SI Dimensions of Physical Quantities listed by Category

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Quantity	Dimension	Alternatives	Root definition and Notes
Basic SI quantities			
Length	m	**m**	**meter**
Mass	kg	**kg**	**kilogram**
Time	s	**s**	**second**
Current, electric	A	**A**	**ampere**
Temperature	K	**K**	**kelvin**
Quantity of substance	mol	**mol**	**mole**
Luminosity | Luminous intensity	cd	**cd**	**candle**
Pseudo-dimensional quantities:			
Plane angle	1	**rad**	**radian**
Solid angle	1	**sr**	**steradian**
Universal dimensionless quantities			
Count of events | Number of instances	1		This covers all kinds of **enumerations**

Probability of an event	1		Real number in a dimensionless interval [0,1]
Ratio of commensurable quantities	1		Q1/Q2, with Q1 and Q2 having the same dimension
Relative variation	1		ΔQ/Q, for any quantity Q
Logarithmic ratio $\log_b$(A/A') in any base b	1		Applicable to any ratio of commensurable quantities
Logarithmic scale differential | Relative differential	1		d{ln(Q)} = dQ/Q, for any quantity Q
Pseudo-dimensional quantities:			
Phase | Phase angle	1	rad	φ typically in exp(i(ωt+φ))
Logarithmic ratio Log(P/P')/10	1	**dB**	**decibel**. Uses base-10 logarithm. Applies to power P
Logarithmic ratio Log(X/X')/20	1	**dB**	**decibel**. Uses base-10 logarithm. Applies to amplitudes X
Gain or Loss of a device	1	usually in **dB**	[Output]/[Input], provided they are commensurable quantities
Attenuation | Amplification (generic)	1	usually in **dB**	[Quantity(p)]/[Quantity(p')], with p being some parameter
Logarithmic ratio ln(A/A')	1	**Np**	Neper. Uses natural logarithm
Logarithmic scale probability density	1	1/Np	[Probability]/[Natural-logarithmic ratio]

Operators

Derivative with respect to **time**	s^{-1}		d/d**t**, ∂/∂**t**
Derivative with respect to a **length**	m^{-1}		d/d**r**, ∂/∂**r**, r = x | y | z
Nabla (∇) | div | grad | rot | curl	m^{-1}		Any derivative-like construct with respect to a distance
Laplace operator | Laplacian	m^{-2}		$\nabla^2 = \partial^2/\partial \mathbf{x}^2 + \partial^2/\partial \mathbf{y}^2 + \partial^2/\partial \mathbf{z}^2$
D'Alembert operator | D'Alembertian	m^{-2}		$(1/c^2)\partial^2/\partial \mathbf{t}^2 - \partial^2/\partial \mathbf{x}^2 - \partial^2/\partial \mathbf{y}^2 - \partial^2/\partial \mathbf{z}^2$
Multiple derivatives with respect to **time**	s^{-p}		$d^p/d\mathbf{t}^p$, $\partial^p/\partial \mathbf{t}^p$; for p = 1,2,3,..
Multiple derivatives with respect to a **length**	m^{-p}		$d^p/d\mathbf{r}^p$, $\partial^p/\partial \mathbf{r}^p$; for p = 1,2,3,..., r = x | y | z

Quantities related only to time

Time | Duration	s	**s**	**second**
Half life	s		of a non-conservative / decaying quantity
Settling time	s	typically dB/s	Used to describe transient phenomena
Relaxation time	s		Used for returns to equilibria
Activity | Frequency of events	s^{-1}		[Counts]/[Time]
Count rate | Expectation frequency	s^{-1}		[Counts]/[Time]
Relative growth rate	s^{-1}		[Relative variation]/[Time]

Relative evolution rate | Log-scale evolution rate	s^{-1}		d{ln(Q)}/dt = (dQ/dt)/Q
Settling rate	s^{-1}	typically dB/s	[Ratio]/[ΔTime]. Used for transient phenomena
Relaxation rate	s^{-1}		1/[Relaxation time]
Frequency of waves	s^{-1}	**Hz**	**hertz**
Phase drift rate	s^{-1}	$rad.s^{-1}$	[Phase angle]/[Time]
Angular velocity / speed	s^{-1}	$rad.s^{-1}$	[Plane angle]/[Time]
Frequency drift rate	s^{-2}	$Hz.s^{-1}$	[ΔFrequency]/[Time]. Applicable to waves
Angular acceleration / deceleration	s^{-2}	$rad.s^{-2}$	[ΔAngularVelocity]/[Time]

Quantities related only to space

Position vector	m		in all Euclidean n-dimensional spaces
Length | Distance	m	**m**	**meter**
Perimeter | Circumference | Radius	m		
Thickness	m		usually referred to planar structures
Wavelength	m		[Wave velocity]/[Frequency]
Wavenumber	m^{-1}		[Number of waves]/[Distance]
K-space vector | Reciprocal space position	m^{-1}		
Curvature radius	m		of a line in plane/space or surface in space
Curvature	m^{-1}		1/[Curvature radius]
Convergence	m^{-1}	**dioptry**	used in optics, but not only ..
Attenuation / amplification over a distance	m^{-1}	dB/m	[Attenuation]/[Distance]. Mostly in acoustic and electronics
Extinction coefficient	m^{-1}	dB/m	[Ratio]/m. Used mostly for radiation
Propagation / transmission loss	m^{-1}	dB/m	[Ratio]/m. Generic, usable for any quantity
Area | Cross section	m^2		[Distance]*[Distance]
Surface element | Surface area	m^2		[Distance]*[Distance]. Applicable to 3D bodies
Volume element | Volume	m^3		[Area]*[Distance]

