APPENDIX A

CONSTANTS AND CONVERSION FACTORS

TABLE A.1
Physical constants.

Speed of light in vacuum	c_0	$= 2.9979 \times 10^8$ m/s
First Planck function constant	C_1	$= 3.7418 \times 10^{-16}$ W m^2 $= 2\pi h c_0^2$
Second Planck function constant	C_2	$= 14{,}388\ \mu$m K $= hc_0/k$
Wien's constant	C_3	$= 2897.8\ \mu$m K
Electron charge	e	$= 1.6022 \times 10^{-19}$ C
Planck's constant	h	$= 6.6261 \times 10^{-34}$ J s
Modified Planck's constant	$\hbar$	$= 1.0546 \times 10^{-34}$ J s $= h/2\pi$
Boltzmann's constant	k	$= 1.3807 \times 10^{-23}$ J/K
Electron rest mass	m_e	$= 9.1094 \times 10^{-31}$ kg
Neutron rest mass	m_n	$= 1.6749 \times 10^{-27}$ kg
Proton rest mass	m_p	$= 1.6726 \times 10^{-27}$ kg
Avogadro's number	N_A	$= 6.0221 \times 10^{23}$ molecules/mol
Solar constant (at mean R_{SE})	q_{sol}	$= 1367$ W/m^2
Radius of Earth (mean)	R_{Earth}	$= 6.371 \times 10^6$ m
Radius of solar disk	R_{sun}	$= 6.955 \times 10^8$ m
Earth–sun distance (mean)	R_{SE}	$= 1.4960 \times 10^{11}$ m
Universal gas constant	R_u	$= 8.3145$ J/mol K
Effective surface T of sun	T_{sun}	$= 5777$ K
Molar volume of ideal gas	$\mathscr{V}_{\text{mol}}$	$= 22.4140\ \ell$/mol
(at 273.15 K, 101.325 kPa)		$= 22.4140$ m^3/kmol
Electrical permittivity of vacuum	ϵ_0	$= 8.8542 \times 10^{-12}$ C^2/N m^2
Magnetic permeability of vacuum	μ_0	$= 4\pi \times 10^{-7}$ N s^2/C^2
Stefan–Boltzmann constant	σ	$= 5.6704 \times 10^{-8}$ W/m^2 K^4

TABLE A.2
Conversion factors.

Acceleration	1 m/s^2	= 4.2520×10^7 ft/h^2
Area	1 m^2	= 1550.0 in^2 = 10.764 ft^2
Diffusivity	1 m^2/s	= 3.875×10^4 ft^2/h
Energy	1 J	= 9.4787×10^{-4} Btu
	1 eV = 1.6022×10^{-19} J	= 1.5187×10^{-22} Btu
Force	1 N	= 0.22481 lb$_f$
Heat transfer rate	1 W	= 3.4123 Btu/h
Heat flux	1 W/m^2	= 0.3171 Btu/h ft^2
Heat generation rate	1 W/m^3	= 0.09665 Btu/h ft^3
Heat transfer coefficient	1 W/m^2 K	= 0.17612 Btu/h ft^2 °F
Intensity	1 W/m^2 sr	= 0.3171 Btu/h ft^2 sr
Kinematic viscosity	1 m^2/s	= 3.875×10^4 ft^2/h
Latent heat	1 J/kg	= 4.2995×10^{-4} Btu/lb$_m$
Length	1 m	= 39.370 in = 3.2808 ft
	1 km	= 0.62137 mi
Mass	1 kg	= 2.2046 lb$_m$
Mass density	1 kg/m^3	= 0.062428 lb$_m$/ft^3
Mass flow rate	1 kg/s	= 7936.6 lb$_m$/h
Power	1 W	= 3.4123 Btu/h
Pressure and stress	1 Pa = 1 N/m^2	= 1.4504×10^{-4} lb$_f$/in^2
	1.0133×10^5 N/m^2	= 1 standard atmosphere
Specific heat	1 J/kg K	= 2.3886×10^{-4} Btu/lb$_m$ °F
Temperature	T(K)	= (5/9)T(°R) = (5/9)(T(°F) + 459.67)
		= T(°C) + 273.15
Temperature difference	1 K	= 1°C = (9/5)°R = (9/5)°F
Thermal conductivity	1 W/m K	= 0.57782 Btu/h ft °F
Thermal resistance	1 K/W	= 0.52750 °F h/Btu
Velocity and speed	1 m/s	= 3.2808 ft/s
		= 2.2364 mph
Viscosity (dynamic)	1 N s/m^2 = 1 kg/s m	= 2419.1 lb$_m$/ft h
Volume	1 m^3	= 6.1023×10^4 in^3
		= 35.314 ft^3
Volume flow rate	1 m^3/s	= 1.2713×10^5 ft^3/h
		= 2.1189×10^3 ft^3/min

TABLE A.3
Conversion factors for spectral variables.

Wavelength to energy	a μm = a × 10^3 nm	≙ 1.240/a eV
to frequency	a μm = a × 10^4 Å	≙ 2.9979×10^{14}/a Hz
to wavenumber	a μm	≙ 10^4/a cm^{-1}
Energy to frequency	a eV	≙ 2.418×10^{14}a Hz
to wavelength	a eV	≙ 1.240/a μm
to wavenumber	a eV	≙ 8.066×10^3a cm^{-1}
Wavenumber to energy	a cm^{-1}	≙ 1.240×10^{-4} a eV
to frequency	a cm^{-1}	≙ 2.9979×10^{10} a Hz
to wavelength	a cm^{-1}	≙ 10^{+4}/a μm
Frequency to energy	a Hz	≙ 4.136×10^{-15} a eV
to wavelength	a Hz	≙ 2.9979×10^{14}/a μm
to wavenumber	a Hz	≙ 3.336×10^{-11} a cm^{-1}