

Table 5 CONVERSION FACTORS

LENGTH

$$\begin{aligned}
 1 \text{ m} &= 10^{-3} \text{ km} = 10^2 \text{ cm} = 10^3 \text{ mm} = 10^6 \mu\text{m} = 10^9 \text{ nm} = 10^{10} \text{ \AA} \\
 1 \mu &= 1 \mu\text{m} = 10^{-6} \text{ m} = 10^{-4} \text{ cm} = 10^{-3} \text{ mm} = 10^3 \text{ m}\mu = 10^3 \text{ nm} = 10^4 \text{ \AA} \\
 1 \text{ m}\mu &= 1 \text{ nm} = 10^{-9} \text{ m} = 10^{-7} \text{ cm} = 10^{-6} \text{ mm} = 10 \text{ \AA} \\
 1 \text{ \AA} &= 10^{-10} \text{ m} = 10^{-8} \text{ cm} = 10^{-4} \mu = 10^{-1} \text{ m}\mu = 10^{-1} \text{ nm}
 \end{aligned}$$

AREA

$$1 \text{ m}^2 = 10^{-6} \text{ km}^2 = 10^4 \text{ cm}^2 = 10^6 \text{ mm}^2$$

VOLUME

$$\begin{aligned}
 1 \text{ m}^3 &= 10^{-9} \text{ km}^3 = 10^3 \text{ l} = 10^6 \text{ cm}^3 \\
 1 \text{ l} &= 10^3 \text{ ml} = 10^3 \text{ cm}^3 = 10^{-3} \text{ m}^3
 \end{aligned}$$

ANGULAR

$$\begin{aligned}
 1^\circ &= 1.74 \times 10^{-2} \text{ radian} = 2.78 \times 10^{-3} \text{ revolution} \\
 1 \text{ radian} &= 57.3^\circ = 1.59 \times 10^{-1} \text{ revolution} \\
 1 \text{ revolution} &= 360^\circ = 6.28 \text{ radians}
 \end{aligned}$$

MASS

$$\begin{aligned}
 1 \text{ kg} &= 10^3 \text{ g} = 10^6 \text{ mg} = 6.02 \times 10^{26} \text{ u} \\
 1 \text{ g} &= 10^{-3} \text{ kg} = 10^3 \text{ mg} = 6.02 \times 10^{23} \text{ u} \\
 1 \text{ u} &= 1.66 \times 10^{-24} \text{ g} = 1.66 \times 10^{-21} \text{ mg} = 1.66 \times 10^{-27} \text{ kg}
 \end{aligned}$$

TIME

$$\begin{aligned}
 1 \text{ hr} &= 60 \text{ min} = 3.6 \times 10^3 \text{ sec} \\
 1 \text{ min} &= 60 \text{ sec} = 1.67 \times 10^{-2} \text{ hr} \\
 1 \text{ sec} &= 1.67 \times 10^{-2} \text{ min} = 2.78 \times 10^{-4} \text{ hr}
 \end{aligned}$$

VELOCITY

$$\begin{aligned}
 1 \text{ km/hr} &= 10^3 \text{ m/hr} = 16.7 \text{ m/min} = 2.78 \times 10^{-1} \text{ m/sec} \\
 1 \text{ m/min} &= 10^2 \text{ cm/min} = 1.67 \times 10^{-2} \text{ m/sec} = 1.67 \text{ cm/sec} \\
 1 \text{ m/sec} &= 10^{-3} \text{ km/sec} = 3.6 \text{ km/hr} = 10^2 \text{ cm/sec}
 \end{aligned}$$

ACCELERATION

$$\begin{aligned}
 1 \text{ cm/sec}^2 &= 10^{-2} \text{ m/sec}^2 = 10^{-5} \text{ km/sec}^2 \\
 1 \text{ m/sec}^2 &= 10^2 \text{ cm/sec}^2 = 10^{-3} \text{ km/sec}^2 \\
 1 \text{ km/hr/sec} &= 10^3 \text{ m/hr/sec} = 2.78 \times 10^{-1} \text{ m/sec}^2 = 2.78 \times 10^1 \text{ cm/sec}^2 = 2.78 \times 10^2 \text{ mm/sec}^2
 \end{aligned}$$

FORCE

$$\begin{aligned}
 1 \text{ n} &= 10^5 \text{ dynes} \\
 1 \text{ dyne} &= 10^{-5} \text{ n}
 \end{aligned}$$

PRESSURE

$$\begin{aligned}
 1 \text{ atm} &= 760.00 \text{ mm Hg} = 1.013 \times 10^5 \text{ n/m}^2 = 1.013 \times 10^6 \text{ dynes/cm}^2 \\
 1 \text{ n/m}^2 &= 10 \text{ dynes/cm}^2 = 9.87 \times 10^{-6} \text{ atm}
 \end{aligned}$$

ENERGY

$$\begin{aligned}
 1 \text{ j} &= 10^7 \text{ ergs} = 2.39 \times 10^{-1} \text{ cal} = 2.39 \times 10^{-4} \text{ kcal} = 2.78 \times 10^{-7} \text{ kw hr} = 6.25 \times 10^{18} \text{ ev} \\
 1 \text{ cal} &= 10^{-3} \text{ kcal} = 4.19 \text{ j} = 1.16 \times 10^{-6} \text{ kw hr} \\
 1 \text{ kcal} &= 10^3 \text{ cal} = 4.19 \times 10^3 \text{ j} = 1.16 \times 10^{-3} \text{ kw hr} \\
 1 \text{ ev} &= 10^{-6} \text{ Mev} = 1.60 \times 10^{-12} \text{ erg} = 1.60 \times 10^{-19} \text{ j} \\
 1 \text{ kw hr} &= 10^3 \text{ w hr} = 3.6 \times 10^3 \text{ kw sec} = 3.6 \times 10^6 \text{ w sec} = 8.6 \times 10^5 \text{ cal} \\
 1 \text{ w sec} &= 2.78 \times 10^{-4} \text{ w hr} = 2.78 \times 10^{-7} \text{ kw hr}
 \end{aligned}$$

