SI PREFIXES

The magnitudes of physical quantities vary over a wide range. The CGPM recommended standard prefixes for magnitude too large or too small so as to be expressed more compactly in certain powers of 10.

Prefixes used for different powers of 10

Power of 10	Prefix	Symbol	Power of 10	Prefix	Symbol
10^{18}	exa	E	10^{-1}	deci	d
10^{15}	peta	P	10^{-2}	centi	c
10^{12}	tera	T	10^{-3}	milli	m
10^{9}	giga	G	10^{-6}	micro	μ
10^{6}	mega	M	10^{-9}	nano	n
10^{3}	kilo	k	10^{-12}	pico	p
10^{2}	hecto	h	10^{-15}	femto	f
10^{1}	deca	da	10^{-18}	atto	a

General Guidelines for using Symbols for SI Units, Some other Units, and SI prefixes

(i) Symbols for units of physical quantities are printed/written in Roman (upright type), and not in italics
For Example : 1 N is correct but 1 *N* is incorrect.

(ii) (i) Unit is never written with capital initial letter if it is named after a scientist.
For example :
SI unit of force is newton (correct) not Newton (incorrect)
(ii) For a unit named after a scientist, the symbol is a capital letter.
But for other units, the symbol is NOT a capital letter.

For example :
force → newton (N)
energy → joule (J)
electric current → ampere (A)
temperature → kelvin (K)
frequency → hertz (Hz)

For example :
length → metre (m)
mass → kilogram (kg)
luminous intensity → candela (cd)
time → second (s)

Note : The single exception is L, for the unit litre.

(iii) Symbols for units do not contain any final full stop at the end of recommended letter and remain unaltered in the plural, using only singular form of the unit.
For example :

Quantity	Correct	Incorrect
25 centimetres	25 cm	25 cm. 25 cms

(iv) Use of solidus (/) is recommended only for indicating a division of one letter unit symbol by another unit symbol. Not more than one solidus is used.

For example :

Correct	Incorrect
m / s^2	m / s / s
N s / m^2	N s / m / m
J / K mol	J / K / mol
kg / m s	kg / m / s

(v) Prefix symbols are printed in roman (upright) type without spacing between the prefix symbol and the unit symbol. Thus certain approved prefixes written very close to the unit symbol are used to indicate decimal fractions or multiples of a SI unit, when it is inconveniently small or large.

For example :

megawatt	1 MW = 10^6 W
centrimetre	1 cm = 10^{-2} m
kilometre	1 km = 10^3 m
millivolt	1 mV = 10^{-3} V
kilowatt-hour	1 kW h = 10^3 W h = 3.6 MJ = 3.6 $\times 10^6$ J
microampere	1 μA = 10^{-6} A
angstrom	1 Å = 0.1 nm = = 10^{-10} m
nanosecond	1 ns = 10^{-9} s
picofarad`	1 pF = 10^{-12} F
microsecond	1 μs = 10^{-6} s
gigahertz	1 GHz = 10^9 Hz
micron	1 μm = 10^{-6} m

The unit 'fermi', equal to a femtometre or 10^{-15} m has been used as the convenient length unit in nuclear studies.

(vi) When a prefix is placed before the symbol of a unit, the combination of prefix and symbol is considered as a new symbol, for the unit, which can be raised to a positive or negative power without using brackets. These can be combined with other unit symbols to form compound unit.

For example :

Quantity	Correct	Incorrect
cm^3	$(cm)^3 = (0.01\ m)^3 = (10^{-2}\ m)^3 = 10^{-6} m^3$	0.01 m^3 or 10^{-2} m^3 or 1 cm^3
mA^2	$(mA)^2 = (0.001\ A)^2 = (10^{-3}\ A)^2 = 10^{-6}\ A^2$	0.001 A^2 or mA^2

(a) A prefix is never used alone. It is always attached to a unit symbol and written or fixed before the unit symbol.

For example : 10^3 / m^3 = 1000 /m^3 or 1000 m^{-3}, but not k/m^3 or k m^{-3} .

(vii) Prefix symbol is written very close to the unit symbol without space between them, while unit symbols are written separately with spacing when units are multiplied together.

For example :

Quantity	Correct	Incorrect
1 ms^{-1}	1 metre per second	1 milli per second
1 ms	1 millisecond	1 metre second.
1 Cm	1 coulomb metre	1 centimetre
1 cm	1 centimetre	1 coulomb metre

(viii) The use of double prefixes is avoided when single prefixe is available.

