

Physics: Laws of Motion

Newton's Laws of Motion

Newton's Laws of Motion, formulated by Sir Isaac Newton in the late 17th century, are fundamental principles in classical mechanics that describe the relationship between a body and the forces acting upon it.

First Law: Law of Inertia

An object at rest stays at rest, and an object in motion stays in motion with a constant velocity, unless acted upon by a net external force. This is often summarized as:

$$F_{\text{net}} = 0 \implies a = 0$$

where F_{net} is the net force and a is acceleration.

Second Law: Law of Acceleration

The acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass. Mathematically:

$$F = ma$$

where F is the force (in Newtons), m is the mass (in kilograms), and a is the acceleration (in meters per second squared).

Third Law: Action-Reaction

For every action, there is an equal and opposite reaction. If object A exerts a force on object B, then object B exerts an equal force in the opposite direction on object A. This can be written as:

$$F_{A \text{ on } B} = -F_{B \text{ on } A}$$

Applications

These laws apply to everyday phenomena, such as:

- A car accelerating when the gas pedal is pressed (Second Law).
- A book remaining on a table unless pushed (First Law).
- The recoil of a gun when fired (Third Law).