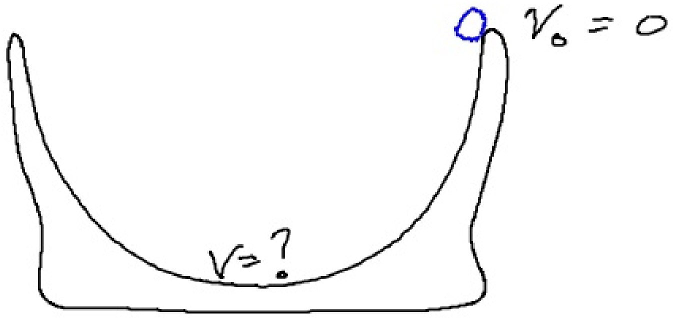
11.

a)



$$U_{g_0} + \underbrace{\cancel{K_0}}_{v_0=0} + \underbrace{\cancel{W_{NC}}}_{0} = \underbrace{\cancel{U_{g_f}}}_{h_f=0} + K_f$$

$$mgh_0 = \tfrac{1}{2} m v_f^2$$ divide both sides by m

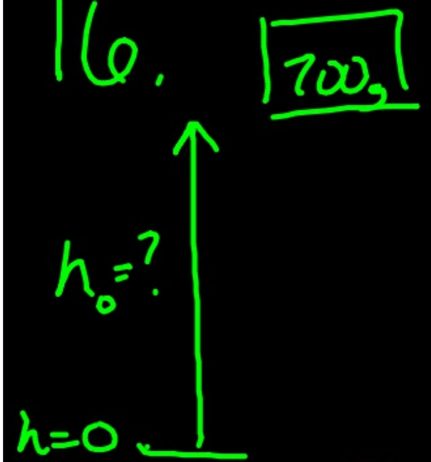
$$gh_0 = \tfrac{1}{2} v_f^2 \qquad v_f = \sqrt{2gh_0} = \sqrt{2(9.8)(0.22_m)}$$

$$v_f = 2.08 \, m/s$$

b) doubling the m does NOT change v_f, since mass canceled! (It would have 2x the U_0, then 2x the K_f, but same v_f)

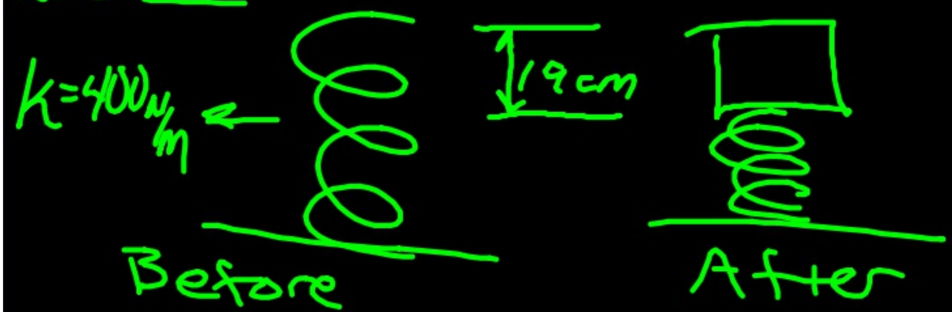
c) if $v_0 \neq 0$, then $K_0 \neq 0$ so K_f would be greater, so v_f would be greater.

16.



$$U_{g_o} = U_{g_f} + U_{e_f}$$

$$mgh_o = mgh_f + \frac{1}{2}kx_f^2$$



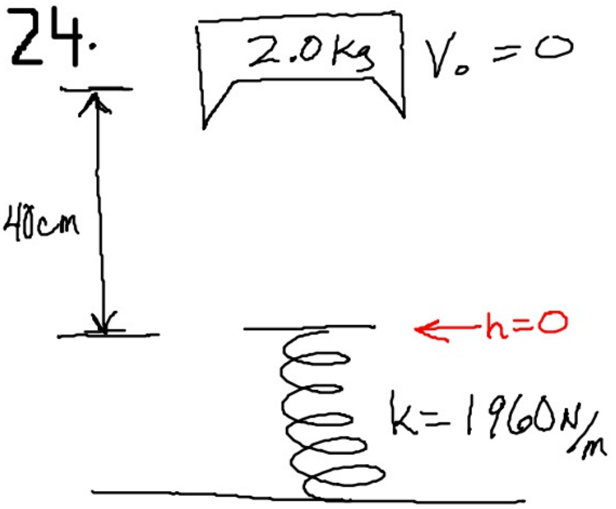
$$(0.7)(9.8)(h_o) = 0.7(9.8)(h_f) + \frac{1}{2}(400)(x_f)^2$$

$$6.86h_o = 6.86(-0.19) + 200(.19)^2$$

$$h_o = 0.86\text{m}$$

86cm

24.



How far does the spring compress? $(x_f = ?)$

$$E_{mech_o} + W_{NC} = E_{mech_f}$$

$$U_{g_o} = U_{s_f} + U_{g_f}$$

$$mgh_o = \tfrac{1}{2}kx_f^2 + mgh_f$$

cannot cancel mass!!!

$$(2)(9.8)(0.4) = \tfrac{1}{2}(1960)x^2 + 2(9.8)(-x)$$

$$7.84 = 980x^2 - 19.6x$$

$$0 = 980x^2 - 19.6x - 7.84$$

$$x = 0.1$$

spring compressed 0.1m