Propagation through space and time

Velocity | Speed	$m.s^{-1}$		[Distance]/[Time]
Acceleration | Deceleration	$m.s^{-2}$		[ΔVelocity]/[ΔTime]

Drift speed	m.s^{-1}		Steady-state speed of an object
Surface / area growth rate	m^{2}.s^{-1}		[ΔArea]/[Time]
Volume growth rate	m^{3}.s^{-1}		[ΔVolume]/[Time]. For example, of a crystal
Volume flow	m^{3}.s^{-1}		[Volume]/[Time]. For example, through a device
Matter distribution and transport			
Particle density	m^{-3}		[Count]/[Volume]. Obsolete: **number density**
Mass	kg	**kg**	**kilogram**
Mass production rate	kg.s^{-1}		[ΔMass]/[Time]
Mass density | Specific density	kg.m^{-3}		[Mass]/[Volume]
Mass density gradient | Specific density gradient	kg.m^{-4}		[Mass density]/[Distance]
Specific volume	m^{3}.kg^{-1}		[Volume]/[Mass]
Concentration ratio by volume	1	Dimensionless	[Partial volume]/[Total volume]
Concentration ratio by mass	1	Dimensionless	[Partial mass]/[Total mass]. Not *by weight*: obsolete)
Mass flow (total)	kg.s^{-1}		[ΔMass]/[Time]. For example, through a device
Diffusion coefficient	m^{2}.s^{-1}		[Distance^{2}]/[Time]
Molar distribution and transport quantities:			
Particle count, molar	mol^{-1}		[Count]/[Mol]. For example, the Avogadro constant
Molar production rate	mol.s^{-1}		[ΔQuantity]/[Time]
Molar mass	kg.mol^{-1}		[Mass]/[Quantity]
Molar volume	m^{3}.mol^{-1}		[Volume]/[Quantity]
Molar density | Density of substance	m^{-3}.mol		[Quantity]/[Volume]
Molarity | Concentration	m^{-3}.mol		[Quantity]/[Volume]. Same as **molar density**
Molarity gradient | Concentration gradient	m^{-4}.mol		[Molarity]/[Distance]
Molar concentration ratio	1	Dimensionless	[Partial quantity]/[Total quantity]
Molality (intended as concentration)	kg^{-1}.mol	mol/kg	[Quantity]/[Mass]. Obsolete
Katalytic activity	mol.s^{-1}	**katal**	[ΔQuantity]/[Time]
Mechanics and hydrodynamics			
Force	kg.m.s^{-2}	**N**	**newton**. [Mass]*[Acceleration]
Moment of motion	kg.m.s^{-1}		[Mass]*[Velocity], [Mass flow]*[Distance]

Impulse	kg.m.s^{-1}		[ΔMoment of motion], [Force]*[ΔTime], [Mass]*[ΔVelocity]
Moment of force | Torque	kg.m^{2}.s^{-2}	N.m	[Force]*[Distance]. Like **energy**
Couple	kg.m^{2}.s^{-2}	N.m	2*[Force]*[Distance] for two non-aligned opposing forces
Pressure	kg.m^{-1}.s^{-2}	N.m^{-2}, **Pa**	**pascal**. [Force]/[Area]
Pressure gradient	kg.m^{-2}.s^{-2}	N.m^{-3}, **Pa/m**	[Pressure]/[Distance]
Energy | Lagrangian | Hamiltonian	kg.m^{2}.s^{-2}	N.m, **J**	**joule**. [Force]*[Distance], [Power]*[Time]
Specific energy	m^{2}.s^{-2}	J.kg^{-1}	[Energy]/[Mass]
Energy density	kg.m^{-1}.s^{-2}	J.m^{-3}	[Energy]/[Volume]
Power | Energy flux	kg.m^{2}.s^{-3}	J.s^{-1}, **W**	**watt**. [ΔEnergy]/[ΔTime]
Action	kg.m^{2}.s^{-1}	J.s	[Energy]*[Time], [Moment of motion]*[Distance]
Angular moment of inertia	kg.m^{2}		[Mass]*[Distance^{2}]
Angular moment of motion	kg.m^{2}.s^{-1}	J.s	[Moment of motion]*[Distance]
Circulation	m^{2}.s^{-1}	J.s.kg^{-1}	[Angular moment]/[Mass], [Velocity]*[Loop length]
Spin	1	Dimensionless	of a quantum particle
Stress | Tension | Compression	kg.m^{-1}.s^{-2}	N.m^{-2}, **Pa** (pascal)	[Force]/[Area]. ... same as pressure
Compressive strength	kg.m^{-1}.s^{-2}	N.m^{-2}, Pa	[Force]/[Area]. Like **pressure**
Strain (mechanical)	1	Dimensionless	[ΔLength]/[Length] Relative deformation
Friction	kg.m.s^{-2}	**N**	Tangential force between two moving surfaces
Traction	kg.m.s^{-2}	**N**	Maximum tangential force before slipping
Velocity, superficial	m.s^{-1}	m/s	In **porous media**; as if the space was filled only by the fluid
Velocity, advection	m.s^{-1}	m/s	In **porous media**; actual progress along pressure gradient
Wave function for N particles (quantum)	m$^{-3N/2}$	tentative	$\|\psi\|^{2}d\tau^{N}$ is a dimensionless probability element.
Mechanical and hydrodynamic properties of matter			
Compressibility | Modulus of compression	kg^{-1}.m.s^{2}	Pa^{-1}	[Pressure]/([ΔVolume]/[Volume]). Inverse of bulk modulus
Bulk modulus	kg.m^{-1}.s^{-2}	N.m^{-2}, Pa	([ΔVolume]/[Volume])/[Pressure]. Inverse of compressibility
Young modulus	kg.m^{-1}.s^{-2}	N.m^{-2}, Pa	[Stress]/[Strain]. Like **shear modulus**
Shear modulus | Modulus of rigidity	kg.m^{-1}.s^{-2}	N.m^{-2}, Pa	[Stress]/[Strain]. Same dimension aas Young modulus
Poisson's ratio	1	Dimensionless	[Transversal striction]/[Londitudinal elongation]
Impact | Notch resistance	kg.s^{-2}	J.m^{-2}	[Energy]/[Area]

