

$$\begin{aligned}
 4. \quad \text{power output} &= F_g v = mgh \\
 &= (8.50 \times 10^2 \text{ kg})(9.81 \text{ m/s}^2)(1.00 \text{ m/s}) \\
 &= 8.34 \times 10^3 \text{ W}
 \end{aligned}$$

$$\begin{aligned}
 \text{efficiency} &= \frac{\text{power out}}{\text{power in}} \times 100 \\
 &= \frac{8.34 \times 10^3 \text{ W}}{10.0 \times 10^3 \text{ W}} \times 100 \\
 &= 83.4\%
 \end{aligned}$$

$$\begin{aligned}
 5. \quad v^2 &= v_0^2 + 2ad \\
 (6.0 \text{ m/s})^2 &= 2(a)(2.0 \text{ m}) \\
 a &= 9.0 \text{ m/s}^2
 \end{aligned}$$

$$\begin{aligned}
 F_{\text{net}} &= ma \\
 &= (5.0 \text{ kg})(9.0 \text{ m/s}^2) \\
 &= 45 \text{ N}
 \end{aligned}$$

$$\begin{aligned}
 F_{\text{net}} &= F_T - F_{\text{fr}} \\
 F_T &= F_{\text{net}} + F_{\text{fr}} \\
 &= 45 \text{ N} + 4.0 \text{ N} \\
 &= 49 \text{ N}
 \end{aligned}$$

$$\begin{aligned}
 v_{\text{av}} &= \frac{v + v_0}{2} \\
 &= \frac{6.0 \text{ m/s} + 0}{2} \\
 &= 3.0 \text{ m/s}
 \end{aligned}$$

$$\begin{aligned}
 P &= F_T v_{\text{av}} \\
 &= (49 \text{ N})(3.0 \text{ m/s}) \\
 &= 1.5 \times 10^2 \text{ W}
 \end{aligned}$$

$$\begin{aligned}
 6. \quad \text{power out} &= \frac{mgh}{t} \\
 &= \frac{(20.0 \text{ kg})(9.81 \text{ m/s}^2)(5.00 \text{ m})}{3.50 \text{ s}} \\
 &= 280 \text{ W}
 \end{aligned}$$

$$\begin{aligned}
 \text{efficiency} &= \frac{\text{power out}}{\text{power in}} \times 100\% \\
 &= \frac{280 \text{ W}}{5.00 \times 10^2 \text{ W}} \times 100\% \\
 &= 56.0\%
 \end{aligned}$$

$$\begin{aligned}
 7. \quad \text{efficiency} &= \frac{\text{power out}}{\text{power in}} \times 100\% \\
 \text{power out} &= \frac{\text{efficiency} \times \text{power in}}{100\%} \\
 &= (0.82)(1.00 \times 10^5 \text{ W}) \\
 &= 8.2 \times 10^4 \text{ W}
 \end{aligned}$$

$$\begin{aligned}
 \text{power} &= \frac{mgh}{t} \\
 t &= \frac{mgh}{\text{power}} \\
 &= \frac{(50.0 \text{ kg})(9.81 \text{ m/s}^2)(8.00 \text{ m})}{(8.2 \times 10^4 \text{ W})} \\
 &= 0.048 \text{ s}
 \end{aligned}$$

### Lesson 3—Potential Energy

#### PRACTICE EXERCISES ANSWERS AND SOLUTIONS

$$\begin{aligned}
 1. \quad E_p &= F_g d \\
 &= (25.0 \text{ N})(2.10 \text{ m}) \\
 &= 52.5 \text{ J}
 \end{aligned}$$

$$\begin{aligned}
 2. \quad E_p &= Fd \\
 &= (65.0 \text{ N})(6.5 \times 10^{-2} \text{ m}) \\
 &= 4.2 \text{ J}
 \end{aligned}$$

$$\begin{aligned}
 3. \quad E_p &= mgh \\
 &= (2.75 \text{ kg})(9.81 \text{ m/s}^2)(7.00 \text{ m}) \\
 &= 189 \text{ J}
 \end{aligned}$$

$$\begin{aligned}
 4. \quad E_p &= mgh \\
 &= (2.0 \text{ kg})(9.81 \text{ m/s}^2)(0.25 \text{ m}) \\
 &= 4.9 \text{ J}
 \end{aligned}$$

$$\begin{aligned}
 5. \quad E_p &= mgh \\
 &= (2.0 \times 10^2 \text{ kg})(9.81 \text{ m/s}^2)(6.0 \text{ m}) \\
 &= 1.2 \times 10^4 \text{ J}
 \end{aligned}$$

### Lesson 4—Kinetic Energy

#### PRACTICE EXERCISES ANSWERS AND SOLUTIONS

$$\begin{aligned}
 1. \quad E_k &= \frac{1}{2}mv^2 \\
 &= \frac{1}{2}(3.0 \text{ kg})(7.5 \text{ m/s})^2 \\
 &= 84 \text{ J}
 \end{aligned}$$