Units, Dimension and Measurements and Physical World

Physical Quantity: The quantities by means of which we describe the laws of physics are called Physical Quantities. Measurement: The comparison of any physical quantity with its standard unit is called measurement. Unit: The 'Standard' of measurement of a physical quantity is called the unit. The magnitude of the physical quantity:

Magnitude = (Numerical value of the measure of the quantity) * (Unit of the quantity)

Systems of Units: A system of units is the complete set of units, both fundamental and derived, for all kinds of physical quantities.

- CGS System: In this system, the unit of length is centimetre, the unit of mass is gram and the unit of time is second.
- FPS System: In this system, the unit of length is foot, the unit of mass is pound and the unit of time is second.
- MKS System: In this system, the unit of length is metre, the unit of mass is kilogram and the unit of time is second.
- SI System: This system contains seven fundamental units and two supplementary fundamental units.

Fundamental Units: Those physical quantities which are independent of each other are called fundamental quantities and their units are called fundamental units. Fundamental quantities: length, mass, time, electric current, temperature, luminous intensity, and

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SI Units

Physical Quantity	Symbol	SI Unit
length	m	metre
mass	kg	kilogram
time	s	second
electric current	A	ampere
temperature	K	kelvin
luminous intensity	cd	candela
amount of substance	mol	mole
angle	rad	radian
solid angle	sr	steradian
area	m^2	square metre
volume	m^3	cubic metre
density	$kg{\cdot}m^{-3}$	kilogram per cubic metre
speed	$m{\cdot}s^{-1}$	metre per second
acceleration	$m{\cdot}s^{-2}$	metre per second squared
concentration	$mol{\cdot}m^{-3}$	mole per cubic metre
energy	joule	J
force	newton	N
pressure	pascal	Pa
power	watt	W
electric charge	coulomb	C
electric potential difference	volt	V
electric resistance	ohm	W
frequency	hertz	Hz

SI prefixes

Multiple	Prefix	Symbol
10^{-24}	yocto	y
10^{-21}	zepto	z
10^{-18}	atto	a
10^{-15}	femto	f
10^{-12}	pico	p
10^{-9}	nano	n
10^{-6}	micro	µ
10^{-3}	milli	m
10^{-2}	centi	c
10^{-1}	deci	d
10	deca	da
10^{2}	hecto	h
10^{3}	kilo	k
10^{6}	mega	M
10^{9}	giga	G
10^{12}	tera	T
10^{15}	peta	P
10^{18}	exa	E
10^{21}	zetta	Z
10^{24}	yotta	Y

Dimensions of a physical quantity are the powers to which the fundamental quantities must be raised to represent the given physical quantity.

Quantity	Dimension	Unit
length	$[L]$	metre
area	$[L^2]$	metre^2
volume	$[L^3]$	Metre^3
density	$[ML^{-3}]$	kg m^{-3}
Speed (Velocity)	$[LT^{-1}]$	ms^{-1}
acceleration	$[LT^{-2}]$	ms^{-2}
Momentum or Impulse	$[MLT^{-1}]$	kg ms^{-1}
force	$[MLT^{-2}]$	newton (N)
pressure	$[ML^{-1}T^{-2}]$	Nm^{-2}
energy/work	$[ML^2T^{-2}]$	joule (J)
power	$[ML^2T^{-3}]$	J s^{-1} or watt

In mechanics, all physical quantities can be expressed in terms of mass (M), length (L) and time (T).

Homogeneity Principle: If the dimensions of the left-hand side of an equation are equal to the dimensions of the right-hand side of the equation, then the equation is dimensionally correct.

Applications of Dimensions:

- To check the accuracy of physical equations.
- To change a physical quantity from one system of units to another system of units.
- To obtain a relation between different physical quantities