Hardness | Tensile strength	$kg.m^{-1}.s^{-2}$	$N.m^{-2}$, Pa	[Force]/[Area]. Like **pressure**
Stiffness (linear)	$kg.s^{-2}$	$N.m^{-1}$	[Force]/[Displacement]. ... of a structure
Stiffness (rotational)	$kg.m^2.s^{-2}.rad^{-1}$	$N.m.rad^{-1}$	[Moment of force]/[Angle]. ... of a structure
Friction coefficient	1	Dimensionless	[Tangential force]/[Normal force]
Traction coefficient	1	Dimensionless	[Traction]/[Weight]
Self-diffusion coefficient	$m^2.s^{-1}$		[Distance^2]/[Time]
Surface tension	$kg.s^{-2}$	N/m	[Force]/[Length]. Same as surface energy
Surface energy	$kg.s^{-2}$	J/m^2	[Energy]/[Area]. Same as surface tension
Viscosity, dynamic	$kg.m^{-1}.s^{-1}$	Pa.s	([Force]/[Area])/[ΔVelocity]
Viscosity, kinematic	$m^2.s^{-1}$		[Dynamic viscosity]/[Density]
Reynolds number	1	Dimensionless	[Velocity]*[length]/[Kinematic viscosity]
Critical angle of repose	rad	or degree	Steepest angle of a slope before a slide
Porosity, volume	1	Dimensionless	[Volume of pores]/[Total volume], in **porous media**
Porosity, superficial	1	Dimensionless	[Void cross section]/[Total cross section], in **porous media**
Permeability, hydraulic	m^2	1 darcy = 10^{-12} m^2	[Velocity]*[Viscosity]/[Pressure gradient], in **porous media**
Conductivity, hydraulic	$m.s^{-1}$	m/s	Used for **porous media**
Specific acoustic impedance / resistance / reactance	$kg.m^{-2}.s^{-1}$	Pa.s/m , **reyl**	[ΔPressure]*[Velocity], intensive property
Specific acoustic conductance / susceptance	$kg^{-1}.m^2.s$	$reyl^{-1}$	Inverse of specific acoustic impedance
Acoustic impedance / resistance / reactance	$kg.m^{-4}.s^{-1}$	$Pa.s/m^3$, $reyl/m^2$	[ΔPressure]/[Volume flow rate], extensive property

Thermodynamics

Temperature	K	**K**	**kelvin**
Temperature gradient | Thermal gradient	$K.m^{-1}$		[ΔTemperature]/[Distance]
Heat | Internal energy | Enthalpy	$kg.m^2.s^{-2}$	J	Same as **energy**
Specific heat | internal energy | enthalpy	$m^2.s^{-2}$	$J.kg^{-1}$	[Heat]/[Mass]
Heat capacity	$kg.m^2.s^{-2}.K^{-1}$	$J.K^{-1}$	[ΔHeat]/[ΔTemperature]
Heat flux	$kg.m^2.s^{-3}$	J.s, W	[ΔHeat]/[ΔTime]. Same as **power**
Heat flux density | Irradiance	$kg.s^{-3}$	$W.m^{-2}$	[Heat flux]/[Area]
Entropy	$kg.m^2.s^{-2}.K^{-1}$	$J.K^{-1}$	[ΔHeat]/[Temperature]
Specific entropy	$m^2.s^{-2}.K^{-1}$	$J.K^{-1}.kg^{-1}$	[Entropy]/[Mass]

Free energy | Free enthalpy	kg.m^2.s^{-2}	J	**Helmholtz | Gibbs functions**, respectively
Specific free energy | free enthalpy	m^2.s^{-2}	J.kg^{-1}	[Energy]/[Mass]. Also specific **Helmholtz | Gibbs functions**
Molar thermodynamical quantities:			
Molar heat | internal energy | enthalpy	kg.m^2.s^{-2}.mol^{-1}	J.mol^{-1}	[Heat]/[Quantity]
Molar energy	kg.m^2.s^{-2}.mol^{-1}	J.mol^{-1}	[Energy]/[Quantity]
Molar entropy	kg.m^2.s^{-2}.K^{-1}.mol^{-1}	J.K^{-1}.mol^{-1}	[Entropy]/[Quantity]
Molar free energy | free enthalpy	kg.m^2.s^{-2}.mol^{-1}	J.mol^{-1}	[Energy]/[Quantity]. Molar versions of the above

