

Appendix A

Units and Conversions

Table A.1 English Units, SI Units, and Their Conversion Factors

Quantity	English units	International system ^a SI	Conversion factor
Length	inch	millimeter	1 in = 25.4 mm
	foot	meter	1 ft = 0.3048 m
	mile	kilometer	1 mi = 1.609 km
Area	square inch	square centimeter	1 in ² = 6.452 cm ²
	square foot	square meter	1 ft ² = 0.09290 m ²
Volume	cubic inch	cubic centimeter	1 in ³ = 16.39 cm ³
	cubic foot	cubic meter	1 ft ³ = 0.02832 m ³
	gallon		1 gal = 0.003789 m ³
Mass	pound mass	kilogram	1 lb = 0.4536 kg
	slug		1 slug = 14.59 kg
Density	slug per cubic foot	kilogram per cubic meter	1 slug/ft ³ = 515.4 kg/m ³
Force	pound force	newton	1 lb = 4.448 N
Work/torque	foot pound	newton meter	1 ft-lb = 1.356 N·m
Pressure	pound per square inch	newton per square meter (pascal)	1 lb/in ² = 6895 Pa
			1 lb/ft ² = 47.88 Pa
Temperature	degree Fahrenheit	degree Celsius	°F = 9/5°C + 32
	degree Rankine	kelvin	°R = 9/5 K
Energy	British thermal unit	joule	1 Btu = 1055 J
	calorie		1 cal = 4.186 J
Power	foot pound		1 ft-lb = 1.356 J
	horsepower	watt	1 hp = 745.7 W
Velocity	foot pound per second		1 ft-lb/s = 1.356 W
	foot per second	meter per second	1 ft/s = 0.3048 m/s
Acceleration	foot per second squared	meter per second squared	1 ft/s ² = 0.3048 m/s ²
Frequency	cycle per second	hertz	1 c/s = 1.000 Hz
Viscosity	pound second per square foot	newton second per square meter	1 lb-s/ft ² = 47.88 N·s/m ²

^a The reversed initials in this abbreviation come from the French form of the name: *Système International*.

Table A.2 Conversions of Units

Length	Force	Mass	Velocity
1 cm = 0.3937 in	1 lb = 0.4536 kg	1 oz = 28.35 g	1 mph = 1.467 ft/s
1 m = 3.281 ft	1 lb = 0.4448 × 10 ⁶ dyn	1 lb = 0.4536 kg	1 mph = 0.8684 kn
1 km = 0.6214 mi	1 lb = 32.17 pdl	1 slug = 32.17 lb	1 ft/s = 0.3048 m/s
1 in = 2.54 cm	1 kg = 2.205 lb	1 slug = 14.59 kg	1 m/s = 3.281 ft/s
1 ft = 0.3048 m	1 N = 0.2248 lb	1 kg = 2.205 lb	1 km/h = 0.278 m/s
1 mi = 1.609 km	1 dyn = 2.248 × 10 ⁻⁶ lb	1 kg = 0.06852 slug	
1 mi = 5280 ft	1 lb = 4.448 N		
1 mi = 1760 yd			

Work, energy, and power	Pressure	Volume	Flow rate	Viscosity
1 Btu = 778.2 ft-lb	1 lb/in ² = 2.036 in Hg	1 ft ³ = 28.32 L	1 ft ³ /min = 4.719 × gal 10 ⁻⁴ m ³ /s	1 stoke = 10 ⁻⁴ m ² /s
1 J = 10 ⁷ ergs	1 lb/in ² = 27.7 in H ₂ O	1 ft ³ = 7.481 gal (U.S.)	1 ft ³ /s = 0.02832 m ³ /s	1 P = 0.1 (N·s)/m ²
1 J = 0.7376 ft-lb	14.7 lb/in ² = 22.92 in Hg	1 gal (U.S.) = 231 in ³	1 m ³ /s = 35.31 ft ³ /s	1 (lb·s)/ft ² = 47.88 (N·s)/m ²
1 cal = 3.088 ft-lb	14.7 lb/in ² = 33.93 ft H ₂ O	1 gal (Brit.) = 1.2 gal (U.S.)	1 gal/min = 0.002228 ft ³ /s	1 ft ² /s = 0.0929 m ² /s
1 cal = 0.003968 Btu	14.7 lb/in ² = 1.0332 kg/cm ²	1 m ³ = 1000 L		
1 kWh = 3413 Btu	14.7 lb/in ² = 1.0133 bar	1 ft ³ = 0.02832 m ³		
	1 kg/cm ² = 14.22 lb/in ²	1 m ³ = 35.31 ft ³		
1 Btu = 1.055 kJ	1 in Hg = 0.4912 lb/in ²			
1 ft-lb = 1.356 J	1 ft H ₂ O = 0.4331 lb/in ²			
1 hp = 550 ft-lb/sec	1 lb/in ² = 6895 Pa			
1 hp = 0.7067 Btu/s	1 lb/ft ² = 47.88 Pa			
1 hp = 0.7455 kW	10 ⁵ Pa = 1 bar			
1 W = 1 J/s	1 kPa = 0.145 lb/in ²			
1 W = 1.0 × 10 ⁷ (dyn·cm)/s				
1 erg = 10 ⁻⁷ J				
1 quad = 10 ¹⁵ Btu				
1 therm = 10 ⁵ Btu				