For example :

Quantity	Correct	Incorrect
10^{-9} m	1 nm (nanometre)	1 mμm (millimicrometre)
10^{-6} m	1 μm (micron)	1 mmm (millimillimetre)
10^{-12} F	1 pF (picofarad)	1 μμF (micromicrofarad)
10^9 W	1 GW (giga watt)	1 kMW (kilomegawatt)

(ix) The use of a combination of unit and the symbols for units is avoided when the physical quantity is expressed by combining two or more units.

Quantity	Correct	Incorrect
joule per mole Kelvin	J/mol K or J mol^{-1} K^{-1}	joule / mole K or J /mol Kelvin or J/mole K
newton metre second	N m s	newton m second or N m second or N metre s or newton metre s

DIMENSIONAL FORMULAE OF PHYSICAL QUANTITIES

Physical quantity	Relationship with other physical quantities	Dimensions	Dimensional formula
Area	Length × breadth	$[L^2]$	$[M^0 L^2 T^0]$
Volume	Length × breadth × height	$[L^3]$	$[M^0L^3T^0]$
Mass density	Mass/volume	$[M]/[L^3]$ or $[M L^{-3}]$	$[ML^{-3}T^0]$
Frequency	1/time period	$1/[T]$	$[M^0 L^0 T^{-1}]$
Velocity, speed	Displacement/time	$[L]/[T]$	$[M^0LT^{-1}]$
Acceleration	Velocity /time	$[LT^{-1}]/[T]$	$[M^0LT^{-2}]$
Force	Mass × acceleration	$[M][LT^{-2}]$	$[M LT^{-2}]$
Impulse	Force × time	$[M LT^{-2}][T]$	$[M LT^{-1}]$
Work, Energy	Force × distance	$[MLT^{-2}][L]$	$[M L^2 T^{-2}]$
Power	Work/time	$[ML^2 T^{-2}]/ [T]$	$[ML^2 T^{-3}]$
Momentum	Mass × velocity	$[M] [LT^{-1}]$	$[MLT^{-1}]$
Pressure, stress	Force/area	$[MLT^{-2}]/[L^2]$	$[ML^{-1}T^{-2}]$
Strain	$\frac{\text{Change in dimension}}{\text{Original dimension}}$	$[L] / [L]$ or $[L^3]/[L^3]$	$[M^0L^0 T^0]$
Surface tension	Force/length	$[MLT^{-2}/[L]$	$[ML^0 T^{-2}]$
Modulus of elasticity	Stress/strain	$\frac{[ML^{-1}T^{-2}]}{[M^0L^0T^0]}$	$[ML^{-1} T^{-2}]$
Surface energy	Energy/area	$[ML^2T^{-2}]/[L^2]$	$[ML^0T^{-2}]$
Velocity gradient	Velocity/distance	$[LT^{-1}] / [L]$	$[M^0L^0T^{-1}]$
Pressure gradient	Pressure/distance	$[ML^{-1}T^{-2}]/[L]$	$[ML^{-2}T^{-2}]$
Pressure energy	Pressure × volume	$[ML^{-1}T^{-2}] [L^3]$	$[ML^2 T^{-2}]$
Coefficient of viscosity	Force/(area × velocity gradient)	$\frac{[MLT^{-2}]}{[L^2][LT^{-1}/L]}$	$[ML^{-1}T^{-1}]$
Angle, Angular displacement	Arc/radius	$[L]/[L]$	$[M^0L^0T^0]$
Trigonometric ratio	Length/length	$[L]/[L]$	$[M^0L^0T^0]$
Angular velocity	Angle/time	$[L^0]/[T]$	$[M^0L^0T^{-1}]$
Angular acceleration	Angular velocity/time	$[T^{-1}]/[T]$	$[M^0L^0T^{-2}]$
Radius of gyration	Distance	$[L]$	$[M^0LT^0]$
Moment of inertia	Mass ×(radius of gyration)^2	$[M] [L^2]$	$[ML^2 T^0]$
Angular momentum	Moment of inertia × angular velocity	$[ML^2] [T^{-1}]$	$[ML^2 T^{-1}]$
Moment of force (Couple)	Force ×distance	$[MLT^{-2}] [L]$	$[ML^2 T^{-2}]$
Torque	Angular momentum/time, Or Force × distance	$[ML^2 T^{-1}]/[T]$ or $[MLT^{-2}] [L]$	$[ML^2 T^{-2}]$
Angular frequency	2π × Frequency	$[T^{-1}]$	$[M^0L^0T^{-1}]$
Wavelength	Distance	$[L]$	$[M^0LT^0]$
Hubble constant	Recession speed/distance	$[LT^{-1}]/[L]$	$[M^0L^0T^{-1}]$
Intensity of wave	(Energy/time)/area	$[ML^2 T^{-2}/T]/[L^2]$	$[ML^0T^{-3}]$

