

## Unit Conversion Factors

### Length

1 m = $10^{10}$ Å	1 Å = $10^{-10}$ m
1 m = $10^9$ nm	1 nm = $10^{-9}$ m
1 m = $10^6$ μm	1 μm = $10^{-6}$ m
1 m = $10^3$ mm	1 mm = $10^{-3}$ m
1 m = $10^2$ cm	1 cm = $10^{-2}$ m
1 mm = 0.0394 in.	1 in. = 25.4 mm
1 cm = 0.394 in.	1 in. = 2.54 cm
1 m = 3.28 ft	1 ft = 0.3048 m

### Area

1 m <sup>2</sup> = $10^4$ cm <sup>2</sup>	1 cm <sup>2</sup> = $10^{-4}$ m <sup>2</sup>
1 mm <sup>2</sup> = $10^{-2}$ cm <sup>2</sup>	1 cm <sup>2</sup> = $10^2$ mm <sup>2</sup>
1 m <sup>2</sup> = 10.76 ft <sup>2</sup>	1 ft <sup>2</sup> = 0.093 m <sup>2</sup>
1 cm <sup>2</sup> = 0.1550 in. <sup>2</sup>	1 in. <sup>2</sup> = 6.452 cm <sup>2</sup>

### Volume

1 m <sup>3</sup> = $10^6$ cm <sup>3</sup>	1 cm <sup>3</sup> = $10^{-6}$ m <sup>3</sup>
1 mm <sup>3</sup> = $10^{-3}$ cm <sup>3</sup>	1 cm <sup>3</sup> = $10^3$ mm <sup>3</sup>
1 m <sup>3</sup> = 35.32 ft <sup>3</sup>	1 ft <sup>3</sup> = 0.0283 m <sup>3</sup>
1 cm <sup>3</sup> = 0.0610 in. <sup>3</sup>	1 in. <sup>3</sup> = 16.39 cm <sup>3</sup>

### Mass

1 Mg = $10^3$ kg	1 kg = $10^{-3}$ Mg
1 kg = $10^3$ g	1 g = $10^{-3}$ kg
1 kg = 2.205 lb <sub>m</sub>	1 lb <sub>m</sub> = 0.4536 kg
1 g = $2.205 \times 10^{-3}$ lb <sub>m</sub>	1 lb <sub>m</sub> = 453.6 g

### Density

1 kg/m <sup>3</sup> = $10^{-3}$ g/cm <sup>3</sup>	1 g/cm <sup>3</sup> = $10^3$ kg/m <sup>3</sup>
1 Mg/m <sup>3</sup> = 1 g/cm <sup>3</sup>	1 g/cm <sup>3</sup> = 1 Mg/m <sup>3</sup>
1 kg/m <sup>3</sup> = 0.0624 lb <sub>m</sub> /ft <sup>3</sup>	1 lb <sub>m</sub> /ft <sup>3</sup> = 16.02 kg/m <sup>3</sup>
1 g/cm <sup>3</sup> = 62.4 lb <sub>m</sub> /ft <sup>3</sup>	1 lb <sub>m</sub> /ft <sup>3</sup> = $1.602 \times 10^{-2}$ g/cm <sup>3</sup>
1 g/cm <sup>3</sup> = 0.0361 lb <sub>m</sub> /in. <sup>3</sup>	1 lb <sub>m</sub> /in. <sup>3</sup> = 27.7 g/cm <sup>3</sup>

### Force

1 N = $10^5$ dynes	1 dyne = $10^{-5}$ N
1 N = 0.2248 lb <sub>f</sub>	1 lb <sub>f</sub> = 4.448 N

### Stress

1 MPa = 145 psi	1 psi = $6.90 \times 10^{-3}$ MPa
1 MPa = 0.102 kg/mm <sup>2</sup>	1 kg/mm <sup>2</sup> = 9.806 MPa
1 Pa = 10 dynes/cm <sup>2</sup>	1 dyne/cm <sup>2</sup> = 0.10 Pa
1 kg/mm <sup>2</sup> = 1422 psi	1 psi = $7.03 \times 10^{-4}$ kg/mm <sup>2</sup>

### Fracture Toughness

1 psi √in. = $1.099 \times 10^{-3}$ MPa √m	1 MPa √m = 910 psi √in.
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### Energy

