

Table A.1 Physical Constants

Name	Value	Units of measure
Speed of light in a vacuum	2.9979×10^8	m/s
Gravitational constant	6.673×10^{-11}	N-m ² / kg ²
Avogadro's number	6.022×10^{23}	atoms/g-mole
Boltzmann constant	1.38×10^{-23}	J / °K
Universal gas constant	0.082057	L-atm/g-mole - °K
	8.314	kJ /kg-mole - °K
	1545.3	ft-lb _f /lb-mole - °R
	1.986	Btu /lb-mole - °R
	1.986	cal / g-mole - °K
	0.730	atm-ft ³ /lb-mole - °R
	10.73	psia - ft ³ /lb-mole - °R
Volume of ideal gas, at STP	22.41	m ³ /kg-mole
Unified atomic mass unit, amu	1.660531×10^{-27}	kg
Planck's constant	6.626196×10^{-34}	J-s
Electron charge	1.602192×10^{-19}	C
Electron rest mass	9.109558×10^{-31}	kg
	5.485930×10^{-4}	amu
Proton rest mass	1.672614×10^{-27}	kg
	1.00727661	amu
Neutron rest mass	1.674920×10^{-27}	kg
	1.00866520	amu
Electron-charge-to-mass ratio	1.758803×10^{11}	C / kg
Stefan-Boltzmann constant	5.66961×10^{-8}	W / m ² - °K ⁴
Faraday's constant	9.6487×10^7	C / kg-mole

Table A.2

Conversion Factors

Length

1 ft	= 0.3084 m
1 in	= 2.540 cm
1 mile	= 5280 ft
	= 1.6093 km
1 km	= 1000 m
1 m	= 100 cm
	= 1.0936 yd
	= 3.2808 ft
1 cm	= 0.3937 in.

Mass

1 lb _m	= 0.45359237 kg
	= 7000 grain
1 slug	= 32.174 lb _m
	= 14.5939 kg
1 kg	= 1000 g
	= 2.2046 lb _m
1 ton:	
metric	= 1000 kg
short	= 2000 lb _m

Pressure

1 kPa	= 1000 N / m ²
	= 20.886 lb _f /ft ²
1 atm	= 760 torr
	= 1.01325 x 10 ⁵ N/m ²
	= 14.696 lb _f /in ²
	= 29.92 in. Hg
1 torr	= 1 mm Hg
	= 1.933 x 10 ⁻² psi
1 mm Hg	= 0.01934 lb _f /in ²
1 bar	= 0.9869 atm
	= 10 ⁵ N / m ²
	= 10 ⁶ dyne/cm ²
1 in. Hg	= 0.491 lb _f /in ²
	= 0.0334 atm
	= 33,864 dyne/cm ²
1 dyne/cm ²	= 10 ⁻¹ N/m ²

Volume

1 liter	= 10 ⁻³ m ³
	= 1000 cm ³
	= 0.035313 ft ³
	= 0.26417 gal
	= 61.025 in ³
1 gal	= 3.7854 liter
	= 0.13368 ft ³
1 ft ³	= 28.317 liter
	= 7.4805 gal
1 in ³	= 16.387 cm ³

Force

1 lb _f	= 4.4482 N
	= 444,800 dyne
	= 32.174 lb _m -ft/s ²
1 N	= 1 kg-m/s ²
	= 0.22481 lb _f
1 dyne	= 1 g-cm/s ²
	= 10 ⁻⁵ N

Time

1 h	= 3600 s
1 min	= 60 s
1 ms	= 10 ⁻³ s
1 μs	= 10 ⁻⁶ s

Energy

1 J	= 1 kg-m ² /s ²
	= 9.478 x 10 ⁻⁴ Btu
	= 10 ⁷ erg
1 erg	= 1 dyne-cm
1 cal	= 4.186 J
1 Btu	= 252.16 cal
	= 1.05504 kJ
	= 778.16 ft-lb _f
1 ft-lb _f	= 1.3558 J
1 ev	= 1.602 x 10 ⁻¹⁹ J

Table A.2 (continued)

Temperature

1 °K	= 1.8 °R
°K	= °C + 273.15
°C	= (°F – 32)/1.8
°R	= °F + 459.67

Electromagnetic units

1 ampere	= 1 C/s
	= 1 W/v
1 volt	= 1 J/C
1 ohm	= 1 v/A
1 farad	= 1 A-s/v
1 henry	= 1 v-s/A
1 weber	= 1 v-s
1 tesla	= 1 Wb/m ²
	= 1 N/A-m
	= 10 ⁴ gauss

Density

1 lb _m /ft ³	= 0.01602 g/cm ³
	= 16.02 kg / m ³

Power

1 W	= 1 J/s
	= 1 kg-m ² /s ³
	= 860.42 cal /hr
1 kW	= 1000 W
	= 3412.2 Btu/h
	= 1.341 hp
	= 737.56 lb _f -ft/s
1 hp	= 2544.5 Btu/h
	= 745.7 W
	= 550 ft-lb _f /s
	= 33,000 ft-lb _f /min

Specific Energy

1 Btu/lb _m	= 2.3259 kJ/kg
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Energy Flux

1 Btu/ft ² -s	= 11.356 kW/m ²
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