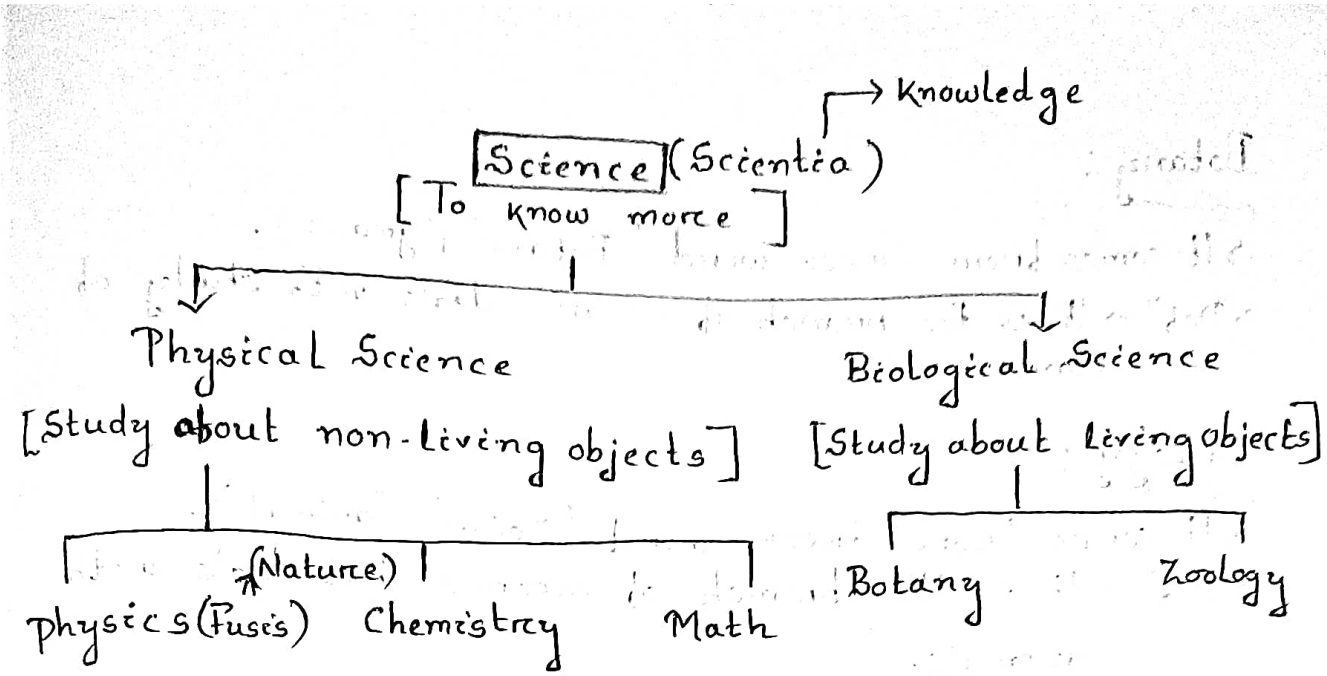


Physics : (Natural Science)

→ It comes from Greek word "Fusis" (nature).
→ Sanskrit word → Bhautiki
→ Def^{n} → Physics is the branch of science which deals with nature and natural phenomenon.

Chemistry : (Chemical Science)

→ It comes from Greek word "Khemeia" (Cast or pour or flow together)
→ Def^{n} → Chemistry is the branch of science that deals with the properties, composition and structure of elements and compounds.

Mathematics

→ It comes from ancient Greek word máthēma (μάθημα).
→ Def^{n} → It is the branch of science that deals with numbers and their properties, relation and operations and with shapes in space and their structure and measurement.

Botany :

→ It comes from Greek word "Bqtane" (grass).

