Chapter 4

total 16.5

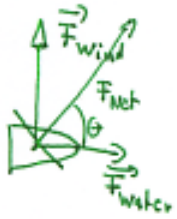
7.

(0.5)

$ma = F_A - F_R$ (Newton 2)

$\rightsquigarrow F_R = F_A - ma = 10\,N - 0.20\,kg \cdot 2.0\,\frac{m}{s^2} = 9.6\,N$

14.



(1)

$\vec{F}_{Net} = \vec{F}_{wind} + \vec{F}_{water}$

x-comp:

$ma_x = 180\,N$

y-comp.:

$ma_y = 390\,N$

$\rightsquigarrow a_x = 0.667\,\frac{m}{s^2}$

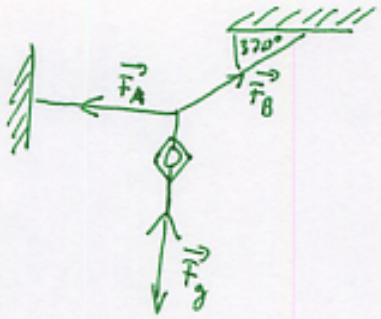
$a_y = 1.44\,\frac{m}{s^2}$

$\rightsquigarrow a = \underline{1.59\,\frac{m}{s^2}}$

$\tan\theta = \frac{390}{180}$

$\theta = \underline{65.2^\circ\ N\ of\ E}.$

15.



(1)

y-comp:

$F_B \cdot \sin 37.0° - mg = 0$

$\rightarrow F_B = \frac{mg}{\sin 37.0°} = \frac{600\,N}{\sin 37.0°} = \underline{\underline{997\,N}}$

x-comp:

$F_B \cos 37.0° - F_A = 0$

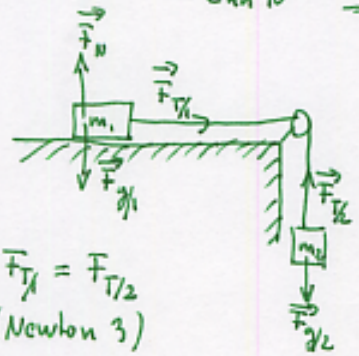
$\rightarrow F_A = F_B \cos 37.0° = \underline{\underline{796\,N}}$

16. y-comp: (0.5)

$F \cdot \sin 40° + F \cdot \sin 40° - mg = 0$

$\rightarrow F = \frac{mg}{2 \sin 40°} = \underline{\underline{78\,N}}$

30.



$F_{T1} = F_{T2}$ (Newton 3)

1st block: x-comp: (1)

(i) $F_T = m_1 a$ (Newton 2)

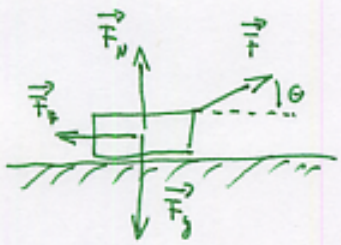
2nd block: y-comp:

(ii) $F_T - m_2 g = m_2(-a)$ (Newton 2)

(i) in (ii) $\rightarrow$ $m_1 a - m_2 g = -m_2 a \rightarrow a = \frac{m_2 g}{m_1 + m_2} = \frac{10.0\,kg \cdot 9.80\,\frac{m}{s^2}}{10.0\,kg + 5.00\,kg} = \underline{\underline{6.53\,\frac{m}{s^2}}}$

$F_T = m_1 a = \underline{\underline{32.7\,N}}$

40.



