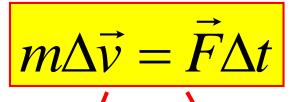
Conservation Laws

2nd Newton's Law



Only conservative forces:

Energy conservation

$$K + U = const$$

Mo external forces: **Momemtum conservation**

$$\vec{p}_1 + \vec{p}_2 + \ldots + \vec{p}_n = const$$

Examples of Potential Energy, U:

Earth gravity,
$$F = -mg$$
: $U(x) = mgh$

Earth gravity,
$$F = -mg$$
: $U(x) = mgh$
Hooke's spring, $F = -kx$: $U(x) = \frac{kx^2}{2}$

Homework

A bullet of mass \mathbf{m} that moves horizontally with speed \mathbf{v} , hits boxer's punch bag that is hang up from the sealing. The punch bag has mass \mathbf{M} , and bullets gets stuck in it. As a result, the punch bag starts moving as a pendulum. Find the maximum height $\Delta \mathbf{h}$ that it will reach, with respect to its initial position.

Hint: you need to split the problem onto two parts: momentum is conserved in one part, and energy in the other.