Physical quantity	Relationship with other physical quantities	Dimensions	Dimensional formula
Radiation pressure	$\frac{\text{Intensity of wave}}{\text{Speed of light}}$	$[MT^{-3}]/[LT^{-1}]$	$[ML^{-1}T^{-2}]$
Energy density	Energy/volume	$[ML^2 T^{-2}]/[L^3]$	$[ML^{-1} T^{-2}]$
Critical velocity	$\frac{\text{Reynold's number} \times \text{coefficient of viscocity}}{\text{Mass density} \times \text{radius}}$	$\frac{[M^0L^0T^0][ML^{-1} T^{-1}]}{[ML^{-3}][L]}$	$[M^0LT^{-1}]$
Escape velocity	$(2 \times \text{acceleration due to gravity} \times \text{earth's radius})^{1/2}$	$[LT^{-2}]^{1/2} \times [L]^{1/2}$	$[M^0LT^{-1}]$
Heat energy, internal energy	Work (= Force $\times$ distance)	$[MLT^{-2}][L]$	$[ML^2 T^{-2}]$
Kinetic energy	(1/2) mass $\times$ (velocity)^2	$[M][LT^{-1}]^2$	$[ML^2T^{-2}]$
Potential energy	Mass $\times$ acceleration due to gravity $\times$ height	$[M][LT^{-2}][L]$	$[ML^2 T^{-2}]$
Rotational kinetic energy	1/2 $\times$ moment of inertia $\times$ (angular velocity)^2	$[M^0L^0T^0][ML^2] \times [T^{-1}]^2$	$[ML^2 T^{-2}]$
Efficiency	$\frac{\text{Output work or energy}}{\text{Input work or energy}}$	$\frac{[ML^2T^{-2}]}{[ML^2T^{-2}]}$	$[M^0L^0T^0]$
Angular impulse	Torque $\times$ time	$[ML^2T^{-2}][T]$	$[ML^2T^{-1}]$
Gravitational constant	$\frac{\text{Force} \times (\text{distance})^2}{\text{mass} \times \text{mass}}$	$\frac{[MLT^{-2}][L^2]}{[M][M]}$	$[M^{-1}L^3T^{-2}]$
Planck constant	Energy/frequency	$[ML^2 T^{-2}]/[T^{-1}]$	$[ML^2T^{-1}]$
Heat capacity, entropy	Heat energy /temperature	$[ML^2T^{-2}]/[K]$	$[ML^2T^{-2}K^{-1}]$
Specific heat capacity	$\frac{\text{Heat Energy}}{\text{Mass} \times \text{temperature}}$	$[ML^2T^{-2}]/[M][K]$	$[M^0L^2T^{-2}K^{-1}]$
Latent heat	Heat energy/mass	$[ML^2 T^{-2}]/[M]$	$[M^0L^2T^{-2}]$
Thermal expansion coefficient or Thermal expansivity	$\frac{\text{Change in dimension}}{\text{Original dimension} \times \text{temperature}}$	$[L]/[L][K]$	$[M^0L^0K^{-1}]$
Thermal conductivity	$\frac{\text{Heat Energy} \times \text{thickness}}{\text{Area} \times \text{temperature} \times \text{time}}$	$\frac{[ML^2T^{-2}][L]}{[L^2][K][T]}$	$[MLT^{-3} K^{-1}]$
Bulk modulus or (compressibility)$^{-1}$	$\frac{\text{Volume} \times (\text{Change in pressure})}{\text{Change in volume}}$	$\frac{[L^3][ML^{-1}T^{-2}]}{[L^3]}$	$[ML^{-1}T^{-2}]$
Centripetal acceleration	(Velocity)^2/radius	$[LT^{-1}]^2/[L]$	$[M^0LT^{-2}]$
Stefan constant	$\frac{(\text{Energy}/\text{area} \times \text{time})}{(\text{Temperature})^4}$	$\frac{[ML^2T^{-2}]}{[L^2][T][K]^4}$	$[ML^0T^{-3}K^{-4}]$
Wien constant	Wavelength $\times$ temperature	$[L][K]$	$[M^0LT^0K]$
Boltzmann constant	Energy/temperature	$[ML^2T^{-2}]/[K]$	$[ML^2T^{-2}K^{-1}]$

