

Physics Notes

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Class:10+1

Unit: I

Topic: Physical World & Measurement

SYLLABUS: UNIT-I-A

Physics-scope and excitement; Physics, technology and society. Force in nature, conservation laws; Examples of gravitational, electromagnetic and nuclear forces form daily-life experiences (qualitative description only).

Need for measurement; Units of measurement; Systems of units; SI units, Fundamental and derived units, Length, mass and time measurements; Accuracy and precision of measuring instruments, Errors in measurement; Significant figures.

Dimensions of physical quantities, dimensional analysis and its applications.



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2.	Give one example of "Minor modification" and one example of "major modification" in theory to explain some phenomenon.	
3.	a) What is Physics? b) Explain two principle thrusts in physics i.e., "Unification" and "Reduction".	
4.	What is 'Scope' and 'Excitement' of physics?	
5.	How Physics is related to a) Other Sciences b) Technology and Society	
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7.	State four conservation laws used in Physics.	

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- Q.1. a) What is Science?
b) Explain 'Scientific Method' with example?

Ans.a) **Science**:-

Science is a systematic attempt to understand natural phenomenon in as much detail and depth as possible and to use the knowledge so gained to predict, modify and control phenomenon.

b) **Scientific Method**:-

Various steps involved are:-

1. **Observations**:-

Scientist will observe a natural phenomenon with curiosity eg:- Observation of Newton for a falling apple, motion of moon around earth, etc.

2. **Controlled Experiments**:-

Eg:- Objects are made to fall from h , where h was different in different experiments.

3. **Qualitative Reasoning**:-

Eg:- If h increases, time of fall t also increases.

4. **Quantitative Reasoning**:-

Eg:- If h becomes 4 times, t becomes 2 times.

5. **Mathematical Modeling**:-

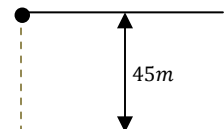
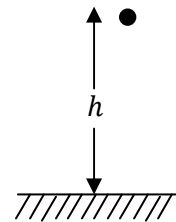
Eg:- $h = \frac{1}{2}gt^2$

6. **Prediction**:-

Eg:- If $h = 45$, time taken to fall will come out to be 3 seconds.

7. **Verification**:-

Object was made to fall from 45m and time was noted. Time came out be 3.1 seconds. Formula was declared "Correct".



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Q.2. Give one example of “Minor modification” and one example of “major modification” in theory to explain some phenomenon.

Ans. **Minor Modification**:-

Eg:- Circular Orbits

Kepler’s Modification:-

Eg:- Elliptical Orbits

Major Modification:-

Eg:- Classical Mechanics was not sufficient to explain “Atom”.

Quantum Physics:-

A new concept was introduced to explain “Atom”.

Additional Knowledge:-

1. Theory
2. Experiment

OR

1. Experiment
2. Theory

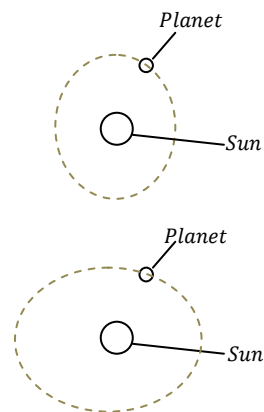
Eg. 1.

Rutherford α scattering experiment – 1911
Bohar model of atom (theory) – 1913

Eg.2.

Paul Dirac gave theory of antiparticle – 1930
Confirmed by experiment of Care Anderson – 1932

Example of antiparticle of $\rightarrow e^-$ e^+
(Electron) (Positron)



- Q.3. a) What is Physics?
 b) Explain two principle thrusts in physics i.e., “Unification” and “Reduction”.

Ans.a) **Physics:-**

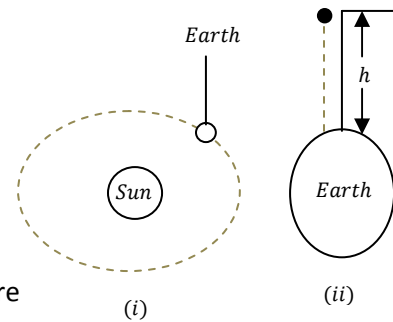
Physics is a branch of natural sciences which deals with the study of physical world by studying basic laws of nature. e.g. Gravity.

b) **Unification:-**

Process in which diverse phenomenon are explained in terms of few laws.

Example:

Falling apple or motion of earth around sun both are explained through the law i.e., “Law of Gravitation”.

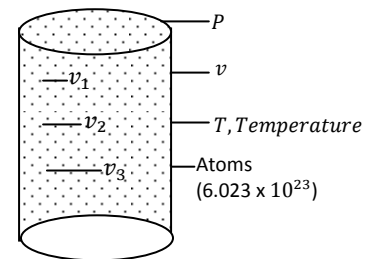


Reductionism:-

Process to derive the properties of bigger systems by understanding properties of constituent parts.

Example:

Property i.e. temperature, of big system i.e. cylinder, is explained in terms of property i.e. speed of atom.



Q.4. What is 'Scope' and 'Excitement' of physics?

Ans. The two domain of interest in Physics are: **Macroscopic** and **Microscopic**. The macroscopic domain includes the study of phenomenon of involving objects of large finite size on terrestrial deals. This is called Classical Physics. It was developed upto year 1900. The microscopic domain includes the study of phenomenon involving molecular, atoms, nuclei, electrons, etc. This make up Modern Physics.

A new domain intermediate between macroscopic and microscopic domains has emerged. It involves the study of a few tons or hundreds of atoms or molecules. It is called **Mesoscopic Physics**.

The Classical Physics includes subjects like Mechanics, Thermodynamics, Electrodynamics and Optics.

Mechanics deals with the study of general propulsion of water and sound waves etc. Thermodynamics deals with the study of changes in temperature, internal energy. Modes of transfer of heat, efficiency of heat engines and refrigerator are included in thermodynamics.

Electrodynamics deals with the study of electric and magnetic phenomenon. The basic laws governing these phenomenon are given by Coulombs, Oersted, Ampere and Faraday.

Optics involves the study of various phenomenon involving light and optical instruments like microscope, telescope etc.

Quantum theory is currently accepted as the proper framework for explaining microscopic domain.

Physics includes the study of (small) electron, proton, nuclei, of size 10^{-14} m or less, And at the end, it deals with galaxies and entire universe of size 10^{26} m.

- Q.5. How Physics is related to**
a) Other Sciences
b) Technology and Society

Ans.a) **Other Sciences:-**

1. **Chemistry:-**

X-rays are used to study atom or molecular orientation.

2. **Biology:-**

Microscope is used to see fine structure of leaf, curd, onion, etc.

3. **Astronomy:-**

Telescope is used to see fine structure of objects far away from earth. Eg: Sun, Moon, Stars, etc.

b) **Technology and Society:-**

Use of Physics has great impact on society. Technologies like T.V., Mobile Phone, etc., have changed the society. It has resulted in betterment of society. e.g. Comfortable life, Knowledge, Connectivity, Big thinking skills, Infrastructure. It has negative impact on our society. e.g. use of weapons, pollution, complicated life.

Q.6. Discuss properties/characteristics of 'Fundamental Forces'.

Ans.a) Gravitational Force:-

The gravitational force is the force of mutual attraction between any two objects by virtue of their masses.

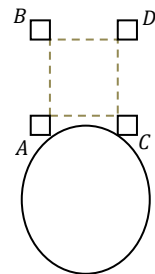
1. Gravitational force is universal attractive force. It means it acts between two objects having mass
e.g. It acts between two atoms and also between two planets.
2. These are the weakest forces in nature.
e.g. $m_1 = 1\text{Kg}$, $m_2 = 1\text{Kg}$, $r = 1\text{m}$, Force = ?
 $F = 6.6 \times 10^{-11} \text{ N}$
3. Range i.e. distance upto which they operate is very large
Eg:- Sun & Earth. Distance between two is 15 crore km.
4. Inverse square law i.e.,

$$F \propto \frac{1}{r^2}$$

5. Central force. When force

To move, masses m_1 and m_2 will move along the line joining centers of two masses.

