20. $v_f = ?$ $U_0 + K_0 + W_{NNC} = U_f + K_f$

$$\tfrac{1}{2}mv_0^2 = mgh_f + \tfrac{1}{2}mv_f^2$$

$$\tfrac{1}{2}v_0^2 = gh_f + \tfrac{1}{2}v_f^2$$

$$v_f = \sqrt{2\left(\tfrac{1}{2}v_0^2 - gh_f\right)}$$

$$v_f = \sqrt{2\left(\tfrac{1}{2}(8)^2 - 9.8(2)\right)}$$

$$v_f = 4.98\ m/s$$

b) $h_f = ?$ $(v_f = 0)$

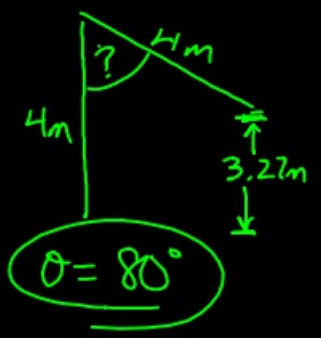
$$\tfrac{1}{2}mv_0^2 = mgh_f$$

$$\tfrac{1}{2}v_0^2 = gh_f$$

$$\frac{v_0^2}{2g} = h_f$$

$$\frac{8^2}{19.6} = h_f$$

$$3.27 = h_f$$

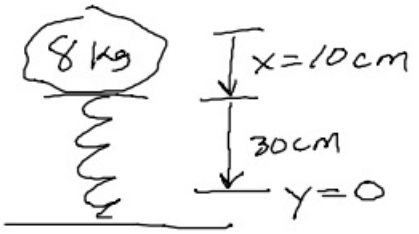


$\theta = 80°$

c) $E = ?$

$$E = K_0 = \tfrac{1}{2}mv_0^2 = \tfrac{1}{2}(2)(8)^2 = 64\,J$$

19. $k = ?$ $\quad \vec{F}_s = -k\vec{x}$



$78.4N = -k(-0.1m)$

$784 N/m = k$

b) $U_s = ?$ $\quad k = 784 N/m$ $\quad x = 0.4m$

$U_s = \frac{1}{2}kx^2 = \frac{1}{2}(784)(.4)^2 = 62.7J$

c) skip (**irrelevant!!!**)

d) $y_f = ?$ (release to zenith)

$U_i + K_i + W_{NC} = U_f + K_f$

$U_{s_i} = U_{g_f}$

$62.7J = mgy_f$

$62.7 = (8)(9.8)y_f$

$0.800m = y_f$