Units and Dimensions

Physical quantity	Relationship with other physical quantities	Dimensions	Dimensional formula
Universal gas constant	$\frac{\text{Pressure} \times \text{volume}}{\text{mole} \times \text{temperature}}$	$\frac{[ML^{-1}T^{-2}][L^3]}{[mol][K]}$	$[ML^2T^{-2}K^{-1}mol^{-1}]$
Charge	Current × time	[A][T]	$[M^0L^0TA]$
Current density	Current/area	$[A]/[L^2]$	$[M^0L^{-2}T^0A]$
Voltage, electric potential, electromotive force	Work/charge	$[ML^2T^{-2}]/[AT]$	$[ML^2T^{-3}A^{-1}]$
Resistance	$\frac{\text{Potential difference}}{\text{Current}}$	$\frac{[ML^2T^{-3}A^{-1}]}{[A]}$	$[ML^2T^{-3}A^{-2}]$
Capacitance	Charge/potential difference	$\frac{[AT]}{[ML^2T^{-3}A^{-1}]}$	$[M^{-1}L^{-2}T^4A^2]$
Electrical resistivity or (electrical conductivity)$^{-1}$	$\frac{\text{Resistance} \times \text{area}}{\text{length}}$	$[ML^2T^{-3}A^{-2}][L^2]/[L]$	$[ML^3T^{-3}A^{-2}]$
Electric field	Electrical force/charge	$[MLT^{-2}]/[AT]$	$[MLT^{-3}A^{-1}]$
Electric flux	Electric field × area	$[MLT^{-3}A^{-1}][L^2]$	$[ML^3T^{-3}A^{-1}]$
Electric dipole moment	Torque/electric field	$\frac{[ML^2T^{-2}]}{[MLT^{-3}A^{-1}]}$	$[M^0LTA]$
Electric field strength or electric field intensity	$\frac{\text{Potential difference}}{\text{distance}}$	$\frac{[ML^2T^{-3}A^{-1}]}{[L]}$	$[MLT^{-3}A^{-1}]$
Magnetic field, magnetic flux density, magnetic induction	$\frac{\text{Force}}{\text{Current} \times \text{length}}$	$[MLT^{-2}]/[A][L]$	$[ML^0T^{-2}A^{-1}]$
Magnetic flux	Magnetic field × area	$[MT^{-2}A^{-1}][L^2]$	$[ML^2T^{-2}A^{-1}]$
Inductance	$\frac{\text{Magnetic flux}}{\text{Current}}$	$\frac{[ML^2T^{-2}A^{-1}]}{[A]}$	$[ML^2T^{-2}A^{-2}]$
Magnetic dipole moment	Torque/magnetic field or current × area	$[ML^2T^{-2}]/[MT^{-2}A^{-1}]$ or $[A][L^2]$	$[M^0L^2T^0A]$
Magnetic field strength, magnetic intensity or magnetic moment density	$\frac{\text{Magnetic moment}}{\text{Volume}}$	$\frac{[L^2A]}{[L^3]}$	$[M^0L^{-1}T^0A]$
Permittivity constant (of free space)	$\frac{\text{Charge} \times \text{charge}}{4\pi \times \text{electric force} \times (\text{distance})^2}$	$\frac{[AT][AT]}{[MLT^{-2}][L]^2}$	$[M^{-1}L^{-3}T^4A^2]$
Permeability constant (of free space)	$\frac{2\pi \times \text{force} \times \text{distance}}{\text{current} \times \text{current} \times \text{length}}$	$\frac{[M^0L^0T^0][MLT^{-2}][L]}{[A][A][L]}$	$[MLT^{-2}A^{-2}]$
Refractive index	$\frac{\text{Speed of light in vacuum}}{\text{Speed of light in medium}}$	$[LT^{-1}]/[LT^{-1}]$	$[M^0L^0T^0]$
Faraday constant	Avogadro constant × elementary charge	[AT]/[mol]	$[M^0L^0TA\,mol^{-1}]$

