Appendix 1 Summary
Measurement Fundamentals

SI base units

Quantity	Name	Symbol
Length	Meter	m
Mass	Kilogram	kg
Time	Second	s
Electric current	Ampere	A
Thermodynamic temperature	Kelvin	K
Amount of matter	Mole	mol
Luminous intensity	Candela	cd

SI supplemental units

Quantity	Name	Symbol	Expression
Frequency	Hertz	Hz	$1/s$
Force	Newton	N	$kg{\cdot}m/s^2$
Pressure, stress	Pascal	Pa	$N/m^2 = kg/m{\cdot}s^2$
Energy, work	Joule	J	$N{\cdot}m = kg{\cdot}m^2/s^2$
Power, radiant flux	Watt	W	$J/s = kg{\cdot}m^2/s^3$
Electric charge	Coulomb	C	$A{\cdot}s$
Voltage, electric potential	Volt	V	$W/A = kg{\cdot}m^2/A{\cdot}s^3$
Capacitance	Farad	F	$C/V = s^4A^2/m^2kg$
Electric resistance	Ohm	Ω	$V/A = m^2kg/s^3A^2$
Conductance	Siemens or mho	S or	$1/\Omega = s^3A^2/m^2kg$
Magnetic field	Tesla	T	$N/A{\cdot}m = kg/s^2A$
Magnetic flux	Weber	Wb	$T{\cdot}m^2 = m^2kg/s^2A$
Inductance	Henry	H	$V{\cdot}s/A = m^2kg/s^2A^2$

Unit prefixes

Name	Symbol	Quantity
Yotta	Y	10^{24}
Zetta	Z	10^{21}
Exa	E	10^{18}
Tera	T	10^{12}
Giga	G	10^{9}
Mega	M	10^{6}
Kilo	k	10^{3}
Hecto	h	10^{2}
Deca	da	10
Deci	d	10^{-1}
Centi	c	10^{-2}
Milli	m	10^{-3}
Micro	μ	10^{-6}
Nano	n	10^{-9}
Pico	p	10^{-12}
Fempto	f	10^{-15}
Atto	a	10^{-18}
Zepto	z	10^{-21}
Yocto	y	10^{-24}

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Useful English to SI conversion factors

Physical quantity	English unit	SI unit
Length	1 in.	2.540 cm
	1 ft	0.3048 m
	1 mi (mile)	1.609 km
Mass	1 lbm (pound mass)	0.4536 kg
Force	1 lbf (pound force)	4.448 N
Temperature	Fahrenheit temperature (T_F)	$T_K = 5/9 \cdot (T_F - 32) + 273.15$
Pressure	1 lb/in^2 (psi)	6.895×10^3 Pa
	1 atm	1.013×10^5 Pa
Power	1 Btu/h	0.2929 W
	1 hp	745.7 W
Magnetic field	1 gauss	1.000×10^{-4} tesla

Statistics:

average:
$$\bar{x} = \frac{\sum_{i=1}^{N} x_i}{N}$$

geometric mean:
$$GM = \sqrt[N]{x_1 x_2 \ldots x_N}$$

variance:
$$v = \sigma^2 = \sum_{i=1}^{N} \frac{(x_i - \bar{x})^2}{N-1}$$

standard deviation:
$$\sigma = \sqrt{v} = \sqrt{\sum_{i=1}^{N} \frac{(x_i - \bar{x})^2}{N-1}}$$

Error analysis:

total error:
$$E = \Delta X = \left| \frac{\partial X}{\partial v_1} \Delta v_1 \right| + \left| \frac{\partial X}{\partial v_2} \Delta v_2 \right| + \ldots + \left| \frac{\partial X}{\partial v_n} \Delta v_n \right|$$

rms error:
$$E_{rms} = \sqrt{ \left(\frac{\partial X}{\partial v_1} \Delta v_1 \right)^2 + \left(\frac{\partial X}{\partial v_2} \Delta v_2 \right)^2 + \ldots + \left(\frac{\partial X}{\partial v_n} \Delta v_n \right)^2 }$$