Thermodynamic and thermal properties of matter

Thermal expansion coefficient	K^{-1}		([ΔLength]/[Length])/[Temperature]
Heat capacity, specific	m^2.s^{-2}.K^{-1}	J.K^{-1}.kg^{-1}	[Heat capacity]/[Mass]
Heat capacity, molar	kg.m^2.s^{-2}.K^{-1}.mol^{-1}	J.K^{-1}.mol^{-1}	[Heat capacity]/[Quantity]
Heat of fusion | evaporation, specific	m^2.s^{-2}	J.kg^{-1}	[Energy]/[Mass]
Heat of fusion | evaporation, molar	kg.m^2.s^{-2}.mol^{-1}	J.mol^{-1}	[Energy]/[Quantity]
Heat conductivity	kg.m.s^{-3}.K^{-1}	W.m^{-1}.K^{-1}	[Heat flux]/([Distance]*[ΔTemperature])
Thermal diffusivity	m^2.s^{-1}		([∂Temp]/[∂Time])/[∇^2Temp].
Prandtl number	1	Dimensionless	[Kinematic viscosity]/[Thermal diffusivity]
Joule-Thomson coefficient	kg^{-1}.m.s^2.K	K.Pa^{-1}	[ΔTemperature]/[ΔPressure]
Pi coefficient, molar	kg.m^{-1}.s^{-2}.mol^{-1}	J.m^{-3}	[ΔInternalEnergy]/[ΔVolume]
Chemical potential, molar	kg.m^2.s^{-2}.mol^{-1}	J.mol^{-1}	[ΔInternalEnergy]/[ΔQuantity]
Softening point	K		Temperature at which hardness drops below a level
Annealing point	K		Temperature at which viscosity drops below 10^{12} Pa.s
Strain point	K		Temperature at which viscosity drops below 10$^{13.5}$ Pa.s
Flash point	K		Temperature at which vapour can be kept burning
Fire point	K		Temperature at which ignited vapour keeps burning

Thermal properties of devices

Thermal resistance	kg^{-1}.m^{-2}.s^{3}K	K/W	[ΔT]/[Power].

Electromagnetism

Charge, electric	s.A	**C**	**coulomb**. [Current]*[Time]

Charge density	$m^{-3}.s.A$	$C.m^{-3}$	[Charge]/[Volume]
Current, electric	A	**A**	**ampere**. [Charge]/[Time]
Current density | Current intensity	$m^{-2}.A$		[Current]/[Area]
Specific charge | Charge/mass ratio	$kg^{-1}.s.A$	$C.kg^{-1}$	[Charge]/[Mass]
Molar charge	$s.A.mol^{-1}$	$C.mol^{-1}$	[Charge]/[Quantity]
Quantum charge	1	Dimensionless	[Charge]/[Elementary charge quantum]
Surface density of charge	$m^{-2}.s.A$	$C.m^{-2}$	[Charge]/[Area]
Potential, electric	$kg.m^2.s^{-3}.A^{-1}$	$W.A^{-1}$, $J.C^{-1}$, $C.F^{-1}$, **V**	**volt**. [Power]/[Current], [Energy]/[Charge]
Electric dipole moment	m.s.A	C.m	[Charge]*[Distance]
Electric quadrupole moment	$m^2.s.A$	$C.m^2$	[Electric dipole]*[Distance], [Electric charge]*[Distance^2]
Electric field strength | Electric intensity	$kg.m.s^{-3}.A^{-1}$	$V.m^{-1}$	[ΔPotential]/[Distance]
Electric field gradient	$kg.s^{-3}.A^{-1}$	$V.m^{-2}$	[ΔEl.field strength]/[Distance]
Electric flux density | Electric induction	$m^{-2}.s.A$	$C.m^{-2}$	[Charge]/[Area]
Electric polarization | Electric displacement	$m^{-2}.s.A$	$C.m^{-2}$	[Charge]/[Area]. Same as **electric flux density**
Magnetic field strength | Magnetic intensity	$m^{-1}.A$		[Current]/[Distance]
Magnetic flux	$kg.m^2.s^{-2}.A^{-1}$	V.s, $W.s.A^{-1}$, **Wb**	**weber**. [ΔPotential]*[Time], [Power]/[dCurrent/dt]
Magnetic flux density | Magnetic induction	$kg.s^{-2}.A^{-1}$	$Wb.m^{-2}$, **T**	**tesla**. [Mag.flux]/[Area]
Magnetic vector potential	$kg.m.s^{-2}.A^{-1}$	$m^{-1}.s.V$, m.T	[Mag.flux density]*[Distance], [El.field strength]*[Time]
Magnetization	$m^{-1}.A$		[Magnetic moment]/[Volume]. Like **magnetic field strength**
Magnetic charge (bound)	$m^{-2}.A$		- ∇.[Magnetization] , -Divergence of **magnetization**
Poynting vector	$kg.s^{-3}$	$W.m^{-2}$	[El.field strength]/[Mag.field strength]. Same as **irradiance**
Magnetic field gradient	$kg.m^{-1}.s^{-2}.A^{-1}$	$T.m^{-1}$	[ΔMagnetic flux density]/[Distance]
Magnetic dipole moment	$m^2.A$	$J.T^{-1}$	[Current]*[Area]. Same as **magnetic moment**
Magnetic quadrupole moment	$m^3.A$	$m.J.T^{-1}$	[Magnetic dipole]*[Distance]
Gyromagnetic ratio	$kg^{-1}.s.A$	$Hz.T^{-1}$	[Mag.moment]/[Angular moment of motion]
Magnetogyric ratio	$kg.s^{-1}.A^{-1}$	$T.Hz^{-1}$	[Angular moment of motion]/[Mag.moment]
Relativistic four-current (J^α)	$m^{-2}.A$		Like **current density** and [Charge]*[c]
Relativistic four-potential (A^α)	$kg.m.s^{-2}.A^{-1}$	$m^{-1}.s.V$, m.T	Like **magnetic vector potential** and [El.potential]/[c]
Relativistic electromagnetic field tensor ($F^{\mu\nu}$)	$kg.s^{-2}.A^{-1}$	**T**	Like **magnetic flux density**

