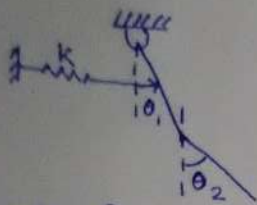


Section-c



$$T_2 = \frac{1}{2} M L^2 \dot{\theta}_1^2 + M L \dot{\theta}_1 \dot{\theta}_2 \cos(\theta_1 - \theta_2) + \frac{1}{6} M L^2 \dot{\theta}_2^2$$

$$d = T - V$$

$$V = \frac{1}{2} k \left(\frac{1}{2} \theta_1\right)^2 + \frac{MgL}{2} (1 - \cos \theta_1) \quad \frac{d}{dt} \frac{\partial L}{\partial \dot{\theta}_1} - \frac{\partial L}{\partial \theta_1} = 0$$

$$+ Mg \left(\frac{3L}{2} - L \cos \theta_1, -\frac{L}{2} \cos \theta_2\right)$$

$$= \frac{1}{2} \frac{kL^2}{4} \theta_1^2 + \frac{MgL}{2} (1 - \cos \theta_1)$$

$$\frac{d}{dt} \frac{\partial L}{\partial \dot{\theta}_2} - \frac{\partial L}{\partial \theta_2} = 0$$

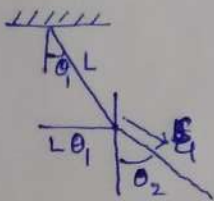
$$+ \frac{MgL}{2} (3 - 2 \cos \theta_1, -\cos \theta_2)$$

100.

$$= \frac{1}{2} \frac{kL^2}{4} \theta_1^2 + \frac{MgL}{2} (4 - 3 \cos \theta_1, -\cos \theta_2)$$

$$T = \frac{1}{2} I \dot{\theta}_1^2 + T_2$$

$$T = \frac{1}{2} \frac{ML^2}{3} \dot{\theta}_1^2 + T_2$$



$$x = L \cos \theta_1 + \xi \sin \theta_2$$

$$y = L \sin \theta_1 + \xi \cos \theta_2$$

$$\dot{x} = -L \sin \theta_1 \dot{\theta}_1 + \xi \cos \theta_2 \dot{\theta}_2$$

$$\dot{y} = L \cos \theta_1 \dot{\theta}_1 - \xi \sin \theta_2 \dot{\theta}_2$$

$$\dot{x}^2 + \dot{y}^2 = L^2 \dot{\theta}_1^2 + \xi^2 \dot{\theta}_2^2$$

$$+ 2L \dot{\theta}_1 \dot{\theta}_2 \cos(\theta_1 - \theta_2)$$

$$dT_2 = \frac{1}{2} dm (\dot{x}^2 + \dot{y}^2)$$

$$T_2 = \int_0^L \frac{1}{2} dm (L^2 \dot{\theta}_1^2 + \xi^2 \dot{\theta}_2^2 + 2L \dot{\theta}_1 \dot{\theta}_2 \cos(\theta_1 - \theta_2))$$

$$= \frac{1}{2} M L^2 \dot{\theta}_1^2 + M L \dot{\theta}_1 \dot{\theta}_2 \cos(\theta_1 - \theta_2)$$

$$+ \int_0^L \frac{1}{2} dm \xi^2 \dot{\theta}_2^2$$

$$\int_0^L \frac{1}{2} \frac{M}{L} \dot{\theta}_2^2 \xi^2 d\xi = \frac{1}{2} \frac{M \dot{\theta}_2^2 L^3}{3L} = \frac{M \dot{\theta}_2^2 L^2}{6}$$