

68. This is a completely inelastic collision, followed by projectile motion. In the collision, we use momentum conservation.

$$\begin{aligned}\vec{p}_{\text{shoes}} &= \vec{p}_{\text{together}} \\ (3.2 \text{ kg})(3.0 \text{ m/s}) &= (5.2 \text{ kg})\vec{v}\end{aligned}$$

Therefore, $\vec{v} = 1.8 \text{ m/s}$ toward the right as the combined system is projected from the edge of the table. Next, we can use the projectile motion material from Ch. 4 or the energy techniques of Ch. 8; we choose the latter.

$$\begin{aligned}K_{\text{edge}} + U_{\text{edge}} &= K_{\text{floor}} + U_{\text{floor}} \\ \frac{1}{2}(5.2 \text{ kg})(1.8 \text{ m/s})^2 + (5.2 \text{ kg})(9.8 \text{ m/s}^2)(0.40 \text{ m}) &= K_{\text{floor}} + 0\end{aligned}$$

Therefore, the kinetic energy of the system right before hitting the floor is $K_{\text{floor}} = 29 \text{ J}$.