Relativistic displacement four-tensor ($D^{\mu\nu}$)	$m^{-1}.A$		Like **magnetic intensity**

Electromagnetic properties of matter

Resistivity	$kg.m^{3}.s^{-3}.A^{-2}$	Ω.m	[Resistance]*[Length])/[Area]
Conductivity	$kg^{-1}.m^{-3}.s^{3}.A^{2}$	$S.m^{-1}$	1/[Resistivity]
Permittivity, electric	$kg^{-1}.m^{-3}.s^{4}.A^{2}$	$F.m^{-1}$	[El.flux density]/[El.field strength]
Dielectric constant | Relative permittivity	1	Dimensionless	[Permittivity]/[Permittivity of vacuum]
Permeability, magnetic	$kg.m.s^{-2}.A^{-2}$	$N.A^{-2}$, $H.m^{-1}$	[Mag.flux density]/[Mag.field strength]
Reluctance, magnetic	$kg^{-1}.m^{-1}.s^{2}.A^{2}$	$m.H^{-1}$	1/[Permeability]
Relative permeability, magnetic	1	Dimensionless	[Permeability]/[Permeability of vacuum]
Susceptibility, magnetic	1	Dimensionless	[Relative permeability] - 1
Characteristic impedance	$kg.m^{2}.s^{-3}.A^{-2}$	$V.A^{-1}$, Ω, ohm	√([Mag.Permeability]/[El.Permittivity])
Electric | Dielectric strength | rigidity	$kg.m.s^{-3}.A^{-1}$	$V.m^{-1}$	[ΔPotential]/[Distance]
Verdet constant	$kg^{-1}.m^{-1}.s^{2}.A^{1}$	$rad.m^{-1}.T^{-1}$	([Angle]/[Length])/[Magnetic flux density]
Work function	$kg.m^{2}.s^{-2}$	J, eV	[Energy] needed to remove an electron
Thermoelectric power | Thermopower	$kg.m^{2}.s^{-3}.A^{-1}.K^{-1}$	$V.K^{-1}$	[ΔPotential]/[ΔTemperature]
Seeback coefficient	$kg.m^{2}.s^{-3}.A^{-1}.K^{-1}$	$V.K^{-1}$	[ΔPotential]/[ΔTemperature]
Thomson coefficient	$kg.m^{2}.s^{-3}.A^{-1}.K^{-1}$	$W.K^{-1}.A^{-1}$	[Heat flux]/([ΔTemperature]*[Current])
Peltier coefficient	$kg.m^{2}.s^{-3}.A^{-1}$	$W.A^{-1}$, V	[Heat flux]/[Current]
Piezzoelectric coefficient	$kg.m.s^{-3}.A^{-1}$	$V.m^{-1}$	[El.field strength]/([ΔLength]/[Length])
Electrostriction coefficient	$kg^{-2}.m^{-2}.s^{6}.A^{2}$	$m^{2}.V^{-2}$	([ΔVolume]/[Volume])/[El.field strength]^2
g-factor of a particle	1	Dimensionless	[Mag.moment]/([Spin].[Bohr magneton])

Properties of electric/magnetic devices and circuit components

Bandwidth	s^{-1}	Hz	[ΔFrequency]
Voltage | Electromotive force (emf)	$kg.m^{2}.s^{-3}.A^{-1}$	V	[ΔPotential]
Current, electric	A	**A**	**ampere**. [Charge]/[Time]
Magnetomotive force (mmf)	A		[Current]*[Number of turns]
Impedance, of a circuit	$kg.m^{2}.s^{-3}.A^{-2}$	**Ω**	**ohm**
Admittance, of a circuit	$kg^{-1}.m^{-2}.s^{3}.A^{2}$	**S**	**siemens**. 1/[Circuit impedance]
Resistance	$kg.m^{2}.s^{-3}.A^{-2}$	$V.A^{-1}$, **Ω**(ohm)	[ΔPotential]/[Current]

