

## Units & Conversions

**Scientific notation:** is used to express large or small numbers concisely. Each number is written in the form  $a \times 10^n$  where  $a$  is usually a number between 1 and 10. We make use of

$$\dots 0.01 = 10^{-2}, 0.1 = 10^{-1}, \dots, 100 = 10^2, 1000 = 10^3, \dots$$

Then, for example,  $6859 = 6.859 \times 1000 = 6.859 \times 10^3$  and  $0.0932 = 9.32 \times 0.01 = 9.32 \times 10^{-2}$ .

**SI base units:** for most quantities it is necessary to specify the **units** in which they are measured.

Quantity	SI unit	Symbol
length	metre	m
mass	kilogram	kg
time	second	s
temperature	kelvin	K
amount of substance	mole	mol
current	ampere	A
luminous intensity	candela	cd

**Derived units** are formed from the base units. For example, the unit of force is found by combining units of mass, length and time in the combination  $\text{kg m s}^{-2}$ . This combination is more usually known as the newton, N.

Property	unit name	unit symbols
frequency	hertz	$\text{Hz} = \text{s}^{-1}$
force	newton	$\text{N} = \text{kg m s}^{-2}$
pressure	pascal	$\text{Pa} = \text{N m}^{-2}$
energy	joule	$\text{J} = \text{N m} = \text{kg m}^2 \text{s}^{-2}$
charge	coulomb	$\text{A s}$
potential difference	volt	$\text{V} = \text{J C}^{-1}$
power	watt	$\text{W} = \text{J s}^{-1}$
Celsius temperature	degree Celsius	$^{\circ}\text{C}$
Capacitance	farad	$\text{F} = \text{C V}^{-1}$
Resistance	ohm	$\Omega$

**Common prefixes:** a prefix is a method of multiplying the SI unit by an appropriate power of 10 to make it larger or smaller.

Multiple	Prefix	Symbol	Multiple	Prefix	Symbol
$10^{12}$	tera	T	$10^{-1}$	deci	d
$10^9$	giga	G	$10^{-2}$	centi	c
$10^6$	mega	M	$10^{-3}$	milli	m
$10^3$	kilo	k	$10^{-6}$	micro	$\mu$
$10^2$	hecto	h	$10^{-9}$	nano	n
$10^1$	deca	da	$10^{-12}$	pico	p

**Interconversion of units:** Sometimes alternative sets of units are used and conversion between these is needed.

**Pressure** is often quoted in units corresponding to the Standard atmosphere (atm).

Then  $1 \text{ atm} = 1.01325 \times 10^5 \text{ Pa} = 1.01325 \text{ bar} = 760 \text{ mm Hg} = 760 \text{ Torr}$ . ( $1 \text{ bar} = 1 \times 10^5 \text{ Pa}$ ).

**Length** (of bonds) is sometimes quoted in Ångströms, Å where  $1 \text{ Å} = 10^{-10} \text{ m}$ .  $1 \text{ nm} = 10^{-9} \text{ m}$ .  $0.1 \text{ nm} = 100 \text{ pm}$ .

**Energy** is often measured in calories (cal):  $1 \text{ cal} = 4.184 \text{ J}$ .