Write your name here

Surname	Other names

Pearson Edexcel Level 3 GCE

Centre Number | Candidate Number

Specimen Paper

Paper Reference **8FM0-25**

Further Mathematics

Advanced Subsidiary 25: Further Mechanics 1

You must have:
Mathematical Formulae and Statistical Tables, calculator

Total Marks

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. 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.
- Answers should be given to three significant figures unless otherwise stated.

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.

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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.

Answer ALL questions. Write your answers in the spaces provided.

1. A ball is projected with speed $6\,\text{m s}^{-1}$ up a line of greatest slope of an inclined plane.

The plane is inclined to the horizontal at an angle α, where $\sin\alpha = \frac{1}{7}$

The ball is modelled as a particle, the plane is modelled as being smooth and air resistance is modelled as being negligible. Using the conservation of energy principle, find the speed of the ball at the instant when it has travelled a distance of 5 m up the plane.

(5)

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Question 1 continued

(Total for Question 1 is 5 marks)

2. A particle P of mass m is moving in a straight line on a rough horizontal table. The particle collides with a fixed vertical wall. Immediately before P collides with the wall, P is moving with speed u in a direction that is perpendicular to the wall.

In the collision, P receives an impulse of magnitude $\frac{5mu}{3}$

After the collision, the total resistance to the motion of P is modelled as a constant force of magnitude $\frac{mg}{6}$

(a) Find, in terms of u and g, the distance of P from the wall when P comes to rest.

(7)

(b) State how the model for the total resistance could be refined to make it more realistic.

(1)

Question 2 continued

(Total for Question 2 is 8 marks)

3. A car of mass 500 kg is moving at a speed of $v\,\text{m s}^{-1}$. The total non-gravitational resistance to the motion of the car is modelled as having magnitude $(5v + C)$ newtons, where C is a constant.

The car moves up a straight road which is inclined to the horizontal at an angle θ, where $\sin\theta = \frac{1}{14}$. When the engine of the car is working at a constant rate of 25 kW, the car is moving up the road at a constant speed of $20\,\text{m s}^{-1}$.

(a) Find the value of C.

(5)

With the engine of the car again working at 25 kW, the car now moves along a straight horizontal road at a constant speed of $U\,\text{m s}^{-1}$.

(b) Find the value of U, giving your answer to 2 significant figures.

(6)

Question 3 continued

(Total for Question 3 is 11 marks)

4. A particle P of mass m is at rest on smooth horizontal ground between two fixed parallel vertical walls. Another particle Q of mass m is moving in a straight line along the ground between the walls in a direction which is perpendicular to the walls. Particle Q collides with particle P directly. The coefficient of restitution between the particles is e and the speed of Q immediately before the collision is u.

(a) Show that the speed of P immediately after the collision is $\frac{u}{2}(1 + e)$

(6)

(b) Find the speed of Q immediately after the collision.

(1)

Given that the total kinetic energy lost in the collision between the two particles is $\frac{3mu^2}{16}$

(c) find the value of e.

(5)

Suppose now that the coefficient of restitution between the particles is 1 and that the coefficient of restitution between each particle and each wall is 1

(d) By considering at least two collisions between the particles, describe in detail what happens in the subsequent motion, giving reasons for your answer.

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Question 4 continued

Question 4 continued

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Question 4 continued

Question 4 continued

(Total for Question 4 is 16 marks)

TOTAL FOR PAPER IS 40 MARKS

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