Chap. 7  Ex. 5

\[ u_0 \]

\[ \text{h} \]

\[ \text{v}_i = 12.0 \text{ m/s} \]

\[ h = 22.0 \text{ m} \]

\[ \theta = 53.1^\circ \]

a) START: KE + Gravitational PE

END: All KE

\[ \frac{1}{2} m u_0^2 + mgh = \frac{1}{2} m v_f^2 \]

\[ v_i^2 + 2gh = v_f^2 \]

\[ v_f = \sqrt{v_i^2 + 2gh} \]

\[ = \sqrt{(12.0 \text{ m/s})^2 + 2(9.8 \text{ m/s}^2)(22.0 \text{ m})} \]

\[ = 24 \text{ m/s} \]

b) If you throw it 53.1° below horizontal, the equation above is the SAME and you thus get the SAME ANSWER (24 m/s). The ball in a) travels up and then comes down again. When it is at a height h (22.0 m) on the way down, its instantaneous velocity is 12.0 m/s pointing in a direction 53.1° below horizontal.
c) If we include air resistance, we need to consider the length of the path the ball travels. The longer the path (distance), the more work friction will do on the ball. Thus, the shorter path will result in a greater final speed. So 0 gives us a greater final speed.