Physical quantity	Relationship with other physical quantities	Dimensions	Dimensional formula
Wave number	2π/ wavelength	$[M^0L^0T^0]/[L]$	$[M^0L^{-1}T^0]$
Radiant flux, Radiant power	Energy emitted/time	$[ML^2T^{-2}]/[T]$	$[ML^2T^{-3}]$
Luminosity of radiant flux or radiant intensity	$\frac{\text{Radiant power or radiant flux of source}}{\text{Solid angle}}$	$[ML^2T^{-3}]/[M^0L^0T^0]$	$[ML^2T^{-3}]$
Luminous power or luminous flux of source	$\frac{\text{Luminous energy emitted}}{\text{time}}$	$[ML^2T^{-2}]/[T]$	$[ML^2T^{-3}]$
Luminous intensity or illuminating power of source	$\frac{\text{Luminous flux}}{\text{Soild angle}}$	$\frac{[ML^2T^{-3}]}{[M^0L^0T^0]}$	$[ML^2T^{-3}]$
Intensity of illumination or luminance	$\frac{\text{Liminous intensity}}{(\text{distance})^2}$	$[ML^2T^{-3}]/[L^2]$	$[ML^0T^{-3}]$
Relative luminosity	$\frac{\text{Luminous flux of a source of given wavelength and intensity}}{\text{luminous flux of peak sensitivity wavelength (555 nm) source of same power}}$	$\frac{[ML^2T^{-3}]}{[ML^2T^{-3}]}$	$[M^0L^0T^0]$
Luminous efficiency	$\frac{\text{Total luminous flux}}{\text{Total radiant flux}}$	$[ML^2T^{-3}]/[ML^2T^{-3}]$	$[M^0L^0T^0]$
Illuminance or illumination	$\frac{\text{Luminous flux incident}}{\text{area}}$	$[ML^2T^{-3}]/[L^2]$	$[ML^0T^{-3}]$
Mass defect	(sum of masses of nucleons)-(mass of the nucleus)	$[M]$	$[ML^0T^0]$
Binding energy of nucleus	Mass defect $\times$(speed of light in vacuum)^2	$[M][LT^{-1}]^2$	$[ML^2T^{-2}]$
Decay constant	0.693/half life	$[T^{-1}]$	$[M^0L^0T^{-1}]$
Resonant frequency	$(\text{Inductance}\times\text{capacitance})^{-1/2}$	$[ML^2T^{-2}A^{-2}]^{-\frac{1}{2}}[M^{-1}L^{-2}T^4A^2]^{-\frac{1}{2}}$	$[M^0L^0A^0T^{-1}]$
Quality factor or Q- factor of coil	$\frac{\text{Resonant frequency}\times\text{inducatance}}{\text{Resistance}}$	$\frac{[T^{-1}][ML^2T^{-2}A^{-2}]}{[ML^2T^{-3}A^{-2}]}$	$[M^0L^0T^0]$
Power of lens	(Focal length)$^{-1}$	$[L^{-1}]$	$[M^0L^{-1}T^0]$
Magnification	$\frac{\text{Image distance}}{\text{Object distance}}$	$[L]/[L]$	$[M^0L^0T^0]$
Fluid flow rate	$\frac{(\pi/8)\,(\text{pressure})\times(\text{radius})^4}{(\text{viscosity coefficient})\times\text{length}}$	$\frac{[ML^{-1}T^{-2}][L^4]}{[ML^{-1}T^{-1}][L]}$	$[M^0L^3T^{-1}]$
Capacitive reactance	(Angular frequency $\times$ capacitance)$^{-1}$	$[T^{-1}]^{-1}[M^{-1}L^{-2}T^4A^2]^{-1}$	$[ML^2T^{-3}A^{-2}]$
Inductive reactance	(Angular frequency $\times$ inductance)	$[T^{-1}][ML^2T^{-2}A^{-2}]$	$[ML^2T^{-3}A^{-2}]$

