

## FACTORS FOR UNIT CONVERSIONS

Quantity	Equivalent Values
Mass	$1 \text{ kg} = 1000 \text{ g} = 0.001 \text{ metric ton} = 2.20462 \text{ lb}_m = 35.27392 \text{ oz}$ $1 \text{ lb}_m = 16 \text{ oz} = 5 \times 10^{-4} \text{ ton} = 453.593 \text{ g} = 0.453593 \text{ kg}$
Length	$1 \text{ m} = 100 \text{ cm} = 1000 \text{ mm} = 10^6 \text{ microns } (\mu\text{m}) = 10^{10} \text{ angstroms } (\text{\AA})$ $= 39.37 \text{ in} = 3.2808 \text{ ft} = 1.0936 \text{ yd} = 0.0006214 \text{ mile}$ $1 \text{ ft} = 12 \text{ in.} = 1/3 \text{ yd} = 0.3048 \text{ m} = 30.48 \text{ cm}$
Volume	$1 \text{ m}^3 = 1000 \text{ liters} = 10^6 \text{ cm}^3 = 10^6 \text{ ml}$ $= 35.3145 \text{ ft}^3 = 220.83 \text{ imperial gallons} = 264.17 \text{ gal}$ $= 1056.68 \text{ qt}$ $1 \text{ ft}^3 = 1728 \text{ in}^3 = 7.4805 \text{ gal} = 0.028317 \text{ m}^3 = 28.317 \text{ liters}$ $= 28\,317 \text{ cm}^3$
Force	$1 \text{ N} = 1 \text{ kg}\cdot\text{m}/\text{s}^2 = 10^5 \text{ dynes} = 10^5 \text{ g}\cdot\text{cm}/\text{s}^2 = 0.22481 \text{ lb}_f$ $1 \text{ lb}_f = 32.174 \text{ lb}_m\cdot\text{ft}/\text{s}^2 = 4.4482 \text{ N} = 4.4482 \times 10^5 \text{ dynes}$
Pressure	$1 \text{ atm} = 1.01325 \times 10^5 \text{ N}/\text{m}^2 \text{ (Pa)} = 101.325 \text{ kPa} = 1.01325 \text{ bars}$ $= 1.01325 \times 10^6 \text{ dynes}/\text{cm}^2$ $= 760 \text{ mm Hg at } 0^\circ \text{ C (torr)} = 10.333 \text{ m H}_2\text{O at } 4^\circ \text{ C}$ $= 14.696 \text{ lb}_f/\text{in}^2 \text{ (psi)} = 33.9 \text{ ft H}_2\text{O at } 4^\circ \text{ C}$ $100 \text{ kPa} = 1 \text{ bar}$
Energy	$1 \text{ J} = 1 \text{ N}\cdot\text{m} = 10^7 \text{ ergs} = 10^7 \text{ dyne}\cdot\text{cm}$ $= 2.778 \times 10^{-7} \text{ kW}\cdot\text{h} = 0.23901 \text{ cal}$ $= 0.7376 \text{ ft}\cdot\text{lb}_f = 9.47817 \times 10^{-4} \text{ Btu}$
Power	$1 \text{ W} = 1 \text{ J}/\text{s} = 0.23885 \text{ cal}/\text{s} = 0.7376 \text{ ft}\cdot\text{lb}_f/\text{s} = 9.47817 \times 10^{-4} \text{ Btu}/\text{s} = 3.4121 \text{ Btu}/\text{h}$ $= 1.341 \times 10^{-3} \text{ hp (horsepower)}$
Viscosity	$1 \text{ Pa}\cdot\text{s} = 1 \text{ N}\cdot\text{s}/\text{m}^2 = 1 \text{ kg}/\text{m}\cdot\text{s}$ $= 10 \text{ poise} = 10 \text{ dynes}\cdot\text{s}/\text{cm}^2 = 10 \text{ g}/\text{cm}\cdot\text{s}$ $= 10^3 \text{ cP (centipoise)}$ $= 0.67197 \text{ lb}_m/\text{ft}\cdot\text{s} = 2419.088 \text{ lb}_m/\text{ft}\cdot\text{h}$
Density	$1 \text{ kg}/\text{m}^3 = 10^{-3} \text{ g}/\text{cm}^3$ $= 0.06243 \text{ lb}_m/\text{ft}^3$ $10^3 \text{ kg}/\text{m}^3 = 1 \text{ g}/\text{cm}^3 = 62.428 \text{ lb}_m/\text{ft}^3$
Volumetric Flow	$1 \text{ m}^3/\text{s} = 35.3145 \text{ ft}^3/\text{s} = 15,850.2 \text{ gal}/\text{min (gpm)}$ $1 \text{ gpm} = 6.30907 \times 10^{-5} \text{ m}^3/\text{s} = 2.22802 \times 10^{-3} \text{ ft}^3/\text{s}$

