

Parallels between momentum and energy (algebra-based physics)

Impulse and momentum	Work and energy
$\vec{p} := m\vec{v}$	$K := \frac{1}{2}mv^2$
$\Delta\vec{J}_F := \vec{F}_{AVG} \Delta t$ $\Delta J_{F,x} = F_{x,AVG} \Delta t$ $\Delta J_{F,y} = F_{y,AVG} \Delta t$ $\Delta J_{F,x,y} = \text{Signed area under graph of } F_{x,y} \text{ vs. } t$	$\Delta W_F := F_{\parallel,AVG} \Delta \ell$ $= (F \cos \theta)_{AVG} \Delta \ell$ $\Delta W_F = \text{Signed area under graph of } F_{\parallel} \text{ vs. } \ell$ $[W] = \text{N} \cdot \text{m} = \text{J}$
$\vec{p}_i + \sum_F \overbrace{\Delta\vec{J}_F}^{\Delta\vec{J}_{\Sigma F}} = \vec{p}_f$	$K_i + \sum_F \Delta W_F = K_f$ <p>If system has no internal degrees of freedom, $\sum_F \Delta W_F = \Delta W_{\Sigma F}$.</p>
$\vec{F}_{AVG} = \frac{\Delta\vec{J}_F}{\Delta t} = \frac{\Delta\vec{p}_F}{\Delta t}$	$P_{F,AVG} := \frac{\Delta W_F}{\Delta t}$ $P_F = (F \cos \theta)v$ $[P] = \frac{\text{J}}{\text{s}} = \text{W}$
	$-\Delta U_{F,1\dots N} := \Delta W_{F,2 \rightarrow 1} + \Delta W_{F,1 \rightarrow 2} + \dots + \Delta W_{F,N-1 \rightarrow N}$ $F_{x,AVG} = -\frac{\Delta U_F}{\Delta x}$ $\Delta U_G = mg\Delta h$ $\Delta U_S = \frac{1}{2}k(\Delta x)^2$
$\Sigma\vec{p}_i + \sum_{EXT \rightarrow SYS} \overbrace{\Delta\vec{J}_F}^{\Delta\vec{J}_{\Sigma F,EXT \rightarrow SYS}} = \Sigma\vec{p}_f$	$\overbrace{\Sigma K_i + \Sigma U_{G,i} + \Sigma U_{S,i}}^{\Sigma ME_{SYS,i}} + \Sigma \Delta W_{OUF} = \overbrace{\Sigma K_f + \Sigma U_{G,f} + \Sigma U_{S,f}}^{\Sigma ME_{SYS,f}} + \Sigma \Delta U_{INT}$