(a) x-comp:

$$F\cos\theta - F_F = 0$$

$$\cos\theta = \frac{F_F}{F} = \frac{20.0}{35.0}$$

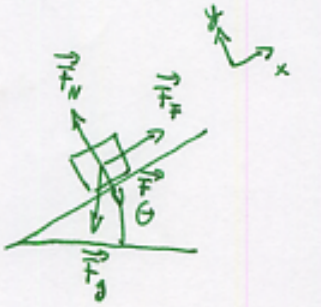
$$\rightarrow \theta = \underline{55.2^\circ}$$

(b) y-comp:

$$F_N + F\sin\theta - mg = 0$$

$$F_N = mg - F\sin\theta = 20.0\,kg \cdot 9.80\,\frac{m}{s^2} - 35.0\,N \sin 55.2^\circ = \underline{167\,N}.$$

41.



x-comp: $\vec{F}_F - mg\sin\theta = 0$

$$\mu_s F_N - mg\sin\theta = 0$$

$$\rightarrow F_N = \frac{mg\sin\theta}{\mu_s} = \frac{3.00\,kg \cdot 9.80\,\frac{m}{s^2} \cdot \sin 35.0^\circ}{0.300} = 56.2\,N$$

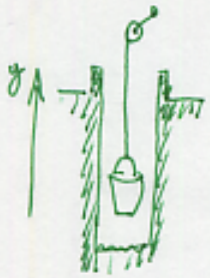
y-comp: $F_N - mg\cos\theta - F = 0$

$$F = F_N - mg\cos\theta = 56.2\,N - 3.00\,kg \cdot 9.80\,\frac{m}{s^2}\cos 35.0^\circ =$$

$$= \underline{32.1\,N}$$

Chapter 5:

2.



$W = F \cdot \Delta y = mg \cdot \Delta y = 20.0\,kg \cdot 9.80\,\frac{m}{s^2} \cdot \Delta y$ (0.5)

$\rightsquigarrow \Delta y = \frac{W}{mg} = \frac{6.00 \cdot 10^3\,kg\,m^2}{s^2 \cdot 20.0\,kg \cdot 9.80\,\frac{m}{s^2}} = \underline{\underline{30.6\,m}}$.

4.

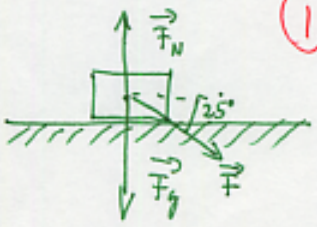
$\Delta x = 50\,m$

$F = 35\,N$

$\theta = 25°$ (0.5)

$W = \Delta x \cdot F \cdot \cos 25° = 50\,m \cdot 35\,N \cdot \cos 25° = \underline{\underline{1.6 \cdot 10^3\,J}}$

8.



(1)

(a) $W = \Delta x \cdot F \cdot \cos 25.0° = 2.20\,m \cdot 16.0\,N \cdot \cos 25.0° = \underline{\underline{31.9\,J}}$

(b) $W_N = \Delta x\ F_N \cdot \cos 90° = \underline{\underline{0}}$

(c) $W_g = \Delta x \cdot F_g \cdot \cos 90° = \underline{\underline{0}}$

(d) $F_{Net/y} = 0$

$F_{Net/x} = F_x = F \cdot \cos 25.0°$.

$\rightsquigarrow W_{Net} = \Delta x \cdot F_{Net/x} = W = \underline{\underline{31.9\,J}}$.

10. $kE_{Bowling} = \frac{1}{2} \cdot 7.00\,kg \cdot 13.00\,\frac{m}{s})^2 = 31.5\,J$ (0.5)

$kE_{Ping\ Pong} = \frac{1}{2} \cdot 2.45 \cdot 10^{-3}\,kg \cdot v^2 \overset{!}{=} 31.5\,J$

$\rightarrow v = \sqrt{\frac{31.5\,kg\,m^2 \cdot 2}{s^2 \cdot 2.45 \cdot 10^{-3}\,kg}} = \underline{\underline{160\,\frac{m}{s}}}$

18. $\Delta KE = W$ (1)

