

Write your name here

Surname

Other names

Pearson Edexcel
International
Advanced Level

Centre Number

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Candidate Number

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Mechanics M2

Advanced/Advanced Subsidiary

Monday 23 June 2014 – Morning

Time: 1 hour 30 minutes

Paper Reference

WME02/01

You must have:

Mathematical Formulae and Statistical Tables (Blue)

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). Coloured pencils and highlighter pens must not be used.
- **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.
- Whenever a numerical value of g is required, take $g = 9.8 \text{ m s}^{-2}$, and give your answer to either two significant figures or three significant figures.
- When a calculator is used, the answer should be given to an appropriate degree of accuracy.

Information

- The total mark for this paper is 75.
- 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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The diagram shows a vertical line with points A and C . A line segment AB starts at A and extends upwards and to the right. A line segment CD starts at C and extends upwards and to the right, intersecting AB at point D . The angle between the vertical line and AB at point A is labeled 60° .

A uniform rod AB of weight W is freely hinged at end A to a vertical wall. The rod is supported in equilibrium at an angle of 60° to the wall by a light rigid strut CD . The strut is freely hinged to the rod at the point D and to the wall at the point C , which is vertically below A , as shown in Figure 1. The rod and the strut lie in the same vertical plane, which is perpendicular to the wall. The length of the rod is $4a$ and $AC = AD = 2.5a$.

- (a) Show that the magnitude of the thrust in the strut is $\frac{4\sqrt{3}}{5}W$. (3)
- (b) Find the magnitude of the force acting on the rod at A. (6)



4.

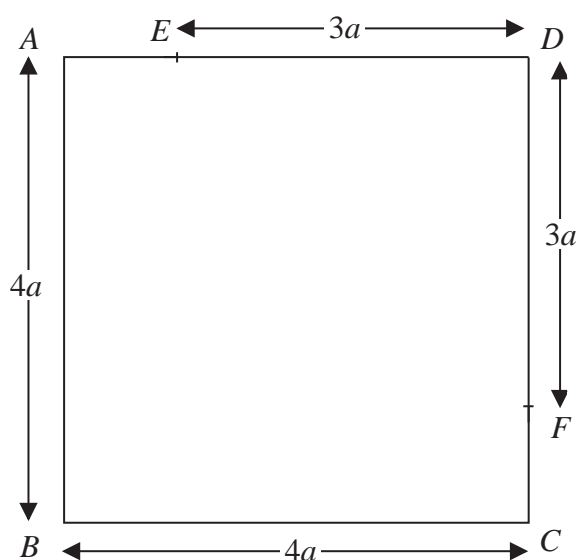


Figure 2

The uniform square lamina $ABCD$ shown in Figure 2 has sides of length $4a$. The points E and F , on DA and DC respectively, are both at a distance $3a$ from D .

The portion DEF of the lamina is folded through 180° about EF to form the folded lamina $ABCFE$ shown in Figure 3 below.

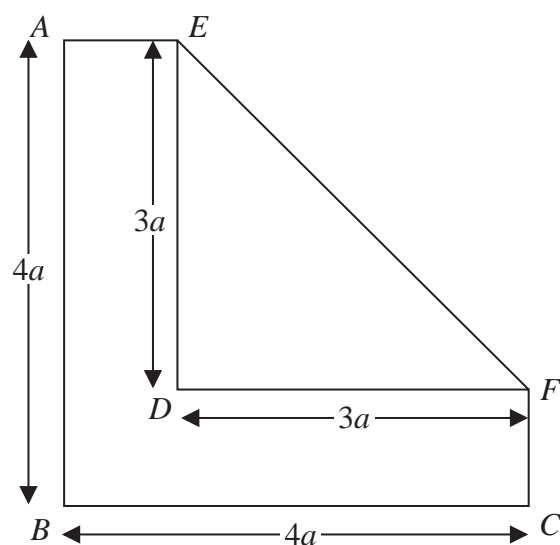


Figure 3

- (a) Show that the distance from AB of the centre of mass of the folded lamina is $\frac{55}{32}a$. (6)

The folded lamina is freely suspended from E and hangs in equilibrium.

- (b) Find the size of the angle between ED and the downward vertical. (4)



[illegible]

- Find

- (7)**

6. Three particles P , Q and R have masses $3m$, km and $7.5m$ respectively. The three particles lie at rest in a straight line on a smooth horizontal table with Q between P and R . Particle P is projected towards Q with speed u and collides directly with Q . The coefficient of restitution between P and Q is $\frac{1}{9}$.

(a) Show that the speed of Q immediately after the collision is $\frac{10u}{3(3+k)}$. (6)

- (b) Find the range of values of k for which the direction of motion of P is reversed as a result of the collision.
- (3)**

Following the collision between P and Q there is a collision between Q and R . Given that $k = 7$ and that Q is brought to rest by the collision with R ,

- (c) find the total kinetic energy lost in the collision between Q and R . (5)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



- (a) By considering energy, find the vertical distance between A and B.

(4)

(b) Find the size of angle α .

(3)

- (c) Find the horizontal distance between A and B.

(7)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

(Total 14 marks)

END