Pearson Edexcel

Examiners' Report

Principal Examiner Feedback

November 2021

Pearson Edexcel GCE

In AS Further Mathematics (8FM0)

Paper 25 Further Mechanics 1

Edexcel and BTEC Qualifications

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October 2021
Publications Code 8FM0_25_2111_ER

The entry for this paper was small. The majority of candidates offered a response to all four questions, with solutions that were set out clearly. The candidates showed some understanding of the topics examined, but did not always follow the information given or the instructions in the questions. As has been noted in previous papers, accuracy marks were often lost through slips in algebraic manipulation. Some skills were not as well developed as usual – there were several examples of confusion between sine and cosine when resolving.

Question 1.

(a) Most candidates started by resolving the weight of the book. Some stated that they were using $mg\sin\alpha$ rather than $mg\cos\alpha$. A small number of candidates used unnecessarily complicated expressions such as $\cos\left(\tan^{-1}\frac{3}{4}\right)$, sometimes evaluating this using a calculator. It is perfectly acceptable to recognise the 3, 4, 5 triangle and simply write down the trigonometric ratios. Several candidates went beyond the demand of the question and found the maximum friction as part of this solution.

(b) The question clearly states that the work-energy principle should be used, but the majority of candidates used the *suvat* equations for part or all of their solution. Some candidates obtained an answer using the *suvat* equations and then attempted to match this using energy. No candidate obtained the correct answer using the *suvat* equations. The work-energy equations were often incomplete: the maximum friction was not multiplied by the distance to find the work done against friction, or only part of the loss in potential energy was considered. In equations containing the correct terms there were some sign errors.

Question 2.

(a) The majority of the candidates obtained a correct expression for the speed of the particle after the second impact. In a collision between a particle and a wall, it is acceptable to write down the speeds eu and e^2u without showing a detailed explanation of the use of the impact law. To find the total loss of kinetic energy only the initial speed and the final speed need to be considered, but some candidates had an expression involving all three speeds. The candidates understood how to find the kinetic energy, but many answers were incorrect due to the use of the incorrect mass; m was used in place of em.

(b) The candidates were asked to find the value of e for which their expression from part (a) was a maximum. Very few approached this using calculus. If a solution was offered it often involved considering the maximum and minimum possible values for e.

(c) Elements of some responses were correct, but few conveyed the image of continuing motion between the two walls with reducing speed. Some candidates said that the particle would stop, sometimes after the first two impacts.

Question 3.

(a) The majority of candidates attempted to form equations for the motion down and up the two slopes. There were several examples of correct equations for the motion up the second slope. The equation for the motion down the first slope often included a driving force because the candidates did not seem to understand that to "freewheel, without pedalling" meant that there was no driving force. There was evidence of knowledge of the relationship $P = Fv$ but not all candidates understood that power was not simply a force.

(b) Some candidates scored the first two marks here for writing down a correct equation of motion, but there was some confusion between *U* and *V*, and 35 was used in place of 35*V*. This part of the question could not be completed without a correct equation for the motion down the slope from part (a).

Question 4.

(a) Several candidates scored the first four marks here for the correct use of conservation of momentum and correct use of the Newton's Experimental Law. There were some errors in using the mass *em* for *Q*, and some errors in the algebra, but most candidates did obtain the given answer correctly.

(b) Most candidates used their equations to find an expression for the speed of *P*. Some used completion of the square, some split $e^2 - e + 1$ and considered e^2 and $1 - e$. One candidate had the speed of *P* as $\frac{e^3+1}{e+1}u$ and considered the numerator and denominator. The solution needed to apply to all possible values of *e*, so consideration of only $e = 0$ and $e = 1$ scored no marks.

(c) The question gives candidates the speeds of *Q* before and after the impact, so this part can be completed independently of the other two. Those candidates who applied the impulse-momentum principle correctly usually reached the correct answer. To apply the principle correctly, a candidate needs to consider *Q* only or *P* only, not a mixture of the two.