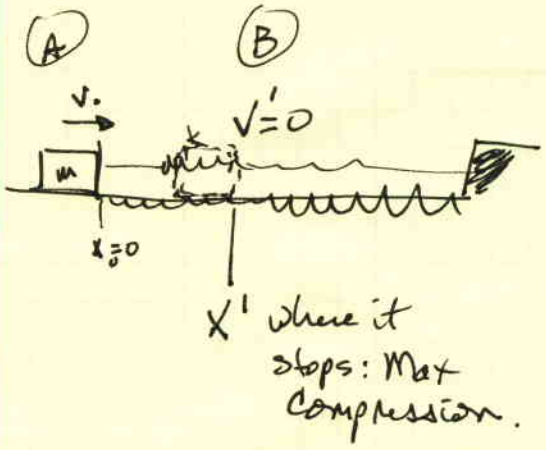
Variation: Block-spring on a rough surface of variable friction

$\mu = bx$

same mass m, slides into unstretched/uncompressed spring @ $x_0 = 0$; when it has V_0 = speed. Compresses spring to x' when it finally stops. friction increases linearly from $\mu = 0$ @ $x = 0$ to $\mu = bx'$ at x'.



Model 1 Body

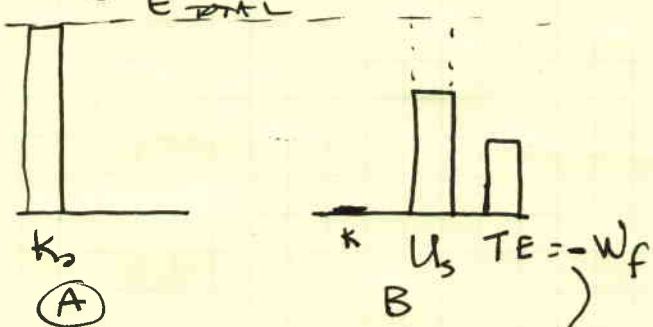
Interacti: F_{spring}, friction ($\vec{N}$ + grav.)

Model: $\vec{E}$ conservati.

Non-Cons. force friction = Work

Neg. Work means Reductn in ME = K + U

Energy conservat

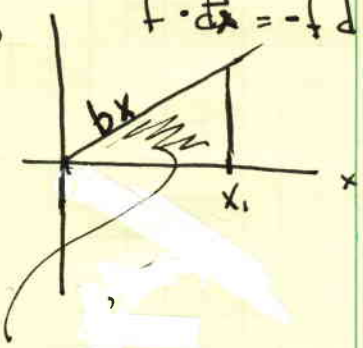


$E_A = E_B = U_s(x') - W_{fric}$

$\frac{1}{2}mV_0^2 = \frac{1}{2}kx'^2 - \int_{x=0}^{x'} f \cdot dx$

Area UNDER CURVE METHOD.

$\vec{f} \cdot d\vec{x} = -f\,dx$



Area $= \frac{1}{2}(x_1)(bx_1)$

$\int_0^{x_1} \vec{f} \cdot d\vec{x} \rightarrow \frac{1}{2}bx_1^2$

Initial KE is more than final stored spring potential Energy $U = \frac{1}{2}kx'^2$ because of the friction force opposing Motion; does negative work: transforming Mechanical energy into some other form (Thermal Energy)

$\frac{1}{2}mV_0^2 = \frac{1}{2}kx'^2 + \frac{1}{2}bx'^2$

This amt of Energy has been transformed. NO longer ME. Now another form shows up. Thermal Energy.

$\Delta ME = ME' - ME_0 = -\frac{1}{2}bx'^2$

↑ lost energy