TABLE K.1 Conversion factors

Mass Standard SI unit: kilogram (kg). Equivalent unit: $N \cdot s^2/m$.

$$\frac{14.59\ kg}{slug} \quad \frac{32.174\ lb_m}{slug} \quad \frac{2.205\ lb_m}{kg} \quad \frac{453.6\ grams}{lb_m} \quad \frac{2000\ lb_m}{ton_m} \quad \frac{1000\ kg}{metric\ ton_m}$$

Force Standard SI unit: Newton (N). Equivalent unit: $kg \cdot m/s^2$.

$$\frac{4.448\ N}{lb_f} \quad \frac{10^5\ dynes}{N} \quad \frac{4.448 \times 10^5\ dynes}{lb_f} \quad \frac{224.8\ lb_f}{kN}$$

Length

$$\frac{3.281\ ft}{m} \quad \frac{39.37\ in}{m} \quad \frac{12\ in}{ft} \quad \frac{1.609\ km}{mi} \quad \frac{5280\ ft}{mi} \quad \frac{6076\ ft}{nautical\ mile}$$

Area

$$\frac{144\ in^2}{ft^2} \quad \frac{10.76\ ft^2}{m^2} \quad \frac{645.2\ mm^2}{in^2} \quad \frac{10^6\ mm^2}{m^2} \quad \frac{43\ 560\ ft^2}{acre} \quad \frac{10^4\ m^2}{hectare}$$

Volume

$$\frac{1728\ in^3}{ft^3} \quad \frac{231\ in^3}{gal} \quad \frac{7.48\ gal}{ft^3} \quad \frac{264.2\ gal}{m^3} \quad \frac{3.785\ L}{gal} \quad \frac{35.31\ ft^3}{m^3}$$

$$\frac{28.32\ L}{ft^3} \quad \frac{1000\ L}{m^3} \quad \frac{61.02\ in^3}{L} \quad \frac{1000\ cm^3}{L} \quad \frac{1.201\ U.S.\ gal}{Imperial\ gallon}$$

Volume Flow Rate

$$\frac{449\ gal/min}{ft^3/s} \quad \frac{35.31\ ft^3/s}{m^3/s} \quad \frac{15\ 850\ gal/min}{m^3/s} \quad \frac{3.785\ L/min}{gal/min}$$

$$\frac{60\ 000\ L/min}{m^3/s} \quad \frac{2119\ ft^3/min}{m^3/s} \quad \frac{16.67\ L/min}{m^3/h} \quad \frac{101.9\ m^3/h}{ft^3/s}$$

Density **(mass/unit volume)**

$$\frac{515.4\ kg/m^3}{slug/ft^3} \quad \frac{1000\ kg/m^3}{gram/cm^3} \quad \frac{32.17\ lb_m/ft^3}{slug/ft^3} \quad \frac{16.018\ kg/m^3}{lb_m/ft^3}$$

Specific Weight **(weight/unit volume)**

$$\frac{157.1\ N/m^3}{lb_f/ft^3} \quad \frac{1728\ lb/ft^3}{lb/in^3}$$

Pressure Standard SI unit: pascal (Pa). Equivalent units: N/m^2 or $kg/m \cdot s^2$.

$$\frac{144\ lb/ft^2}{lb/in^2} \quad \frac{47.88\ Pa}{lb/ft^2} \quad \frac{6895\ Pa}{lb/in^2} \quad \frac{1\ Pa}{N/m^2} \quad \frac{100\ kPa}{bar} \quad \frac{14.50\ lb/in^2}{bar}$$

$$\frac{27.68\ inH_2O}{lb/in^2} \quad \frac{249.1\ Pa}{inH_2O} \quad \frac{2.036\ inHg}{lb/in^2} \quad \frac{3386\ Pa}{inHg} \quad \frac{133.3\ Pa}{mmHg} \quad \frac{51.71\ mmHg}{lb/in^2}$$

$$\frac{14.696\ lb/in^2}{Std.\ atmosphere} \quad \frac{101.325\ kPa}{Std.\ atmosphere} \quad \frac{29.92\ inHg}{Std.\ atmosphere} \quad \frac{760.1\ mmHg}{Std.\ atmosphere}$$

