Hooke's Law

Question Paper 11

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	Hooke's Law
Sub Topic	
Booklet	Question Paper 11

Time Allowed: **48 minutes**

Score: **/40**

Percentage: **/100**

Grade Boundaries:

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

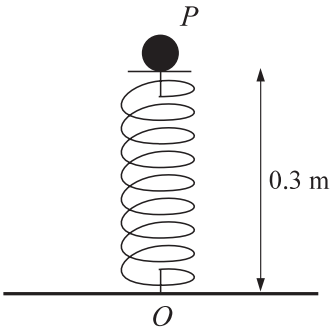
1

One end of a light elastic string of natural length 4 m and modulus of elasticity 200 N is attached to a fixed point A. The other end is attached to the end C of a uniform rod CD of mass 10 kg. One end of another light elastic string, which is identical to the first, is attached to a fixed point B and the other end is attached to D, as shown in the diagram. The distance AB is equal to the length of the rod, and AB is horizontal. The rod is released from rest with C at A and D at B. While the strings are taut, the speed of the rod is v m s^{-1} when the rod is at a distance of $(4 + x)$ m below AB.

(i) Show that $v^2 = 10(8 + 2x - x^2)$. [5]

(ii) Hence find the value of x when the rod is at its lowest point. [2]

2



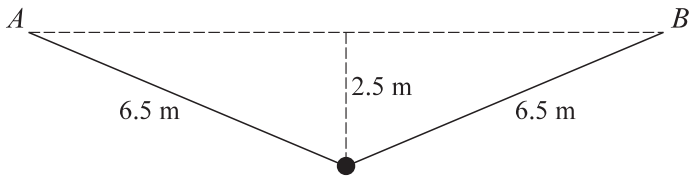
One end of a light elastic spring, of natural length 0.4 m and modulus of elasticity 88 N, is attached to a fixed point O. A particle P of mass 0.2 kg is attached to the other end of the spring and is held, with the spring compressed, at a point 0.3 m vertically above O, as shown in the diagram. P is now released from rest and moves vertically upwards.

(i) Find the initial acceleration of P. [3]

(ii) Find the initial elastic potential energy of the spring. [2]

(iii) Find the speed of P when the distance OP is 0.4 m. [3]

3



A light elastic string has natural length 10 m and modulus of elasticity 130 N. The ends of the string are attached to fixed points A and B, which are at the same horizontal level. A small stone is attached to the mid-point of the string and hangs in equilibrium at a point 2.5 m below AB, as shown in the diagram. With the stone in this position the length of the string is 13 m.

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

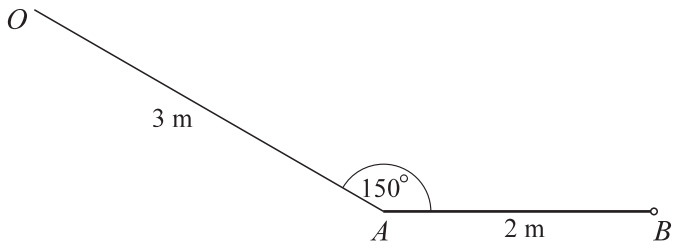
(ii) Show that the mass of the stone is 3 kg. [2]

The stone is now held at rest at a point 8 m vertically below the mid-point of AB.

(iii) Find the elastic potential energy of the string in this position. [3]

(iv) The stone is now released. Find the speed with which it passes through the mid-point of AB. [4]

4



A uniform rod AB, of length 2 m and mass 10 kg, is freely hinged to a fixed point at the end B. A light elastic string, of modulus of elasticity 200 N, has one end attached to the end A of the rod and the other end attached to a fixed point O, which is in the same vertical plane as the rod. The rod is horizontal and in equilibrium, with $OA = 3$ m and angle $OAB = 150^\circ$ (see diagram). Find

(i) the tension in the string, [2]

(ii) the natural length of the string. [3]

5 A light elastic string has natural length 2 m and modulus of elasticity 1.5 N. One end of the string is attached to a fixed point O of a smooth plane which is inclined at 30° to the horizontal. The other end of the string is attached to a particle P of mass 0.075 kg. P is released from rest at O. Find

(i) the distance of P from O when P is at its lowest point, [5]

(ii) the acceleration with which P starts to move up the plane immediately after it has reached its lowest point. [4]