Answer on Question #70392-Physics - Mechanics | Relativity

An elevator manufacturing company is stress-testing a new elevator in an airless test shaft. The elevator is traveling at an unknown velocity when the cable snaps. The elevator falls 1.70 meters before hitting the bottom of the shaft. The elevator was in free fall for 0.900 seconds. Determine its velocity when the cable snapped. As usual, up is the positive direction.

Solution

The equation of motion is

$$y(t) = h + vt - \frac{gt^2}{2}$$

Assume $y(t) = 0$ at the ground:

$$h + vt - \frac{gt^2}{2} = 0$$

The velocity when the cable snapped is

$$v = \frac{\frac{gt^2}{2} - h}{t} = \frac{\frac{(9.81)0.9^2}{2} - 1.7}{0.9} = 2.53\frac{m}{s}.$$

Answer: $2.53\frac{m}{s}$.