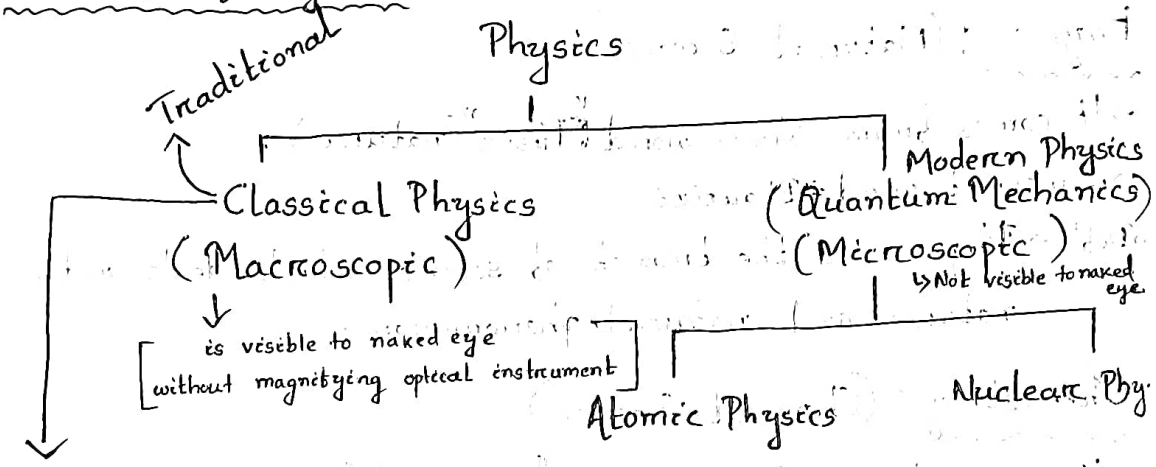
→ Defⁿ ⇒ It is the branch of science, deals with study of plants.

Zoology :

→ It comes from Greek, word "zoion" (animal).

→ Defⁿ ⇒ It is the branch of science that deals with animals.

Branches of Physics :-



(1) Mechanics

- It is the branch of physics which deals with the study of particles or bodies when they are at rest or in motion.
- It is divided into,
  - (i) Static ⇒ It is the study of body which is at rest.
  - (ii) Dynamics ⇒ It is the study of body which is in motion.
    - (a) Kinematics ⇒ is the study of relationship between displacement, velocity, acceleration and time of given motion, without considering the forces that cause the motion.
    - (b) Kinetics ⇒ deals with the relationship between the motion of body and forces acting on them.

(2) Optics :

- It is the branch of physics which deals with various phenomenon related to light.

(i) Geometrical Optics => Study of description of light propagation interms of rays using geometry.

(ii) Physical Optics => Study of nature of light.

- (a) Wave optics => Wave nature of light
- (b) Quantum Optics => Particle nature of light

(3) Thermodynamics

- The study of relationship between the heat and other forms of energy.
- It is only concerned with large scale observation.

[It happens over a very wide area or involves a lot of people or things]

(4) Electromagnetism

- The study of properties of electric current and magnetism and their relationship.

(i) Electrostatic => The study of electric charges at rest.
(ii) Electrodynamics => The study of moving electric charges.
(iii) Magnetostatic => The study of magnetic poles at rest.
(iv) Magnetodynamics => The study of magnetic poles at motion.

(5) Fluid Dynamics

- The study of motion in fluids (in both liquid and gaseous state).

(6) Aerodynamics

The branch of dynamics that deals with the motion of air and other gaseous fluids.

(7) Plasma Physics

The study of fourth state of matter - plasma. Sun is made of plasma.

(8) Acoustics

The study of production and propagation of soundwaves.

(9) Geophysics

It is the branch of physics deals with earth.

(10) Biophysics

It is the branch of physics deals with biological phenomena and problems.

(11) Astrophysics

It is the branch of physics deals with universe i.e. stars, galaxy, planets etc.

(12) Cosmology

Study of origin, development, structure, history and future of entire universe.

(13) Particle Physics

The branch of physics deals with properties and behaviour of elementary particle (smaller than atom). It is also High Energy physics.

