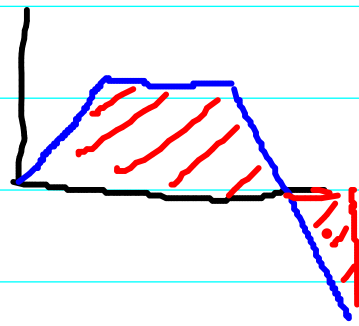
Ch 7:

23 

$$W = \int_0^8 F_x \, dx$$

40 □ − 30 □ = 3 □

each □ = 2 Nm = 2 J

so $W = 6\ J$

37) $K = \frac{1}{2} m V^2$

$$\left(\frac{212.52\ km}{hr}\right)\left(\frac{1000\ m}{km}\right)\left(\frac{1\ hr}{3600\ s}\right) = 59.03\ m/s$$

$$\left(\frac{44.88\ km}{hr}\right)\left(\frac{1000\ m}{km}\right)\left(\frac{1\ hr}{3600\ s}\right) = 12.47\ m/s$$

$$K_1 = \frac{1}{2}(75\ kg)(59.03\ m/s)^2 = 1.3 \times 10^5\ J$$

$$K_2 = \frac{1}{2}(75\ kg)(12.47\ m/s)^2 = 5.8 \times 10^3\ J$$

Ratio: 22.4 |

48) conserves Energy

$$mgh = \tfrac{1}{2}mv_0^2 = \frac{\tfrac{1}{2}mv_0^2}{2} + mgh'$$

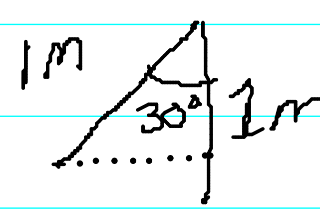
$$\text{so } mgh' = \tfrac{1}{4}mv_0^2 \quad \text{so } h' = \frac{\tfrac{1}{4}v_0^2}{g}$$

or $h' = \tfrac{1}{2}h$ ✓

64) $mgh = \tfrac{1}{2}mv^2$ so $V = \sqrt{2gh}$

$$= \sqrt{2(9.81\,m/s^2)(148\,m)} = 53.9\,m/s$$

74) 

$\Rightarrow$ 

$h = 1m\cos 30^0$
$= .866$

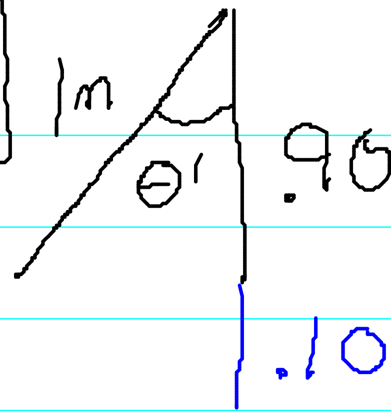
So it is raised .134 m

lowest: $mg(.134m) = \tfrac{1}{2}mV_0^2$ so $V = 1.6\,m/s$

half speed: $mg(.134m) = \tfrac{1}{2}m(\tfrac{1}{2}V_0)^2 + mgh'$

$$h' = .134m - \left(\tfrac{1}{8}(1.6m/s)^2/g\right) = .101 \Rightarrow$$

$h' = .10$



$.90 = 1m \cos\theta'$

so $\theta = \cos^{-1}(.9)$

$= 26^\circ$

ch8) 7, 10, 28, 39, 61, 64, 73, 97

7) $U = -\int F_x\,dx = -\int -(2x + x^3)\,dx = x^2 + \frac{1}{4}x^4$

so $U(1m) = 1 + \frac{1}{4} = 5/4\ J$

$U(2m) = 2^2 + \frac{1}{4}(2^4) = 16\ J$

$U(3m) = 3^2 + \frac{1}{4}(3^4) = 29.25\ J$

10) $U = -\int F_x\,dx = +\frac{F_0 \cos(ax)}{a}$

28)

	Turning Point		Speed Max	Speed min
E_1	~.1m only	unbound	~.9m	~.1m
E_2	~.25m, 3m	bound	~.9m	~.25m, 3m
E_3	~.5m, 1.25m	bound	~.9m	~.5m, 1.25m

39) Stairs are ~ 3m

$m \sim 75\,kg$ linear relationship so about $(3m)(5) = 15m$

61) $1.1\,W \left(\frac{1.341 \times 10^{-3}\,hp}{W} \right) = 1.5 \times 10^{-3}\,hp$

$1.1\,W = 1.1\,J/s \left(86400\,s/Day \right) = 9.5 \times 10^{4}\,J/day$

$9.5 \times 10^{4}\,J/day \left(.2388\,cal/J \right) \left(\frac{1\,Kcal}{1000\,cal} \right)$

$= 23\,Kcal$

64) $(180\,kg) \left(\frac{100\,W}{kg} \right) = 1.8 \times 10^{4}\,W \left(\frac{1.341 \times 10^{-3}\,hp}{W} \right)$

$= 24\,hp$

73) $P = \vec{F} \cdot \vec{v} = Fv\cos\theta = 40N\,(3.5\,m/s)\cos\theta = 90\,W$

$\theta = 25°$

97) $K = \frac{\frac{1}{2} m v^2}{s}$ $m = \rho \text{Volume}$

$\rho = 1000 \text{kg/m}^3$

$K = \frac{1}{2} \rho (\text{Volume}) v^2$

$v = 4.6 \frac{\text{km}}{\text{hr}} \left(\frac{1000\text{m}}{\text{km}}\right)\left(\frac{1\text{hr}}{3600\text{s}}\right) = 1.28 \text{m/s}$

