Exam 1 out of 40

36 + A
about
27-35 ? B
23-26 C
?
lower: Seek Help!

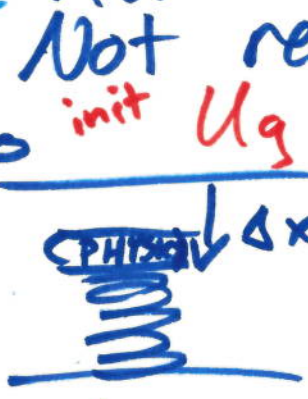
Conservation of Energy:

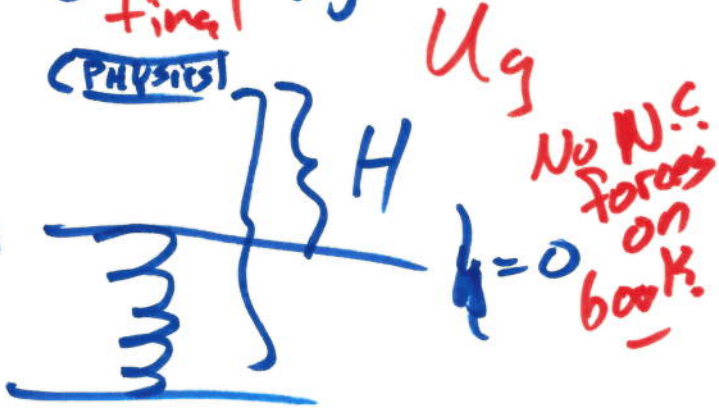
$$\Sigma W_{N.C.} = \Delta E_K + \sum_i \Delta U_i$$

$F_e \leftrightarrow U_e = \frac{1}{2}k(\Delta x)^2$
$F_g \leftrightarrow U_g = mgh$

New Example:
a vertical spring, $k = 678 \frac{N}{m}$ is compressed $\Delta x = 0.55m$, and a 1.1 kg textbook is placed upon it. How high, above the natural spring height, does book rise?

Note: Assume all spring energy → book. Not realistic.





$W_{NC} = \Delta E_K + \Sigma \Delta U$:

$0 = 0 + U_{g_f} - U_{g_0} - U_{e_0}$

$0 = mgh_f - mgh_0 - \frac{1}{2}k(\Delta x)^2$

$\frac{}{mg} \quad \frac{}{mg} \quad \frac{}{mg}$

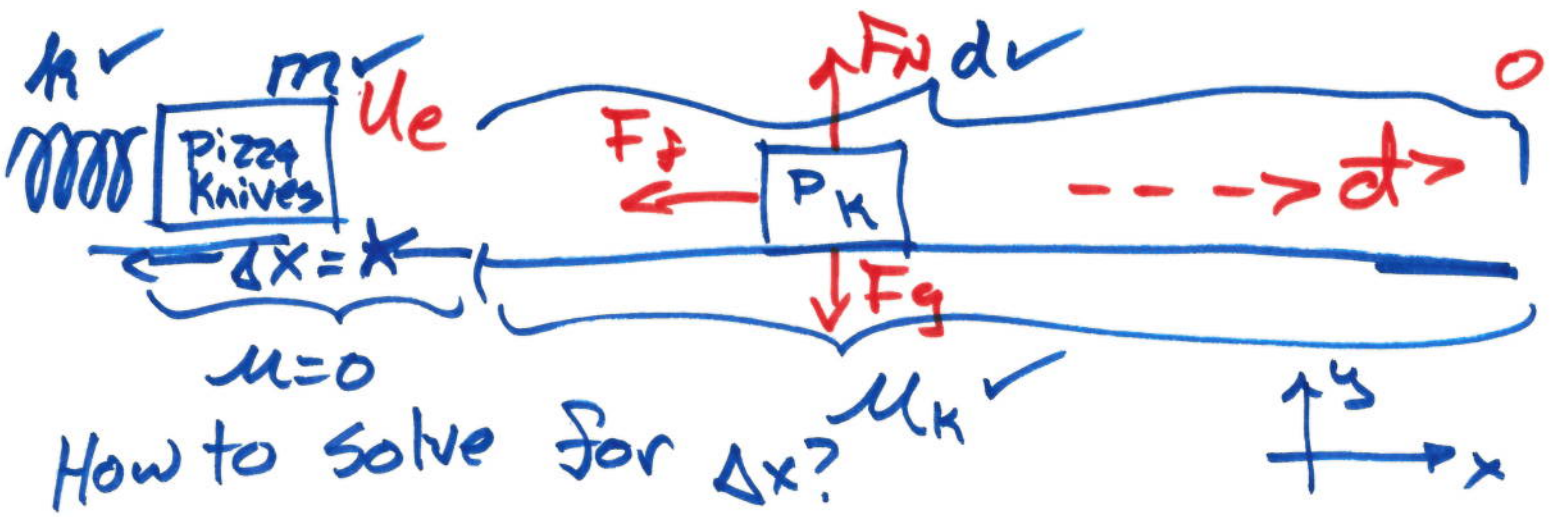
$0 = h_f - h_0 - \frac{k(\Delta x)^2}{2mg}$

