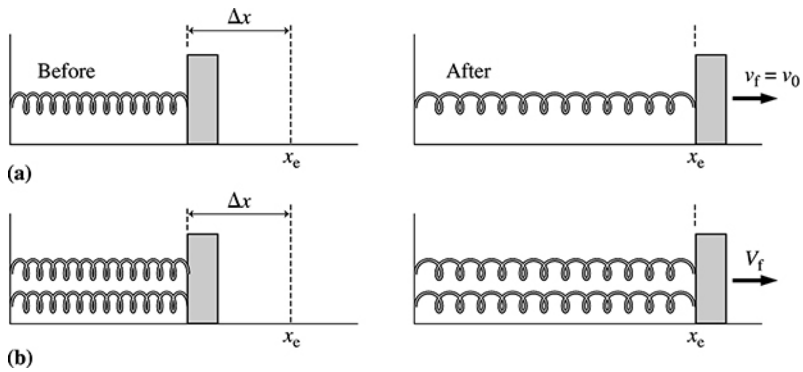
10.38. Model: Model the block as a particle and the springs as ideal springs obeying Hooke's law. There is no friction, hence the mechanical energy $K + U_s$ is conserved.

Visualize:



Note that $x_f = x_e$ and $x_i - x_e = \Delta x$. The before-and-after pictorial representations show that we put the origin of the coordinate system at the equilibrium position of the free end of the springs.

Solve: The conservation of energy equation $K_f + U_{sf} = K_i + U_{si}$ for the single spring is

$$\frac{1}{2}mv_f^2 + \frac{1}{2}k(x_f - x_e)^2 = \frac{1}{2}mv_i^2 + \frac{1}{2}k(x_i - x_e)^2$$

Using the value for v_f given in the problem, we get

$$\frac{1}{2}mv_0^2 + 0 \text{ J} = 0 \text{ J} + \frac{1}{2}k(\Delta x)^2 \Rightarrow \frac{1}{2}mv_0^2 = \frac{1}{2}k(\Delta x)^2$$

Conservation of energy for the two-spring case:

$$\frac{1}{2}mV_f^2 + 0 \text{ J} = 0 \text{ J} + \frac{1}{2}k(x_i - x_e)^2 + \frac{1}{2}k(x_i - x_e)^2 \qquad \frac{1}{2}mV_f^2 = k(\Delta x)^2$$

Using the result of the single-spring case,

$$\frac{1}{2}mV_f^2 = mv_0^2 \Rightarrow V_f = \sqrt{2}v_0$$

Assess: The block separates from the spring at the equilibrium position of the spring.