32. All heights h are measured from the lower end of the incline (which is our reference position for computing gravitational potential energy mgh). Our x axis is along the incline, with $+x$ being uphill (so spring compression corresponds to $x > 0$) and its origin being at the relaxed end of the spring. The 1.00 m distance indicated in Fig. 8-40 will be referred to as ℓ, and the 37.0° angle will be referred to as θ. Thus, the height that corresponds to the canister's initial position (with spring compressed amount $x = 0.200$ m) is given by $h_1 = (\ell + x)\sin\theta$.

(a) Energy conservation leads to

$$\begin{aligned} K_1 + U_1 &= K_2 + U_2 \\ 0 + mg(\ell + x)\sin\theta + \frac{1}{2}kx^2 &= \frac{1}{2}mv_2^2 + mg\ell\sin\theta \end{aligned}$$

which yields $v_2 = \sqrt{2gx\sin\theta + kx^2/m} = 2.40$ m/s using the data $m = 2.00$ kg and $k = 170$ N/m.

(b) In this case, energy conservation leads to

$$\begin{aligned} K_1 + U_1 &= K_3 + U_3 \\ 0 + mg(\ell + x)\sin\theta + \frac{1}{2}kx^2 &= \frac{1}{2}mv_3^2 + 0 \end{aligned}$$

which yields $v_3 = \sqrt{2g(\ell + x)\sin\theta + kx^2/m} = 4.19$ m/s.