1 J = $10^7$ ergs	1 erg = $10^{-7}$ J
1 J = $6.24 \times 10^{18}$ eV	1 eV = $1.602 \times 10^{-19}$ J
1 J = 0.239 cal	1 cal = 4.184 J
1 J = $9.48 \times 10^{-4}$ Btu	1 Btu = 1054 J
1 J = 0.738 ft-lb <sub>f</sub>	1 ft-lb <sub>f</sub> = 1.356 J
1 eV = $3.83 \times 10^{-20}$ cal	1 cal = $2.61 \times 10^{19}$ eV
1 cal = $3.97 \times 10^{-3}$ Btu	1 Btu = 252.0 cal

**Power**

$$1 \text{ W} = 0.239 \text{ cal/s} \qquad 1 \text{ cal/s} = 4.184 \text{ W}$$

$$1 \text{ W} = 3.414 \text{ Btu/h} \qquad 1 \text{ Btu/h} = 0.293 \text{ W}$$

$$1 \text{ cal/s} = 14.29 \text{ Btu/h} \qquad 1 \text{ Btu/h} = 0.070 \text{ cal/s}$$

**Viscosity**

$$1 \text{ Pa-s} = 10 \text{ P} \qquad 1 \text{ P} = 0.1 \text{ Pa-s}$$

**Temperature, T**

$$T(\text{K}) = 273 + T(^{\circ}\text{C}) \qquad T(^{\circ}\text{C}) = T(\text{K}) - 273$$

$$T(\text{K}) = \frac{5}{9}[T(^{\circ}\text{F}) - 32] + 273 \qquad T(^{\circ}\text{F}) = \frac{9}{5}[T(\text{K}) - 273] + 32$$

$$T(^{\circ}\text{C}) = \frac{5}{9}[T(^{\circ}\text{F}) - 32] \qquad T(^{\circ}\text{F}) = \frac{9}{5}[T(^{\circ}\text{C})] + 32$$

**Specific Heat**

$$1 \text{ J/kg-K} = 2.39 \times 10^{-4} \text{ cal/g-K} \qquad 1 \text{ cal/g-}^{\circ}\text{C} = 4184 \text{ J/kg-K}$$

$$1 \text{ J/kg-K} = 2.39 \times 10^{-4} \text{ Btu/lb}_m\text{-}^{\circ}\text{F} \qquad 1 \text{ Btu/lb}_m\text{-}^{\circ}\text{F} = 4184 \text{ J/kg-K}$$

$$1 \text{ cal/g-}^{\circ}\text{C} = 1.0 \text{ Btu/lb}_m\text{-}^{\circ}\text{F} \qquad 1 \text{ Btu/lb}_m\text{-}^{\circ}\text{F} = 1.0 \text{ cal/g-K}$$

**Thermal Conductivity**

$$1 \text{ W/m-K} = 2.39 \times 10^{-3} \text{ cal/cm-s-K} \qquad 1 \text{ cal/cm-s-K} = 418.4 \text{ W/m-K}$$

$$1 \text{ W/m-K} = 0.578 \text{ Btu/ft-h-}^{\circ}\text{F} \qquad 1 \text{ Btu/ft-h-}^{\circ}\text{F} = 1.730 \text{ W/m-K}$$

$$1 \text{ cal/cm-s-K} = 241.8 \text{ Btu/ft-h-}^{\circ}\text{F} \qquad 1 \text{ Btu/ft-h-}^{\circ}\text{F} = 4.136 \times 10^{-3} \text{ cal/cm-s-K}$$

**Periodic Table of the Elements**

Key

- Atomic number
- Symbol
- Atomic weight

Metal (white box)

Nonmetal (grey box)

Intermediate (diagonal box)

1 H 1.0080																	2 He 4.0026																	
3 Li 6.941	4 Be 9.0122											5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180																	
11 Na 22.990	12 Mg 24.305	13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.064	17 Cl 35.453	18 Ar 39.948							19 K 39.098	20 Ca 40.08	21 Sc 44.956	22 Ti 47.87	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.845	27 Co 58.933	28 Ni 58.69	29 Cu 63.54	30 Zn 65.41	31 Ga 69.72	32 Ge 72.64	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.80			
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc 99.94	44 Ru 101.07	45 Rh 102.91	46 Pd 106.4	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.30	55 Cs 132.91	56 Ba 137.34	57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
87 Fr (223)	88 Ra (226)	Acti- nide series (261)	104 Rf (262)	105 Db (262)	106 Sg (266)	107 Bh (264)	108 Hs (277)	109 Mt (268)	110 Ds (281)	79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.19	83 Bi 208.98	84 Po (209)	85 At (210)	86 Rn (222)																	
Rare earth series		57 La 138.91	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm (145)	62 Sm 150.35	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.50	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97																		
Actinide series		89 Ac (227)	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)																		