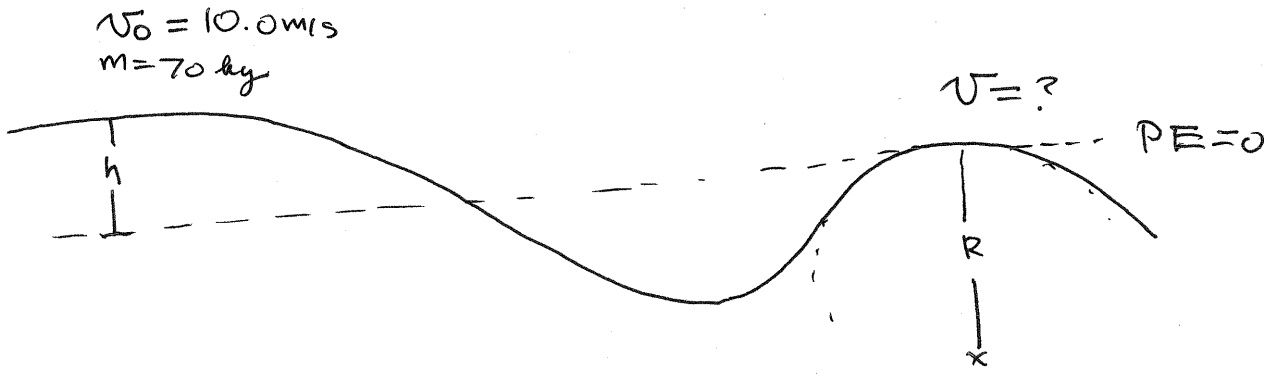
Exam #2
#17

$R = 20\,m$

$W_{NC} = -1671\,J$



I) "Conserve" Energy (including Nonconservative work) to get v at top of hill

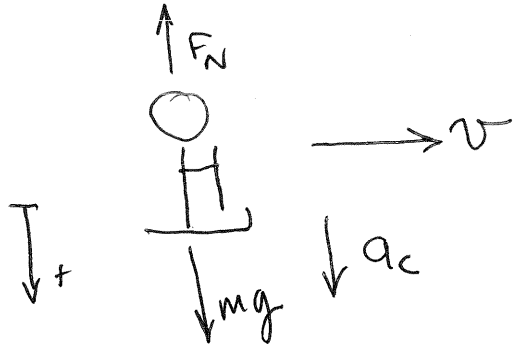
$$KE_i + PE_i + W_{NC} = KE_f + PE_f$$

$$\frac{1}{2}mv_0^2 + mgh + W_{NC} = \frac{1}{2}mv^2 + 0$$

$$\frac{1}{2}mv^2 = \frac{1}{2}mv_0^2 + mgh + W_{NC}$$

$$v^2 = v_0^2 + 2gh + \frac{2W_{NC}}{m} \quad \text{I}$$

II) Apply Newton's Second Law at top of hill



$$mg - F_N = m a_c$$

$$mg - F_N = m\frac{v^2}{R}$$

Lose Contact $\Rightarrow$ $F_N = 0 \rightarrow$

$$mg = \frac{mv^2}{R} \qquad \{v^2 = Rg\} \quad \text{II}$$

I = II solve for h =>

$$v_0^2 + 2gh + \frac{2W_{NC}}{m} = Rg$$

$$2gh = Rg - \frac{2W_{NC}}{m} - v_0^2$$

$$h = \frac{1}{2g}\left[Rg - \frac{2W_{NC}}{m} - v_0^2\right]$$

$$h = \left[\frac{R}{2} - \frac{W_{NC}}{mg} - \frac{v_0^2}{2g}\right]$$

$$h = \left[\frac{20m}{2} + \frac{(-1671J)}{(70kg)(9.8m/s^2)} - \frac{(10m/s)^2}{2(9.8m/s^2)}\right]$$

$$h = [10m + 2.4358m - 5.1024m]$$

$$\{h = 7.3330m\}$$ ✓