77. (a) At the top of its flight, the vertical component of the velocity vanishes, and the horizontal component (neglecting air friction) is the same as it was when it was thrown. Thus,

$$K_{\text{top}} = \frac{1}{2}mv_x^2 = \frac{1}{2}(0.050\,\text{kg})\left((8.0\,\text{m/s})\cos 30^\circ\right)^2$$

which yields $K_{\text{top}} = 1.2$ J.

(b) We choose the point 3.0 m below the window as the reference level for computing the potential energy. Thus, equating the mechanical energy when it was thrown to when it is at this reference level, we have (with SI units understood)

$$\begin{aligned} mgy_0 + K_0 &= K \\ m(9.8)(3.0) + \frac{1}{2}m(8.0)^2 &= \frac{1}{2}mv^2 \end{aligned}$$

which yields (after canceling m and simplifying) $v = 11$ m/s.

(c) As mentioned, m cancels – and is therefore not relevant to that computation.

(d) The v in the kinetic energy formula is the magnitude of the velocity vector; it does not depend on the direction.