Examiner's Report
Principal Examiner Feedback

Summer 2018

Pearson Edexcel GCE
in Mechanics M5 (6681/01)

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General

The paper proved to be accessible with all students able to answer some parts of all questions and there was no evidence of students running out of time. The standard of the work presented was very good and the best solutions were those that were accompanied by clear and concise explanations, with clearly labelled diagrams.

The most successfully answered question was number 3 but questions 2, 4 and 5 were also very well answered. The last two proved to be the most challenging, especially 6(b) and 7(c). The first question also caused some problems, but nevertheless, 61% of students scored full marks on it.

In calculations the numerical value of g which should be used is 9.8, as advised on the front of the question paper. Final answers should then be given to 2 (or 3) significant figures – more accurate answers will be penalised, including fractions but exact multiples of g are usually accepted.

If there is a printed answer to show then students need to ensure that they show sufficient detail in their working to warrant being awarded all of the marks available.

In all cases, as stated on the front of the question paper, students should show sufficient working to make their methods clear to the examiner and correct answers without working may not score all, or indeed, any of the marks available.

If a student runs out of space in which to give his/her answer than he/she is advised to use a supplementary sheet – if a centre is reluctant to supply extra paper then it is crucial for the student to say whereabouts in the script the extra working is going to be done.

Question 1

Almost all students knew that they had to use a scalar product (or equivalent) in this question. However, a large minority used the whole of the vector equation of the line rather than just the direction vector. Those who correctly used a vector in the direction **i** + 2**j** almost invariably arrived at the correct answer.

Question 2

This question proved to be a good source of marks for most students. **R** and **G** were generally calculated correctly, although a few students calculated **F** x **r** instead of **r** x **F**. Most students then realised that **G** had to be a multiple of **R** and solved simultaneous equations to find the values of a and b.

Question 3

This was another question which was well answered by most students. Some students realised that the equation they were given was already exact, but most divided by $\sec^2\left(\frac{1}{2}t\right)$ and then set out to find an integrating factor. The most common error was to omit the 2 when integrating $\tan\left(\frac{1}{2}t\right)$. A small number of students lost the final mark as they forgot to multiply the constant they had found by $\cos^2\left(\frac{1}{2}t\right)$ when making **r** the subject of the equation.

Question 4

This question was better answered than similar questions in the past. Most students chose to split the lamina into strips parallel to the *y*-axis, although the small number who split it the other way were usually successful. The most common error was in finding the moment of inertia of the strip about the *x*-axis. Some used $\frac{4}{3}$ when they should have used $\frac{1}{3}$, others omitted the constant altogether and some took the distance as x rather than y.

Question 5

The majority of students had learnt how to answer part (a) but they should be aware that they need to show some working between their first line and the answer since they were asked to show the given result.
Part (b) was usually answered successfully but part (c) caused more problems. Some students assumed that the fuel was used at a constant rate. Others did a lot of work to show that $\frac{dv}{dt}$ equalled g, although they had already used this fact in part (b). Another error was to forget that the rocket started from rest.

Question 6

Part (a) was straightforward for most students. Drawing a diagram would have removed some of the errors from part (b). Some students got their angles of 30° and 60° the wrong way round while others thought that they did not know the initial angle between AG and the horizontal. Other errors included the omission of 3 from the mass of the framework, ignoring the fact that the framework started from rest, putting a length in with the forces when using Newton's Second Law and not putting a length in the expressions for the radial and tangential accelerations. Those who found $\ddot{\theta}$ by using $L = I\ddot{\theta}$ had less work to do than those who used an energy equation at a general point and then differentiated it. It didn't matter which way students took for the sign on $\ddot{\theta}$ but they did need to be consistent.

Question 7

Students at this level should be aware that their equation of motion for approximate SHM should have a minus sign in it and so, if necessary, should have adjusted their initial equation in part (a) accordingly. The given answer in part (b) enabled some students to go back and correct their errors in part (a). The use of conservation of energy in parts (b) and (d) were done well, but part (c) was a different matter. Students should have been using “moment of impulse = change in angular momentum”. In practice the distance term in “moment of impulse” was frequently omitted. Another common error was to ignore the fact that the angular speeds before and after striking the peg were in opposite directions.

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