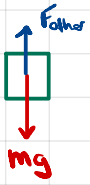

$W_{Res} = W_{other} + W_g = \Delta K$ $\Rightarrow$ $W_{other} = \Delta K + \Delta U = (K_2 + U_2) - (K_1 + U_1) = \Delta E_{mech}$

$W_g = -\Delta U$

Elastic Potential Energy

elastic body: returns to original shape and size after being deformed

$F_s = -kx$

$W_s = \int_{x_1}^{x_2} F_s\,dx = -\frac{k}{2}(x_2^2 - x_1^2) = -\Delta U_{el} = \Delta K = K_2 - K_1$

$\Rightarrow K_2 + U_{el_2} = K_1 + U_{el_1}$

gravitational potential energy, elastic potential energy, other forces

$W_g + W_{el} + W_{other} = \Delta K$

$U_{g_1} - U_{g_2} + U_{el_1} - U_{el_2} + W_{other} = K_2 - K_1$

$W_{other} = (K_2 + U_{g_2} + U_{el_2}) - (K_1 + U_{g_1} + U_{el_1}) = \Delta E_{mech}$

chg in total mechanical energy of the system (mass, Earth, spring)

Law of Conservation of Energy

$\Delta K + \Delta U + \Delta U_{int} = 0$ (ΔU_{int}: chg in internal energy)

$\Delta U_{int} = -W_{other}$

"energy is never created or destroyed, it only changes form"

Force and Potential Energy

→ so far, we've started w/ description of force, calculated work, defined potential energy.

→ if instead we are given a potential energy function of position, how to find corresponding force?

Ex: motion along x-axis, under conservative force $F_x(x)$, pot. fn $U(x)$.

$W = -\Delta U$

For small displacem. Δx, $\Delta W = F_x(x)\,\Delta x = -\Delta U \Rightarrow F_x(x) = \frac{-\Delta U}{\Delta x}$

$\Rightarrow F_x(x) = \lim_{\Delta x \to 0} \frac{-\Delta U}{\Delta x} = -\frac{dU}{dx}$