$h_0 + \frac{k(\Delta x)^2}{2mg} = h_f$

$-0.55m + \frac{678\frac{N}{m}(0.55m)^2}{2(1.1kg)(9.8\frac{m}{s^2})} = h_f$

$-0.55m + 9.51m = h_f$

$8.96m = h_f$



How to solve for Δx?

$$\Sigma W_{N.C.} = \Delta E_K + \Sigma \Delta U$$

$$= 0 + 0 - U_{e_{(0)}}$$

$$W = F d \cos\theta$$

F	θ	$\cos\theta$
F_N	90°	0
F_f	180°	-1
F_g	90°	0

$$W_{F_f} = F_f \cdot d \cdot (-1)$$

($\cos\theta$)

$F_f = \mu_K \cdot F_N$ (μ_K)

F_N (0)

$$\Sigma F_y = m a_y$$

$$F_N - F_g = 0$$

$$F_N = mg$$

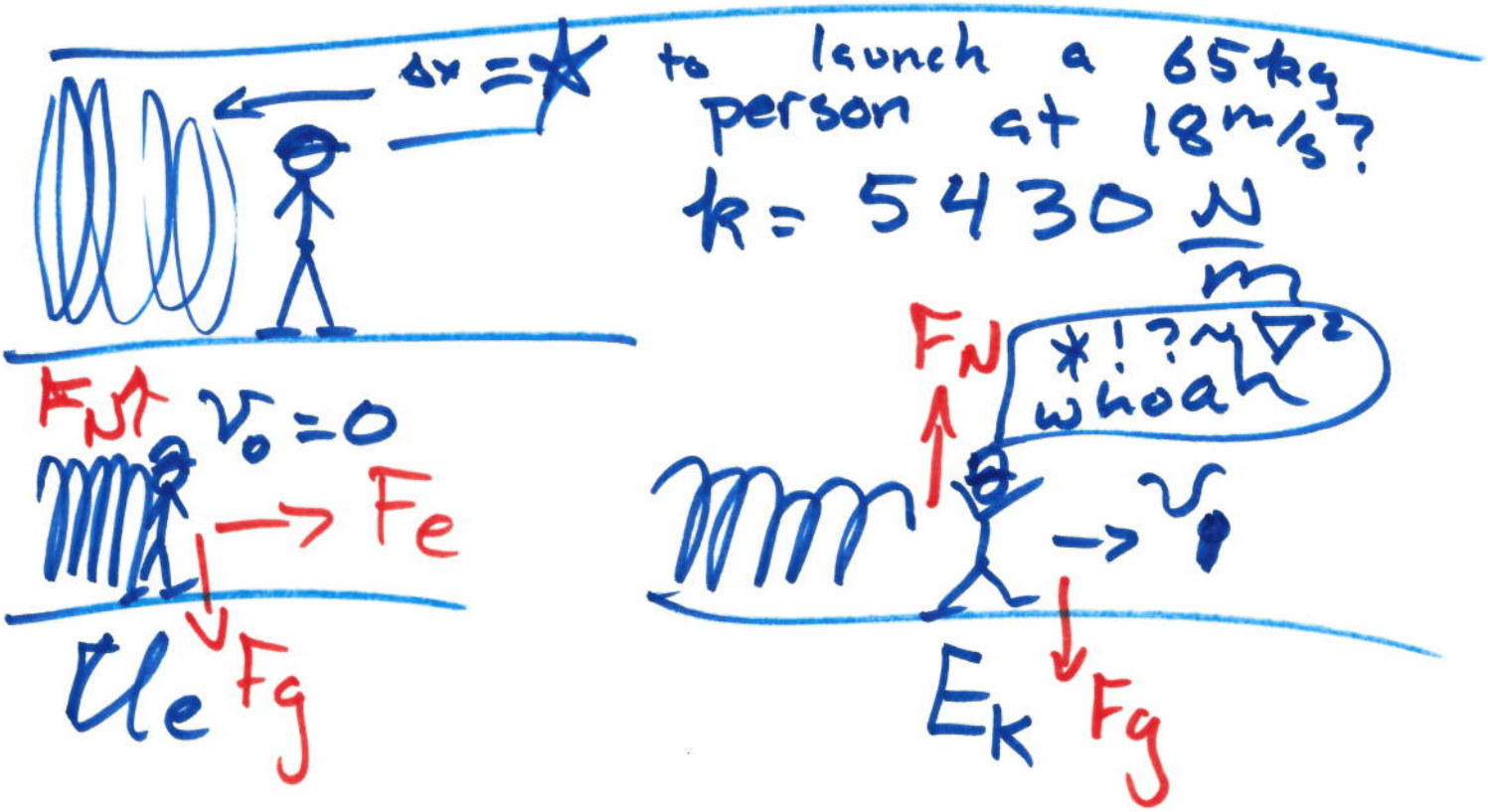
$$W_{F_{f_K}} = -\mu_K mg d$$

$$-\mu_k m g d = -\frac{1}{2} k (\Delta x)^2$$

$$\sqrt{\frac{2 \mu_k m g d}{k}} = \Delta x$$

$\Delta x = \star$ to launch a 65 kg person at 18 m/s?