Temperature	$T(^{\circ}C) = \frac{5}{9}[T(^{\circ}F) - 32]$ $T(^{\circ}F) = \frac{9}{5}T(^{\circ}C) + 32 = 1.8T(^{\circ}C) + 32$
Absolute Temperature	$T(K) = T(^{\circ}C) + 273.15$ $T(^{\circ}R) = T(^{\circ}F) + 459.67$
Temperature Interval ( $\Delta T$ )	$1\text{ }^{\circ}C = 1\text{ K} = 1.8\text{ }^{\circ}F = 1.8\text{ }^{\circ}R$ $1\text{ }^{\circ}F = 1\text{ }^{\circ}R = (5/9)\text{ }^{\circ}C = (5/9)\text{ K}$

## USEFUL QUANTITIES

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$$SG = \rho(20^{\circ}C) / \rho_{\text{water}}(4^{\circ}C)$$

$$\rho_{\text{water}}(4^{\circ}C) = 1000\text{ kg/m}^3 = 62.43\text{ lb}_m/\text{ft}^3 = 1.000\text{ g/cm}^3$$

$$\rho_{\text{water}}(25^{\circ}C) = 997.08\text{ kg/m}^3 = 62.25\text{ lb}_m/\text{ft}^3 = 0.99709\text{ g/cm}^3$$

$$g = 9.8066\text{ m/s}^2 = 980.66\text{ cm/s}^2 = 32.174\text{ ft/s}^2$$

$$\mu_{\text{water}}(25^{\circ}C) = 8.937 \times 10^{-4}\text{ Pa}\cdot\text{s} = 0.8937\text{ cP} = 6.005 \times 10^{-4}\text{ lb}_m/\text{ft}\cdot\text{s}$$

Composition of air:	$N_2$	78.03%
	$O_2$	20.99%
	Ar	0.94%
	$CO_2$	0.03%
	$H_2, He, Ne, Kr, Xe$	<u>0.01%</u>
		100.00%

$$M_{\text{air}} = 29\text{ g/mol} = 29\text{ kg/kmol} = 29\text{ lb}_m/\text{lbmole}$$

$$\hat{C}_{p,\text{water}}(25^{\circ}C) = 4.182\text{ kJ/kg}\cdot\text{K} = 0.9989\text{ cal/g}\cdot^{\circ}C = 0.9997\text{ Btu/lb}_m\cdot^{\circ}F$$

$$\begin{aligned} R &= 8.314\text{ m}^3\text{Pa/mol}\cdot\text{K} = 0.08314\text{ liter}\cdot\text{bar/mol}\cdot\text{K} = 0.08206\text{ liter}\cdot\text{atm/mol}\cdot\text{K} \\ &= 62.36\text{ liter}\cdot\text{mm Hg/mol}\cdot\text{K} = 0.7302\text{ ft}^3\cdot\text{atm/lbmole}\cdot^{\circ}R \\ &= 10.73\text{ ft}^3\cdot\text{psia/lbmole}\cdot^{\circ}R \\ &= 8.314\text{ J/mol}\cdot\text{K} \\ &= 1.987\text{ cal/mol}\cdot\text{K} = 1.987\text{ Btu/lbmole}\cdot^{\circ}R \end{aligned}$$