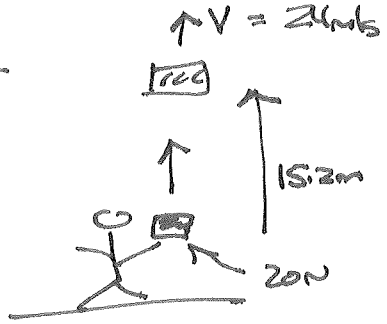
Physics 160

Extra Credit #16

6.20



$W = 20N$

$\Rightarrow m = \frac{20N}{9.8 m/s^2} = 2.04kg$

Use work-Energy Thm to find Launch speed.

↑ 15.2m = s

gravity only force doing work in Air $\Rightarrow W_{total} = W_g$

↓ $\vec{w}$ — gravity

Constant force $\Rightarrow W_g = W s \cos\phi$

$\phi = 180°$

$\cos 180° = -1$

$\therefore W_g = (20N)(15.2m)(-1) = -304J$

$W_{TOTAL} = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$ $\quad v_2 = 24 m/s,\ v_1 = ?$

$-304J = \frac{1}{2}(2.04kg)(24m/s)^2 - \frac{1}{2}(2.04kg)v_1^2 \Rightarrow -304J = 587.8J - \frac{1}{2}(2.04kg)v_1^2$

$\Rightarrow v_1 = \sqrt{\frac{2(891.8J)}{2.04kg}} = 29.5568 m/s = 29.6 m/s$

b) Find max height. $W_{TOTAL} = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2$

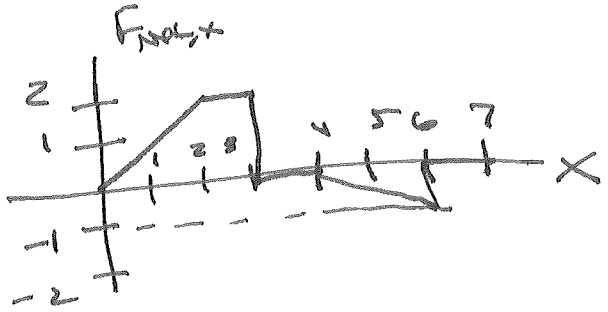
at max height $v_2 = 0 \Rightarrow W_{total} = 0 - \frac{1}{2}(2.04\,kg)(29.6\,m/s)^2$

$\Rightarrow W_{total} = -891.8\,J$

$W_{total} = W_g = -ws$ Still $\Rightarrow s = s_{max} = \frac{-891.8\,J}{-20\,N}$

$\Rightarrow s_{max} = 44.59\,m = 44.6\,m$ { unit: $\frac{J}{N} = \frac{N \cdot m}{N} = m$

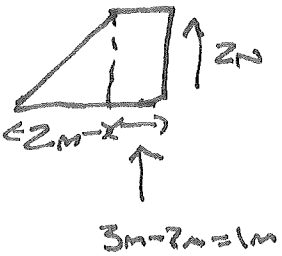
6.42



$m = 5kg$

$V_1 = 0$

a) Find V at $x = 3m$. ● Variable force $\Rightarrow W = Area$



$W = \frac{1}{2}(2m)(2N) + (1m)(2N) = 2J + 2J = 4J$

$F = F_{net} \Rightarrow W_{TOTAL} = 4J$

$W_{total} = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2 \Rightarrow 4J = \frac{1}{2}(5kg)v_2^2 \Rightarrow v_2 = \sqrt{\frac{2(4J)}{5kg}} =$

$1.26 m/s$

$= 1.3 m/s$ to 2 sig figs

b) Find speed at $x = 4$

From $x = 3m$ to $x = 4m$, $F = 0 \Rightarrow W = 0 \Rightarrow V$ at 4 $= V$ at 3

c) Find Speed at $x = 7$

Probably easiest to find total Area Since we already Know that "Top" is 4J

~~Look Negative Area Slows~~

~~Slows~~

$\frac{1}{2}(2m)(-1N) = -1J$

↑ Negative Area ⇒ Slows down

$W_{TOTAL} = 4J - 1J = 3J$

$\therefore \quad 3J = \frac{1}{2}(5kg)V_2^2 - 0 \Rightarrow V_2 = \sqrt{\frac{2(3J)}{5kg}} = \frac{1.095 m/s}{} = 1.1 m/s$

6.49 How many Joules does 100watt use per hour

$$P_{av} = \frac{\Delta W}{\Delta t} \Rightarrow \Delta W = P_{av}\Delta t = (100\text{J/s})(3600\text{s}) = 360000\text{J}$$

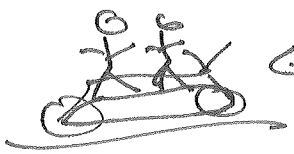
(1 watt = 1 J/s; 1 hour)

b) How fast, m = 75kg? Run ⇒ Kinetic Energy K = 360000J

$$K = \tfrac{1}{2}mv^2 \Rightarrow \quad v = \sqrt{\frac{2K}{m}} = \sqrt{\frac{2(360000\text{J})}{75\text{kg}}} = 97.98\text{m/s}$$

$$= 98\text{m/s}$$

(yikes!)

6.53  165N ⟵ ⟶ 9m/s to maintain 9m/s, they must exert 165N →, $P = \vec{F}\cdot\vec{v}$

165N →
9m/s →

$P = FV\cos\phi$ $\phi = 0°$ since both to the right

$$\Rightarrow P = FV\cos 0° = FV = (165\text{N})(9\text{m/s}) = 1485\frac{\text{N·m}}{\text{s}} = 1485\text{watt}$$

(J/s = watt)

EACH PERSON: $\frac{1485\text{watt}}{2} = 742.5\text{watt}$ $742.5\text{watt} \times \frac{1\text{hp}}{746\text{watt}} = 0.9953\text{hp}$