Newton's Laws

- **Newton's 1st Law (Same as Galileo's law of inertia): No force => no acceleration.**

"An object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction unless acted upon by a force."

$$\vec{F} = 0 \quad \Rightarrow \quad \vec{v} = const$$

- **Newton's 2nd Law:**

"Force equals mass times acceleration"

$$\vec{F} = m\vec{a}$$

- **Newton's 3rd Law:**

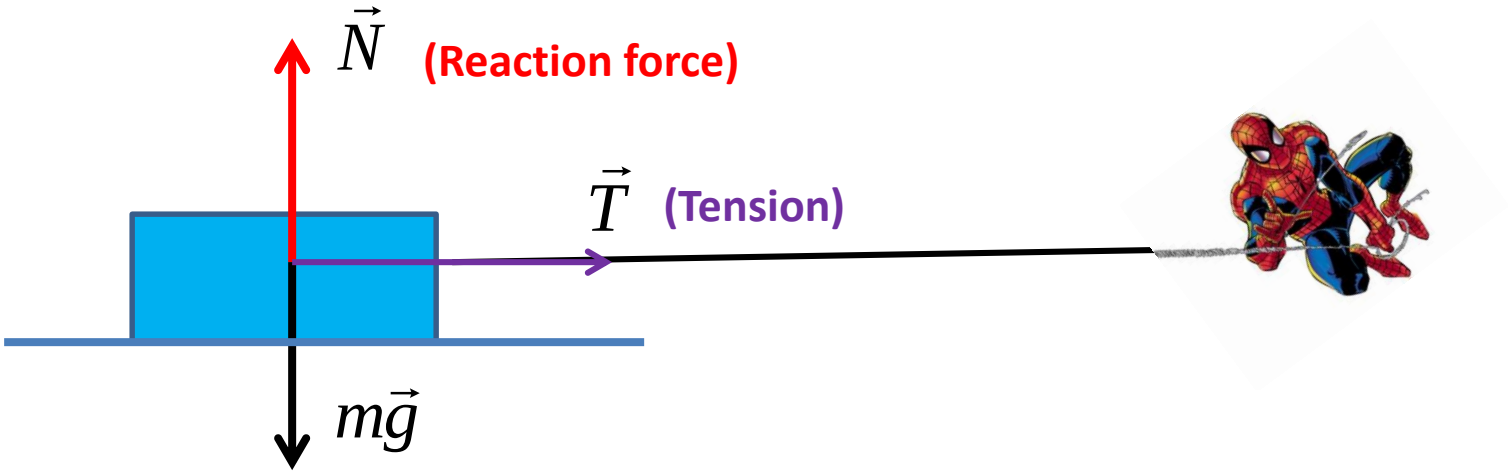
"Any Force of action has an equal and opposite Force of reaction "

$$\vec{F}_{B\to A} = -\vec{F}_{A\to B}$$

Unit of force is called Newton (N)

$$1N = 1\frac{kg \cdot m}{s^2}$$

Examples of Forces



(Gravitational force.
g=9.8 m/s² is gravitational acceleration)

Forces are vectors! The total force is the *vector sum* of all applied forces:

$$\vec{F}_{total} = \vec{N} + \vec{T} + m\vec{g}$$

Adding vectors

There are two ways of thinking about **vectors**:

- **Geometrically,** vector is a directed line segment. It has direction and magnitude.
- **Algebraically,** vectors can be written as a list of numbers: their X, Y and Z components. For instance (3,4,-5).

To add vectors A and B geometrically you can use the "triangle" or "parallelogram" rules: