

## MiniChem 2: Physical Constants and Conversion Factors

### Useful Physical Constants (<http://physics.nist.gov>)

Constant	Symbol	Value
Atomic mass constant	$m_u$	$1.660\ 538\ 782 \times 10^{-27}$ kg
Electron rest mass	$m_e$	$9.109\ 382\ 15 \times 10^{-31}$ kg
Proton rest mass	$m_p$	$1.672\ 621\ 637 \times 10^{-27}$ kg
Proton charge	$e$	$1.602\ 176\ 487 \times 10^{-19}$ C
Avogadro's constant	$N_A$	$6.022\ 141\ 79 \times 10^{23}$ mol <sup>-1</sup>
Boltzmann's constant	$k_B$	$1.380\ 650\ 4 \times 10^{-23}$ J.K <sup>-1</sup>
Molar gas constant	$R$	$8.314\ 472$ J.K <sup>-1</sup> .mol <sup>-1</sup> $0.0820574$ L.atm.mol <sup>-1</sup> .K <sup>-1</sup> $0.0831447$ L.bar.mol <sup>-1</sup> .K <sup>-1</sup> $1.987\ 207$ cal.mol <sup>-1</sup> .K <sup>-1</sup>
Molar volume of ideal gas (at $T = 273.15$ K and $P = 101.325$ kPa)	$V_m$	$22.413\ 996$ m <sup>3</sup> .mol <sup>-1</sup>
Planck constant	$h$	$6.626\ 068\ 96 \times 10^{-34}$ J.s
Speed of light	$c$	$299\ 792\ 458$ m.s <sup>-1</sup>
Permittivity of vacuum	$\epsilon_0$	$8.854\ 187\ 817 \times 10^{-12}$ C <sup>2</sup> .J <sup>-1</sup> m <sup>-1</sup>
Faraday constant	$F$	$96\ 485.3401$ C.mol <sup>-1</sup>

### Useful Conversion Factors

#### Length

$$1\text{ m (meter=SI unit)} = 10^2\text{ cm} = 10^3\text{ mm} = 10^6\ \mu\text{m} = 10^9\text{ nm} = 10^{10}\ \text{\AA}$$

$$1\text{ in (inch)} = 2.54 \times 10^{-2}\text{ m}$$

$$1\text{ mile (mil)} = 1,609.35\text{ m}$$

$$1\ \text{\AA} (\text{angstrom}) = 10^{-10}\text{ m}$$

#### Mass

$$1\text{ kg (kilogram =SI unit)} = 1000\text{ g (gram)}$$

$$1\text{ lb (pound)} = 0.453\ 592\ 37\text{ kg}$$

## Volume

$$1 \text{ m}^3 \text{ (cubic meter=SI unit)} = 1000 \text{ L (liter)}$$

$$1 \text{ L} = 10^{-3} \text{ m}^3 = 1000 \text{ mL} = 1000 \text{ cm}^3$$

$$1 \text{ gal (US gallon)} = 3.785 412 \text{ L}$$

## Energy

$$1 \text{ J (joule= SI unit)} = 1 \text{ N}\cdot\text{m} = 1 \text{ kg}\cdot\text{m}^2\cdot\text{s}^{-2}$$

$$1 \text{ cal (calorie)} = 4.184 \text{ J}$$

$$1 \text{ eV (electron-volt)} = 1.602 176 487 \times 10^{-19} \text{ J}$$

$$\text{(Note that } 1 \text{ N (newton)} = 1 \text{ kg}\cdot\text{m}\cdot\text{s}^{-2}\text{)}$$

## Pressure

$$1 \text{ Pa (pascal= SI unit)} = 1 \text{ N}\cdot\text{m}^{-2} = 1 \text{ kg}\cdot\text{m}^{-1}\cdot\text{s}^{-2}$$

$$1 \text{ Pa} = 10^{-5} \text{ bar} = 9.869 23 \times 10^{-6} \text{ atm} = 7.500 62 \times 10^{-3} \text{ torr}$$

$$1 \text{ bar} = 10^5 \text{ Pa} = 0.986 923 \text{ atm} = 750.062 \text{ torr}$$

$$1 \text{ atm} = 1.013 25 \times 10^5 \text{ Pa} = 1.013 25 \text{ bar} = 760 \text{ torr}$$

$$1 \text{ torr} = 133.322 \text{ Pa} = 1.333 22 \times 10^{-3} \text{ bar} = 1.315 79 \times 10^{-3} \text{ atm}$$

## Temperature

$$t (^{\circ}\text{C} = \text{celsius}) + 273.15 = T (\text{K} = \text{Kelvin})$$

$$5/9 \times t (^{\circ}\text{C} = \text{celsius}) + 32 = t (^{\circ}\text{F} = \text{Fahrenheit})$$

## Common prefixes

Name	Symbol	Value	Name	Symbol	Value
deci	d	$10^{-1}$	deca	da	$10^1$
centi	c	$10^{-2}$	hecto	h	$10^2$
milli	m	$10^{-3}$	kilo	k	$10^3$
micro	$\mu$	$10^{-6}$	mega	M	$10^6$
nano	n	$10^{-9}$	giga	G	$10^9$
pico	p	$10^{-12}$	tera	T	$10^{12}$
femto	f	$10^{-15}$	peta	P	$10^{15}$
atto	a	$10^{-18}$	exa	E	$10^{18}$