Conductance	$kg^{-1}.m^{-2}.s^3.A^2$	$A.V^{-1}$, **S** (siemens)	1/[Resistance]
Capacitance	$kg^{-1}.m^{-2}.s^4.A^2$	$C.V^{-1}$, **F**	**farad**. [Charge]/[ΔPotential]
Reactance, capacitive	$kg.m^2.s^{-3}.A^{-2}$	**Ω** (ohm)	1/(i[Angular frequency].[Capacitance])
Susceptance, capacitive	$kg^{-1}.m^{-2}.s^3.A^2$	**S** (siemens)	1/[Reactance]
Inductance | Mutual inductance	$kg.m^2.s^{-2}.A^{-2}$	$V.s.A^{-1}$, $Wb.A^{-1}$, **H**	**henry**. [ΔPotential]/[dCurrent/dt] or [Magnetic flux]/[Current]
Impedance, inductive	$kg.m^2.s^{-3}.A^{-2}$	**Ω** (ohm)	i[Angular frequency].[Inductance]
Admittance, inductive	$kg^{-1}.m^{-2}.s^3.A^2$	**S** (siemens)	1/[Inductive impedance]
Number of turns	1		Applicable to coils, transformers, etc
Current noise, variance n_J^2	$s.A^2$	A^2/Hz	$[Current]^2/[Bandwidth]$
Voltage noise, variance n_V^2	$kg^2.m^4.s^{-5}.A^{-2}$	V^2/Hz	$[Voltage]^2/[Bandwidth]$
Chemistry, physical chemistry, atomic and molecular physics			
Concentration | Molar density | Molarity	$m^{-3}.mol$		[Quantity]/[Volume]. Same as **Density of substance**
Molality	$kg^{-1}.mol$	mol/kg	[Quantity]/[Mass]
Katalytic activity | Molar production rate	$mol.s^{-1}$	katal	[Quantity]/[Time]
Molar mass	$kg.mol^{-1}$		[Mass]/[Quantity]
Molar charge	$s.A.mol^{-1}$	$C.mol^{-1}$	[Charge]/[Quantity]
Molecular | ionic quantum charge	1	Dimensionless	[Charge of a molecule or ion]/[Elementary charge quantum]
Ionic strength | Ionic force	$m^{-3}.mol$		Sum([Conc.]*[Ionic quantum charge]^2)
Ion mobility	$kg^{-1}.m^{-1}.s^2.A$	$m^2.s^{-1}.V^{-1}$	[Velocity]/[Electric field strength] .
Drift speed	$m.s^{-1}$		Steady-state speed of ions in electric field .
Fugacity	$kg.m^{-1}.s^{-2}$	Pa	Effective pressure in real gases
Osmotic pressure	$kg.m^{-1}.s^{-2}$	Pa	
Thermodynamic force	$kg.m.s^{-2}.mol^{-1}$	N/mol	[ΔChemical potential]/[Distance]
Chemico-physical properties of elements			
Atomic number	1	Dimensionless	Number of protons in an atomic nucleus
Atomic weight | Relative atomic mass	au	atomic units	Average over a typical isotopic composition
Mass number of an isotope	1	Dimensionless	Number of protons+neutrons in the isotope nuclide
Electronegativity, Pauling χ	1	Dimensionless	Relative tendency of an atom to attract electrons; χ(H)=2.20.

Electron affinity (always molar)	$kg.m^{2}.s^{-2}.mol^{-1}$	$J.mol^{-1}$	Energy released when binding an electron
Chemico-physical properties of matter			
Ionization energy, molar	$kg.m^{2}.s^{-2}.mol^{-1}$	$J.mol^{-1}$	Energy to ionize a molecule/atom
Volume, molar	$m^{3}.mol^{-1}$		[Volume]/[Quantity]
Heat of fusion | evaporation, molar	$kg.m^{2}.s^{-2}.mol^{-1}$	$J.mol^{-1}$	[Energy]/[Quantity]
Chemical potential, molar	$kg.m^{2}.s^{-2}.mol^{-1}$	$J.mol^{-1}$	[ΔInternalEnergy]/[ΔQuantity]
Solubility, molar	$m^{-3}.mol$		[Quantity]/[Volume]
Reduction | Redox potential	$kg.m^{2}.s^{-3}.A^{-1}$	**V** (volt)	
Conductivity, molar	$kg^{-1}.s^{3}.A^{2}.mol^{-1}$	$S.m^{2}.mol^{-1}$	[El.conductivity]/[Concentration]
Relaxivity, molar	$s^{-1}.mol^{-1}$		[Relaxation rate]/[Concentration]
Ebullioscopic constant	$kg.mol^{-1}.K$	K/(mol/kg)	[ΔTemperature]/[Molality]
Cryoscopic constant	$kg.mol^{-1}.K$	K/(mol/kg)	[ΔTemperature]/[Molality]
Compression factor of a real gas	1	Dimensionless	pV/(nRT). For ideal gas equals 1; temperature dependent
van der Waals constant: a	$kg.m^{5}.s^{-2}.mol^{-2}$	$Pa.m^{6}$	a in $(p+a/V^{2})(V-b)=RT$, where V is molar volume
van der Waals constant: b	$m^{3}.mol^{-1}$		b in $(p+a/V^{2})(V-b)=RT$, where V is molar volume
Virial coefficient: second	$m^{3}.mol^{-1}$		B in $pV/(nRT)=1+B(n/V)+C(n/V)^{2}+D(n/V)^{3}+...$
Virial coefficient: third	$m^{6}.mol^{-2}$		C in $pV/(nRT)=1+B(n/V)+C(n/V)^{2}+D(n/V)^{3}+...$
Virial coefficient: fourth	$m^{9}.mol^{-3}$		C in $pV/(nRT)=1+B(n/V)+C(n/V)^{2}+D(n/V)^{3}+...$
Gravitation, Astronomy, Cosmology			
Gravitational field intensity | Gravity	$m.s^{-2}$		[Force]/[Mass], Same as acceleration
Gravitational field potential	$m^{2}.s^{-2}$		[Energy]/[Mass]
Gravitational constant G	$kg^{-1}.m^{3}.s^{-2}$		$[Force]*[Distance]^{2}/[Mass]^{2}$. Appears in Newton's equation
Mean motion	s^{-1}		Of a body on a Kepler orbit; $sqrt(G(M_{1}+M_{2})/r^{3})$
Mean anomaly	1	Dimensionless	Of a body on a Kepler orbit; $t.sqrt(G(M_{1}+M_{2})/r^{3})$
Star magnitude (astronomy)	1	Dimensionless	$m-m'= -10^{0.4}(S/S')$. S,S' are luminous fluxes of two stars
Cosmological constant Λ	m^{-2}		Appears in Einstein's equation
Cosmological expansion rate	s^{-1}	km/s/Mpc	[Velocity]/[Distance]. Mpc stands for Megaparsec
Optics			

