

Chapter - 1

Physical world.

5 Science and Scientific Method:-

★ Science → Complete and proper knowledge about anything is known as science. The word 'science' originally comes from the Latin verb *scientia*, it means that 'to know'. The Sanskrit word 'Vijnan' and Arabic word 'Ilm' also carry similar meaning of science as organised knowledge.

★ 15 Scientific Method →

The Scientific Method involves several interdependent and inter-related steps such as systematic observations, controlled experimentation, qualitative and quantitative reasoning to look for logical behaviour and understanding observation.

What is Physics?

→ The branch of science in which we study about nature or natural phenomena and its laws. Physics comes from a Greek term 'Phiz' meaning 'nature'.

Physics deals with all the phenomena which occur in the material world. A wide variety of events and phenomena in nature take place according to a set of a few general principles of basic laws.

Unification and Reductionism

- Unification → Unification refers to attempting to describe diverse physical phenomena in terms of a few concepts and laws.
- Reductionism → Reductionism refers to attempting to obtain or derive the properties of a bigger, more complex.

Scope and excitement of Physics

- ~~The scope of Physics is very wide.~~
- Physics covers a tremendous range of magnitude of physical quantities like 10^{27} .
- Mechanics is based on Newton's law of Gravitation.

- Electrodynamics - (Electric + electric dynamic motion) as electric motor, generator.

- It deals with electric and magnetic phenomena associated with

Macroscopic and Microscopic domain:

- Macroscopic domain → the study of phenomena that involve finite size object at the laboratory or terrestrial scale and large size celestial object on gigantic astronomical scale.
- Microscopic domain → the study of the phenomena that involve atoms, nuclei, molecules, electrons, protons and large number of other elementary particles even on tiny sub-atomic scale.

Mechanics → Mechanics was founded mainly on laws of motion and the law of gravitation. It deals with the study of different types.



NAME	Major Contribution/Discoveries	Country of origin
(i) James Clerk	Electromagnetic theory	U.K
(ii) J.C Bose	Ultra short radiations	India
(iii) J.J Thomson	Electron	U.K
(iv) Albert Einstein	Theory of relativity	Germany
(v) Victor Brans	Cosmic radiation	Austria
(vi) R.A Millikan	Measurement of electric charge	U.S.A
(vii) Rutherford	Nuclear Model of atom	New Zealand
(viii) M.N Saha	Thermal ionisation	India
(ix) S.N Bose	Quantum statistics	India
(x) Wolfgang Pauli	Exclusion Principle	Austria
(xi) Oswald Lawrence	Cyclotron	U.S.A
(xii) James Chadwick	Neutron	U.K
(xiii) Hideki Yukawa	Theory of Nuclear force	Japan
(xiv) S. Chandrasekhar	Structure and evolution	India

Fundamental forces in nature

→ In our experience, force is needed to push, carry or throw object, claym or break them. At the present stage of our understanding, we know of four fundamental forces in nature, which are described in brief here:-

Gravitational force:-

The force of mutual attraction between one of two objects is known as gravitational force.

Electromagnetic force:-

The force between charged particles. In the simple case when charges at rest, the force is given by Coulomb's law: Attraction for unlike charges and repulsion for like charges.

Strong Nuclear force:-

The strong nuclear force binds protons and neutrons in a nucleus.

Weak nuclear force:-

The weak nuclear force appears only in certain nuclear process.



Towards unification of forces
 → Newton unified terrestrial and celestial domains under a common law of gravitation

Name	Relative length	Range	operates among
• Gravitational force	10^{-39}	Infinite	All object in universe
• Weak Nuclear force	10^{-13}	Very short sub	Some elementary
• Electromagnetic force	10^{-2}	Infinite	Particle electron
• Strong Nuclear force	1	Short Nuclear size	Particles Nucleus

Name of Physicist	Year	Achievement in unification
• Isaac Newton	1687	Law of motion and law of Gravitation are equally applicable
• Oersted Michael Faraday	1820	The existence electricity and magnetism are closely linked
• James Clerk Maxwell	1830	Unified electricity, magnetism and optics into a single subject of electromagnetism
• Sheldon Glashow, Abdus Salam	1979	Reduced the fundamental forces from four to three by showing that weak, Nuclear force
• Carlo Rubbia	1984	Verified experimentally the predictions of the theory of electroweak forces

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 Law of Conservation of mass → The mass of a given atom or a given sub-atomic particles remain constant