$k = 5430 \frac{N}{m}$



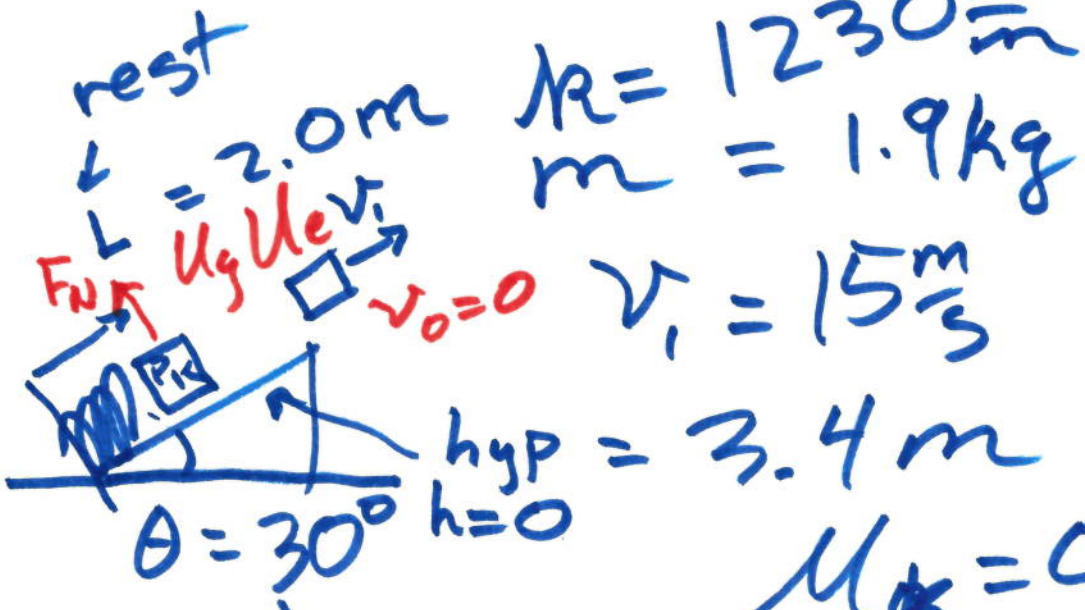
$$\Sigma W_{N.C.} = \Delta E_K + \Sigma \Delta U$$

$$0 = \frac{1}{2} m v_f^2 - 0 + 0 - U_e$$

$$0 = \frac{1}{2} m v_1^2 - \frac{1}{2} k (\Delta x)^2 \qquad -\frac{1}{2} k (\Delta x)^2$$

$$\Delta x = v_1 \sqrt{\frac{m}{k}} = 18 \frac{m}{s} \sqrt{\frac{65 kg}{5430 \frac{N}{m}}}$$

$\Delta x = 1.97\,m$



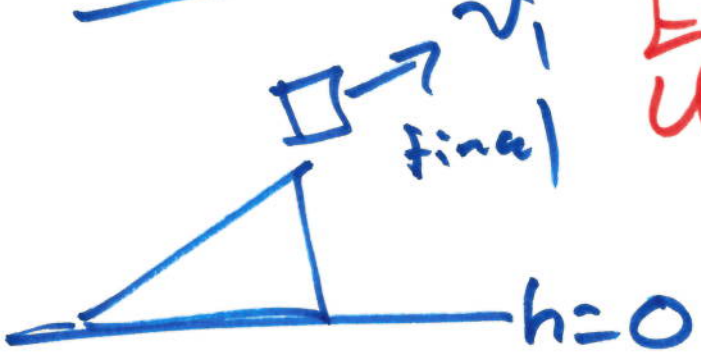
$k = 1230\,\frac{N}{m}$

$m = 1.9\,kg$

$v_1 = 15\,\frac{m}{s}$

$U_K = 0$ because were out of time.

Find: Δx



$$W_{NC} = \Delta E_K + \sum_i \Delta U_i$$

$$0 = E_{K_1} - \underset{\uparrow}{0} + U_{g_1} - U_{g_0} - U_{e_0}$$

$v_0 = 0$

$$0 = \frac{1}{2}mv_1^2 + mgh_y - mgh_0 - \frac{1}{2}k(\Delta x)^2$$

$h_1 = \text{opp.}$ $\sin 30° = \frac{\text{opp}}{\text{hyp}} = \frac{h_1}{3.4m}$

$h_1 = 3.4m \cdot \sin 30°$

$h_0 = (L - \Delta x) \sin 30°$