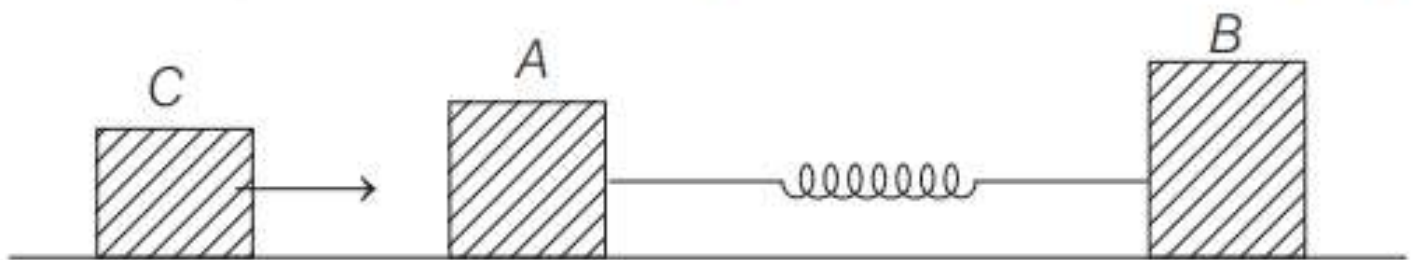
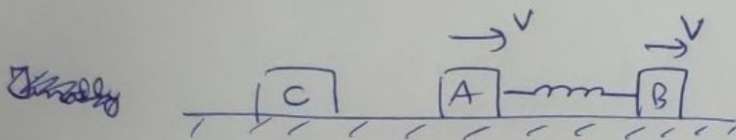
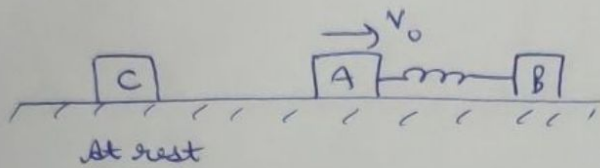
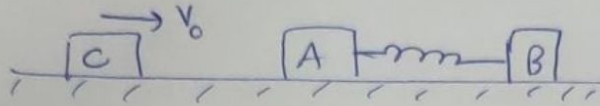


Two bodies A and B of masses m and $2m$ respectively are placed on a smooth floor. They are connected by a spring. A third body C of mass m moves with velocity v_0 along the line joining A and B and collides elastically with A as shown in figure. At a certain instant of time t_0 after collision, it is found that the instantaneous velocities of A and B are the same. Further at this instant the compression of the spring is found to be x_0 . Determine (a) the common velocity of A and B at time t_0 and (b) the spring constant. (1984, 6M)



Solution

- a) Collision between A and C is elastic. ~~Some both~~
As both have same mass, they will exchange their velocities



$$m_A v_0 = (m_A + m_B) v \Rightarrow v = v_0/3$$

$$\begin{pmatrix} m_A = m \\ m_B = 2m \end{pmatrix}$$

- b) from conservation of energy,

$$\frac{1}{2} m_A v_0^2 = \frac{1}{2} (m_A + m_B) v^2 + \frac{1}{2} K x_0^2$$

$$\frac{1}{2} m_A v_0^2 = \frac{1}{2} 3m \left(\frac{v_0}{3}\right)^2 + \frac{1}{2} K x_0^2$$

$$\frac{1}{2} K x_0^2 = \frac{1}{3} m v_0^2$$

$$K = \frac{2m v_0^2}{3 x_0^2}$$