$\frac{\text{Vol}}{\text{day}} = 2.2 \times 10^3 \text{km}^3/\text{day} \left(\frac{1000\text{m}}{\text{km}}\right)^3 \left(\frac{1 \text{day}}{86400\text{s}}\right)$

$= 2.55 \times 10^7 \text{m}^3/\text{s}$

so $K = \frac{1}{2}\left(\frac{1000\text{kg}}{\text{m}^3}\right)\left(2.55 \times 10^7 \text{m}^3/\text{s}\right)\left(1.28 \text{m/s}\right)^2$

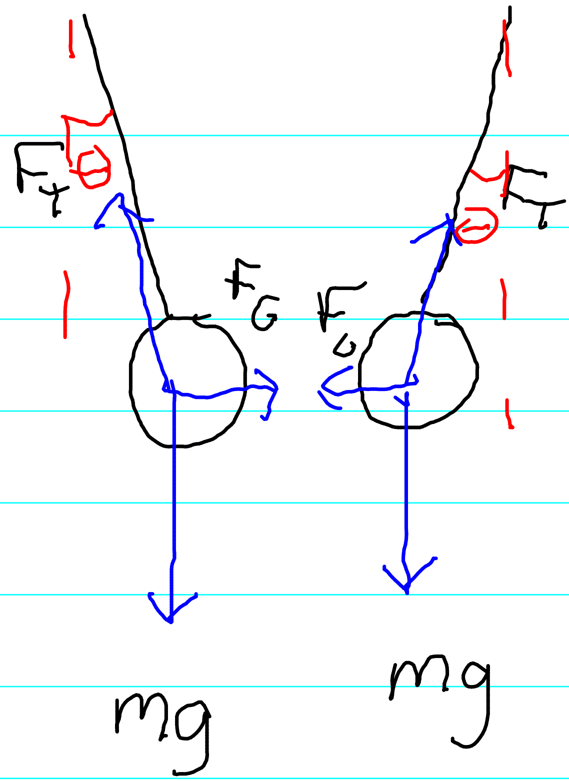
$= 2.1 \times 10^{10} \text{J/s} = 2.1 \times 10^{10} \text{W} = 2.1 \times 10^7 \text{kW}$

Ch 9) 2, 12, 22

2) $F = \frac{\left(6.67 \times 10^{-11} \frac{\text{Nm}^2}{\text{kg}^2}\right)\left(1.673 \times 10^{-27} \text{kg}\right)^2}{\left(2 \times 10^{-15} \text{m}\right)^2} =$

$4.6 \times 10^{-34} \text{N}$

12)



$x: 0 = F_G - F_T \sin\theta$

$y: 0 = F_T \cos\theta - mg$

$F_{Tx} = F_G = \frac{G(1.5kg)^2}{(.08m)^2}$

$F_{Ty} = mg$

$F_{Tx} = 2.34 \times 10^{-8}\, N$ $\quad F_{Ty} = (1.5kg)(9.8m/s^2) = 14.7N$

so $\tan\theta = \frac{2.34 \times 10^{-8} N}{14.7N}$ $\quad \theta = 4.6 \times 10^{-8\,\circ}$

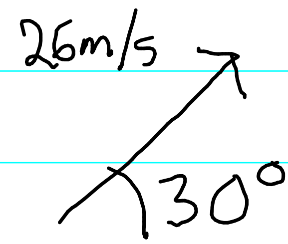
22) $V_v = \sqrt{\frac{GM_s}{r_v}}$ $\quad \frac{r_E}{r_V} = 1.38$

$r_V = \frac{r_E}{1.38} = \frac{1.5 \times 10^{11} m}{1.38} = 1.14 \times 10^{11} m$

so $V_v = 3.4 \times 10^4 \, m/s$

Ch 10) 7, 17, 22

7) a)



m = .43Kg

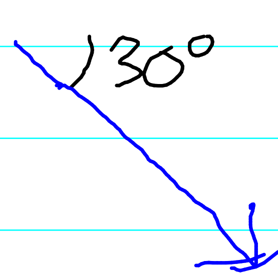
so $mv = (.43kg)(26m/s) = 11.2\ kg\,m/s\ 30°$ above the horizontal

b) $V_x = \text{const} = 26m/s \cos 30° = 22.5\ m/s$

All velocity is in x direction at top

$p = (.43Kg)(22.5m/s) = 9.7\ kg\,m/s$ in horizontal direction

c) at end momentum is 11.2 Kg m/s at 30° below horizontal.



17) Conserves momentum $p_{before} = 0 = p_{After}$

$K_\alpha = 7.26 \times 10^{-16} J = \frac{1}{2} m_\alpha V_\alpha^2$

so $V_\alpha = \sqrt{\frac{2(7.26 \times 10^{-16} J)}{6.68 \times 10^{-27} kg}} = 4.66 \times 10^5 m/s$

(1) $m_\alpha V_\alpha + m_{Ra-\alpha} V_{Ra-\alpha} = 0$

$m_{Ra-\alpha} = m_{Ra} - m_\alpha = 3.70 \times 10^{-25} kg$

(1) $(6.68 \times 10^{-27} kg)(4.66 \times 10^5 m/s)$
$+ (3.7 \times 10^{-25} kg)(V_{Ra-\alpha}) = 0$

$V_{Ra-\alpha} = 8.4 \times 10^3 m/s$

(Recoil)

22) conservation of momentum

$(.25 kg)(4 m/s) + (.050 kg)(0 m/s) = .3 kg V$

$V = 3.33 m/s$