Physics 1A (HW 4)

7) $W = (35 N)\cdot(\cos 25^\circ)(50 m) = 1586\ J$

8) a) $W = (16 N)\cdot(\cos 25^\circ)(2.20 m) = 31.9\ J$

b) $W = 0$

c) $W = 0$

d) $W = (16 N)\cdot(\cos 25^\circ)(2.20 m) = 31.9\ J$

9) a) $\Delta KE = W \implies \frac{1}{2}mv^2 - 0 = 5000\ J \implies$

$$v = \left(\frac{2 \cdot 5000\ J}{2.5\times 10^3\ kg}\right)^{1/2} = 2.0\ m/s$$

b) $W = F_x \Delta x \implies F_x = \frac{5000\ J}{25.0\ m} = 200\ N$

14) At the highest point of the motion, the velocity of the baseball is equal to the horizontal component of its velocity initially:

$$KE = \frac{1}{2}mv^2 = \frac{1}{2}(.15\ kg)\cdot\left[(40\ m/s)(\cos 30^\circ)\right]^2$$

$$= 90\ J$$

18) $\Delta KE = W \implies 0 - \frac{1}{2}mv_0^2 = -\mu_k N \cdot \Delta x$

i.e. $-\frac{1}{2}(10\,kg)(2.0\,m/s)^2 = -(.1)(10\,kg)(9.8\,m/s^2)\Delta x$

$\implies \Delta x = 2.04\ m$

19) a) $PE = mgy$; $(PE)_{heart} - (PE)_{feet} = mg(y_{feet} + 1.3\,m) - mgy_{feet}$

$= mg(1.3\,m) = 6.4\,J$

b) $(PE)_{heart} - (PE)_{head} = mg(1.3\,m - 1.8\,m) = mg(.5\,m)$

$= -2.5\,J$

24) The net work done on the ball is the result of the forces exerted by gravity and the pitcher:

$W_{net} = -mg\Delta h + F_{pitcher}(\pi \cdot .6\,m)$

$= (.25\,kg)(9.8\,m/s^2)(2 \cdot .6\,m) + (30\,N)\underbrace{(\pi \cdot .6\,m)}_{\text{(length of semicircle)}}$

$= 59.5\,J$

But, by work-energy theorem,

$59.5\,J = \frac{1}{2}mv_{bottom} - \frac{1}{2}m(15\,m/s)^2$

$\implies v_{bottom} = 26.5\,m/s$

30) a) $\Delta KE = -\Delta PE \Longrightarrow 0 - \frac{1}{2} m v_B^2 = mgy_B - mgy_A$

$\Longrightarrow \frac{1}{2} \cancel{m} v_B^2 = \cancel{m} g (y_A - y_B) \Longrightarrow v_B = \left[2 \cdot (9.8\,m/s^2) \cdot (1.8\,m)\right]^{1/2}$

$= 5.9\ m/s$

Similarly, $\frac{1}{2} \cancel{m} v_c^2 = \cancel{m} g (y_A - y_c) \Longrightarrow v_c = \left[2 \cdot (9.8\,m/s^2) \cdot (3.0\,m)\right]^{1/2}$

$= 7.7\ m/s$

b) $W_g = \Delta KE = \frac{1}{2} m v_c^2 - 0 = 148.2\ J$ (or $W_g = -mg\Delta h$)

61) a) $\Delta PE = -\Delta KE \Longrightarrow -mg\Delta y = \frac{1}{2} m v^2 - 0$

$\Longrightarrow V = \left[2 \cdot (9.8\,m/s^2) \cdot (1.0\,m)\right]^{1/2} = 4.4\ m/s$

b) $W = \Delta KE \Longrightarrow -F_{avg} \cdot (.005\ m) = 0 - \frac{1}{2}(75\,kg) \cdot (4.4\,m/s)^2$

$\Longrightarrow F_{avg} = 1.5 \times 10^5\ N$

68) a) $\Delta KE = W \Longrightarrow -F_{avg}(2 \times 10^{-2}\,m) = 0 - \frac{1}{2}(.15\ kg)(25\,m/s)^2$

$\Longrightarrow F_{avg} = 2344\ N$

b) $\Delta KE = W \Longrightarrow -F_{avg}(.1\,m) = 0 - \frac{1}{2}(.15\ kg)(25\,m/s)^2$

$\Longrightarrow F_{avg} = 468.8\ N$