

Problem 15.17

What is the speed of a car that is run into a wall if the bumper acts like a spring and no energy is lost in the collision?

This is one of those amazingly unrealistic collision problems in which the energy required to deform the bumper and heat the bumper and create sound is ignored. Having whined about this some, we proceed:

If energy is conserved and all the energy ends up with the spring, we can write:

$$\begin{aligned}\sum KE_1 + \sum U_1 + \sum W_{\text{ext}} &= \sum KE_2 + \sum U_2 \\ \frac{1}{2}m(v_o)^2 + 0 + 0 &= 0 + \frac{1}{2}kx^2 \\ \Rightarrow v_o &= \left[\frac{kx^2}{m} \right]^{1/2} \\ &= \left[\frac{(5.00 \times 10^6 \text{ N/m})(3.16 \times 10^{-2} \text{ m})^2}{(1.00 \times 10^3 \text{ kg})} \right]^{1/2} \\ &= 2.23 \text{ m/s}\end{aligned}$$