CLASS XI PHYSICS

Day 1

Units and Measurement

UNIT

Measurement of any physical quantity involves comparison with a certain basic, arbitrarily chosen, internationally accepted reference standard called **unit**.

The result of a measurement of a physical quantity is expressed by a number (or numerical measure) accompanied by a unit.

If Q is a quantity

We can write

$Q = n_1 u_1 = n_2 u_2 = ...$

Where n_1, n_2..... are various numerical measure

Although the number of physical quantities appears to be very large, we need only a limited number of units for expressing all the physical quantities, since they are interrelated with one another.

The units for the fundamental or base quantities are called **fundamental** or **base units**. The units of all other physical quantities can be expressed as combinations of the base units. Such units obtained for the derived quantities are called **derived units**.

A complete set of these units, both the base units and derived units, is known as the **system of units**.

The base units for length, mass and time in these systems were as follows :

- In CGS system they were centimetre, gram and second respectively.

- In FPS system they were foot, pound and second respectively.
- In MKS system they were metre, kilogram and second respectively

The system of units which is at present internationally accepted for measurement is the *Système Internationale d' Unites* (French for International System of Units), abbreviated as SI.

FUNDAMENTAL QUANTITIES and THEIR SI UNITS

a) Distance	Metre	m
b) Mass	Kilogram	kg
c) Time	Second	s
d) Amount of substance	Mole	mol
e) Electric Current	Ampere	A
f) Temperature	Kelvin	K
g) Luminous Intensity	Candela	Cd

Some of these SI units have been defined as follows:

a) The metre is the length of the path travelled by light in vacuum during a time interval of 1/299792458 second in

b) Mole: The number of entities (atoms, molecules, ions) present in 12 g of c 12 atom. This fixed quantity is called Avagadro's number and is equal to 6.023 X 10^{23}

c) Besides the seven base units, there are two more units that are defined for

a) Plane angle dθ as the ratio of length of arc l to the radius *r* and

b) solid angle $d\Omega$ as the ratio of the intercepted area dA of the spherical surface, described about the apex O as the centre, to the square of its radius r

Measuring large Distances – Parallax Method

- **Parallax** is a displacement or difference in the apparent position of an object viewed along two different lines of sight, and is measured by the angle or semi-angle of inclination between those two lines. Distance between the two viewpoints is called **Basis**.

$$\theta = \frac{\text{Length of Arc}}{\text{Radius}}$$

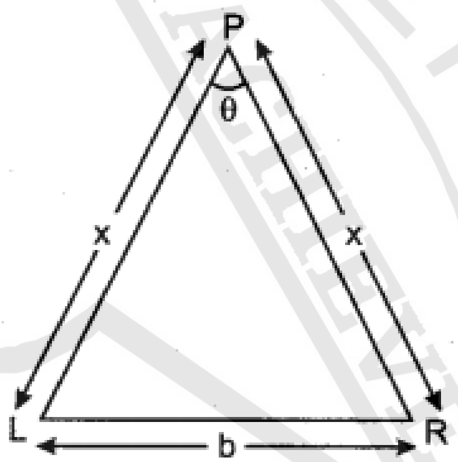

Fig. : Parallax Method

$$\theta = \frac{b}{x} \quad \text{or} \quad x = \frac{b}{\theta}$$

The following conversions are used

(a) We have $3600 = 2\pi$ rad

$1^0 = (\pi/180)$ rad $= 1.745\times10^{-2}$ rad

(b) $1^0 = 60' = 1.745\times10^{-2}$ rad

$1' = 2.908\times10^{-4}$ rad $= 2.91\times10-4$ rad (approx.)

(c) $1' = 60'' = 2.908\times10^{-4}$ rad

$1'' = 4.847\times10^{-4}$ rad $= 4.85\times10^{-6}$ rad (approx.)

Q) The moon is observed from two diametrically opposite points A and B on Earth. The angle θ subtended at the moon by the two directions of observation is $1^{o}\ 54'$. Given the diameter of the Earth to be about 1.276×10^{7} m, compute the distance of the moon from the Earth