

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:

$$\text{Magnitude} = (\text{Numerical value of the measure of the quantity}) * (\text{Unit of the quantity})$$

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

Fundamental quantities: length, mass, time, electric current, temperature, luminous intensity, and amount of substance. Radian and steradian are two supplementary fundamental units. It measures

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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·m ⁻³	kilogram per cubic metre
speed	m·s ⁻¹	metre per second
acceleration	m·s ⁻²	metre per second squared
concentration	mol·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.



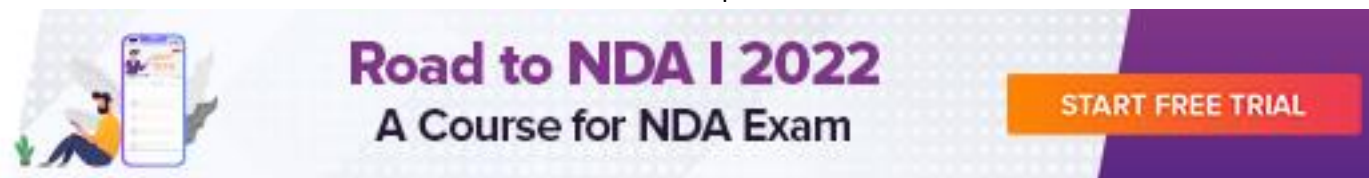
Quantity	Dimension	Unit
length	[L]	metre
area	[L ²]	metre ²
volume	[L ³]	Metre ³
density	[ML ⁻³]	kg m ⁻³
Speed (Velocity)	[LT ⁻¹]	ms ⁻¹
acceleration	[LT ⁻²]	ms ⁻²
Momentum or Impulse	[MLT ⁻¹]	kg ms ⁻¹
force	[MLT ⁻²]	newton (N)
pressure	[ML ⁻¹ T ⁻²]	Nm ⁻²
energy/work	[ML ² T ⁻²]	joule (J)
power	[ML ²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



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