Examiners' Report
Principal Examiner Feedback

Summer 2022

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

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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 a very friendly starter with 73% of candidates able to score all 5 marks and 57% scored at least 6 of the 8 marks available on the second question. Of the four questions, question 3 proved to be marginally the most challenging but 32% of candidates were still able to score full marks. Some didn't follow the instructions in the question to use conservation of energy in part (a) and/or to use the work-energy principle in part (b), 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 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, 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 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 candidate to say whereabouts in the script the extra working is going to be done.

Question 1
This question was very well answered with $P = Fv$ being used correctly by nearly all. Many simply wrote down their equation of motion, made their substitutions and solved for R. Others worked their way through each stage, calculating forces as they went. The most common error was to ignore the relevant component of the weight. Incorrect resolutions and omission of g were only seen occasionally.

Question 2
In part (a), the most efficient method for finding e was to use the impulse-momentum principle for each particle to find the speeds after the collision and then substitute these values, with the correct signs into NEL. This was the most common and successful method. Those candidates who obtained expressions for either or both speeds in terms of e often lost their way in the algebra involved, usually due to incorrect multiplying out of brackets. Most candidates wrote down a correct CLM equation, but errors occurred most often in the Impulse-momentum equations, usually in assigning the correct direction to the impulse on the particle. Other errors occurred through a lack of consistency in the use of signs assigned to velocities. A few wrote the NEL equation with $3u$ in the numerator or had $(2u - u)$ in the denominator. In the second part, almost all who obtained $e = 1$ by a correct method went on to gain the final B mark. Most of these stated that the collision was perfectly elastic because $e = 1$ so there was no loss in KE, but a few actually calculated the change in KE, sometimes as a check.

Question 3

In part (a), most candidates scored the first B1 for a correct expression for the change in GPE and then went on to write down a correct equation for the conservation of mechanical energy, which they solved correctly to get $v = 24$. However, some omitted $\frac{1}{2} m \times 25^2$ from their equation or had a sign error, often as a result of having the KE terms the wrong way round. Some found the deceleration and then used a *suvat* equation instead of the work-energy principle and scored nothing. In the second part, most resolved perpendicular to the plane correctly but a few used sin instead of cos and a few omitted g. The majority went on to use $F = 3/5\ R$ and then multiplied their F by 25/6 to find the work done against friction. A few multiplied R by 25/6. A common error was to use F in the work-energy equation which lost the M mark. A few multiplied $mg\sin\alpha$ by 25/6 and then included this in their work-energy equation to get an extra term and so lost the M mark. Some candidates lost the final mark after rounding to 2 d.p. rather than 2 or 3 s.f. after the use of $g = 9.8$

Question 4

In part (a), the given result was successfully proven by almost all of the many candidates who attempted this question. Those who stumbled with initial inconsistent directions in their CLM and NEL equations usually recovered well. The algebra required was not a problem with various substitutions or eliminations handled competently. Most gave a correct verification in part (b) by substituting $e = 0$ and $e = 1$ into the expression for v to find the max and min values. Some rearranged the expression for v to make e the subject and then used $0 \leq e \leq 1$ to set up an inequality. A few stated that $1 \leq e + 1 \leq 2$ and substituted 1 and 2 into their expression for v. In the third part, most solved their CLM and NEL equations simultaneously to find an expression for w. The most common answer was $\frac{2u}{5}(2-3e)$. Some realised that the direction had changed so added a minus sign in front of their answer. A couple added the modulus symbol. Quite a few rewrote their CLM and NEL equations with minus signs for w and so obtained a correct speed for P. Some didn't attempt part (d), but of those that did, the majority scored the first M mark but didn't gain the second M mark because the sign of their speed for P was incorrect. Some of those who gave an answer of $-\frac{2u}{5}(2-3e)$ in part (c) did not include the minus sign in part (d). So most candidates scored M1M0M1A0A0 for part (d). Of those who wrote a correct inequality and solved it correctly to get $e < 7/8$ only a handful realised that they also needed to solve $2u/5(3e - 2) > 0$ or $2u/5(2 - 3e) < 0$ to find the lower bound for e.

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