Albedo, of a surface	1	Dimensionless	[Reflected elmag power]/[Incident elmag power]
Convergence	m^{-1}	**dioptry**	**dioptry**
Luminosity | Luminous intensity	cd	**cd**	**candle** or **lumen/sr**
Luminous flux | Luminous power	cd.sr	**lm**	**lumen**. [Luminosity]*[Solid angle]
Luminance	$cd.m^{-2}$		[Luminosity]/[Area]
Luminous energy	cd.sr.s	lm.s	[Luminous flux]*[Time]. Also known as **talbot**
Illuminance	$cd.sr.m^{-2}$	$lm.m^{-2}$, **lx**	**lux**. [Luminous flux]/[Area]
Luminous emittance	$cd.sr.m^{-2}$	$lm.m^{-2}$, **lx**	**lux**. Same as **illuminance**, but for sources
Luminous efficacy	$cd.sr.kg^{-1}.m^{-1}.s^{3}$	lm/W	[Luminous flux]/[Power]
Luminous efficiency | Luminous coefficient	1	Dimensionless	[Luminous efficacy]/[683 lm/W]
Irradiance	$kg.s^{-3}$	$W.m^{-2}$	[Power]/[Area]. For all kinds of energy deposition
Radiance	$kg.s^{-3}.sr^{-1}$	$W.m^{-2}.sr^{-1}$	([Power]/[Area])/[Solid angle]
Optical properties of matter			
Extinction coefficient	m^{-1}		
Refractive index	1	Dimensionless	Light speeds ratio (in medium)/(in vacuum)
Specific refractivity	$m^{3}.kg^{-1}$		$[(r^2-1)/(r^2+2)]$/[Specific density], where r is refractive index
Molar refractivity	$m^{3}.mol^{-1}$		$[(r^2-1)/(r^2+2)]$/[Concentration]
Dispersivity quotient	m^{-1}		[ΔRefractive index]/[ΔWavelength]
Dispersive power	1	Dimensionless	Ratio of differences of refractive indices
Constringence | Abbé number | V-number	1	Dimensionless	$V_D = (n_D-1)/(n_F-n_C)$
Radiation and radioactivity			
Radioactivity | Activity	s^{-1}	**Bq**	**bequerel**. [Counts]/[Time]
Irradiance	$kg.s^{-3}$	$W.m^{-2}$	[Power]/[Area]. For all kinds of energy deposition
Absorbed dose	$m^{2}.s^{-2}$	$J.kg^{-1}$, **Gy**	**gray**. [Energy]/[Mass]
Absorbed dose rate	$m^{2}.s^{-3}$	$Gy.s^{-1}$	[Absorbed dose]/[Time]
Absorbed dose equivalent	$m^{2}.s^{-2}$	$J.kg^{-1}$, **Sv**	**sievert**. [const].[Energy]/[Mass]
Exposure	$kg^{-1}.s.A$	$C.kg^{-1}$	[Charge]/[Mass]. For ionising radiations
Radiation properties of matter			

Half life	s		Of a radioisotope
Radiation power	$m^2.s^{-3}$	**W/kg**	[Power]/[Mass]. Heat generated by a radioisotope
Radiation power, molar	$kg.m^2.s^{-3}.mol^{-1}$	**W/mol**	[Power]/[Quantity]. Heat generated by a radioisotope
Informatics			
Information	bit^{-1}	**bit**	**bit**; the elementary information quantum
Baud rate | Information flux	$bit.s^{-1}$	**Baud**	**baud**. [Information]/[Time]
Economy and finance			
Transactions count	1	Dimensionless	All kinds of counts
Interest	1	%	[ΔWealth]/[Wealth]. Usually expressed as percentage
Wealth | Asset	cur	**currency**	Currencies like $, EUR, Yuan, ... are different units
Debt | Liability	cur	**currency**	Usually intended as negative wealth
Value | Price	cur	currency	Prefixes: **K**..thousands, **M**..millions, **B**..billions
Transaction value | Sale | Purchase	cur	currency	Often used: mean and total values
Time period	s	**year**,**quarter**,**month**	Abbrevs: **mrq**.. most recent quarter, **ttm**.. trailing twelve months
Fiscal year | Calendar year	s	year	Abbrevs: **lfy**.. last fiscal year, **yoy**.. year over year
Transactions rate | Activity	s^{-1}	1/year	[Transactions]/[Time period]
Transactions volume | Sales flow	$cur.s^{-1}$		[Value]/[Time period]. For example $/day or Eur/year
Velocity / circulation of money	s^{-1}	1/year	[Transactions]/[Time period]
Interest rate	s^{-1}	%/year	[Interest]/[Time period]
Return on asset / equity	s^{-1}	%/year	([ΔValue]/[Value])/[Time period]
Cash flow | **Flow** (generic)	$cur.s^{-1}$	currency/year	[Value]/[ΔTime]. Mathematically, time derivative
Earnings | Income rate	$cur.s^{-1}$	currency/year	[Value]/[Time period]
GDP Gross domestic product	$cur.s^{-1}$	currency/year	[Earnings]. Usually refered to nations/states/admin.regions
Debt/GDP ratio	s	year	[Debt]/[Earnings]. Independent of currency / population size
P/E Price/Earnings ratio	s	year	[Value]/[Earnings]. Used to assess an asset/company
Bond duration	s	year	In general, the duration of a fixed cash flow

