Hooke's Law

Question Paper 10

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	Hooke's Law
Sub Topic	
Booklet	Question Paper 10

Time Allowed: **60 minutes**

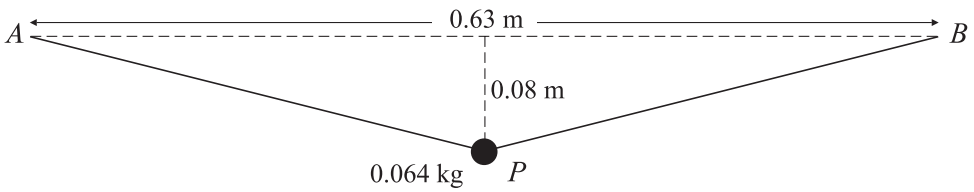
Score: **/50**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1



A light elastic string has natural length 0.6 m and modulus of elasticity λ N. The ends of the string are attached to fixed points A and B, which are at the same horizontal level and 0.63 m apart. A particle P of mass 0.064 kg is attached to the mid-point of the string and hangs in equilibrium at a point 0.08 m below AB (see diagram). Find

(i) the tension in the string, [3]

(ii) the value of λ. [2]

2 A light elastic string has natural length 2 m and modulus of elasticity 0.8 N. One end of the string is attached to a fixed point O of a rough plane which is inclined at an angle α to the horizontal, where $\sin\alpha = \frac{12}{13}$. A particle P of mass 0.052 kg is attached to the other end of the string. The coefficient of friction between the particle and the plane is 0.4. P is released from rest at O.

(i) When P has moved d metres down the plane from O, where $d > 2$, find expressions in terms of d for

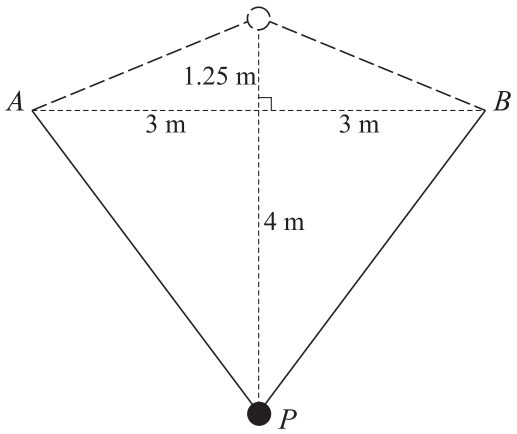
(a) the loss in gravitational potential energy of P, [2]

(b) the gain in elastic potential energy of the string, [2]

(c) the work done by the frictional force acting on P. [2]

(ii) Show that $d^2 - 6d + 4 = 0$ when P is at its lowest point, and hence find the value of d in this case. [3]

3



A particle P of mass 0.2 kg is attached to the mid-point of a light elastic string of natural length 5.5 m and modulus of elasticity λ N. The ends of the string are attached to fixed points A and B which are at the same horizontal level and 6 m apart. P is held at rest at a point 1.25 m vertically above the mid-point of AB and then released. P travels a distance 5.25 m downwards before coming to instantaneous rest (see diagram). By considering the changes in gravitational potential energy and elastic potential energy as P travels downwards, find the value of λ. [8]

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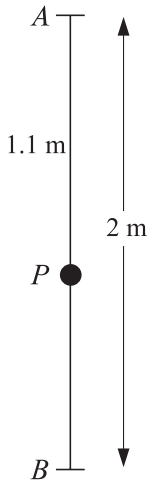

A particle P of mass m kg is attached to the mid-point of a light elastic string of natural length 0.8 m and modulus of elasticity 8 N. One end of the string is attached to a fixed point A and the other end is attached to a fixed point B which is 2 m vertically below A. When the particle is in equilibrium the distance AP is 1.1 m (see diagram). Find the value of m. [4]

5 A particle P of mass 0.4 kg is attached to one end of a light elastic string of natural length 1.5 m and modulus of elasticity 6 N. The other end of the string is attached to a fixed point O on a rough horizontal table. P is released from rest at a point on the table 3.5 m from O. The speed of P at the instant the string becomes slack is $6\,\text{m s}^{-1}$. Find

(i) the work done against friction during the period from the release of P until the string becomes slack, [5]

(ii) the coefficient of friction between P and the table. [2]

6 A light elastic string has natural length 1.5 m and modulus of elasticity 60 N. The string is stretched between two fixed points A and B, which are at the same horizontal level and 2 m apart.

(i) Find the tension in the string. [2]

A particle of weight W N is now attached to the mid-point of the string and the particle is in equilibrium at a point 0.75 m vertically below the mid-point of AB.

(ii) Find the value of W. [4]

7 One end of a light elastic string of natural length 0.4 m and modulus of elasticity 16 N is attached to a fixed point O of a horizontal table. A particle P of mass 0.8 kg is attached to the other end of the string. The particle P is released from rest on the table, at a point which is 0.5 m from O. The coefficient of friction between the particle and the table is 0.2. By considering work and energy, find the speed of P at the instant the string becomes slack. [7]

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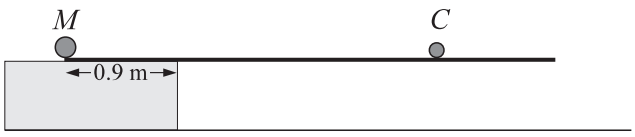

A uniform rigid plank has mass 10 kg and length 4 m. The plank has 0.9 m of its length in contact with a horizontal platform. A man M of mass 75 kg stands on the end of the plank which is in contact with the platform. A child C of mass 25 kg walks on to the overhanging part of the plank (see diagram). Find the distance between the man and the child when the plank is on the point of tilting. [4]