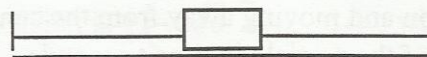
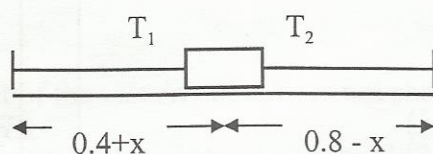


- 6 (b) A particle of mass 0.5 kg at rest on a smooth horizontal table is attached to two points p and q, which are 1.2 m apart, by two light elastic strings. The string attached to p has a natural length 0.4 m and elastic constant 75 N/m. The string attached to q has a natural length 0.6 m and elastic constant 50 N/m.



(i) Find the equilibrium position.

(ii) Prove that if the particle is displaced in the direction pq, through such a distance that neither string goes slack and is then released, it moves with simple harmonic motion.



(i)

$$T_1 = T_2$$

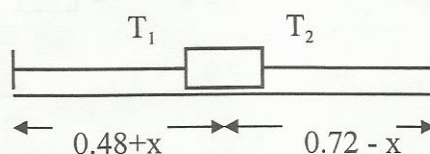
$$k_1(x) = k_2(0.2 - x)$$

$$75x = 50(0.2 - x)$$

$$3x = 0.4 - 2x$$

$$x = 0.08$$

$$\Rightarrow \text{distance} = 0.48 \text{ m from p}$$



(ii) Force in direction of x increasing = $T_2 - T_1$

$$= 50(0.12 - x) - 75(0.08 + x)$$

$$= 6 - 50x - 6 - 75x$$

$$= -125x$$

$$\text{acceleration} = \frac{\text{Force}}{\text{Mass}} = \frac{-125x}{0.5} = -250x$$

$$\Rightarrow \text{S.H.M. about } x = 0 \text{ with } \omega = \sqrt{250}$$