Notes

Purpose

Physical (or rather metrological) dimensions are often bewildering, even though the international SI system of units has simplified things a lot, compared to early 20th century and before. The main purpose of this page is to provide a **fast, handy reference** to the dimension you might need at the spur of a moment. Another, less evident, purpose is to **stimulate curiosity** and the desire to study Metrology and Dimensional Analysis.

Formats and editorial comments

- **Bold magenta symbols** in the **Alternatives** column indicate commonly used quantities, mostly defined by the SI system.
- **Square brackets** convert the quantity they enclose into its *dimension*.
- Abbreviations **El.** and **Mag.** stand for **Electric** and **Magnetic**, respectively.
- [Quantity] stands for [Quantity of substance] and its dimension is **mol**.
- Names of units are always written with small first letter, even when derived from names of persons (for example 1 newton).

Many links, other than those appearing below,

will be soon scattered through the text, accompanying the particular quantities. This feature will be intensified.

Feedback:

If you think a link, or a quantity, are missing, please, let me know. Such suggestions are most appreciated.

Disclaimer:

Since errors do happen, and also because not all metrological conventions are agreed upon and shared by everybody, the Editor of this page declines any responsibility for any damages that might result from its content, directly or indirectly. In other words, if you crash a spacecraft because some of your engineers used *meters* and others used *feet*, do not pretend that I should pay for it :-)

References

1. Beaman Jr. Joseph J., Longoria Raul G.,
   Modeling of Physical Systems,
   Wiley 2016. ISBN 978-1119945048. Hardcover >>.
2. Zohuri Bahman,
   Dimensional Analysis and Self-Similarity Methods for Engineers and Scientists,
   Springer 2015. ISBN 978-3319134758. Hardcover >>.
3. Isakov Edmund,
   International System of Units (SI):
   How the world measures almost everything, and the people who made it possible,
   Industrial Press 2014. ISBN 978-0831102319. Paperback >>. Also available as Multimedia CD.
4. Bridgman Percy W.,
   Dimensional Analysis,
   Reprint of the 1922 clasic. TheClassics.us 2013. ISBN 978-1230226214. Paperback >>. Kindle >>.
5. Crease Robert P.,
   World in the Balance: The Historic Quest for an Absolute System of Measurement,
   W.W.Norton & Company 2012. ISBN 978-0393343540. Paperback >>. Kindle >>.
6. Gibbings J.C.,
   Dimensional Analysis,
   Springer 2011. ISBN 978-1849963169. Paperback >>. Kindle >>.
7. Klein Herbert A.,
   The Science of Measurement: A Historical Survey,
   Dover Publications 2011. ISBN 978-0486258393. Paperback >>. Kindle >>.
8. Gupta S.V.,
   Units of Measurement: Past, Present and Future. International System of Units,
   Springer 2009. ISBN 978-3642007378. Hardcover >>. Kindle >>.

9. Palmer Andrew C.,
   Dimensional Analysis and Intelligent Experimentation,
   World Scientific Publishing 2008. ISBN 978-9812708199. Paperback >>.
10. Charalambos D. Aliprantis, Border Kim,
   Infinite Dimensional Analysis: A Hitchhiker's Guide,
   3rd Edition, Springer 2007. ISBN 978-3540326960. Paperback >>.
11. Strothman J, Editor,
   ISA Handbook of Measurement Equations and Tables,
   2nd Edition, ISA (Instrumentation, Systems, and Automation) 2006.
   ISBN 978-1556179464. Paperback >>. 2015 Kindle >>.
12. Szirtes Thomas,
   Applied Dimensional Analysis and Modeling,
   2nd Edition, Butterworth-Heinemann 2006. ISBN 978-0123706201. Paperback >>. Kindle >>.
13. Jerrard H.G.,
   Dictionary of Scientific Units Including Dimensionless Numbers and Scales,
   Springer 1992. ISBN 978-0412467202. Paperback >>.
14. Sena L.A.,
   Units of physical quantities and their dimensions,
   Mir Publishers 1973. Hardcover >>.
15. For more, see References on Systems of Units of Measurements

Links

Dimensional analysis on Wikipedia.

BIPM. The home page of the SI System of Units.

NIST Units of Measurements page.

NIST Units Bibliography to official on-line publications about the SI system.

Unit Converters list.

SI Units. A related resource on this website.

Constants of physics and mathematics. A related resource on this website.

Math Constants. A related resource on this website.

SI Dimensions of Physical Quantities. A related resource on this website (sorted alphabetically).

Dimensions of Physical Quantities by Category. Link to this resource. You can also cite its **DOI link:** 10.3247/SL1Phys06.004.

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