7.

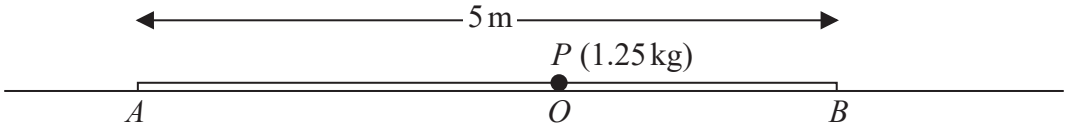


Figure 5

Figure 5 shows two fixed points, A and B, which are 5 m apart on a smooth horizontal floor.

A particle P of mass 1.25 kg is attached to one end of a light elastic string, of natural length 2 m and modulus of elasticity 20 N. The other end of the string is attached to A

A second light elastic string, of natural length 1.2 m and modulus of elasticity λ newtons, has one end attached to P and the other end attached to B

Initially P rests in equilibrium at the point O, where $AO = 3$ m

(a) Show that $\lambda = 15$

(3)

The particle is now projected along the floor towards B

At time t seconds, P is a displacement x metres from O in the direction OB

(b) Show that, while both strings are taut, P moves with simple harmonic motion where $\ddot{x} = -18x$

(4)

The initial speed of P is $10\,\text{m}\,\text{s}^{-1}$

(c) Find the speed of P at the instant when the string PB becomes slack.

(3)

Both strings are taut for T seconds during one complete oscillation.

(d) Find the value of T

(6)

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TOTAL FOR PAPER IS 75 MARKS

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