

Tools & Rules: Working in the Metric (SI) System

Common multiples expressed in prefixes:

- “centi-” (x 10⁻²) Example: 1 cm = 0.01 m
- “micro-” (x 10⁻⁶) Example: 1 μm = 0.000 001 m
- “nano-” (x 10⁻⁹) Example: 1 nm = 0.000 000 001 m
- “kilo-” (x 10³) Example: 1 kg = 1000 g
- “Mega-” (x 10⁶) Example: 1 Mbyte = 1,000,000 bytes
- “Giga-” (x 10⁹) Example: 1 Gbyte

SI prefixes					
<u>Factor</u>	<u>Prefix</u>	<u>Symbol</u>	<u>Factor</u>	<u>Prefix</u>	<u>Symbol</u>
10 ²⁴	Yotta	Y	10 ⁻¹	deci	d
10 ²¹	Zeta	Z	10 ⁻²	centi	c
10 ¹⁸	Exa	E	10 ⁻³	milli	m
10 ¹⁵	Peta	P	10 ⁻⁶	micro	μ
10 ¹²	Tera	T	10 ⁻⁹	nano	n
10 ⁹	Giga	G	10 ⁻¹²	pico	p
10 ⁶	Mega	M	10 ⁻¹⁵	femto	f
10 ³	Kilo	K	10 ⁻¹⁸	ato	a
10 ²	Hector	H	10 ⁻²¹	zepto	z
10 ¹	Deka	Da	10 ⁻²⁴	yocto	y

NOT Working in the Metric System:

- Astronomical Unit (AU) = 1.496 x 10¹¹ m
- Light year (lt-yr) = 9.461 x 10¹⁵ m
- Parsec (pc) = 3.086 x 10¹⁶ m = 3.26 lt-yr
- Angstrom (Å) = 10⁻¹⁰ m = 0.1 nm

Temperature

Scientists use the Kelvin temperature scale. Absolute zero on the Kelvin scale is the coldest anything can theoretically be. A change of one degree in the Kelvin scale is the same as a change of one degree in the Celsius scale, so the difference between Kelvin and Celsius is just an offset of 273 degrees: $\text{Kelvin} = \text{Celsius} + 273$ or $\text{Celsius} = \text{Kelvin} - 273$.

The Celsius scale, sometimes called Centigrade, is defined by the freezing and boiling points of water at standard atmospheric pressure. Freezing occurs at 0 C and boiling at 100 C at sea level on the Earth. Note that the freezing and boiling temperatures depend on pressure, and thus change with altitude. The Fahrenheit scale is not used much anymore, except by non-scientists in the U.S. To convert, use the following: $F = (9/5 \times C) + 32$ or $C = 5/9 \times (F - 32)$.

For example, $100 F = 5/9 \times (100-32) = 5/9 \times (68) = 37.8 C$.

Fun question: What is -40 C equal to in Fahrenheit?

	Fahrenheit	Kelvin
Absolute zero	-459.4 F	0 K
Pluto's surface	-390 F	40 K
Water freezes (1 atm)	32 F	273 K
Room temperature	70 F	300 K
Water boils (1 atm)	212 F	373 K
Venus's surface	870 F	740 K
Sun's photosphere	9980 F	5800 K

"Order of magnitude" lengths

Electron	10^{-13} cm
Atomic nucleus	10^{-11} cm
Atom	10^{-8} cm
Interstellar dust	10^{-4} cm
Human	~ 100-200 cm
Planet	10^9 cm
Star	10^{11} cm
Solar System	10^{15} cm
Galaxy	10^{23} cm
Most distant objects	10^{28} cm

Comparison of Velocities (approximate)

Speed limit on I-8	0.029 km/s
Commercial jet airplane	0.25 km/s
Air molecule at room temperature	0.5 km/s
Moon in orbit around the Earth	1 km/s
Earth in orbit around the Sun	30 km/s
Sun in orbit around the galaxy	225 km/s
** Speed of light **	300,000 km/s