and it was clear that there was a good understanding of the basic techniques required, although the complexity of some of the setups (in particular questions 3, 4 and 7) proved to be challenging to the majority of candidates.

Report on Individual Questions

Question 1

Most candidates knew how to approach this question and the majority gained at least 4 marks. However, many candidates did not know how to find ω, and there was confusion between radians per second and revs per minute. It was also not uncommon for there to be confusion between T and ω. Most candidates did know how to use what they thought was ω, to find a minimum value for m, although some had their inequality the wrong way round. Some candidates went straight to an inequality, without considering the frictional force and centripetal force separately.

Question 2

Part (a) was generally answered well, with the majority of candidates able to separate variables and integrate correctly. Ommission of c was very rare and most candidates successfully solved their quadratic and rejected the answer of -2. The most common difficulty arose from simply integrating v with respect to x, rather than separating variables, and this lost all marks in (a).

Part (b) generally proved more of a challenge. Not all candidates knew that they needed to find $v\frac{dv}{dx}$, and when they did, the differentiation often went wrong, with the 4 disappearing. Other common mistakes were to only find acceleration, rather than the force, which lost the final 2 marks.

Question 3

This was the first question to cause candidates significant difficulties, largely due to the problem of correctly finding the angle. Many candidates struggled to get to grips with the geometry of the situation. If the angle was not found, marks were still available for attempted resolution and solving for T. If the angle (or correct trig values) were found, candidates generally managed to successfully find an expression for T.
Part (b) was generally not answered well, with many candidates setting $T \geq 0$, rather than R and losing all marks. If part (a) was correct and $R \geq 0$ used, then the given result was almost always correctly reached.

Question 4

Whilst almost all candidates attempted to form an energy equation with the correct terms, it was very common for a mistake to appear, usually in the distances used in both the work done and GPE terms (often $0.5l + e$, rather than $1.5l + e$). The EPE terms was usually found correctly and trig mistakes were rare. The algebra involved in reaching the given result was fairly complex and the clarity of working was variable, with many candidates often making fairly large jumps towards the given solution. Inevitably, candidates that made a mistake in forming their original equation managed to arrive at the given result. It should be remembered that no credit will be given for this, so if your equation is not yielding the required result, you should go back to the first line and look for the error.

In part (b) most candidates were able to pick up the first mark and most did find a correct friction, often embedded in their equations. However, the majority did not realise the need to form two equations and those that did often ommitted a term, losing the final 3 marks.

Question 5

Part (a) proved straight forward for most candidates and the majority scored full marks. In part (b), most candidates realised that they needed to use energy to find the velocities as the particle passed through the lowest point and most attempted to use restitution correctly for the second velocity. There were, however, frequent mistakes in the resolution, with many forgetting to include weight, using a for the radius instead of $4a$,*or* making a sign error. A very large number of correct solutions gave a final answer of 52/49, rather than the asked for ratio 52 : 49. Whilst this was accepted, it should be noted that the expectation when a ratio is asked for, is for an answer of the form $a : b$.

Question 6

In part (a), proving SHM caused more difficulties than in recent papers, largely due to confusion over the lengths involved, with many candidates using a natural length of 0.8, rather than 0.4, although most did manage to find correct extensions. Almost all candidates used the required $\ddot{x}$ notation and it was rare for candidates to forget to give a concluding statement.

Parts (b) and (c) both proved straightforward, with all marks available as follow through, providing that an SHM equation had been reached in (a). Part (d) caused significantly more difficulty. Many candidates did not realise that they needed to use a displacement of ± 0.1 and this cost them all of the marks. Sin and Cos were used equally, but candidates often struggled to work out the valid approach to complete the problem, with uncertainty over whether they should be using T or T/2, or whether they should be doubling their time.

Question 7

Part (a) was generally answered well. Most candidates did show algebraic integration as instructed. Those who did not lost most of the marks available. It was disappointing that many candidates did not show a clear substitution of limits to reach the given answer. Finding the centre of mass generally caused little difficulty and most candidates did give the answer to the specified 3s.f.

Part (b) was not generally answered well, with few candidates achieving full marks. It was rare for candidates to use the main method on the mark scheme, with the majority instead attempting to consider the hollowed out shape (S_1) and the additional cylinder, often without finding a new centre of mass for S_1. Other common mistakes were to mix up distances from O and distances from B, and to treat M as a mass, and not consider the volumes. Even when a fully correct method was used, candidates that used the rounded answer of 1.58 from (a) lost the final mark due to an inaccurate final answer.

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