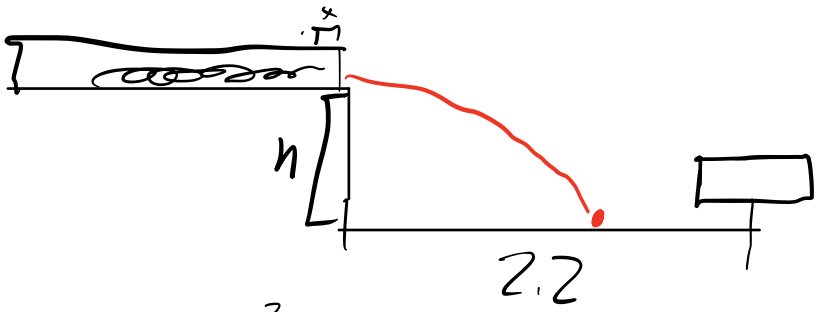
9.)



PE: $\frac{1}{2}k(\Delta x)^2 = \frac{1}{2}mv^2$

$v = \Delta x\sqrt{\left(\frac{k}{m}\right)}$

$h = \frac{1}{2}(10 \times t^2)$

$t = \sqrt{2\frac{h}{10}} = \sqrt{\frac{h}{5}}$

$\text{trajectory} = v \cdot t = \Delta x \cdot \sqrt{\frac{k}{m} \cdot \frac{h}{5}}$

$2.2 - .27 = \Delta x_{Bobby} \cdot \sqrt{\frac{k}{m} \cdot \frac{h}{5}}$

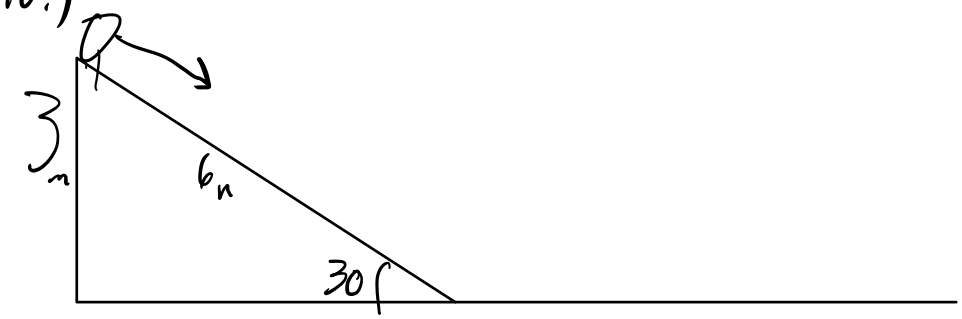
$2.2 = \Delta x_{Rhonda} \cdot \sqrt{\frac{k}{m} \cdot \frac{h}{5}}$

$\frac{2.2 - .27}{2.2} = \frac{\Delta x_{Bobby}}{\Delta x_{Rhonda}}$

$\Delta x_{Rhonda} = \Delta x_{Bobby} \cdot \frac{2.2}{2.2 - .27} \Rightarrow .011 \cdot \frac{2.2}{2.2 - .27}$

$\Delta x_{Rhonda} = .0125\ m$

10.)



$\sin(30) = \frac{3}{x}$

$x = 6$

$I = \frac{1}{2}(2)(.2)^2 = .04$

$\Delta\theta = \frac{6}{.4\pi} \cdot 2\pi = 30$ radians

$F = ma = I\alpha$

$F = 2 \cdot 10 = 20N$ $\quad 20\sin(30) = 10$

a.)

$10 = .4 \cdot P$ $\quad \tau = 25 \cdot .2 = 5$

$P = 25$

net $\tau = I\alpha$

$5 = .4\alpha$

$12.5 = \alpha$

$\alpha \cdot r = a$

$12.5 \cdot .2 = \boxed{2.5\ m/s^2}$

b.) $\quad .5\Delta w^2 = KE$

$w_f^2 = 0^2 + 2\alpha 30$ radians

$w_f^2 = 750$

$.5(750) = KE = 375\ J$

11.)

a.) $PV = nRT$

C: $(1)(2) = n(8.314)(300)$

$8.02E\text{-}4 \text{ moles} = n$

B: $(4)(2) = (8.02E\text{-}4)(8.314)T_B$

$T_B = 1200\ K$

A: $(4)(.5) = (8.02E\text{-}4)(8.314)T_A$

$T_A = 300\ K$

b.) $W = P\Delta V$

$A \rightarrow B$

$W = (4 \times 10^5)(1.5 \times 10^{-3}) = 600\ J$

$B \rightarrow C$

$W = 0\ J$

$C \rightarrow A$

$$W = \frac{(4 \times 10^5)(1.5 \times 10^{-3})}{2} = 300\ J$$

c.)

$A \rightarrow B$

$\Delta V = Q - W$

$\Delta V = (1200 - 300) - 600 = 300\ J$

$B \rightarrow C$

$\Delta V = [300 - 1200] - 0$

$\Delta V = -900\ J$

$C \rightarrow A$

$\Delta V = (300 - 300) - 300$

$\Delta V = -300\ J$

d.) $Q = mc\Delta T$

$A \to B$

e.) $\frac{|300 - 900 - 300|}{1500} = .6$

$1 - .6 = 40\%$

12.)

a.) $\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{1}{\sqrt{1 - \frac{.3^2}{c^2}}} = 1.048 \text{ years}$

b.) $\frac{10.8c}{.3c} = 36 \text{ years}$

c.) $v_x = \frac{v_x' + V}{1 + \frac{V}{c^2} v_x'} = \frac{-.7c + .3c}{1 + \frac{.3}{c^2}(-.7c)} = -.506c$