$KE_f - KE_i = -\Delta x \cdot F_f$

$-\frac{1}{2} m v_0^2 = -\Delta x \cdot \mu_k F_N$

$= -\Delta x \cdot \mu_k \cdot mg$

$\rightarrow \Delta x = \frac{v_0^2}{2\mu_k g} = \frac{(2.0\,\frac{m}{s})^2}{2 \cdot 0.10 \cdot 9.8\,\frac{m}{s^2}} = \underline{\underline{2.0\,m}}$

28. $E_A = KE_A + PE_A = 0 + mg y_A$ (1)

$E_B = KE_B + PE_B = \frac{1}{2} m v_B^2 + 0$

$E_C = KE_C + PE_C = \frac{1}{2} m v_C^2 + mg y_C$

(a) $E_B = E_A$

$\frac{1}{2} m v_B^2 = mg y_A$

$v_B = \sqrt{2 g y_A} = \sqrt{2 \cdot 9.80\,\frac{m}{s^2} \cdot 5.00\,m} = \underline{\underline{9.90\,\frac{m}{s}}}$

(b) $E_C = E_A$

$\frac{1}{2} m v_C^2 + mg y_C = mg y_A$

$v_C = \sqrt{2g(y_A - y_C)} = \underline{7.67\,\frac{m}{s}}$

29. $E_i = KE_i + PE_i = 0 + R \cdot g \cdot m$ (1)

$E_f = KE_f + PE_f = \frac{1}{2} m v_f^2 - R \cdot g \cdot m$

$E_f = E_i$

$\rightarrow \frac{1}{2} v_f^2 = 2Rg$

$v_f = \sqrt{4Rg} = \sqrt{4 \cdot 1.20\,m \cdot 9.80\,\frac{m}{s^2}} = \underline{\underline{6.86\,\frac{m}{s}}}$

35. $E_i = kE_i + PE_{s/i} + PE_{g/i}$ (1)

$= 0 + \frac{1}{2} k y_i^2 + mg \cdot y_i$

$E_f = kE_f + PE_{s/f} + PE_{g/f} =$

$= 0 + 0 + mg\, y_f$

$\rightsquigarrow mg\, y_f = mg\, y_i + \frac{1}{2} k y_i^2$

$y_f - y_i = \frac{k}{2mg} y_i^2 = \frac{5.00 \cdot 10^3 \frac{N}{m}}{2 \cdot 0.250\,kg \cdot 9.80 \frac{m}{s^2}} \cdot (0.100\,m)^2 = \underline{\underline{10.2\,m}}$

52. (a)

$kE_f = \frac{1}{2} m v_f^2 \doteq W$ (1)

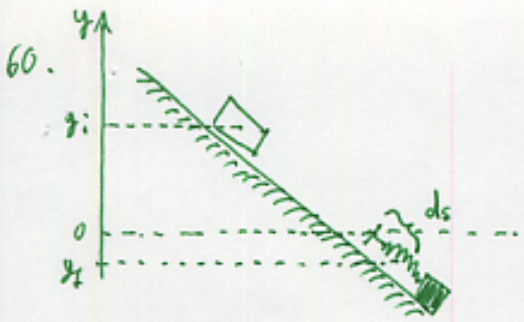
$\rightsquigarrow W = \frac{1}{2} \cdot 1.50 \cdot 10^3\,kg \cdot (10.0 \frac{m}{s})^2 = 75.0\,kJ$

(b) $\overline{P} = \frac{W}{t} = 25.0\,kW$

(c) $v = a\,t = \frac{v_f}{t_f} \cdot t = \frac{10.0 \frac{m}{s}}{3.00\,s} \cdot 2.00\,s = 6.67 \frac{m}{s}$

$P = v \cdot F = v \cdot m \cdot a = \frac{v_f}{t_f} \cdot t \cdot m \cdot \frac{v_f}{t_f} = 33.3 \cdot kW$

60.



