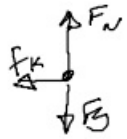
53 a) $\Delta E_{th} = ?$ b) $K_{max} = ?$ c) $x_i = ?$

$$E_i + W_{NC} = E_f$$

a) launched block $\rightarrow$ stopped block

$$K_i + W_f = 0$$



$$W_f = -\Delta E_{th}$$

$F_N = F_g (a_y = 0)$ $\quad (f)(\Delta r)\cos\theta = -\Delta E_{th}$

$$(.25)(3.5)(9.8)(7.8)\cos 180^\circ = -\Delta E_{th}$$

$$66.9\,J = \Delta E_{th}$$

b) $K_{max} + W_f = 0$

$$K_{max} = 66.9\,J$$

c) compressed $\rightarrow$ launch

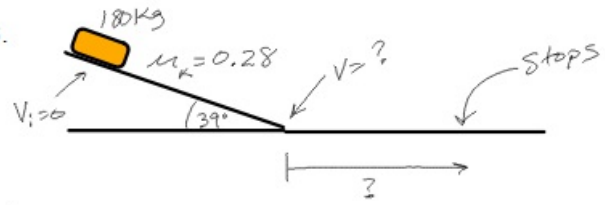
$$U_{s_i} = K_{max}$$

$$\tfrac{1}{2} k x_i^2 = 66.9\,J$$

$$\tfrac{1}{2}(640)\, x_i^2 = 66.9\,J$$

$$x_i = 0.457\,m$$

95.



a) ramp: $E_i + W_{NC} = E_f$

$$U_{g_i} + W_{f_k} = K_f$$

$$mgh_i + (f)(\Delta r)\cos 180° = \tfrac{1}{2}mv_f^2$$

$$mgh_i + (\mu)(F_N)(\Delta r)(-1) = \tfrac{1}{2}mv_f^2$$

$F_N - mg\cos\theta = ma_y$

$F_N = mg\cos\theta$

$$mgh_i + \mu(mg\cos\theta)(\Delta r)(-1) = \tfrac{1}{2}mv_f^2$$

$$gh_i - \mu g\cos\theta(\Delta r) = \tfrac{1}{2}v_f^2$$

$$(9.8)(3.7\sin 39°) - (.28)(9.8)\cos 39°(3.7) = \tfrac{1}{2}v_f^2$$

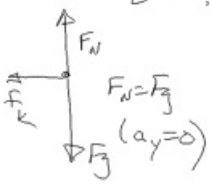
$5.46\,m/s = v_f$

b) skid to a stop

$$K_i + W_f = 0$$

$$\tfrac{1}{2}mv^2 + (f)(\Delta x)\cos 180° = 0$$

$$\tfrac{1}{2}mv_i^2 + (\mu F_N)(\Delta x)(-1) = 0$$



$$\tfrac{1}{2}mv_i^2 - \mu mg(\Delta x) = 0$$

$$\tfrac{1}{2}v_i^2 = \mu g(\Delta x)$$

$$\tfrac{1}{2}(5.46)^2 = (.28)(9.8)(\Delta x)$$

$5.44\,m = \Delta x$

c) mass cancelled: it don't matter!