

Work and Energy #1

$$\begin{aligned}\textcircled{1} \quad W &= Fd \cos \theta \\ &= (50 \text{ kg})(9.8 \text{ m/s}^2)(4 \text{ m}) \\ &= \underline{1960 \text{ J}}\end{aligned}$$

$$\begin{aligned}\textcircled{2} \quad W &= Fd \cos \theta \\ &= (5 \text{ kg})(9.8 \text{ m/s}^2)(0.4 \text{ m}) \\ &= \underline{19.6 \text{ J}}\end{aligned}$$

$$\begin{aligned}\textcircled{3} \quad W &= Fd \cos \theta \\ &= (2500 \text{ N})(1500 \text{ m}) = \underline{3.75 \times 10^6 \text{ J}}\end{aligned}$$

$$\begin{aligned}\textcircled{4} \quad W &= Fd \cos \theta \\ &= (6 \text{ N})(4 \text{ m}) \cos 37^\circ = \underline{19.2 \text{ J}}\end{aligned}$$

$$\begin{aligned}\textcircled{5} \quad E_b &= E_a \\ mgh &= \frac{1}{2}mv^2 \\ (9.8 \text{ m/s}^2)(12.5 \text{ m}) &= \frac{1}{2}v^2\end{aligned}$$

$$v = \underline{15.7 \text{ m/s}}$$

$$\begin{aligned}\textcircled{6} \quad E_b &= E_a \\ \frac{1}{2}mv^2 &= mgh \\ \frac{1}{2}(12 \text{ m/s})^2 &= (9.8 \text{ m/s}^2)h\end{aligned}$$

$$h = \underline{7.35 \text{ m}}$$

$$\begin{aligned}\textcircled{7} \quad E_b &= E_a \\ mgh &= \frac{1}{2}mv^2 \\ (9.8 \text{ m/s}^2)(2.5 \text{ m}) &= \frac{1}{2}v^2\end{aligned}$$

$$v = \underline{7.0 \text{ m/s}}$$

$$\textcircled{8} \quad F = -kx$$

$$-(0.250 \text{ kg})(9.8 \text{ m/s}^2) = -k(0.15 \text{ m})$$

$$k = \underline{16.3 \text{ N/m}}$$

$$\textcircled{9} \quad E_b = E_a$$

$$mgh = \frac{1}{2} kx^2$$

$$(0.5 \text{ kg})(9.8 \text{ m/s}^2)(0.4 \text{ m}) = \frac{1}{2}(20 \text{ N/m})x^2$$

$$x = \underline{0.44 \text{ m}}$$

$$\textcircled{10} \quad E_b = E_a$$

$$\frac{1}{2} kx^2 = \frac{1}{2} mv^2$$

$$(5.0 \text{ N/m})(0.1 \text{ m})^2 = (0.25 \text{ kg})v^2$$

$$v = \underline{0.45 \text{ m/s}}$$

$$\textcircled{11} \quad E_b = E_a$$

$$\frac{1}{2} kx^2 = mgh$$

$$\frac{1}{2}(19.6 \text{ N/m})(1.0 \text{ m}) = (0.5 \text{ kg})(9.8 \text{ m/s}^2)h$$

$$h = \underline{2.0 \text{ m}}$$

Calculate k for spring

$$F = kx$$

$$(0.5 \text{ kg})(9.8 \text{ m/s}^2) = k(0.25 \text{ m})$$

$$k = 19.6 \text{ N/m}$$

$$\textcircled{12} \text{ (a)} \quad W_f = Fd \cos \theta$$

$$= (5.88 \text{ N})(10 \text{ m})$$

$$= \underline{-58.8 \text{ J}}$$

$$F_f = \mu F_N$$

$$= (0.12)49$$

$$= 5.88 \text{ N}$$

$$F_N = F_g = mg$$

$$= (5 \text{ kg})(9.8 \text{ m/s}^2)$$

$$= 49 \text{ N}$$

* friction opposes the motion, therefore, work is negative

$$\text{(b)} \quad W_p = Fd \cos \theta$$

$$= (250 \text{ N})(10.0 \text{ m}) = \underline{2500 \text{ J}}$$

$$\text{(c)} \quad W_{\text{total}} = W_f + W_p = (-58.8 \text{ J}) + 2500 \text{ J} = \underline{2441 \text{ J}}$$