

# Conversion Factors

## MASS AND DENSITY

$$1 \text{ kg} = 2.2046 \text{ lb}$$

$$1 \text{ g/cm}^3 = 10^3 \text{ kg/m}^3$$

$$1 \text{ g/cm}^3 = 62.428 \text{ lb/ft}^3$$

$$1 \text{ lb} = 0.4536 \text{ kg}$$

$$1 \text{ lb/ft}^3 = 0.016018 \text{ g/cm}^3$$

$$1 \text{ lb/ft}^3 = 16.018 \text{ kg/m}^3$$

## LENGTH

$$1 \text{ cm} = 0.3937 \text{ in.}$$

$$1 \text{ m} = 3.2808 \text{ ft}$$

$$1 \text{ in.} = 2.54 \text{ cm}$$

$$1 \text{ ft} = 0.3048 \text{ m}$$

## VELOCITY

$$1 \text{ km/h} = 0.62137 \text{ mile/h}$$

$$1 \text{ mile/h} = 1.6093 \text{ km/h}$$

## VOLUME

$$1 \text{ cm}^3 = 0.061024 \text{ in.}^3$$

$$1 \text{ m}^3 = 35.315 \text{ ft}^3$$

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

$$1 \text{ L} = 0.0353 \text{ ft}^3$$

$$1 \text{ in.}^3 = 16.387 \text{ cm}^3$$

$$1 \text{ ft}^3 = 0.028317 \text{ m}^3$$

$$1 \text{ gal} = 0.13368 \text{ ft}^3$$

$$1 \text{ gal} = 3.7854 \times 10^{-3} \text{ m}^3$$

## FORCE

$$1 \text{ N} = 1 \text{ kg} \cdot \text{m/s}^2$$

$$1 \text{ N} = 0.22481 \text{ lbf}$$

$$1 \text{ lbf} = 32.174 \text{ lb} \cdot \text{ft/s}^2$$

$$1 \text{ lbf} = 4.4482 \text{ N}$$

## PRESSURE

$$1 \text{ Pa} = 1 \text{ N/m}^2 = 1.4504 \times 10^{-4} \text{ lbf/in.}^2$$

$$1 \text{ bar} = 10^5 \text{ N/m}^2$$

$$1 \text{ atm} = 1.01325 \text{ bar}$$

$$1 \text{ lbf/in.}^2 = 6894.8 \text{ Pa}$$

$$1 \text{ lbf/in.}^2 = 144 \text{ lbf/ft}^2$$

$$1 \text{ atm} = 14.696 \text{ lbf/in.}^2$$

## ENERGY AND SPECIFIC ENERGY

$$1 \text{ J} = 1 \text{ N} \cdot \text{m} = 0.73756 \text{ ft} \cdot \text{lbf}$$

$$1 \text{ kJ} = 737.56 \text{ ft} \cdot \text{lbf}$$

$$1 \text{ kJ} = 0.9478 \text{ Btu}$$

$$1 \text{ kJ/kg} = 0.42992 \text{ Btu/lb}$$

$$1 \text{ kJ} = 1000 \text{ kg} \cdot \text{m}^2/\text{s}^2$$

$$1 \text{ ft} \cdot \text{lbf} = 1.35582 \text{ J}$$

$$1 \text{ Btu} = 778.17 \text{ ft} \cdot \text{lbf}$$

$$1 \text{ Btu} = 1.0551 \text{ kJ}$$

$$1 \text{ Btu/lb} = 2.326 \text{ kJ/kg}$$

$$1 \text{ kcal} = 4.1868 \text{ kJ}$$

## ENERGY TRANSFER RATE

$$1 \text{ W} = 1 \text{ J/s} = 3.413 \text{ Btu/h}$$

$$1 \text{ kW} = 1.341 \text{ hp}$$

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

$$1 \text{ hp} = 2545 \text{ Btu/h}$$

$$1 \text{ hp} = 550 \text{ ft} \cdot \text{lbf/s}$$

$$1 \text{ hp} = 0.7457 \text{ kW}$$

## SPECIFIC HEAT

$$1 \text{ kJ/kg} \cdot \text{K} = 0.238846 \text{ Btu/lb} \cdot \text{°R}$$

$$1 \text{ kcal/kg} \cdot \text{K} = 1 \text{ Btu/lb} \cdot \text{°R}$$

$$1 \text{ Btu/lb} \cdot \text{°R} = 4.1868 \text{ kJ/kg} \cdot \text{K}$$

## 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**

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

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

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

**Viscosity**

$$1 \text{ Pa}\cdot\text{s} = 10 \text{ P} \quad 1 \text{ P} = 0.1 \text{ Pa}\cdot\text{s}$$

**Temperature, T**

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

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

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

**Specific Heat**

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

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

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

**Thermal Conductivity**

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

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

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

**Periodic Table of the Elements**

	Metal
	Nonmetal
	Intermediate

**Key**

29	← Atomic number
Cu	← Symbol
63.54	← Atomic weight

IA	IIA											IIIA	IVA	VA	VIA	VIIA	0																	
1 H 1.0080	2 He 4.0026											3 Li 6.939	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 20.183															
11 Na 22.990	12 Mg 24.312	13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.064	17 Cl 35.453	18 Ar 39.948	VIII				19 K 39.102	20 Ca 40.08	21 Sc 44.956	22 Ti 47.90	23 V 50.942	24 Cr 51.996	25 Mn 54.938	26 Fe 55.847	27 Co 58.933	28 Ni 58.71	29 Cu 63.54	30 Zn 65.37	31 Ga 69.72	32 Ge 72.59	33 As 74.922	34 Se 78.96	35 Br 79.91	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)	44 Ru 101.07	45 Rh 102.91	46 Pd 106.4	47 Ag 107.87	48 Cd 112.40	49 In 114.82	50 Sn 118.69	51 Sb 121.75	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)	Rare earth series										89 Ac (227)	90 Th 232.04	91 Pa (231)	92 U 238.03	93 Np (237)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (254)	99 Es (254)	100 Fm (253)	101 Md (256)	102 No (254)	103 Lw (257)								