FURTHER MATHEMATICS

General Certificate of Education

Summer 2023

Advanced Subsidiary/Advanced

FURTHER MECHANICS A – AS UNIT 3

Overview of the Unit

The attempt rates for all questions indicate that there was sufficient time to complete the paper and it allowed candidates of all abilities to display their knowledge and demonstrate their skills. Many high scoring scripts with exemplar responses were seen. However, this paper appeared to be more challenging than the Summer 2022 paper. Questions 3 and 6 were the most demanding questions on the paper, with facility factors of less than 40.

Comments on individual questions/sections

Q.1 This was the most successful question on the paper and part (a) provided a gentle start to the paper. Therefore, as expected, it was answered successfully by the majority of candidates. In part (b), it was encouraging that almost all candidates correctly identified that the Conservation of Energy was required with three energy forms. However, many candidates did not consider the necessary two instances of elastic energy in their resulting equation.

Q.2 Almost all candidates scored full marks on part (a). In part (b), the most frequent errors were due to incorrect differentiation of $\sin\left(\frac{t}{2}\right)$ and $\cos\left(\frac{t}{2}\right)$. Unfortunately, many candidates arrived at expressions for the velocity of B with trigonometric functions that were not functions of t. For example,

$$\mathbf{v}_B = \frac{3}{2}\cos\left(\frac{1}{2}\right)\mathbf{i} + \frac{3}{2}\sin\left(\frac{1}{2}\right)\mathbf{j}$$

Q.3 A standard question on motion in a horizontal circle. There are no areas to highlight.

Q.4 The response to part (a)(i) was very disappointing, as a large number of candidates did not seem to understand what was initially required. Many candidates chose to begin with calculations for kinetic and potential energy, with some leaving out the term $1440\ \mathrm{kJ}$ completely. A small number of candidates did not identify the k prefix as meaning kilo (Joules). Part (b) saw many fully correct solutions and so there is no area to highlight.

Q.5 Most candidates successfully calculated the required impulse in part (a), but many did not fully answer the question, as a direction was not provided.

In part (b), the use of signposting was much improved this year. Reassuringly, statements such as 'Using Conservation of Momentum' and 'Using Kinetic Energy' were frequently seen. Moreover, candidates seem to be comfortable in dealing with differences in kinetic energy in this style of question.

The most prominent issues were due to sign errors in setting up the kinetic energy equation and/or in the direction of motion of sphere B. Additional sign errors were also seen during algebraic manipulation.

Q.6 Efforts in this vertical circle question were disappointing. Candidates may have found the underlying 'real world' application of the question more challenging than was expected. The main difficulty was dealing with the potential energy in relation to the circular arc AB. Frequent sign errors were seen, resulting in many candidates unable to convincingly arrive at the result provided. The result for v^2 was provided in the question to allow accessibility to (ii), irrespective of earlier efforts. However, many candidates who were unsuccessful in (i), also struggled with the initial setup for Newton's second law in (ii), and hence did not attempt to substitute the v^2 that was provided.