List of physical quantities

This is a list of physical quantities The first table lists the base quantities used in the International System of Units to define the physical dimension of physical quantities for dimensional analysis. The second table lists the derived physical quantities. Derived quantities can be mentioned in terms of the base quantities.

Note that neither the names nor the symbols used for the physical quantities are international standards. Some quantities are known as several different names such as the magnetic *B-field* which known as the *magnetic flux density*, the *magnetic induction* or simply as the *magnetic field* depending on the context. Similarly, surface tension can be denoted by either σ, γ or T. The table usually lists only one name and symbol.

The final column lists some special properties that some of the quantities have, such as their scaling behavior (i.e. whether the quantity is intensive or extensive), their transformation properties (i.e. whether the quantity is a scalar, vector or tensor) or whether the quantity is conserved.

Base quantity	Symbol	Description	SI base unit	Dimension	Comments
Length	l	The one-dimensional extent of an object	metre (m)	**L**	
Mass	m	A measure of resistance to acceleration	kilogram (kg)	**M**	extensive, scalar
Time	t	The duration of an event	second (s)	**T**	scalar
Electric current	I	Rate of flow of electrical charge per unit time	ampere (A)	**I**	
Temperature	T	Average kinetic energy per degree of freedom of a system	kelvin (K)	**Θ**	intensive, scalar
Amount of substance	n	Number of particles compared to the number of atoms in 0.012 kg of ^{12}C	mole (mol)	**N**	extensive, scalar
Luminous intensity	L	Wavelength-weighted power of emitted light per unit solid angle	candela (cd)	**J**	scalar

Derived quantity	Symbol	Description	SI derived unit	Dimension	Comments
Absement	A	Measure of sustained displacement: the first integral of displacement	m s	**L T**	vector
Absorbed dose rate		Absorbed dose received per unit of time	Gy s^{-1}	$\mathbf{L}^2\ \mathbf{T}^{-3}$	
Acceleration	$\vec{a}$	Change of the speed or velocity per unit time	m s^{-2}	$\mathbf{L}\ \mathbf{T}^{-2}$	vector
Angular		Change in angular			

acceleration	α	speed or velocity per unit time	rad s^{-2}	$\mathbf{T}^{-2}$	
Angular momentum	$\boldsymbol{L}$	Measure of the extent and direction an object rotates about a reference point	kg m^2 s^{-1}	$\mathbf{M}\ \mathbf{L}^2\ \mathbf{T}^{-1}$	conserved quantity, pseudovector
Angular speed (or angular velocity)	ω	The angle incremented in a plane by a segment connecting an object and a reference point per unit time	rad s^{-1}	$\mathbf{T}^{-1}$	scalar or pseudovector
Area	A	Extent of a surface	m^2	$\mathbf{L}^2$	scalar
Area density	ρ_A	Mass per unit area	kg m^{-2}	$\mathbf{M}\ \mathbf{L}^{-2}$	
Capacitance	C	Stored charge per unit electric potential	farad (F = A^2 s^4 kg^{-1} m^{-2})	$\mathbf{M}^{-1}\ \mathbf{L}^{-2}\ \mathbf{T}^4\ \mathbf{I}^2$	scalar
Catalytic activity		Change in reaction rate due to presence of a catalyst	katal (kat = mol s^{-1})	$\mathbf{T}^{-1}\ \mathbf{N}$	
Catalytic activity concentration		Change in reaction rate due to presence of a catalyst per unit volume of the system	kat m^{-3}	$\mathbf{L}^{-3}\ \mathbf{T}^{-1}\ \mathbf{N}$	
Chemical potential	μ	Energy per unit change in amount of substance	J mol^{-1}	$\mathbf{M}\ \mathbf{L}^2\ \mathbf{T}^{-2}\ \mathbf{N}^{-1}$	intensive
Crackle	$\vec{c}$	Change of jounce per unit time: the fifth time derivative of position	m s^{-5}	$\mathbf{L}\ \mathbf{T}^{-5}$	vector
Current density	$\vec{J}$	Electric current per unit cross-section area	A m^{-2}	$\mathbf{L}^{-2}\ \mathbf{I}$	vector
Dose equivalent	H	Received radiation adjusted for the effect on biological tissue	sievert (Sv = m^2 s^{-2})	$\mathbf{L}^2\ \mathbf{T}^{-2}$	
Dynamic viscosity	η	Measure for the resistance of an incompressible fluid to stress	Pa s	$\mathbf{M}\ \mathbf{L}^{-1}\ \mathbf{T}^{-1}$	
Electric charge	Q	The force per unit electric field strength	coulomb (C = A s)	$\mathbf{T}\ \mathbf{I}$	extensive, conserved quantity
Electric charge density	ρ_Q	Electric charge per unit volume	C m^{-3}	$\mathbf{L}^{-3}\ \mathbf{T}\ \mathbf{I}$	intensive
Electric displacement	D	Strength of the electric displacement	C m^{-2}	$\mathbf{L}^{-2}\ \mathbf{T}\ \mathbf{I}$	vector field
Electric field strength	$\vec{E}$	Strength of the electric field	V m^{-1}	$\mathbf{M}\ \mathbf{L}\ \mathbf{T}^{-3}\ \mathbf{I}^{-1}$	vector field
Electrical conductance	G	Measure for how easily current flows through a material	siemens (S = A^2 s^3 kg^{-1} m^{-2})	$\mathbf{M}^{-1}\ \mathbf{L}^{-2}\ \mathbf{T}^3\ \mathbf{I}^2$	scalar
Electrical	σ	Measure of a material's ability to conduct an	S m^{-1}	$\mathbf{M}^{-1}\ \mathbf{L}^{-3}\ \mathbf{T}^3$	scalar