(14) Cryophysics => Study of matter at extremely low temp.

Scope of Physics :-

- It deals with magnitude of physical quantities like length, mass.
- The scope of physics is best understood under three disciplines.

(i) Microscopic ⇒ It takesplace at molecular or atomic level.

(ii) Mesoscopic ⇒ Occurs between microscopic and macroscopic phenomena i.e. Condensed Matter & Material phy. (Solid, liq., gas)

(iii) Macroscopic ⇒ Mechanics, Electrodynamics, optic, thermodynamics

Physics for Technology & Society :-

1. Energy Industry
   - * Use of fossil fuels, petrol, diesel, coal.
   - * Dams, Solar panels, nuclear reactors.
2. IT Industry
   - * Data processing, network speed
   - * Transistors, superconductivity factors used in computers.
   - * Optical fibre used internal reflection of light.
3. Medical Industry
   - * X-rays, ultrasonography
   - * Nuclear medicine used for hyperthyroidism, lymphoma
4. Communication Industry
   - * Telecom & Television - Electromagnetic waves principle
   - * Aeroplanes - operates on Bernoulli's principle

Physics in Relation to Technology :-

Technology is the application of principles of physics for practical purposes.

Sl.No.	Technology	Sl.No.	Basic principles
1.	Steam Engine	1.	Laws of thermodynamics
2.	Rocket Population	2.	Newton's Laws of motion
3.	Aeroplane	3.	Bernoulli's principle
4.	Optical fibres	4.	Total internal reflection of light.
5.	Electric Generators	5.	Faraday's law of electro-magnetic induction.
6.	Photocell	6.	Photoelectric Effect
7.	Electron microscope	7.	wave nature of electrons
8.	Computers	8.	Digital Logic
9.	Nuclear Reactors	9.	Nuclear chain reaction
10.	Genetic Engineering	10.	Role of DNA in heredity

Some Physicists & Major Contribution :-

1. Archimedes → Principle of buoyancy
2. Galileo Galilei → Law of inertia
3. Newton → Universal law of Gravitation
4. J.J. Thomson → Electron
5. Marie Curie → Studies of Natural Radioactivity
6. Einstein → Photoelectric effect
7. R.A. Millikan → Measurement of electronic charge

8. Ernest Rutherford → Nuclear model of atom.
9. Niels Bohr → Quantum model of hydrogen atom.
10. C.V. Raman → Inelastic scattering of light by molecules.
11. S.N. Bose → Quantum Statistics
12. Louis de Broglie → Wave nature of matter.
13. Wolfgang Pauli → Exclusion principles
14. Enrico Fermi → Controlled nuclear fission
15. Werner Heisenberg → Uncertainty principle
16. James Chadwick → Neutron
17. Hideki Yukawa → Theory of nuclear forces
18. Homi Jahangir Bhaba → Cascade process of ~~cosmic ray~~ cosmic radiation.
19. L.D. Landau → Theory of Condensed matter, Liquid helium.
20. C.H. Townes → Maser : Laser

Fundamental Forces in Nature :-

Though the origin of derived forces is complex, yet they can be understood interms of following four fundamental forces i.e. (a) Gravitational forces (b) Weak Nuclear forces (c) Electromagnetic forces (d) Strong Nuclear forces.

(a) Gravitational Forces :-

"This force is the force of mutual attraction between any two objects by virtue of their masses."

The magnitude of force exerted by a particle of mass (m_1) on another particle of mass (m_2) at a distance from it is given by Newton's law of gravitation :

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

, G = Universal Gravitational constant

$= 6.67 \times 10^{-11}\ Nm^2/kg^2$

$= 6.67 \times 10^{-11}\ Nm^2 kg^{-2}$

Important features/properties ($\vec{F}_G$) :-

(i) These are universal attractive forces.

(ii) These are the weakest force in nature as the force of attraction is weak.

(iii) These forces obey inverse square law ($\because F \propto \frac{1}{r^2}$)

(iv) These forces are central forces i.e. they act along the line joining the centre of bodies.

