

Units and Numerical Values

The units used in this book conform to the *Système International d'Unités* (i.e., the SI system) which is the internationally accepted form of the metric system.

<i>Quantity</i>	<i>Name of unit</i>	<i>Symbol</i>	<i>Definition</i>
Basic units			
Length	meter	m	
Mass	kilogram	kg	
Time	second	s	
Electrical current	ampere	A	
Temperature	degree Kelvin	°K	
Derived units			
Force	newton	N	kg m s^{-2}
Pressure	pascal	Pa	$\text{N m}^{-2} = \text{kg m}^{-1} \text{s}^{-2}$
Energy	joule	J	$\text{kg m}^2 \text{s}^{-2}$
Power	watt	W	$\text{J s}^{-1} = \text{kg m}^2 \text{s}^{-3}$
Electrical potential difference	volt	V	$\text{W A}^{-1} = \text{kg m}^2 \text{s}^{-3} \text{A}^{-1}$
Electrical charge	coulomb	C	A s
Electrical resistance	ohm	Ω	$\text{V A}^{-1} = \text{kg m}^2 \text{s}^{-3} \text{A}^{-2}$
Electrical capacitance	farad	F	$\text{A s V}^{-1} = \text{kg}^{-1} \text{m}^{-2} \text{s}^4 \text{A}^2$

<i>Quantity</i>	<i>Name of unit</i>	<i>Symbol</i>	<i>Definition</i>
Frequency	hertz	Hz	s^{-1}
Celsius temperature	degree Celsius	$^{\circ}\text{C}$	$^{\circ}\text{K} - 273.15$
Temperature interval	degree	deg or $^{\circ}$	K or C need not be specified

Acceptable

Volume	liter	l	10^{-3} m^3
Pressure	millibar	mbar	10^2 Pa

(abbreviated
to mb in this
book)

The following prefixes are used to construct decimal multiples of units.

<i>Multiple</i>	<i>Prefix</i>	<i>Symbol</i>	<i>Multiple</i>	<i>Prefix</i>	<i>Symbol</i>
10^{-1}	deci	d	10	deca	da
10^{-2}	centi	c	10^2	hecto	h
10^{-3}	milli	m	10^3	kilo	k
10^{-6}	micro	μ	10^6	mega	M
10^{-9}	nano	n	10^9	giga	G
10^{-12}	pico	p	10^{12}	tera	T
10^{-15}	femto	f			
10^{-18}	atto	a			

SOME USEFUL NUMERICAL VALUES**Universal constants**

Universal gas constant (R^*)	$8.3143 \times 10^3 \text{ J deg}^{-1} \text{ kmol}^{-1}$
Boltzmann's constant (k)	$1.381 \times 10^{-23} \text{ J deg}^{-1} \text{ molecule}^{-1}$
Avogadro's number (N_A)	$6.022 \times 10^{26} \text{ kmol}^{-1}$
Stefan-Boltzmann constant (σ)	$5.6696 \times 10^{-8} \text{ W m}^{-2} \text{ deg}^{-4}$
Planck's constant (h)	$6.6262 \times 10^{-34} \text{ J s}$
Velocity of light (c^*)	$2.998 \times 10^8 \text{ m s}^{-1}$
Permittivity of a vacuum (ϵ_0)	$8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}$

The earth

Average radius (R_E)	$6.37 \times 10^6 \text{ m}$
Acceleration due to gravity at surface of earth (g_0)	9.81 m s^{-2}
Angular velocity of rotation (Ω)	$7.292 \times 10^{-5} \text{ rad s}^{-1}$
Average distance from sun to surface of earth (d)	$1.50 \times 10^{11} \text{ m}$
Solar irradiance on a perpendicular plane at distance d from sun	$1.38 \times 10^3 \text{ W m}^{-2}$

Dry air

Apparent molecular weight (M_d)	28.97
Gas constant (R_d)	287 J deg ⁻¹ kg ⁻¹
Density at 0°C and 1000 mb pressure (varies as p/T)	1.275 kg m ⁻³
Specific heat at constant pressure (c_p)	1004 J deg ⁻¹ kg ⁻¹
Specific heat at constant volume (c_v)	717 J deg ⁻¹ kg ⁻¹
Thermal conductivity at 0°C (independent of pressure)	2.40×10^{-2} J m ⁻¹ s ⁻¹ deg ⁻¹

Water substance

Molecular weight (M_w)	18.016
Gas constant for water vapor (R_v)	461 J deg ⁻¹ kg ⁻¹
Density of liquid water at 0°C	1.000×10^3 kg m ⁻³
Density of ice at 0°C	0.917×10^3 kg m ⁻³
Specific heat of water vapor at constant pressure	1952 J deg ⁻¹ kg ⁻¹
Specific heat of water vapor at constant volume	1463 J deg ⁻¹ kg ⁻¹
Specific heat of liquid water at 0°C	4218 J deg ⁻¹ kg ⁻¹
Specific heat of ice at 0°C	2106 J deg ⁻¹ kg ⁻¹
Latent heat of vaporization at 0°C	2.500×10^6 J kg ⁻¹
Latent heat of vaporization at 100°C	2.25×10^6 J kg ⁻¹
Latent heat of fusion at 0°C	3.34×10^5 J kg ⁻¹
Latent heat of sublimation at 0°C	2.834×10^6 J kg ⁻¹