conductivity		electric current		I^2	
Electric potential	V	Energy required to move a unit charge through an electric field from a reference point	volt (V = kg m^2 A^{-1} s^{-3})	$\mathbf{M\ L^2\ T^{-3}\ I^{-1}}$	extensive, scalar
Electrical resistance	R	Electric potential per unit electric current	ohm (Ω = kg m^2 A^{-2} s^{-3})	$\mathbf{M\ L^2\ T^{-3}\ I^{-2}}$	extensive, scalar, assumes linearity
Electrical resistivity	ρ	Bulk property equivalent of electrical resistance	ohm metre (Ω⋅m = kg m^3 A^{-2} s^{-3})	$\mathbf{M\ L^3\ T^{-3}\ I^{-2}}$	intensive, scalar
Energy	E	Capacity of a body or system to do work	joule (J = kg m^2 s^{-2})	$\mathbf{M\ L^2\ T^{-2}}$	extensive, scalar, conserved quantity
Energy density	ρ_E	Energy per unit volume	J m^{-3}	$\mathbf{M\ L^{-1}\ T^{-2}}$	intensive
Entropy	S	Logarithmic measure of the number of available states of a system	J K^{-1}	$\mathbf{M\ L^2\ T^{-2}\ \Theta^{-1}}$	extensive, scalar
Force	$\vec{F}$	Transfer of momentum per unit time	newton (N = kg m s^{-2})	$\mathbf{M\ L\ T^{-2}}$	extensive, vector
Frequency	f	Number of (periodic) occurrences per unit time	hertz (Hz = s^{-1})	$\mathbf{T^{-1}}$	scalar
Fuel efficiency		Distance traveled per unit volume of fuel		$\mathbf{L^{-2}}$	scalar
Half-life	$t_{1/2}$	Time for a quantity to decay to half its initial value	s	$\mathbf{T}$	
Heat	Q	Thermal energy	joule (J)	$\mathbf{M\ L^2\ T^{-2}}$	
Heat capacity	C_p	Energy per unit temperature change	J K^{-1}	$\mathbf{M\ L^2\ T^{-2}\ \Theta^{-1}}$	extensive
Heat flux density	ϕ_Q	Heat flow per unit time per unit surface area	W m^{-2}	$\mathbf{M\ T^{-3}}$	
Illuminance	E_v	Luminous flux per unit surface area	lux (lx = cd sr m^{-2})	$\mathbf{L^{-2}\ J}$	
Impedance	Z	Resistance to an alternating current of a given frequency, including effect on phase	ohm (Ω = kg m^2 A^{-2} s^{-3})	$\mathbf{M\ L^2\ T^{-3}\ I^{-2}}$	complex scalar
Impulse	J	Transferred momentum	newton second (N⋅s = kg m s^{-1})	$\mathbf{M\ L\ T^{-1}}$	vector
Inductance	L	Magnetic flux generated per unit current through a circuit	henry (H = kg m^2 A^{-2} s^{-2})	$\mathbf{M\ L^2\ T^{-2}\ I^{-2}}$	scalar
Irradiance	E	Electromagnetic radiation power per unit surface area	W m^{-2}	$\mathbf{M\ T^{-3}}$	
Intensity	I	Power per unit cross	W m^{-2}	$\mathbf{M\ T^{-3}}$	

