7.

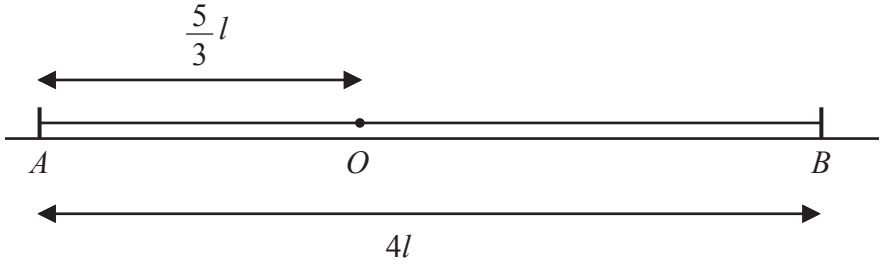


Figure 7

Two points A and B lie on a smooth horizontal table where $AB = 4l$.

A particle P of mass m is attached to one end of a light elastic spring of natural length l and modulus of elasticity $2mg$. The other end of the spring is attached to A. The particle P is also attached to one end of another light elastic spring of natural length l and modulus of elasticity mg. The other end of the spring is attached to B.

The particle P rests in equilibrium on the table at the point O, where $AO = \frac{5}{3}l$, as shown in Figure 7.

The particle P is moved a distance $\frac{1}{2}l$ along the table, from O towards A, and released from rest.

(a) Show that P moves with simple harmonic motion of period T, where

$$T = 2\pi\sqrt{\frac{l}{3g}}$$

(6)

(b) Find, in terms of l and g, the speed of P as it passes through O.

(1)

(c) Find, in terms of g, the maximum acceleration of P.

(1)

(d) Find the exact time, in terms of l and g, from the instant when P is released from rest to the instant when P is first moving with speed $\frac{3}{4}\sqrt{gl}$

(5)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 7 continued

Question 7 continued

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 7 continued

Question 7 continued

(Total for Question 7 is 13 marks)

TOTAL FOR PAPER IS 75 MARKS

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA