

51. (a) The acceleration of the sprinter is (using Eq. 2-15)

$$a = \frac{2\Delta x}{t^2} = \frac{(2)(7.0 \text{ m})}{(1.6 \text{ s})^2} = 5.47 \text{ m/s}^2 .$$

Consequently, the speed at $t = 1.6 \text{ s}$ is

$$v = at = (5.47 \text{ m/s}^2)(1.6 \text{ s}) = 8.8 \text{ m/s} .$$

Alternatively, Eq. 2-17 could be used.

- (b) The kinetic energy of the sprinter (of weight w and mass $m = w/g$) is

$$K = \frac{1}{2}mv^2 = \frac{1}{2}\left(\frac{w}{g}\right)v^2 = \frac{(670)(8.8)^2}{2(9.8)} = 2.6 \times 10^3 \text{ J} .$$

- (c) The average power is

$$P_{\text{avg}} = \frac{\Delta K}{\Delta t} = \frac{2.6 \times 10^3 \text{ J}}{1.6 \text{ s}} = 1.6 \times 10^3 \text{ W} .$$