1. UNITS AND MEASUREMENT

Measurement involves comparison of the quantity to be measured with a reference standard. The reference standard of measurement is what we call a unit. All quantities in physics which can be measured directly or indirectly are called physical qu antities such as length, mass, time, temperature, speed, force, electric current etc. Physical quantities are divided into two classes, Fundamental and Derived. Length for example, is one of the several properties that are said to be fundamental in systems of measurement for science. Other properties are amount of mass, duration in time, temperature, flow of electrical current, and intensity of light. From these fundamental properties other properties can be derived. For example, the property of density in defined in terms of mass per volume, and volume is define in terms of a length cubed (multiplied by itself, then multiplied by itself again).

System of Units. Several systems of units have been use for describing measurements. The common systems are: the CGS system (Centimeter, Gram, Second); the FPS system (Foot, Pound, Second) which is the British system the MKS system (Meter, Kilogram and Second) and now internationally accepted is the Systems Internationale d'Units, abbreviated SI.

System Internationale (SI) Units. In 1971 the General Conference on Weights and Measure (CGPM) gave office status to a single practical system, the International System Units, abbreviated SI in all languages. The system is a modernise version of the metric system. The SI, as subsequently extended includes seven base units, two supplementary units, and nineteen derived units with special names. These derived units, and others without special names, are derived from the base a supplementary units in a coherent manner. A set of prefixes is used to form decimal multiples and submultiples of the SI unit Certain units which are not part of SI but which are widely used or are useful in specialised fields have been accepted for use with the SI or for temporary use in those fields.

The Seven Basic SI Units				
Quantity		Unit		Symbol
Length		metre		m
Mass	kilograr	n	kg	
Time	second		s	
Temperature		kelvin		Κ
Amount of substance mole				mol
Electric current	t 📐	ampere		А
Luminous inter	nsity	candela		cd
Length				

The SI unit of length is the metre [Symbol m]. Metre was originally defined as one ten millionth of the distance

from the North Pole to the equator of the Earth. In 1889, the standard metre was defined as the distance between two lines marked on a platinum-iridium rod preserved at constant temperature of 273.16 at 1 bar pressure in the International Bureau of Weights and Measure at Sevres, near Paris, France.

In 1983 the metre was defined again, as the distance light travels through space in 1/299, 792, 458 of second. Accuracy can be measured to one part in 10^{13} .

Large distances such as the distance of stars from the earth are expressed in light years. A light year is a unit of length equal to the distance travelled by light in one year; 1 light year = 9.46×10^{15} m.

Very small distances are measured in micrometres or microns (im), angstroms (A), nanometers (nm) and femtometre (fm).

Several other units based on metre are:

- 1km = 1000m = 10.3m
- $1 \text{cm} = 1/100 \text{m} = 10^{-2} \text{m}$

 $1 \text{mm} = 1/1000 \text{m} = 10^{-3} \text{m}$

1(im) = 1/1000000 m = 10-6 m

1 (nm) = 1/1000000000 m = 10-9 m

Mass

Mass is the measure of the quantity of matter that an object contains. It is independent of temperature, pressure or location of the object in space.

The SI unit of mass is the kilogram [kg]. The standard kilogram is the mass of a platimum-iridium cylinder stored in a special vault in the International Bureau of Standards in Sevres, France. Other units of mass based on kg are.

1 tonne (t) = 1000 kg = 103 kg

1 gram (g) = 1/1000kg = 10-3 kg

1 milligram (mg) = 1/1000000 kg = 10-6 kg.

Time

The SI unit of time is the second [s]. A natural standard for measurement of time can be derived from the rotation of the earth. The average time between successive passages of the sun across a meridian is called the mean solar day, and the second is 1/86, 400 of it.

Derived Units The units of all other physical quantities can be expressed in terms of the seven base units.

F.P.S. System of Units

In this system, the unit of length is foot (ft), the unit of mass is pound (lb) and the unit of time is second (s).

1 foot = 0.3048 m1 pound = 0.4536 kg

The unit of time is the both the S.I. and the F.P.S system.

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