SOME IMPORTANT CONVERSION FACTORS

LENGTH

- 1 m = 100 cm = 1000 mm = 3.28 ft. = 39.37 in = 1.0936 yd (yard)
- 1 km = 0.6215 mi (mile)
- 1 mi = 1609 m
- 1 n mi (nautical mile) = 1852 m
- 1 in = 2.54 cm
- 1 ft = 12 in = 30.48 cm.
- 1 bohr radius = 0.529 Å
- 1 AU (Astronomical unit) = 1.49×10^{11} m (Average distance between sun and earth)
- 1 ly (light year) = 9.461×10^{15} m (Distance travelled by light in vacuum in one year)
- 1 parsec or parallactic second = 3.08×10^{16}m = 3.26 ly (Distance at which an arc of length 1AU subtends an angle of one second at a point)

MASS

- 1 kg = 1000 g = 2.2 lb (pound)
- 1 quintal = 100 kg
- 1 ton = 907.2 kg
- 1 metric tonne = 1000 kg = 10^6 g
- 1 lb = 454 g
- 1 slug = 14.59 kg
- 1 ounce = 28.35 g
- 1 amu = 1.6606×10^{-27} kg = 931.5 MeV/c^2
- 1 Chandra Shekhar Limit = 1.4 M_{sun}

TIME

- 1 h = 60 min = 3600 s
- 1 d = 24 h = 1440 min = 86.4×10^3 s
- 1 y = 365.24 d = 31.56×10^6 s
- 1 shake = 10^{-8} s

AREA

- 1 m^2 = 10^4 cm^2
- 1 km^2 = 0.386 mi^2 = 247 acres
- 1 acre = 43,560 ft^2 = 4047m^2 = 0.4047 hectare
- 1 hectare = 10^4 m^2 = 2.47 acres
- 1 barn = 10^{-28} m^2 (for measuring cross-sectional areas in sub-atomic particle collisions)

VOLUME

- 1 m^3 = 10^6 cm^3 = 10^6 cc = 10^3 L = 35.31 ft^3
- 1 gal (gallon) = 3.786 L (in U.S.A.) or 4.54 L (in U.K.)

DENSITY

- 1 kg/m^3 = 10^{-3} g/ cm^3 = 10^{-3} kg/L

SPEED

- 1 km h^{-1} = 5/18 m/s or 0.2778 m/s = 0.6215 mi/h
- 1 mi h^{-1} = 0.4470 m/s = 1.609 km/h = 1.467 ft/s
- 1 m s^{-1} = 18/5 km/h or 3.6 km/h = 2.24 mi/h

ACCELARATION

- g = 9.8 m/s^2 (*MKS unit*) = 980 cm/s^2 (*CGS unit*) = 32 ft/s^2 (*FPS unit*)

ANGLE AND ANGULAR SPEED

- π rad = 180^0
- 1 rad = $180°/\pi$ or 57.30^0
- 1^0 = 1.745×10^{-2} rad = 60' = 1/360 revolution
- 1 rev = 360° = 2π rad
- 1' (min) = 60" (second)
- 1 rev/min = 0.1047 rad/s $\approx$ 0.1 rad/s
- 1 rad/s = 9.549 rev/min

FORCE

- 1 N = 10^5 dyne = 7.23 poundal
- 1 kg–wt = 1 kg–f = 9.8 N
- 1 g–wt = 1 g–f = 980 dyne
- 1 lb–wt = 1 lb–f = 32 poundal

PRESSURE

- 1 Pa = 1 N/m^2 = 10 dyne/cm^2
- 1 bar = 10^5 Pa = 10^6 dyne/cm^2
- 1 atm = 1.01325 bar = 1.01×10^5 Pa = 1.01×10^6 dyne/cm^2 = 760 mm of Hg column
- 1 torr = 1 mm of Hg column = 153.32 Pa

WORK ENERGY

- 1 J = 10^7 erg = 0.239 cal
- 1 eV = 1.6×10^{-19} J
- 1 amu = 931 MeV = 1.492×10^{-10} J
- 1 cal = 4.186 J
- 1 kWh = 3.6 MJ = 860 kcal
- 1 Btu (British thermal unit) = 1055 J

POWER

- 1 hp (horse power) = 745.7 W $\approx$ 746 W
- 1 kW = 1000 W = 1.34 hp
- 1 W (watt) = 1 J/s
- 1 cal/s = 4.186 W

TEMPERATURE

- K (kelvin) = [℃ + 273°] = [°F + 459.67]/1.8 = °R/1.8
- ℉ = ℃ × 9/5+ 32

ELECTRIC CHARGE

- 1 C (coulomb) = 3×10^9 stat coulomb = 0.1 ab coulomb
- 1 esu = 1 stat coulomb = 3.33×10^{-10} coulomb
- 1 emu = 1 ab coulomb = 10 coulomb
- 1 A-h = 3600 C (coulomb)