TABLE K.1 Conversion factors (*continued*)

Note: Conversion factors based on the height of a column of liquid (e.g., inH_2O and mmHg) are based on a standard gravitational field ($g = 9.806\,65\ m/s^2$), a density of water equal to $1000\ kg/m^3$, and a density of mercury equal to $13\,595.1\ kg/m^3$, sometimes called *conventional values* for a temperature at or near 0°C. Actual measurements with such fluids may vary because of differences in local gravity and temperature.

Energy Standard SI unit: joule (J). Equivalent units: N·m or $kg \cdot m^2/s^2$.

$$\frac{1.356\ J}{lb\text{-}ft} \quad \frac{1.0\ J}{N \cdot m} \quad \frac{8.85\ lb\text{-}in}{J} \quad \frac{1.055\ kJ}{Btu} \quad \frac{3.600\ kJ}{W \cdot h} \quad \frac{778.17\ ft\text{-}lb}{Btu}$$

Power Standard SI unit: watt (W). Equivalent unit: J/s or N·m/s.

$$\frac{745.7\ W}{hp} \quad \frac{1.0\ W}{N \cdot m/s} \quad \frac{550\ lb\text{-}ft/s}{hp} \quad \frac{1.356\ W}{lb\text{-}ft/s} \quad \frac{3.412\ Btu/hr}{W} \quad \frac{1.341\ hp}{kW}$$

Dynamic Viscosity Standard SI unit: Pa·s or $N \cdot s/m^2$ (cP = centipoise)

$$\frac{47.88\ Pa \cdot s}{lb\text{-}s/ft^2} \quad \frac{10\ poise}{Pa \cdot s} \quad \frac{1000\ cP}{Pa \cdot s} \quad \frac{100\ cP}{poise} \quad \frac{1\ cP}{1\ mPa \cdot s}$$

Kinematic Viscosity Standard SI unit: m^2/s (cSt = centistoke)

$$\frac{10.764\ ft^2/s}{m^2/s} \quad \frac{10^4\ stoke}{m^2/s} \quad \frac{10^6\ cSt}{m^2/s} \quad \frac{100\ cSt}{stoke} \quad \frac{1\ cSt}{1\ mm^2/s} \quad \frac{10^6\ mm^2/s}{m^2/s}$$

Refer to Section 2.6.5 for conversions involving Saybolt Universal seconds.

General Approach to Application of Conversion Factors. Arrange the conversion factor from the table in such a manner that when multiplied by the given quantity, the original units cancel out, leaving the desired units.

Example 1 Convert $0.24\ m^3/s$ to the units of gal/min:

$$(0.24\ m^3/s)\frac{15\,850\ gal/min}{m^3/s} = 3804\ gal/min$$

Example 2 Convert 150 gal/min to the units of m^3/s:

$$(150\ gal/min)\frac{1\ m^3/s}{15\,850\ gal/min} = 9.46 \times 10^{-3}\ m^3/s$$

Temperature Conversions (Refer to Section 1.6)

Given the Fahrenheit temperature T_F in °F, the Celsius temperature T_C in °C is

$$T_C = (T_F - 32)/1.8$$

Given the temperature T_C in °C, the Fahrenheit temperature T_F in °F is

$$T_F = 1.8T_C + 32$$

Given the temperature T_C in °C, the absolute temperature T_K in K (kelvin) is

$$T_K = T_C + 273.15$$

Given the temperature T_F in °F, the absolute temperature T_R in °R (degrees Rankine) is

$$T_R = T_F + 459.67$$

Given the temperature T_F in °F, the absolute temperature T_K in K is

$$T_K = (T_F + 459.67)/1.8 = T_R/1.8$$