		sectional area			
Jerk	$\vec{j}$	Change of acceleration per unit time: the third time derivative of position	m s^{-3}	**L T**$^{-3}$	vector
Jounce (or *snap*)	$\vec{s}$	Change of jerk per unit time: the fourth time derivative of position	m s^{-4}	**L T**$^{-4}$	vector
Linear density	ρ_l	Mass per unit length		**M L**$^{-1}$	
Luminous flux (or *luminous power*)	*F*	Perceived power of a light source	lumen (lm = cd sr)	**J**	
Mach number (or *mach*)	*M*	Ratio of flow velocity to the local speed of sound	unitless	**1**	
Magnetic field strength	*H*	Strength of a magnetic field	A m^{-1}	**L**$^{-1}$ **I**	vector field
Magnetic flux	*Φ*	Measure of magnetism, taking account of the strength and the extent of a magnetic field	weber (Wb = kg m^2 A^{-1} s^{-2})	**M L**^{2} **T**$^{-2}$ **I**$^{-1}$	scalar
Magnetic flux density	*B*	Measure for the strength of the magnetic field	tesla (T = kg A^{-1} s^{-2})	**M T**$^{-2}$ **I**$^{-1}$	pseudovector field
Magnetization	*M*	Amount of magnetic moment per unit volume	A m^{-1}	**L**$^{-1}$ **I**	vector field
Mass fraction	*x*	Mass of a substance as a fraction of the total mass	kg/kg	**1**	intensive
(Mass) Density (or *volume density*)	*ρ*	Mass per unit volume	kg m^{-3}	**M L**$^{-3}$	intensive
Mean lifetime	*τ*	Average time for a particle of a substance to decay	s	**T**	intensive
Molar concentration	*C*	Amount of substance per unit volume	mol m^{-3}	**L**$^{-3}$ **N**	intensive
Molar energy		Amount of energy present in a system per unit amount of substance	J mol^{-1}	**M L**^{2} **T**$^{-2}$ **N**$^{-1}$	intensive
Molar entropy		Entropy per unit amount of substance	J K^{-1} mol^{-1}	**M L**^{2} **T**$^{-2}$ **Θ**$^{-1}$ **N**$^{-1}$	intensive
Molar heat capacity	*c*	Heat capacity of a material per unit amount of substance	J K^{-1} mol^{-1}	**M L**^{2} **T**$^{-2}$ **Θ**$^{-1}$ **N**$^{-1}$	intensive
Moment of inertia	*I*	Inertia of an object with respect to angular acceleration	kg m^2	**M L**^{2}	tensor, scalar
	$\rightarrow$				

