

Answer on Question #90738, Physics / Mechanics | Relativity

A 100-g block is initially moving to the right on a horizontal surface at a speed of 2.0 m/s. Shortly, the block compresses a horizontal spring of $k = 70 \text{ N/m}$. If 120 mJ of the mechanical energy is dissipated by friction, the maximum compression of the spring is

Solution:

Mass of the block, $m = 100 \text{ g} = 0.1 \text{ kg}$

Speed of the block, $v = 2.0 \text{ m/s}$

Spring constant of the spring, $k = 70 \text{ N/m}$

Kinetic energy of the block, $K.E = \frac{1}{2}mv^2$

$$K.E = \frac{1}{2} \times 0.1 \times 2^2$$

$$K.E = 0.2 \text{ J}$$

Energy dissipated by friction = 120 mJ = 0.12 J

If x be the maximum compression of the spring, the potential energy stored in the spring is $\frac{1}{2}kx^2$

By conservation of energy

$$\frac{1}{2}kx^2 + 0.12 = \frac{1}{2}mv^2$$

$$\frac{1}{2} \times 70x^2 + 0.12 = 0.2$$

$$35x^2 = 0.08$$

$$x = 0.048 \text{ m}$$

Answer: The spring will compress by 0.048 m.

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