ELECTRIC CURRENT

- 1 A (ampere) = 3×10^9 stat ampere (*esu of current*) = 0.1 ab ampere (*emu of current*)

RADIOACTIVITY

- 1 Bq (bacquerel) = 1 dps (disintegration per second)
- 1 Ci (curie) = 3.7×10^{10} dps = 3.7×10^{10} Bq = 3.7×10^4 Rd
- 1 Rd (rutherford) = 10^6 dps = 10^6 Bq

OTHERS

- 1 weber = 10^8 maxwell (for *Magnetic flux*)
- 1 T (tesla) = 1 weber/m^2 = 10^4 G (gauss) (for *Magnetic flux density*)
- 1 orested= 79.554 A/m (for *Intensity of Magnetic field*)
- 1 poiseuille (N-s/m^2 or Pa-s) = 10 poise (Dyne-s/cm^2) (for *Viscosity*)

SETS OF QUANTITIES HAVING SAME DIMENSIONS

S.No.	Quantities	Dimensions
1.	Strain, refractive index, relative density, angle, solid angle, phase, distance gradient, relative permeability, relative permittivity, angle of contact, Reynolds number, coefficient of friction, mechanical equivalent of heat, electric susceptibility, etc.	$[M^0 L^0 T^0]$
2.	Mass	$[M^1 L^0 T^0]$
3.	Momentum and impulse.	$[M^1 L^1 T^{-1}]$
4.	Thrust, force, weight, tension, energy gradient.	$[M^1 L^1 T^{-2}]$
5.	Pressure, stress, Young's modulus, bulk modulus, shear modulus, modulus of rigidity, energy density.	$[M^1 L^{-1} T^{-2}]$
6.	Angular momentum and Planck's constant (h).	$[M^1 L^2 T^{-1}]$
7.	Acceleration, g and gravitational field intensity.	$[M^0 L^1 T^{-2}]$
8.	Surface tension, free surface energy (energy per unit area), force gradient, spring constant.	$[M^1 L^0 T^{-2}]$
9.	Latent heat and gravitational potential.	$[M^0 L^2 T^{-2}]$
10.	Thermal capacity, Boltzmann constant, entropy.	$[ML^2 T^{-2}K^{-1}]$
11.	Work, torque, internal energy, potential energy, kinetic energy, moment of force, (q^2/C), (LI^2), (qV), (V^2C), (I^2rt), $(\frac{V^2}{r}t)$, (VIt), (RT) $q \to$ charge, $C \to$ capacitance, $L \to$ inductance, $V \to$ potential, $r \to$ resistance, $I \to$ current $T \to$ temperature, $t \to$ time, $R \to$ gas constant	$[M^1 L^2 T^{-2}]$
12.	Frequency, angular frequency, angular velocity, velocity gradient, radioactivity of a sample, $\left(\frac{R}{L}\right)$, $\left(\frac{1}{RC}\right)$, $\left(\frac{1}{\sqrt{LC}}\right)$. $L \to$ inductance, $R \to$ resistance, $C \to$ capacitance	$[M^0 L^0 T^{-1}]$
13.	$\left(\frac{\ell}{g}\right)^{1/2}, \left(\frac{m}{k}\right)^{1/2}, \left(\frac{L}{R}\right), (RC), (\sqrt{LC})$, time $\ell \to$ length, $g \to$ gravitational acceleration, $k \to$ spring constant	$[M^0 L^0 T^1]$
14.	(VI), (I^2r), (V^2/r), Power (r= resistance)	$[M L^2 T^{-3}]$

