

Answer on Question # 76285, Physics -Mechanics -Relativity:

Question: A block of mass M with a massless spring of force constant k is resting on a horizontal frictionless surface. A block of mass m projected horizontally with a speed u collides and sticks to the spring at the point of maximum compression of the spring. If v is the velocity of the system after mass m sticks to the spring and n is the fraction of the initial kinetic energy of mass m that is stored in the spring then n is?

Solution: For conservation of momentum and conservation of total energy, we have

$$mu = (M + m)v \dots\dots\dots(1)$$

And $\frac{1}{2}mu^2 = \frac{1}{2}(M + m)v^2 + \frac{1}{2}kx^2 \dots\dots\dots(2)$

Dividing equation (2) by equation (1) we get,

$$1 = \frac{(M+m)v^2}{mu^2} + \frac{\frac{1}{2}kx^2}{\frac{1}{2}mu^2}$$

or, $\frac{\frac{1}{2}kx^2}{\frac{1}{2}mu^2} = 1 - \frac{(M+m)v^2}{mu^2} \dots\dots\dots(3)$

Again from equation (1), we get,

$$\frac{v}{u} = \frac{m}{(M+m)} \dots\dots\dots(4)$$

Now from equation (3) and equation (4) we get,

$$\frac{\frac{1}{2}kx^2}{\frac{1}{2}mu^2} = \frac{M}{(M+m)} \dots\dots\dots(5)$$

Answer: $n = \frac{\frac{1}{2}kx^2}{\frac{1}{2}mu^2} = \frac{M}{(M+m)}$

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