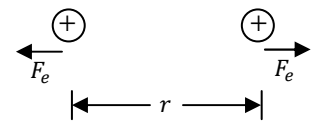
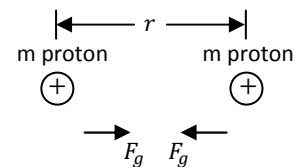
6. Gravitational forces are 'Conservative Forces'. It means work done does not depend on path followed.
Eg:- If a particle of mass m moves from A to B, work done is independent of path followed.
7. Field particle is 'Graviton'.



b) Electromagnetic Force:-

The electromagnetic forces are force which are by virtue of charges on two particles.

1. Attractive or Repulsive
2. Governed by Coulomb's Law
$$\left[F = 9 \times 10^9 \frac{q_1 q_2}{r^2} \right]$$
3. Inverse square law $F \propto \frac{1}{r^2}$
4. $\frac{F_{e.m}}{F_{gravity}} = 10^{36}$
5. Range not as large as gravitational force
6. Central forces
7. Conservative
8. Field particle is 'Photon'.



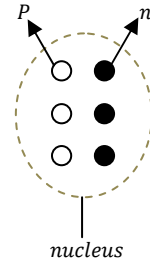
c) **Strong Nuclear Forces:-**

Force that binds the nucleons of nucleus together, is called nuclear force.

1. Strongest force

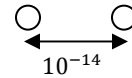
$$\frac{F_{nuclear}}{F_{gravitation}} = 10^{38}$$

$$\frac{F_{nuclear}}{F_{electromagnetic}} = 100$$

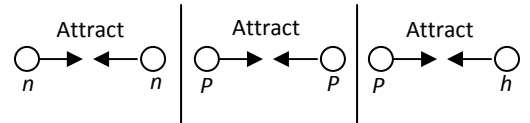


2. Range:-

Shortest range of the order of 10^{-14}



3. Do not depend on charge



4. Do not obey inverse square law

$$F \propto \frac{1}{r^n}$$

$n > 2$ i.e. $n = 3, 4, 5, \dots$

5. Attractive for \longleftrightarrow distance > 0.5 Fermi
 Repulsive for $\cdots\longleftrightarrow$ distance < 0.5 Fermi

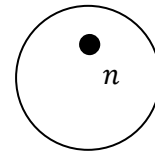
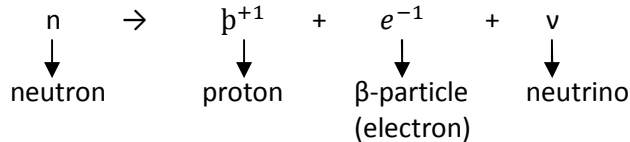
6. Non-Central

7. Non-Conservative

8. Field particle $\rightarrow \pi$ meson

d) **Weak Nuclear Force:-**

These forces are the forces of interaction between elementary particles of short life times.



Q.7. State four conservation laws used in Physics.

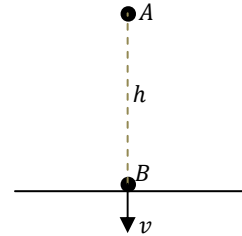
- Ans.
1. Law of Conservation of Energy
 2. Law of Conservation of Linear Momentum
 3. Law of Conservation of Angular Momentum
 4. Law of Conservation of Charge

1. LAW OF CONSERVATION OF ENERGY:-

Energy can neither be created nor destroyed, it can be changed from one form to another.

Example:-

- i) Potential Energy at A is converted to Kinetic Energy at B
- ii) In a Gun, spring energy is converted into Kinetic Energy
- iii) In solar furnaces, Solar Energy is converted into Heat Energy.

**2. Law of Conservation of Linear Momentum:-**

Total momentum of system is conserved if there is no external force acting.

$$P = mv$$

Example:-

- i) When a bullet is fired bullet moves in forward direction and gun moves in backward direction
- ii) Man in a boat jump out at the shore, Man jumps in forward direction, whereas the boat moves backward.

3. Law of Conservation of Angular Momentum:-

Total Angular Momentum of system is conserved if there is no external torque acting.

Example:-

- i) When a person rotates with dumbles in hand, he can change speed by moving the hands in or out

4. Law of Conservation of Charge:-

Charge can neither be created nor destroyed.

Example:-

- i) $n \rightarrow p^{+1} + e^{-1} + \nu$

$$\text{Mechanical Energy} = KE + PE$$

$$[ME_A = KE_A + PE_A = 0 + 100]$$

$$[ME_B = KE_B + PE_B = 100 + 0]$$