1.5

$y_i - y_f = d \cdot \sin 35.0^\circ = 3.00\,m \cdot \sin 35.0^\circ$

$E_i = KE_i + PE_{s/i} + PE_{G/i} = 0 + 0 + mg y_i$

$E_f = KE_f + PE_{s/f} + PE_{G/f} = 0 + \frac{1}{2} k d_s^2 + mg y_f$

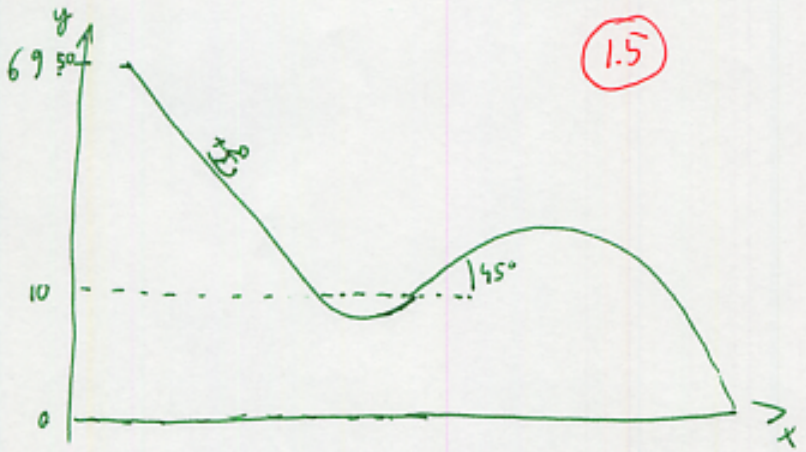
$E_i = E_f$

$mg y_i = \frac{1}{2} k d_s^2 + mg y_f$

$\rightsquigarrow d_s = \sqrt{\frac{2mg(y_i - y_f)}{k}} = \sqrt{\frac{2mg\, d \cdot \sin 35.0^\circ}{k}} = \sqrt{\frac{2 \cdot 12.0\,kg \cdot 9.80\,\frac{m}{s^2} \cdot \sin 35.0^\circ \cdot 3.00\,m}{3.00 \cdot 10^4\,\frac{N}{m}}}$

$= 0.116\,m$.

69.



1.5

(a) $E_i = KE_i + PE_i =$

$= 0 + mg \cdot y_i$

$E_f = KE_f + PE_f =$

$= \frac{1}{2} m v_f^2 + mg y_f$

$\rightsquigarrow \frac{1}{2} v_f^2 + g y_f = g y_i$

$v_f = \sqrt{2g(y_i - y_f)}$

$= \sqrt{2 \cdot 9.80\,\frac{m}{s^2}(50.0\,m - 10.0\,m)}$

$= 28.0\,\frac{m}{s}$

(b) $v_{0|y} = 28.0\,\frac{m}{s} \cdot \sin 45^\circ$ $\qquad v_{f|y} = 0$

y-comp. of motion:

$$v_{f|y}^2 = v_{0|y}^2 - 2g\,\Delta y$$

$$\rightsquigarrow \Delta y = \frac{v_{0|y}^2}{2g} = 20.0\,m$$

$$\rightsquigarrow y_f = 10.0\,m + 20.0\,m = \underline{\underline{30.0\,m}}$$

(c) y-comp of motion

$$-10.0\,m = 28.0\,\frac{m}{s} \cdot \sin 45.0^\circ \cdot t_f - \frac{1}{2} \cdot 9.80\,\frac{m}{s^2} \cdot t_f^2$$

$$\rightsquigarrow t_f = \frac{28.0\,\frac{m}{s} \cdot \sin 45.0^\circ \overset{+}{(-)} \sqrt{(28.0\,\frac{m}{s} \cdot \sin 45.0^\circ)^2 + 2 \cdot 9.80\,\frac{m}{s^2} \cdot 10.0\,m}}{9.80\,\frac{m}{s^2}} = 4.49\,s$$

x-Comp of motion

$$x_f = v_{0|x} \cdot t_f = v_0 \cdot \cos 45.0^\circ \cdot t_f = \underline{\underline{89.0\,m}}$$