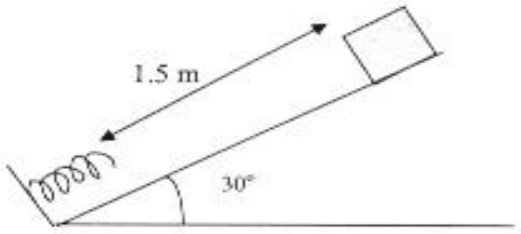
Physics 101-Rec
Quiz # 7

Instructor: Dr. Mekki

Name: Key Id#: Sect.#:

A block of mass 2 kg is released from rest and slides down a 30^0 rough incline having $\mu_k = 0.35$ as seen in the figure. At the bottom of the track, the block strikes a spring of spring constant 200 N/m. Find the maximum distance through which the spring is compressed.



$\Delta E = \Delta K + \Delta U_g + \Delta U_s = W_{f_k}$

$\Delta K = 0$

$\Delta U_g = U_f - U_i$ take $U_f = 0$ (reference)

$= -mgh = -mg(d+x)\sin\theta$

$\Delta U_s = U_f - U_i = \frac{1}{2}kx^2$

$W_{f_k} = -\mu_k N (d+x) = -\mu_k mg\cos\theta\,(d+x)$

$\Rightarrow -mg(d+x)\sin\theta + \frac{1}{2}kx^2 = -\mu_k mg\cos\theta\,(d+x)$

$\Rightarrow -mgd\sin\theta - mgx\sin\theta + \frac{1}{2}kx^2 + \mu_k mg\cos\theta\, d + \mu_k mg\cos\theta\, x = 0$

$kx^2 + (\mu_k mg\cos\theta - mg\sin\theta)x + (\mu_k mg\cos\theta\, d - mgd\cos\theta) = 0$

$100x^2 + (-3.86)x + (-16.5) = 0 \Rightarrow \boxed{x = -0.4\ m}$