Examiners' Report
Principal Examiner Feedback

Summer 2023

Pearson Edexcel GCE
Further Mathematics (8FM0)
Paper 25 Further Mechanics 1

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General

Overall, the quality of the scripts was good and the paper proved to be very accessible. There was no evidence of time being a limiting factor and candidates were very well prepared.
Question 1 proved to be quite a friendly starter with a significant number able to score full marks and the second one was even more friendly. Of the four questions, question 3 proved to be significantly more challenging than the other three. Some didn't follow the instructions in the question to use conservation of energy in part (a) leading to significant loss of marks.
In calculations the numerical value of g which should be used is 9.8, unless otherwise stated. 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 candidates should show sufficient detail in their working to warrant being awarded all of the marks available and that they ensure that their final answer is EXACTLY the same as the printed answer.
If a question specifies a particular method to be employed, as in parts (a) and (c) of question 3, then in order to receive any credit, candidates must use that method as at least a part of their solution.
In all cases, as stated on the front of the question paper, candidates 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 candidate runs out of space in which to give their answer then they are advised to use a supplementary sheet – if a centre is reluctant to supply extra paper then it is crucial for the candidate to say whereabouts in the script the extra working is going to be done.

Question 1

There were many fully correct responses and in part (a), almost all applied the impulse-momentum principle to P. However, it was common to see a sign error which then often also cost the A marks in (b). Most knew that the answer needed to be positive but some gave a negative value for the speed and lost a mark.
In part (b), most opted to first use CLM to find the speed of Q after the collision but the down side of this was that it involved using their answer to (a) which if wrong, led to the loss of all the A marks in the second part. Those who used the impulse-momentum principle on Q could get (a) wrong but (b) fully correct. Most then applied NEL correctly, with a correct approach speed of $3u$ but many got the wrong answer due to an earlier error.
A minority of candidates tried to solve (b) by substituting an expression for v_Q obtained using NEL into their CLM equation (or vice versa) and then substituting the value of v_P from (a). Some did this successfully to obtain a correct value for e. However, some never actually substituted their v_P so were unable to obtain an answer.

Question 2

In part (a), almost all used $P = \frac{60\,000}{v}$ and then set up a correct equation of motion. Most realised that they need to convert the units, although some left the answer as 40. Most of those who scored full marks found v in m/s as 40 and then converted to km/h at the end. A few used an incorrect conversion factor, so lost the final A mark. Many successfully converted U in km/h to v in m/s at the start and then went on to obtain a correct value for U. A few replaced only one of the v's in their equation by U, so lost an A mark.

Most candidates scored full marks in part (b), although there were a few sign errors in their equation of motion or a missing *g*. A minority omitted the component of the weight, a handful used cos instead of sin and a few used 60,000 instead of $\frac{60000}{v}$ for the driving force.

Question 3

In the first part, most set up a correct equation using conservation of energy, although there were a few with sign errors. Some omitted the ½ *m* x 25^2 term and obtained $U = 7$. A few obtained ¼ $U^2 = 144$ from a correct equation but then went on to divide 144 by 4 instead of multiplying. A substantial number only used $v^2 = u^2 + 2as$ to get $U = 24$, and so scored no marks, since the question had specified the use of conservation of energy. Some used one of the alternative methods by considering the upwards and downwards motion separately and then found the distance from the top to the ground and/or from the point of projection to the top and then used these in an energy conservation equation.
In part (b), candidates who remembered that they had just calculated the initial speed of the stone realised that resistance would need to be overcome and so answered correctly. However, most candidates just considered the slowing effect of the resistance and said that the stone would lose speed so the answer would be less.
In the final part, most scored the first M1. The majority of those who set up a dimensionally correct equation with the correct number of terms did not divide *d* by 100, so lost the last two A marks. Sign errors were also common and quite a few candidates only scored the first M1 as they omitted the PE term from their equation. However, there was a significant number of fully correct answers.

Question 4

Part (a) was well answered with most candidates producing and solving the two simultaneous equations using CLM and NEL. The method of solution of the equations varied, and some found v_P before v_Q , but most ensured they achieved the required expression correctly.
In part (b), some candidates produced a rigorous argument moving from an inequality for *e* to an inequality for v_Q, or vice versa, and hence a conclusion. The majority, however, chose to show that $v_Q = ½u$ when $e = ½$ and then argued therefore that when $e > ½$, $v_Q > ½u$ and hence the conclusion.
In the third part, most candidates realised that finding an expression for the speed of *P* would be of help in determining its direction. Those who found a correct expression and considered the effect of the inequality for *e* did not always remember to consider the initial direction they had used for *P* in part (a) and so incorrectly interpreted their expression. Many candidates are still unable to specify a direction correctly and there was a variety of incorrect vague answers: moving left, west, backwards, away from *Q*, in the negative direction etc with even strong candidates, who achieved full marks in the rest of the question, unable to give a precise answer.
In part (d), many candidates knew what was required and had a correct unsimplified expression but were unable to deal with the algebra. Some candidates worked separately with the KE after the collision, simplified it and then placed it into the expression for the loss. A number did, however, achieve a correct simplified answer.
In the final part, many who had not attempted earlier parts of the question, were able to score the mark. Since part (d) was about calculating the total KE loss, stating that the total KE loss would be 0 should have been the obvious answer, but many, who clearly knew the answer, were unable to express it.

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