Answer on Question #56923-Physics-Classical Mechanics

A spring of mass m is pulled such that a given instant, velocity of both of its end is v in the opposite direction. Find the kinetic energy of the spring.

Solution

Let's find the kinetic energy of half of the spring.

Its velocity changes from zero at center to v of its end. The average velocity of half of the spring is

$$V = \frac{1}{2}(0 + v) = \frac{v}{2}.$$

The kinetic energy of half of the spring is

$$K_{\left(\frac{1}{2}\right)} = \frac{1}{2}\left(\frac{m}{2}\right)\left(\frac{v}{2}\right)^2 = \frac{1}{16}mv^2$$

The kinetic energy of the spring is

$$K = 2K_{\left(\frac{1}{2}\right)} = \frac{1}{8}mv^2.$$

Answer: $\frac{1}{8}mv^2$.

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