Surname	Other n	ames
Pearson Edexcel GCE	Centre Number	Candidate Number
Mechani Advanced/Advan		
Wednesday 16 May 201 Time: 1 hour 30 minut	•	Paper Reference 6679/01

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 quide 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 ▶





1.	A rough disc is rotating in a horizontal plane with constant angular speed ω about a vertical axis through the centre of the disc. A particle P is placed on the disc at a distance r from the axis. The coefficient of friction between P and the disc is μ .
	Given that <i>P</i> does not slip on the disc, show that
	$\omega \leqslant \sqrt{rac{\mu g}{r}}$
	(5)

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2.	2. A light elastic string has natural length 1.2 m and modulus of elasticity λ newtons. On the string is attached to a fixed point O. A particle of mass 0.5 kg is attached to other end of the string. The particle is moving with constant angular speed ω rad sa horizontal circle with the string stretched. The circle has radius 0.9 m and its central vertically below O. The string is inclined at 60° to the horizontal. Find				
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	(a) the value of λ ,	(7)			
	(b) the value of ω .	(4)			



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Question 2 continued	



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3.	A particle P of mass m moves in a straight line away from the centre of the Earth. The Earth is modelled as a sphere of radius R . When P is at a distance $x, x \ge R$, from the centre of the Earth, the force exerted by the Earth on P is directed towards the centre of
	the Earth and has magnitude $\frac{mgR^2}{x^2}$. When P is at a distance 2R from the surface of the
	Earth, the speed of P is $\sqrt{\frac{gR}{3}}$.
	Assuming that air resistance can be ignored, find the distance of P from the surface of the
	Earth when the speed of P is $2\sqrt{\frac{gR}{3}}$. (7)



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One end of a light elastic string, of modulus of elasticity 2mg and natural length l, is fixed to a point O on a rough plane. The plane is inclined at angle α to the horizontal, where $\sin \alpha = \frac{3}{5}$. The other end of the string is attached to a particle P of mass m which is held at rest on the plane at the point O. The coefficient of friction between P and the plane is $\frac{1}{4}$. The particle is released from rest and slides down the plane, coming to instantaneous rest at the point A, where OA = kl. Given that k > 1, find, to 3 significant figures, the value of k. **(7)**

Question 4 continued



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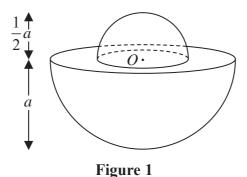
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5. A uniform solid hemisphere has radius r. The centre of the plane face of the hemisphere is O.

(a) Use algebraic integration to show that the distance from O to the centre of mass of the hemisphere is $\frac{3}{8}r$.

[You may assume that the volume of a sphere of radius r is $\frac{4}{3}\pi r^3$] (6)



A solid S is formed by joining a uniform solid hemisphere of radius a to a uniform solid hemisphere of radius $\frac{1}{2}a$. The plane faces of the hemispheres are joined together so that their centres coincide at O, as shown in Figure 1. The mass per unit volume of the smaller hemisphere is k times the mass per unit volume of the larger hemisphere.

(b) Find the distance from O to the centre of mass of S. (5)

When S is placed on a horizontal plane with any point on the curved surface of the larger hemisphere in contact with the plane, S remains in equilibrium.

(c) Find the value of k.



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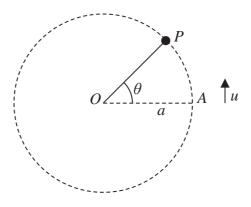


Figure 2

A particle P of mass m is attached to one end of a light inextensible string of length a. The other end of the string is attached to a fixed point O. The particle is held at the point A, where OA = a and OA is horizontal. The particle is projected vertically upwards with speed u, as shown in Figure 2. When the string makes an angle θ with the horizontal through O and the string is still taut, the tension in the string is T.

(a) Show that
$$T = \frac{m}{a} \left(u^2 - 3ag \sin \theta \right)$$
 (8)

The particle moves in complete circles.

(b) Find, in terms of a and g, the minimum value of u.

(2)

Given that the least tension in the string is S and the greatest tension in the string is 4S,

(c) find, in terms of a and g, an expression for u.

(5)	
(3)	



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A particle P of mass 0.5 kg is attached to one end of a light elastic string. The string has natural length l metres and modulus of elasticity 29.4 N. The other end of the string is attached to a fixed point A. The particle hangs freely in equilibrium at the point B, where B is vertically below A and AB = 1.4 m. (a) Show that l = 1.2**(3)** The point C is vertically below A and $AC = 1.8 \,\mathrm{m}$. The particle is pulled down to C and released from rest. (b) Show that, while the string is taut, *P* moves with simple harmonic motion. **(4)** (c) Calculate the speed of P at the instant when the string first becomes slack. **(3)** The particle first comes to instantaneous rest at the point D. (d) Find the time taken by P to return directly from D to C. **(7)**



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		Q7
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	TOTAL FOR PAPER: 75 MARKS	