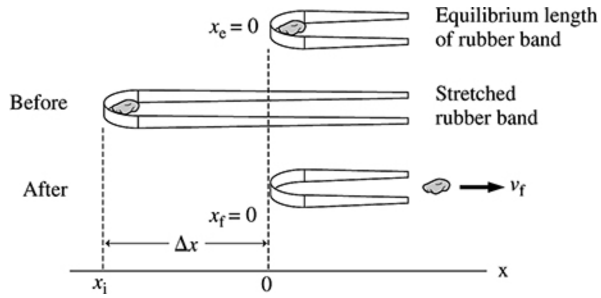
10.37. Model: Assume that the rubber band behaves similar to a spring. Also, model the rock as a particle.
Visualize:



Please refer to Figure P10.37.
Solve: **(a)** The rubber band is stretched to the left since a positive spring force on the rock due to the rubber band results from a negative displacement of the rock. That is, $(F_{sp})_x = -kx,$ where x is the rock's displacement from the equilibrium position due to the spring force F_{sp}.
(b) Since the F_{sp} versus x graph is linear with a negative slope and can be expressed as $F_{sp} = -kx,$ the rubber band obeys Hooke's law.
(c) From the graph, $|\Delta F_{sp}| = 20$ N for $|\Delta x| = 10$ cm. Thus,

$$k = \frac{|\Delta F_{sp}|}{|\Delta x|} = \frac{20 \text{ N}}{0.10 \text{ m}} = 200 \text{ N/m} = 2.0 \times 10^2 \text{ N/m}$$

(d) The conservation of energy equation $K_f + U_{sf} = K_i + U_{si}$ for the rock is

$$\frac{1}{2}mv_f^2 + \frac{1}{2}kx_f^2 = \frac{1}{2}mv_i^2 + \frac{1}{2}kx_i^2 \Rightarrow \frac{1}{2}mv_f^2 + \frac{1}{2}k(0 \text{ m})^2 = \frac{1}{2}m(0 \text{ m/s})^2 + \frac{1}{2}kx_i^2$$
$$v_f = \sqrt{\frac{k}{m}}x_i = \sqrt{\frac{200 \text{ N/m}}{0.050 \text{ kg}}}(0.30 \text{ m}) = 19.0 \text{ m/s}$$

Assess: Note that x_i is Δx, which is the displacement relative to the equilibrium position, and x_f is the equilibrium position of the rubber band, which is equal to zero.