Pearson Edexcel Level 3

GCE Further Mathematics

Advanced Subsidiary

Further Mechanics 2

Specimen paper Time: 50 minutes	Paper Reference(s) 8FM0/26
You must have: **Mathematical Formulae and Statistical Tables, calculator**	

Candidates may use any calculator permitted by Pearson regulations. Calculators must not have the facility for algebraic 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).
- 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.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 3 questions in this section of the paper. The total mark is 40.
- 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.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Unless otherwise indicated, whenever a value of g is required, take $g = 9.8$ 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.

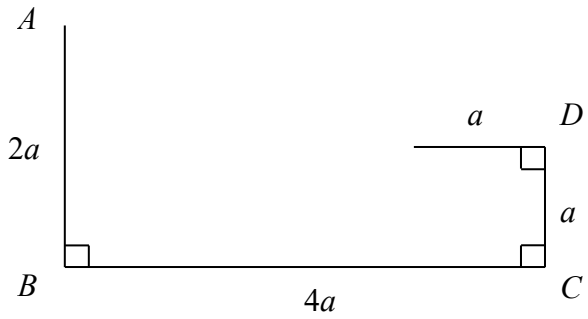

Figure 1

A thin uniform wire of length $8a$ is bent to form the framework $ABCDE$, where $AB = 2a$, $BC = 4a$, $CD = a$ and $DE = a$.

AB is perpendicular to BC, BC is perpendicular to CD and CD is perpendicular to DE, as shown in Figure 1. The points A, B, C, D and E all lie in the same plane.

(a) Find the distance of the centre of mass of the framework from

(i) AB,

(ii) BC.

(7)

(b) Explain how you have used the fact that the wire is uniform in your solutions to part (a).

(1)

The framework is freely pivoted at A and hangs in equilibrium.

(c) Find the size of the angle between AB and the vertical.

(3)

The mass of the framework is M. A particle of mass kM is now attached to the framework at the midpoint of DE. The pivot at A is removed. The loaded framework is now freely pivoted at the midpoint of BC and rests in equilibrium in a vertical plane with BC horizontal.

(d) Find the value of k.

(4)

(Total for Question 1 is 15 marks)

2. A circular race track is banked at an angle α to the horizontal, where $\tan\alpha = \frac{3}{4}$. A car moves round the track at constant speed in a horizontal circle of radius 40 m. The car is modelled as a particle.

In an initial model of the motion of the car it is assumed that there is no sideways friction between the car and the track.

(a) Using this model, find the speed of the car.

(6)

The initial model of the motion of the car is now refined to make it more realistic. It is now assumed that there is sideways friction between the car and the track, with coefficient of friction μ. Under this refined model, the maximum speed at which the car can travel round the track in a horizontal circle of radius 40 m, is 39 m s^{-1}.

(b) Using this refined model, find the value of μ.

(10)

(Total 16 marks)

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3. A car moves in a straight line along a horizontal road. At time t seconds, where $t \geq 0$, the speed of the car is v m s^{-1}.

The acceleration of the car, a m s^{-2}, is modelled by $a = \frac{50}{v} - \frac{v}{8}$.

Given that when $t = 0$, $v = 5$,

(a) find v^2 in terms of t.

(7)

(b) Using your answer to part (a), find the limiting value of the speed of the car as t increases. You must give reasons for your answers.

(2)

(Total 9 marks)

TOTAL FOR PAPER IS 40 MARKS

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