

Please check the examination details below before entering your candidate information

Candidate surname

Other names

Pearson Edexcel
International
Advanced Level

Centre Number

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Candidate Number

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Tuesday 13 October 2020

Afternoon (Time: 1 hour 30 minutes)

Paper Reference **WME03/01**

Mathematics

International Advanced Subsidiary/Advanced Level
Mechanics M3

You must have:

Mathematical Formulae and Statistical Tables (Blue), calculator

Total Marks

Candidates may use any calculator permitted 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.
- 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.

Information

- A booklet 'Mathematical Formulae and Statistical Tables' is provided.
- There are 7 questions in this question paper. 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.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ►

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Question 1 continued

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(Total 6 marks)

Q1



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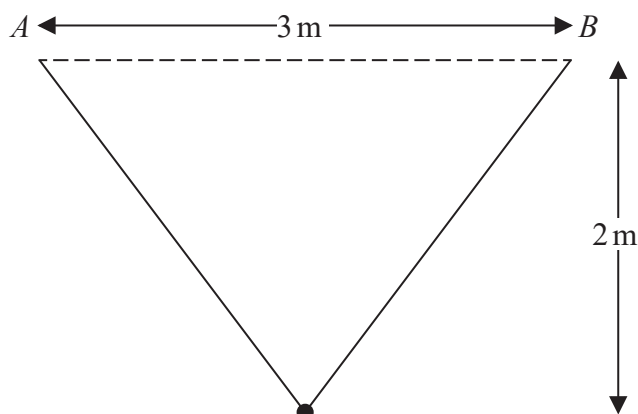


Figure 2

A smooth bead of weight 12 N is threaded onto a light elastic string of natural length 3 m . The points A and B are on a horizontal ceiling, with $AB = 3\text{ m}$. One end of the string is attached to A and the other end of the string is attached to B .

The bead hangs freely in equilibrium, 2 m below the ceiling, as shown in Figure 2.

- (a) Find the tension in the string. (4)

- (b) Show that the modulus of elasticity of the string is 11.25 N. (2)

The bead is now pulled down to a point vertically below its equilibrium position and released from rest.

- (c) Find the elastic energy stored in the string at the instant when the bead is moving at its maximum speed. (2)



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Question 2 continued

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Q2



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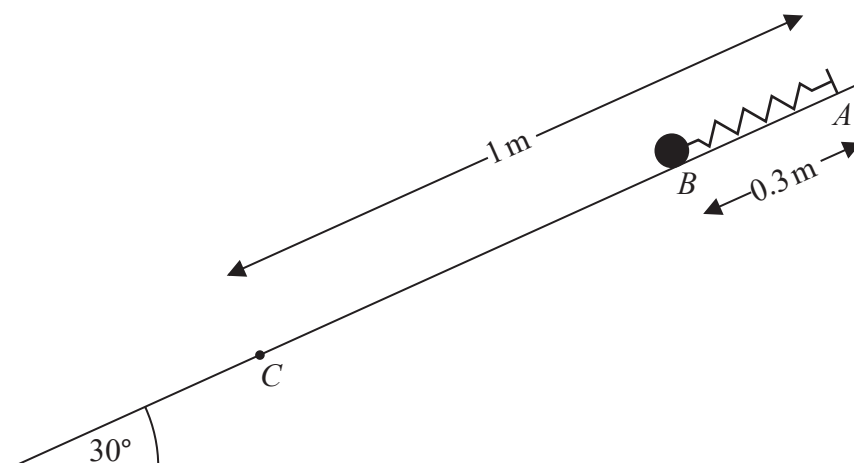


Figure 3

A particle P of mass 2 kg is attached to one end of a light elastic spring, of natural length 0.8 m and modulus of elasticity 12 N . The other end of the spring is attached to a fixed point A on a rough plane. The plane is inclined at 30° to the horizontal. Initially P is held at rest on the plane at the point B , where B is below A , with $AB = 0.3 \text{ m}$ and AB lies along a line of greatest slope of the plane. The point C lies on the plane with $AC = 1 \text{ m}$, as shown in Figure 3.

The coefficient of friction between P and the plane is 0.3

After being released P passes through the point C .

Find the speed of P at the instant it passes through C .

(7)

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Question 4 continued

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(Total 10 marks)



5. A particle P of mass 0.5 kg moves along the positive x -axis in the positive x direction.
At time t seconds, $t \geq 1$, P is x metres from the origin O and is moving with speed $v\text{ m s}^{-1}$.

The resultant force acting on P has magnitude $\frac{2}{x^3}\text{ N}$ and is directed towards O .

When $t = 1$, $x = 1$ and $v = 3$

Show that

(a) $v^2 = \frac{4}{x^2} + 5$ (5)

(b) $t = \frac{a + \sqrt{bx^2 + c}}{d}$, where a , b , c and d are integers to be found. (7)

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Question 5 continued

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Question 5 continued

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- (2)

(6)

(3)

- (4)

Question 6 continued

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Question 6 continued

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Q6	
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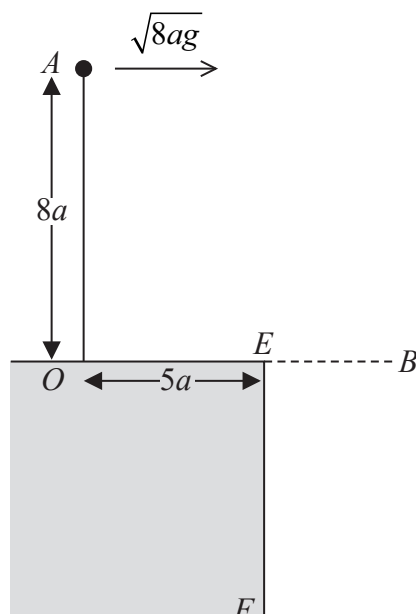


Figure 5

A particle of mass m is attached to one end of a light inextensible string of length $8a$. The other end of the string is fixed to the point O on the smooth horizontal surface of a desk. The point E is on the edge of the desk, where $OE = 5a$ and OE is perpendicular to the edge of the desk. The particle is held at the point A , vertically above O , with the string taut.

The particle is projected horizontally from A with speed $\sqrt{8ag}$ in the direction OE , as shown in Figure 5.

When the particle is above the level of OE the particle is moving in a vertical circle with radius $8a$.

Given that, when the string makes an angle θ with the upward vertical through O , the tension in the string is T ,

(a) show that $T = 3mg(1 - \cos \theta)$ (7)

At the instant when the string is horizontal, the particle passes through the point B .

(b) Find the instantaneous change in the tension in the string as the particle passes through B . (3)

The particle hits the vertical side EF of the desk and rebounds. As a result of the impact, the particle loses one third of the kinetic energy it had immediately before the impact.

In the subsequent motion the string becomes slack when it makes an angle α with the upward vertical through O .

(c) Show that $\cos \alpha = \frac{7}{12}$ (7)

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Q7

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TOTAL FOR PAPER = 75 MARKS

END

