Hooke's Law

Question Paper 6

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	Hooke's Law
Sub Topic	
Booklet	Question Paper 6

Time Allowed: **58 minutes**

Score: **/48**

Percentage: **/100**

Grade Boundaries:

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

1 One end of a light elastic string of natural length 0.5 m and modulus of elasticity 12 N is attached to a fixed point O. The other end of the string is attached to a particle P of mass 0.24 kg. P is projected vertically upwards with speed 3 m s^{-1} from a position 0.8 m vertically below O.

(i) Calculate the speed of the particle when it is moving upwards with zero acceleration. [5]

(ii) Show that the particle moves 0.6 m while it is moving upwards with constant acceleration. [4]

2 The ends of a light elastic string of natural length 0.8 m and modulus of elasticity λ N are attached to fixed points A and B which are 1.2 m apart at the same horizontal level. A particle of mass 0.3 kg is attached to the centre of the string, and released from rest at the mid-point of AB. The particle descends 0.32 m vertically before coming to instantaneous rest.

(i) Calculate λ. [4]

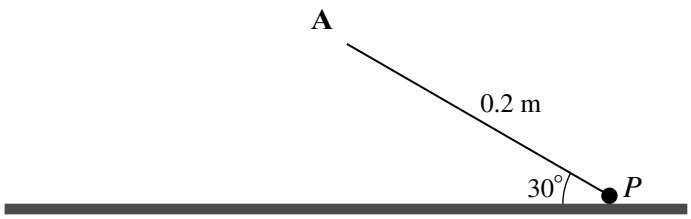
(ii) Calculate the speed of the particle when it is 0.25 m below AB. [4]

3 One end of a light elastic string of natural length 0.3 m and modulus of elasticity 6 N is attached to a fixed point O on a smooth horizontal plane. The other end of the string is attached to a particle P of mass 0.2 kg, which moves on the plane in a circular path with centre O. The angular speed of P is ω rad s^{-1}.

(i) For the case $\omega = 5$, calculate the extension of the string. [4]

(ii) Express the extension of the string in terms of ω, and hence find the set of possible value of ω. [4]

4



One end of a light inextensible string of length 0.2 m is attached to a fixed point A which is above a smooth horizontal surface. A particle P of mass 0.6 kg is attached to the other end of the string. P moves in a circle on the surface with constant speed v m s^{-1}, with the string taut and making an angle of 30° to the horizontal (see diagram).

(i) Given that $v = 1.5$, calculate the magnitude of the force that the surface exerts on P. [4]

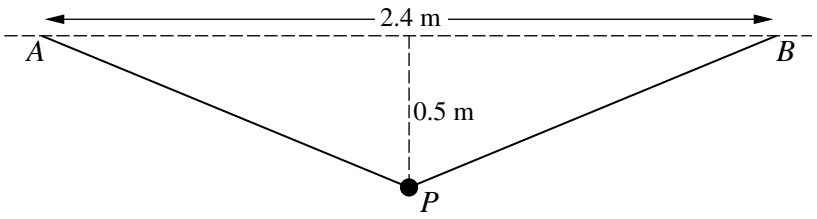
(ii) Given instead that P moves with its greatest possible speed while remaining in contact with the surface, find v. [3]

5 A particle P of mass 0.28 kg is attached to the mid-point of a light elastic string of natural length 4 m. The ends of the string are attached to fixed points A and B which are at the same horizontal level and 4.8 m apart. P is released from rest at the mid-point of AB. In the subsequent motion, the acceleration of P is zero when P is at a distance 0.7 m below AB.

(i) Show that the modulus of elasticity of the string is 20 N. [4]

(ii) Calculate the maximum speed of P. [3]

6



A light elastic string has natural length 2 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 2.4 m apart. A particle P of mass 0.6 kg is attached to the mid-point of the string and hangs in equilibrium at a point 0.5 m below AB (see diagram).

(i) Show that $\lambda = 26$. [4]

P is projected vertically downwards from the equilibrium position, and comes to instantaneous rest at a point 0.9 m below AB.

(ii) Calculate the speed of projection of P. [5]