11.15. Model: Use the work-kinetic energy theorem to find velocities.
Visualize: Please refer to Figure EX11.15.
Solve: The work-kinetic energy theorem is

$$\Delta K = \frac{1}{2}mv_\mathrm{f}^2 - \frac{1}{2}mv_\mathrm{i}^2 = W = \int_{x_\mathrm{i}}^{x_\mathrm{f}} F_x\,dx = \text{ area under the force curve from } x_\mathrm{i} \text{ to } x_\mathrm{f}$$

$$\Rightarrow \frac{1}{2}mv_\mathrm{f}^2 - \frac{1}{2}(0.500\text{ kg})(2.0\text{m/s})^2 = \frac{1}{2}mv_\mathrm{f}^2 - 1.0\text{ J} = \int_{0\text{ m}}^{x_\mathrm{f}} F_x\,dx = \text{area from 0 to } x$$

$$\text{At } x{=}1\text{ m: } \frac{1}{2}(0.500\text{ kg})v_\mathrm{f}^2 - 1.0\text{ J} = 12.5\text{ J} \Rightarrow v_\mathrm{f} = 7.35\text{ m/s}$$

$$\text{At } x = 2\text{ m: } \frac{1}{2}(0.500\text{ kg})v_\mathrm{f}^2 - 1.0\text{ J} = 20\text{ J} \Rightarrow v_\mathrm{f} = 9.17\text{ m/s}$$

$$\text{At } x = 3\text{ m: } \frac{1}{2}(0.500\text{ kg})v_\mathrm{f}^2 - 1.0\text{ J} = 22.5\text{ J} \Rightarrow v_\mathrm{f} = 9.70\text{ m/s}$$