Fundamental and Derived Units.

Normally each physical quantity requires a unit or standard for its specification so it appears that there must be as many units as there are physical quantities. However, it is not so. It has been found that if in mechanics we choose arbitrarily units of any three physical quantities we can express the units of all other physical quantities in mechanics in terms of these. Arbitrarily the physical quantities mass, length and time are chosen for this purpose. So any unit of mass, length and time in mechanics is called a **fundamental, absolute or base unit.** Other units which can be expressed in terms of fundamental units, are called derived units. For example light year or km is a fundamental units as it is a unit of length while s^{-1}, m^2 or kg/m are derived units as these are derived from units of time, mass and length respectively.

System of units: A complete set of units, both fundamental and derived for all kinds of physical quantities is called system of units. The common systems are given below –

(1) CGS system**:** The system is also called Gaussian system of units. In it length, mass and time have been chosen as the fundamental quantities and corresponding fundamental units are centimeter (cm), gram (g) and second (s) respectively.

(2) MKS system**:** The system is also called Giorgi system. In this system also length, mass and time have been taken as fundamental quantities, and the corresponding fundamental units are meter, kilogram and second.

(3) FPS system**:** In this system foot, pound and second are used respectively for measurements of length, mass and time. In this system force is a derived quantity with unit poundal.

(4) S. I. system:It is known as International system of units, and is infact extended system of units applied to whole physics. There are seven fundamental quantities in this system. These quantities and their units are given in the following table

Quantity	Name of Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric Current	ampere	A
Temperature	Kelvin	K
Amount of Substance	mole	mol
Luminous Intensity	candela	cd

Besides the above seven fundamental units two supplementary units are also defined –

Radian (rad) for plane angle and Steradian (sr) for solid angle.

Note: Apart from fundamental and derived units we also use very frequently practical units. These may be fundamental or derived units

e.g., light year is a practical unit (fundamental) of distance while horse power is a practical unit (derived) of power.

Practical units may or may not belong to a system but can be expressed in any system of units

e.g., 1 mile = 1.6 km = 1.6×10^3 m.