Units and Measurement

Unit: The chosen standard of measurement of a quantity which has essentially the same nature as that of the quantity is called the unit of that quantity.

Types of Units

1. **Fundamental units** – the units of measurement of mass, length and time are called fundamental units.
2. **Derived units** – the units of measurement of all other physical quantities, which can be obtained from fundamental units are called derived units

   Example: ms^{-1}, N

Characteristics of a fundamental unit

It should

1. Be of suitable size.
2. Be easily accessible.
3. Be easily reproducible.
4. Not change with time
5. Not change with changing physical conditions like tem., pressure

S.I system of Units

It is based on 7 fundamental units and 2 supplementary units

S.No.	Basic Physical Quantity	Fundamental Unit	Symbol
1	Mass	Kilogram	kg
2	Length	Metre	m
3	Time	Second	s
4	Temperature	Kelvin	K
5	Electric current	Ampere	A
6	Luminous Intensity	Candela	cd
7	Quantity of matter	Mole	mol
S.No.	**Supplementary Physical Quantity**	**Fundamental Unit**	**Symbol**
1	Plane Angle	Radian	rad
2	Solid angle	Steradian	sr

Advantages of S.I

1. It is a **coherent** system of units, i.e. it is based on a certain set of fundamental units from which the derived units are obtained by multiplication or division without introducing numerical factors.
2. It is a **rational** system of units(i.e. one quantity one minute)
   for example : in m.k.s mechanical energy – joule, heat energy – calorie, electrical energy – watt hour
   in S.I Energy(mechanical, heat, electrical) - joule
3. It is an **absolute** system of units(no gravitational units of system)

4. It is a **metric** system (i.e. multiples of units are expressed as power of 10.
5. It is closely related with c.g.s

Some Important practical units

1. **Astronomical unit (AU)**- it is the average distance between the centre of sun to the centre of earth.

1AU = 1.496 x 10^{11} m

2. **Light year** – it is the distance travelled by light in 1 year

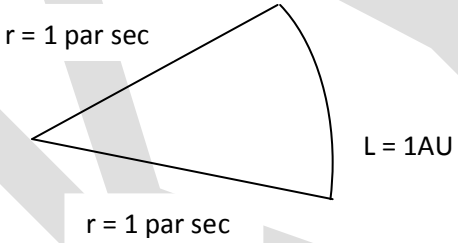
   1 light year = speed of light x 1 year

   = 3 x10^{8} ms^{-1} x 365 x 24 x 60 x 60 sec

   = 9.46 x 10^{15}m

1 light year= 9.46 x 10^{15}m

3. **Par sec** – it is the radius of a circle at the centre of which an arc of the circle, 1AU long subtends an angle of 1”



L = 1AU =1.496 x 10^{11} m, $\theta = \frac{1}{60} min. = \frac{1}{60 \times 60} degree = \frac{1}{60 \times 60} \times \frac{\pi}{180} rad$

Now r = l/θ

So, $1 \text{ par sec} = \frac{1\text{AU}}{1 \text{ sec}} = \frac{1.496 \text{ x } 1011}{\pi} \times 60 \times 60 \times 180 = 3.084 \times 10^{16}\text{m}$

1 par sec =3.084 x 10^{16}m