

International (Metric) System of Units

The International System of Units, known alternately as SI or metric, has been adopted by the International Standards Organization. This simplified and modernized system consists of seven basic units and other units which are coherently derived from them; that is, the product or quotient of any two unit quantities in the system results in another unit quantity.

Base and Supplementary Units

Quantity	Unit	Symbol
Length	meter	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	Kelvin	K
Luminous intensity	candela	cd
Molecular substance	mole	mol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol
Space and Time		
Area	square meter	m ²
Volume	cubic meter	m ³
Velocity	meter per second	m/s
Acceleration	meter per second per second	m/s ²
Angular velocity	radian per second	rad/s
Angular acceleration	radian per second per second	rad/s ²
Frequency	hertz	Hz (cycle/s)

Rotational speed	revolution per second	r/s
	revolution per minute	r/m
Solid angle	steradian	sr

Mechanics

Density	kilogram per cubic meter	kg/m ³
Momentum	kilogram meter per second	kg·m/s
Moment of inertia	kilogram meter squared	kg·m ²
Force	newton	N (kg·m/s ²)
Torque, moment of force	newton meter	N·m
Energy, work, heat quantity	joule	J (N·m)
Power	watt	W (J/s)
Pressure, stress	pascal	Pa (N/m ²)
Solid angle	steradian	sr

Heat

Customary temperature	degree Celsius	°C
Thermal conductivity	watt per meter Kelvin	W/(m·K)
Entropy	joule per Kelvin	J/K
Specific heat	joule per kilogram Kelvin	J/(kg·K)

Electricity and Magnetism

Electric charge	coulomb	C (A·s)
Electric potential, voltage, electromotive force	volt	V (W/A)
Electric field strength	volt per meter	V/m
Capacitance	farad	F (A·s/V)
Current density	ampere per square meter	A/m ²
Magnetic field strength	ampere per meter	A/m
Magnetic flux	weber	Wb (V·s)
Magnetic flux density	tesla	T (Wb/m ²)
Inductance	henry	H=V·s/A

Permeability	henry per meter	H/m
Resistance	ohm	$\Omega=V/A$
Conductance	siemens	$S=A/V$
Magnetomotive force	ampere	A

Light

Luminous flux	lumen	lm (cd·sr)
Illumination	lux	lx (lm/m ²)
Luminance	candela per square meter	cd/m ²

Viscosity

Kinematic viscosity	square meter per second	m ² /s
Dynamic (absolute) viscosity	pascal second	Pa·s

Notes:

The major difference between SI and the gravimetric form of metric engineering units is the separate and distinct units for mass and force. The **kilogram (kg)** is for mass only. Mass is defined as the property of matter to which it owes its inertia. The **Newton (N)** is a unit of force and should be used in place of kilogram force, pound force, etc. The Newton is defined by Newton's First Law of Motion: Force = Mass × Acceleration ($F = ma$), thus: $1 \text{ N} = 1 \text{ kg} \cdot \text{m/s}^2$.

The **Joule (J)** is a unit of energy and is the work done when the object of an application of force of 1 Newton is displaced a distance of one meter in the direction of the force, thus: $1 \text{ J} = 1 \text{ N} \cdot \text{m}$.

The **watt (W)** is a unit of power which gives rise to the production of energy at the rate of 1 Joule per second.

The **Pascal (Pa)** is a unit of pressure or stress of 1 Newton per square meter.

The **degree Kelvin (°K)** is the unit for thermodynamic temperature and should be used as the preferred unit to express temperature and temperature intervals. The Kelvin scale is based from Absolute Zero (the temperature at which all molecular action ceases). The Celsius scale may be used where preferred, especially in the standard temperature range, as Celsius is based from the freezing point of water. In the temperature interval 1 degree Celsius equals 1 degree Kelvin, and the two scales are related by the equation $^{\circ}\text{C} = ^{\circ}\text{K} - 273.15$.