NUMERICAL CONSTANTS

I. FUNDAMENTAL PHYSICAL CONSTANTS

Name	Symbol	Value	Computational Value
Speed of light	**c**	2.99792458×10^8 m/s	3.00×10^8 m/s
Elementary charge	**e**	$1.60217653 \times 10^{-19}$ C	1.60×10^{-19} C
Gravtitational constant	**G**	6.6742×10^{-11} N-m²/kg²	6.67×10^{-11} N-m²/kg²
Universal gas constant	**R**	8.314472 J/mol-K	8.31 J/mol-K
Avogadro's constant	$\mathbf{N_A}$	6.0221415×10^{23} molecules/mol	6.02×10^{23} molecules/mol
Boltzmann constant	**k**	$1.3806505 \times 10^{-23}$ J/K	1.38×10^{-23} J/K
Stefan-Boltzmann constant	**σ**	5.670400×10^{-8} W/m²-K⁴	5.67×10^{-8} W/m²-K⁴
Molar volume of ideal gas at STP*	$\mathbf{V_m}$	22.413996 litre/mol	22.4 litre/mol
Planck's constant	**h**	$6.6260693 \times 10^{-34}$ J-s	6.62×10^{-34} J-s
Mass of electron	$\mathbf{m_e}$	$9.1093826 \times 10^{-31}$ kg	9.11×10^{-31} kg
Mass of proton	$\mathbf{m_p}$	$1.67262171 \times 10^{-27}$ kg	1.67×10^{-27} kg
Mass of neutron	$\mathbf{m_n}$	$1.67492728 \times 10^{-27}$ kg	1.68×10^{-27} kg
Permeability of free space	μ_0	$4\pi \times 10^{-7}$ Wb/A-m	1.27×10^{-6} Wb/A-m
Permittivity of free space	ε_0	$8.85418781762 \times 10^{-12}$ C²/N-m²	8.85×10^{-12} C²/N-m²
	$\frac{1}{4\pi\varepsilon_0}$	8.987551787×10^9 N-m²/C²	9.0×10^9 N-m²/C²

* STP means standard temperature and pressure : 0°C and 1.0 atm

II.OTHER USEFUL PHYSICAL CONSTANTS

Name	Symbol	Value	Computational Value
Mechanical equivalent of heat	J	4.186 J/cal	4.2 J/cal
Standard atmospheric pressure	1 atm	1.01325×10^5 Pa	1.013×10^5 Pa
Absolute zero	0 K	–273.15° C	–273° C
Electron volt	1 eV	$1.60217653 \times 10^{-19}$ J	1.60×10^{-19} J
Atomic mass unit	1 u	$1.66053886 \times 10^{-27}$ kg	1.66×10^{-27} kg
Electron rest energy	m_ec^2	0.510998918 MeV	0.511 MeV
Ratio of proton mass to electron mass	$\frac{m_p}{m_e}$	1836.1526675	1840
Electron charge to mass ratio	$\frac{e}{m_e}$	$1.758820174 \times 10^{11}$ C/kg	1.76×10^{11} C/kg
Bohr magneton	μ_B	$9.27400899 \times 10^{-24}$ J/T	9.2×10^{-24} J/T
Bohr radius	a_0	$5.291772083 \times 10^{-11}$ m	5.29×10^{-11} m
Rydberg constant	R_H	1.097373156×10^7 m⁻¹	1.10×10^7 m⁻¹
Energy equivalent of 1 u	mc^2	931.49404 MeV	931.5 MeV
Acceleration due to gravity (standard)	g	9.80665 m/s²	9.81 m/s²

SI Base Quantities and Units

Base Quantity	SI Units		
	Name	Symbol	Definition
Length	meter	m	The meter is the length of the path traveled by light in vacuum during a time interval of 1/(299, 792, 458) of a second (1983)
Mass	kilogram	kg	The kilogram is equal to the mass of the international prototype of the kilogram (a platinum-iridium alloy cylinder) kept at International Bureau of Weights and Measures, at Sevres, near Paris, France. (1889)
Time	second	s	The second is the duration of 9, 192, 631, 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium-133 atom (1967)
Electric Current	ampere	A	The ampere is that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section, and placed 1 metre apart in vacuum, would produce between these conductors a force equal to 2×10^{-7} Newton per metre of length. (1948)
Thermodynamic Temperature	kelvin	K	The kelvin, is the fraction 1/273.16 of the thermodynamic temperature of the triple point of water. (1967)
Amount of Substance	mole	mol	The mole is the amount of substance of a system, which contains as many elementary entities as there are atoms in 0.012 kilogram of carbon-12. (1971)
Luminous Intensity	candela	Cd	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 (1979).

Note :- On November 16, 2018 at the General Conference on Weights and Measure (GCWM) the 130 years old definition of kilogram was changed forever. It will now defined in terms of plank's constant. It will adopted on 20 May, 2019 (World Metrology Day - 20 May). The new definition of kg involves accurate weighing machine called "Kibble balance".

IMPORTANT NOTES