Question

A block of mass m = 0.1kg is connected to a spring of unknown spring constant k. It is compressed to a distance x from its equilibrium position and released from rest.

After approaching half the distance $\left(\frac{x}{2}\right)$ from equilibrium position, it hits another block and comes to rest momentarily, while the other block moves with a velocity $3ms^{-1}$. The total initial energy of the spring is :

A 1.5 J

B 0.8 J

C 0.3 J

D 0.6 J

E 0.7 J

Solution

Correct option is
D)

Apply principle of conservation of momentum and energy

Momentum before collision = Momentum after collision

$0.1u + m \times 0 = 0.1 \times 0 + m \times 3$

$\frac{1}{2} \times 0.1 \times u^2 = \frac{1}{2} \times m \times 3^2$

Solving these two equations, u = 3

$\frac{1}{2}kx^2 = \frac{1}{2}k(\frac{x}{2})^2 + \frac{1}{2} \times 0.1 \times 3^2$

$\frac{3}{4}kx^2 = 0.9$

$\frac{1}{2}kx^2 = 0.6J$