Momentum	$\vec{p}$	Product of an object's mass and velocity	N s	**M L T^{-1}**	vector, extensive
Permeability	μ	Measure for how the magnetization of material is affected by the application of an external magnetic field	H m^{-1}	**M L T^{-2} I^{-2}**	intensive
Permittivity	ε	Measure for how the polarization of a material is affected by the application of an external electric field	F m^{-1}	**M^{-1} L^{-3} T^{4} I^{2}**	intensive
Plane angle	θ	Ratio of circular arc length to radius	radian (rad)	**1**	
Power	P	Rate of transfer of energy per unit time	watt (W)	**M L^{2} T^{-3}**	extensive, scalar
Pressure	p	Force per unit area	pascal (Pa = kg m^{-1} s^{-2})	**M L^{-1} T^{-2}**	intensive, scalar
Pop	$\vec{p}$	Rate of change of crackle per unit time: the sixth time derivative of position	m s^{-6}	**L T^{-6}**	vector
(Radioactive) Activity	A	Number of particles decaying per unit time	becquerel (Bq = s^{-1})	**T^{-1}**	extensive, scalar
(Radioactive) Dose	D	Ionizing radiation energy absorbed by biological tissue per unit mass	gray (Gy = m^{2} s^{-2})	**L^{2} T^{-2}**	
Radiance	L	Power of emitted electromagnetic radiation per unit solid angle per emitting source area	W m^{-2} sr^{-1}	**M T^{-3}**	
Radiant intensity	I	Power of emitted electromagnetic radiation per unit solid angle	W sr^{-1}	**M L^{2} T^{-3}**	scalar
Reaction rate	r	Rate of a chemical reaction for unit time	mol m^{-3} s^{-1}	**N L^{-3} T^{-1}**	intensive, scalar
Refractive index	n	Factor by which the phase velocity of light is reduced in a medium	unitless	**1**	intensive, scalar
Solid angle	Ω	Ratio of area on a sphere to its radius squared	steradian (sr)	**1**	
Speed	v	Moved distance per unit time: the first time derivative of position	m s^{-1}	**L T^{-1}**	scalar
Specific energy		Energy density per unit mass	J kg^{-1}	**L^{2} T^{-2}**	intensive
Specific heat capacity	c	Heat capacity per unit mass	J kg^{-1} K^{-1}	**L^{2} T^{-2} Θ^{-1}**	intensive

Specific volume	v	Volume per unit mass (reciprocal of density)	$m^3\ kg^{-1}$	$\mathbf{M}^{-1}\ \mathbf{L}^3$	intensive
Spin	S	Quantum-mechanically defined angular momentum of a particle	$kg\ m^2\ s^{-1}$	$\mathbf{M}\ \mathbf{L}^2\ \mathbf{T}^{-1}$	
Strain	ε	Extension per unit length	unitless	$\mathbf{1}$	
Stress	σ	Force per unit oriented surface area	Pa	$\mathbf{M}\ \mathbf{L}^{-1}\ \mathbf{T}^{-2}$	order 2 tensor
Surface tension	γ	Energy change per unit change in surface area	$N\ m^{-1}$ or $J\ m^{-2}$	$\mathbf{M}\ \mathbf{T}^{-2}$	
Thermal conductivity	k	Measure for the ease with which a material conducts heat	$W\ m^{-1}\ K^{-1}$	$\mathbf{M}\ \mathbf{L}\ \mathbf{T}^{-3}\ \mathbf{\Theta}^{-1}$	intensive
Torque	τ	Product of a force and the perpendicular distance of the force from the point about which it is exerted	newton metre (N m)	$\mathbf{M}\ \mathbf{L}^2\ \mathbf{T}^{-2}$	bivector (or pseudovector in 3D)
Velocity	$\vec{v}$	Speed and direction of an object	$m\ s^{-1}$	$\mathbf{L}\ \mathbf{T}^{-1}$	vector
Volume	V	Three dimensional extent of an object	m^3	$\mathbf{L}^3$	extensive, scalar
Wavelength	λ	Perpendicular distance between repeating units of a wave	m	$\mathbf{L}$	
Wavenumber	k	Repetency or spacial frequency: the number of cycles per unit distance	m^{-1}	$\mathbf{L}^{-1}$	scalar
Wavevector	$\vec{k}$	Repetency or spacial frequency vector: the number of cycles per unit distance	m^{-1} with direction	$\mathbf{L}^{-1}$	vector
Weight	w	Gravitational force on an object	newton ($N = kg\ m\ s^{-2}$)	$\mathbf{M}\ \mathbf{L}\ \mathbf{T}^{-2}$	vector
Work	W	Transferred energy	joule ($J = kg\ m^2\ s^{-2}$)	$\mathbf{M}\ \mathbf{L}^2\ \mathbf{T}^{-2}$	scalar
Young's modulus	E	Ratio of stress to strain	pascal ($Pa = kg\ m^{-1}\ s^{-2}$)	$\mathbf{M}\ \mathbf{L}^{-1}\ \mathbf{T}^{-2}$	scalar; assumes isotropic linear material