

Please check the examination details below before entering your candidate information			
Candidate surname		Other names	
Pearson Edexcel Level 3 GCE		Centre Number	Candidate Number
Thursday 14 May 2020			
Afternoon		Paper Reference 8FM0/25	
Further Mathematics Advanced Subsidiary Further Mathematics options 25: Further Mechanics 1 (Part of options C, E, H and J)			
You must have: Mathematical Formulae and Statistical Tables (Green), calculator			Total Marks

Candidates may use any calculator allowed by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Unless otherwise indicated, whenever a value of g is required, take $g = 9.8 \text{ m s}^{-2}$ and give your answer to either 2 significant figures or 3 significant figures.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- The total mark for this part of the examination is 40. There are 4 questions.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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1. Two particles P and Q have masses m and $4m$ respectively. The particles are at rest on a smooth horizontal plane. Particle P is given a horizontal impulse, of magnitude I , in the direction PQ . Particle P then collides directly with Q . Immediately after this collision, P is at rest and Q has speed w . The coefficient of restitution between the particles is e .

(a) Find I in terms of m and w .

(2)

(b) Show that $e = \frac{1}{4}$

(1)

(c) Find, in terms of m and w , the total kinetic energy lost in the collision between P and Q .

(2)



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Question 1 continued

Lined area for writing the answer to Question 1.

(Total for Question 1 is 5 marks)



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Question 2 continued

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Question 2 continued

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Question 2 continued

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(Total for Question 2 is 12 marks)



3. Three particles A , B and C are at rest on a smooth horizontal plane. The particles lie along a straight line with B between A and C .

Particle B has mass $4m$ and particle C has mass km , where k is a positive constant. Particle B is projected with speed u along the plane towards C and they collide directly.

The coefficient of restitution between B and C is $\frac{1}{4}$

- (a) Find the range of values of k for which there would be no further collisions.

(8)

The magnitude of the impulse on B in the collision between B and C is $3mu$

- (b) Find the value of k .

(4)



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Question 3 continued

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Question 3 continued

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Question 3 continued

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(Total for Question 3 is 12 marks)



4. A small ball, of mass m , is thrown vertically upwards with speed $\sqrt{8gH}$ from a point O on a smooth horizontal floor. The ball moves towards a smooth horizontal ceiling that is a vertical distance H above O . The coefficient of restitution between the ball and the ceiling is $\frac{1}{2}$

In a model of the motion of the ball, it is assumed that the ball, as it moves up or down, is subject to air resistance of constant magnitude $\frac{1}{2}mg$.

Using this model,

- (a) use the work-energy principle to find, in terms of g and H , the speed of the ball immediately before it strikes the ceiling, (5)
- (b) find, in terms of g and H , the speed of the ball immediately before it strikes the floor at O for the first time. (5)

In a simplified model of the motion of the ball, it is assumed that the ball, as it moves up or down, is subject to no air resistance.

Using this simplified model,

- (c) explain, without any detailed calculation, why the speed of the ball, immediately before it strikes the floor at O for the first time, would still be less than $\sqrt{8gH}$ (1)



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Question 4 continued

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Question 4 continued

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Question 4 continued

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(Total for Question 4 is 11 marks)

TOTAL FOR FURTHER MECHANICS 1 IS 40 MARKS

