Answer on Question #64086-Physics-Mechanics-Relativity

4. A 200 g mass is attached to a spring of spring constant k. The spring is compressed 15 cm from its equilibrium value. When released the mass reaches a speed of 5 m/s. What is the spring constant (in N/m)?

Solution

From the conservation of energy:

$$\frac{mv^2}{2} = \frac{kx^2}{2}$$

$$k = \frac{mv^2}{x^2} = 0.2\left(\frac{5}{0.15}\right)^2 = 222 \ \frac{N}{m}.$$

5. A 34-g bullet traveling at 120m/s embeds itself in a wooden block on a smooth surface. The block then slides toward a spring and collides with it. The block compresses the spring (k=100 N/m) a maximum of 1.25 cm. Calculate the mass of the block of wood.

Solution

The law of conservation of momentum:

$$mv = (m + M)V$$

$$V = v\frac{m}{m + M}$$

From the conservation of energy:

$$\frac{(m + M)V^2}{2} = \frac{kx^2}{2}$$

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

$$M = \frac{m^2v^2}{kx^2} - m = 0.034\left(\frac{0.034}{100}\left(\frac{120}{0.0125}\right)^2 - 1\right) = 1065 \ kg.$$

6. If a force of 300N is exerted upon a 60 kg mass for 3 seconds, how much impulse does the mass experience?

Solution

The impulse is

$$I = Ft = 300 \cdot 3 = 900 \ Ns.$$

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