

# Physical World

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- Science is a systematic way of acquiring knowledge about the surroundings through careful observations and experimentations over a period of time.
- The study of nature and natural phenomenon put in an organized way in various sub-topics is called physics. It has many branches namely, mechanics, electricity, magnetism, optics, modern physics, etc.
- Physics covers a tremendous range of magnitude of physical quantities such as length, mass, time, energy, etc.
- The connection between physics and technology can be observed in many examples.
  - Carnot's theory of heat engine enabled man to develop refrigerators, engine, air conditioner, etc.
  - Study of electromagnetic waves and propagation helped man to design communication systems.
  - The idea of the nucleus and the energy embedded in it enabled him to generate an enormous amount of energy.
  - Physics and technology are related to each other.
- Physics in relation to society:
  - Physics has tried to help humankind to develop better ideas. Development of the transport system and communication system has brought the world closer.

## **Fundamental forces in nature:**

- **Gravitational force:** The gravitational force exists between any two objects in the universe. It states that the force of mutual attraction is directly proportional to the product of the masses and inversely proportional to the square of the separation.
- **Electro-magnetic force:** The electromagnetic force is between a pair of charges/poles. The electric and magnetic forces are not separable.
- **Strong-nuclear force:** The strong nuclear forces bind the protons and neutrons in a nucleus.
- **Weak-nuclear forces:** The weak nuclear forces appear in certain interactions such as  $\beta$ -decay and exist in distances of the order of  $10^{-15}$  m.

The electromagnetic and the weak nuclear forces are unified into one force called electro-weak force.

- **Conserved Quantities**

- The quantities that remain constant with time for a system.

- **Conservation law:**

Some of the general laws in nature include the laws of conservation of mass, energy, linear momentum, angular momentum, charge, parity, etc. Some conservation laws are true for one fundamental force but not for the other.

- **Law of Conservation of Energy:** For motion under an external conservative force, the total mechanical energy (that is the sum of kinetic and potential energy of a body) remains constant.
- **Law of Conservation of Linear Momentum:** In the absence of an external force, the linear momentum of a system remains unchanged.
- **Law of Conservation of Angular Momentum:** If the total external torque acting on a system is zero, then angular momentum of the system remains constant.
- **Law of Conservation of Charge:** Charges are neither created nor destroyed, but are simply transferred from one body to another.