

Indian School Muscat

CLASS XI CHAPTER 1 PHYSICAL WORLD

Science means organized knowledge.

It is human nature to observe things and happenings around in the nature and then to relate them. This knowledge is organized so that it become well connected and logical. Then it is known as Science. It is a systematic attempt to understand natural phenomenon and use this knowledge to predict, modify and control phenomena.

Natural Sciences can be broadly divided in three branches namely Physics, Chemistry and biology. Physics is a study of basic laws of nature and their manifestation in different phenomena.

Scientific Method

Scientific methods are used to observe things and natural phenomena.

It includes several steps:

- Observations
- Controlled experiments,
- Qualitative and quantitative reasoning,
- Mathematical modeling
- Prediction and
- Verification or falsification of theories.

The scope of Physics can be divided in to two domains; Macroscopic and Microscopic.

- Macroscopic domain includes phenomena at the level of Laboratory, terrestrial and astronomical scales.
- Microscopic domain includes atomic, molecular and nuclear phenomena.

The excitement of Physics is experienced in many fields Like:

- Live transmissions through television.
- Computers with high speed and memory,
- Use of Robots,

- Lasers and their applications

Fundamental Forces in Nature

There is a large number of forces experienced or applied. These may be macroscopic forces like gravitation, friction, contact forces and microscopic forces like electromagnetic and inter-atomic forces. But all these forces arise from some basic forces called Fundamental Forces.

Fundamental Forces in Nature are:

1. Gravitational force.

It is due to Mass of the two bodies.

$$F = G \frac{m_1 m_2}{r^2}$$

where G is universal gravitational constant, $G = 6.67 \times 10^{-11} \text{ N m}^2/\text{kg}^2$

The gravitational force:

- It is always attractive.
- It operates on all objects of universe.
- It's a long range force.
- It's the weakest force in nature
- It is a central force and obeys inverse square law.

Importance of Gravitational Force

- Gravity governs the motion of the moon and artificial satellites around the earth, motion of the earth and other planets around the sun.
- Gravity governs the motion of bodies falling to the earth
- It plays a key role in the large-scale phenomena of the universe, such as formation and evolution of stars, galaxies and galactic clusters.

2. Electromagnetic Forces:

- It is a central force and obeys inverse square law.
- It's due to stationary or moving electrical charge
- It may be attractive or repulsive.
- It is a long range force
- It is a central force and obeys inverse square law

3. **Strong nuclear force:**

- Operate between Nucleons
- It may be attractive in nature
- Its range is very short, within nuclear size
- Its strongest force in nature
- Strong nuclear force is a charge-independent force. It acts equally between a proton and a proton, a neutron and a neutron, and a proton and a neutron.

4. **Weak Nuclear force:**

- It operates among some elementary particles, particularly electron and neutrino during nuclear disintegration process
- Has very short range
- Arrange the fundamental forces in their descending order of the strength.

Strong nuclear force > Electromagnetic force > Weak nuclear force > gravitational force.

Conservation Laws in Nature:

In any physical phenomenon governed by different forces, several quantities do not change with time. These special quantities are conserved quantities of nature.

- **Law of conservation of energy:** Energy can neither be created and nor be destroyed but can be transformed from one form to another. Total energy of an isolated system remains constant.
- **Law of conservation of linear momentum:** Total linear momentum of an isolated system remains constant (ie, provided there is no external force acting on it.)
- **Law of conservation of angular momentum:** Total angular momentum of a system remains constant, provided there is no external torque acting on it.
- **Law of conservation of charge:** Total charge of an isolated system remains constant.