(v) Gravitational forces are conservative forces.
[Conservative forces are those forces which are independent of path]

(vi) The field particle of gravitational forces is called "graviton".

(b) Weak Nuclear Force :-

- These forces were discovered during the study of the phenomenon of β-decay, in radioactivity.
[*Radioactive decay is the process by which an unstable atomic nucleus loses energy by radiation]

* $A = -\frac{dN}{dt}$; A = Total activity
N = Number of particles
t = time

*Radiation is the emission or transmission of energy in the form of waves or particles through space or a material medium at the speed of light.]

- β-decay occurs when a neutron in the nucleus is converted into a proton and an electron.

→ Pauli, in 1930, postulated the existence of an uncharged particle called antineutrino ($\bar{\nu}$) which is emitted along with the β-particle.

When antineutrino carries maximum energy, the energy of β-particle is minimum and vice versa.

Properties of WNF :-

(i) The weak nuclear forces are 10^{25} times stronger than the gravitational forces.

(ii) The weak nuclear forces exist between leptons* and leptons; leptons and mesons* etc.

(c) Electromagnetic Forces :-

"The electromagnetic forces are the forces between charged particles."

The magnitude of electrostatic force F between two static point charges q_1 and q_2 separated by a distance 'r' in air is given by Coulomb's law :

$$F = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2}$$

where $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \, Nm^2/C^2$

& $\epsilon_0 = 8.85 \times 10^{-12} \, C^2 N^{-1} m^{-2}$.

Properties of (EMF) :-

(i) These forces may be attractive or repulsive: like charges repel eachother and unlike charges attract eachother.

(ii) These forces are 10^{36} times stronger than gravitational forces.

(iii) They obey inverse square law.

(iv) They are central forces.

(v) They are conservative forces.

(vi) The field particle of electromagnetic forces is photon, which carries no charge and has zero rest mass.

(d) Strong Nuclear Forces :-

The forces that bind the neutrons and protons together in a nucleus are called strong nuclear forces.

Properties of SNF :-

(i) They are strongest forces in nature. They are 10^{38} times stronger than gravitational forces, 10^{2} times stronger than electrostatic forces and 10^{13} times stronger than weak forces.

(ii) They are basically attractive forces. Only when the distance between nucleons is less than 0.8 fermi, at that time they become repulsive. ($\because 1 \text{ fermi} = 10^{-15} \text{ m}$)

(iii) They don't obey inverse square law.

(iv) They are non central forces.

(v) They are non conservative forces.

(vi) The field particle for nuclear forces is the π-mesons.

SL.NO	NAME	RELATIVE STRENGTH	RANGE	OPERATES AMONG
1.	Gravitational Force	1	infinite	All objects in universe
2.	Weak Nuclear Force	10^{25}	Very short subnuclear size (10^{-16} m)	Some elementary particles like electron, Nucleons, heavier elementary particles
3.	Electromagnetic Force	10^{36}	Not very large	
4.	Strong Nuclear Force	10^{38}	Very short nuclear size (10^{-15} m)	

Nature of Physical Laws :-

In classical physics, we often deal with the following conservation laws ;

1. Law of conservation of energy.
2. Law of conservation of linear momentum.
3. Law of conservation of angular momentum.
4. Law of conservation of charge.

1. Law of conservation of energy :-

The sum total of energy of all kinds in this universe is constant. Energy can be transformed from one form to other or transported from one place to other, but the total amount of energy never changes.

2. Law of conservation of linear momentum :-

According to this law,

"In the absence of external force, the linear momentum of a system remains unchanged."

3. Law of conservation of angular momentum :-

Angular momentum (L) = moment of inertia (I) × angular speed (ω)

"If the total external torque acting on a system is Zero, angular momentum of system remains constant."

4. Law of Conservation of charge :-

It means that charges (in the form of electron) are neither created nor destroyed, but simply transferred from one body to another.