# Conservation Laws

2nd Newton's Law

$$m\Delta\vec{v} = \vec{F}\Delta t$$

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

# Homework 15

A mass **m** is hanged on a spring with spring constant, in the presence of gravity. At the initial moment the mass is held in the position x=0 that corresponds to zero deformation of the spring. It is them released and starts moving down due to gravity.

a) Write down the overall potential energy of the object, as a function of its vertical displacement **x** (let take the positive direction be down). Includes both effects of gravity and the spring. Sketch the function U(x).

b) Using your formula and the plot find the maximum extension of the spring, and maximum speed of the object. Neglect air resistance or any other energy loss.