Physical Quantities | System International(SI) Base Units

A quantity that is measurable and has physical meaning is called physical quantity.

Types of physical quantities

Physical quantities are of two types

1. Base quantities
2. Derived quantities

Base quantities

The quantities which are not derived from other quantities but other quantities are derived from these quantities

Examples: Length, Mass, Time, etc.

Derived quantities

The quantities which are derived from base quantities are called derived quantities

Examples: Velocity, force, etc

Steps for the measurement of a base quantity

There are two steps for the measurement of a base quantity

1. Choice of a standard
2. The establishment of a procedure for comparing the quantity to e measured with the standard so that a number and a unit are determined as the measure of that quantity

Ideal standard

An ideal standard has two principal characteristics

1. It is accessible
2. It is invariable

The international system of units (SI)

SI is the abbreviation of the French word Système International.

In 1960 an international committee agreed on a set of definitions and standards to describe the physical quantities

The International System of Units (SI) is a metric system that is widely used as a measurement standard. Scientific and technical research and development rely heavily on SI units. It consists of seven base units that are used to define 22 derived units.

The SI units can be stated as fractional numbers or as standard multiples. Prefix multipliers with powers of 10 ranging from 10^{-24} to 10^{24} are used to define these numbers.

The system international defines units in two groups

1. Base units
2. Derived unit

SI base unit

The units that belong to the base quantity are called base units.

The SI Base units are the foundation for all other units. There are 7 base units.

Base Quantity	Unit	Unit symbol
Length	Meter	m
Mass	Kilogram	kg
Time	Second	s
Electric current	Ampere	A
Temperature	Kelvin	K
Amount of substance	Mole	mol
Luminous intensity	Candela	cd

Definition of base units

There are 7 base units

What is Meter?

The SI unit of length is the meter, which is defined as the length of the path traveled by light in a vacuum in 1/299 792 458 of a second.

What is Kilogram?

In SI 1 kg is equal to the mass of a cylinder of platinum-iridium, the International Prototype of the Kilogram (IPK)

What is Second?

Second is defined as 1/86400 of a day. This component is derived from the partition of a day into 24 hours, then 60 minutes, and finally 60 seconds (24×60×60 = 86400).

What is Ampere?

Every 1.602176634 seconds, an ampere is the electrical current corresponding to 10^{19} elementary charges passing.

What is Kelvin?

One Kelvin is equal to a change in the thermodynamic temperature T that results in a change of thermal energy kT by 1.380649×10^{-23} J.

What is Mole?

A mole is the amount of a substance that includes exactly 6.02214076 $X10^{-23}$ of the substance's elementary entities.

What is Candela?

The candela is the luminous intensity in a given direction of a source that emits monochromatic radiation of frequency 540×10^{12} hertz and that has a radiant intensity in that direction of 1/683 watt per steradian.

Derived unit

The units which belong to derived quantity are called derived units.

Because they are generated by various operations on the base units, the derived units are limitless. The dimensions of derived units are represented in terms of the dimensions of base units. A combination of base and derived units can also be used to express derived units.

There are some derived units

NAME	Unit	Unit symbol
Frequency	Hertz	Hz
Electric charge	Coulomb	C
Power	Watt	W
Energy, Work, Heat	Joule	J
Inductance	Henry	H
Capacitance	Farad	F

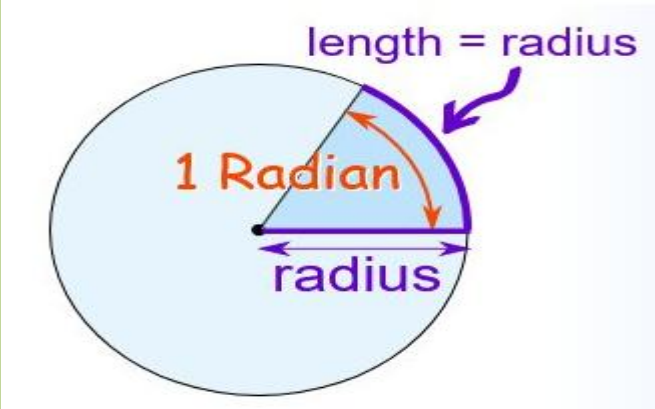
What are Supplementary units?

The units which are not classified under either base or derived units are called supplementary units.

There are two supplementary units Radian and steradian

What is Radian?

An angle of one radian is formed by an arc of a circle with the same length as its radius. In a complete circle, there is 2 radian.



What is Steradian?

The angel covered an area of surface equal to the square of the sphere's radius at the center. In the complete sphere, there are 4 steradians.