MASS-ENERGY

$$\begin{aligned}
 1 \text{ j} &= 1.11 \times 10^{-17} \text{ kg} = 1.11 \times 10^{-14} \text{ g} = 6.69 \times 10^9 \text{ u} \\
 1 \text{ ev} &= 1.07 \times 10^{-9} \text{ u} = 1.78 \times 10^{-33} \text{ g} \\
 1 \text{ u} &= 1.49 \times 10^{-3} \text{ erg} = 1.49 \times 10^{-10} \text{ j} = 931 \text{ Mev} = 9.31 \times 10^8 \text{ ev} \\
 1 \text{ kg} &= 9.00 \times 10^{16} \text{ j} = 9.00 \times 10^{23} \text{ ergs}
 \end{aligned}$$

APPENDIX 7
Table for length conversion

Unit	mm	cm	m	km	in	ft	yd	mi
1 millimeter	1	0.1	0.001	10^{-6}	0.0397	0.00328	0.00109	6.21×10^{-7}
1 centimeter	10	1	0.01	0.0001	0.3937	0.0328	0.0109	6.21×10^{-6}
1 meter	1000	100	1	0.001	39.37	3.281	1.094	6.21×10^{-4}
1 kilometer	10^6	10^5	1000	1	39,370	3281	1093.6	0.621
1 inch	25.4	2.54	0.0254	2.54×10^{-5}	1	0.0833	0.0278	1.58×10^{-5}
1 foot	304.8	30.48	0.3048	3.05×10^{-4}	12	1	0.333	1.89×10^{-4}
1 yard	914.4	91.44	0.9144	9.14×10^{-4}	36	3	1	5.68×10^{-4}
1 mile	1.61×10^6	1.01×10^5	1.61×10^3	1.6093	63,360	5280	1760	1

APPENDIX 8
Table for area conversion

Unit	cm ²	m ²	km ²	ha	in ²	ft ²	yd ²	mi ²	ac
1 sq. centimeter	1	0.0001	10^{-10}	10^{-8}	0.155	1.08×10^{-3}	1.2×10^{-4}	3.86×10^{-11}	2.47×10^{-8}
1 sq. meter	10^4	1	10^{-6}	10^{-4}	1550	10.76	1.196	3.86×10^{-7}	2.47×10^{-4}
1 sq. kilometer	10^{10}	10^6	1	100	1.55×10^9	1.076×10^7	1.196×10^6	0.3861	247.1
1 hectare	10^8	10^4	0.01	1	1.55×10^7	1.076×10^5	1.196×10^4	3.861×10^{-3}	2.471
1 sq. inch	6.452	6.45×10^{-4}	6.45×10^{10}	6.45×10^{-8}	1	6.94×10^{-3}	7.7×10^{-4}	2.49×10^{-10}	1.574×10^{-7}
1 sq. foot	929	0.0929	9.29×10^{-8}	9.29×10^{-6}	144	1	0.111	3.587×10^{-8}	2.3×10^{-5}
1 sq. yard	8361	0.8361	8.36×10^{-7}	8.36×10^{-5}	1296	9	1	3.23×10^{-7}	2.07×10^{-4}
1 sq. mile	2.59×10^{10}	2.59×10^6	4.047×10^{-3}	0.4047	4.01×10^9	2.79×10^7	3.098×10^6	1.562×10^{-3}	640
1 acre	4.04×10^7	4047			6.27×10^6	43,560	4840		1

APPENDIX 9
Table for volume conversion

Unit	mL	liters	m ³	in ³	ft ³	gal	ac-ft	million gal
1 milliliter	1	0.001	10^{-6}	0.06102	3.53×10^{-5}	2.64×10^{-4}	8.1×10^{-10}	2.64×10^{-10}
1 liter	10^3	1	0.001	61.02	0.0353	0.264	8.1×10^{-7}	2.64×10^{-7}
1 cu. meter	10^6	1000	1	61,023	35.31	264.17	8.1×10^{-4}	2.64×10^{-4}
1 cu. inch	16.39	1.64×10^{-2}	1.64×10^{-5}	1	5.79×10^{-4}	4.33×10^{-3}	1.218×10^{-8}	4.329×10^{-9}
1 cu. foot	28,317	28.317	0.02832	1728	1	7.48	2.296×10^{-5}	7.48×10^{-6}
1 U.S. gallon	3785.4	3.785	3.78×10^{-3}	231	0.134	1	3.069×10^{-6}	10^6
1 acre-foot	1.233×10^9	1.233×10^6	1233.5	75.27×10^6	43,560	3.26×10^5	1	0.3260
1 million gallons	3.785×10^9	3.785×10^6	3785	2.31×10^8	1.338×10^5	10^6	3.0684	1

APPENDIX 10
Table for time conversion

Unit	sec	min	hours	days	years
1 second	1	1.67×10^{-2}	2.77×10^{-4}	1.157×10^{-5}	3.17×10^{-8}
1 minute	60	1	1.67×10^{-2}	6.94×10^{-4}	1.90×10^{-6}
1 hour	360	60	1	4.17×10^{-2}	1.14×10^{-4}
1 day	8.64×10^4	1440	24	1	2.74×10^{-3}
1 year	3.15×10^7	5.256×10^5	8760	365	1

Appendix 9.A. Continued Velocity

Unit	Equivalent ^{1,2}				
	feet per day	kilometers per hour	feet per second	miles per hour	meters per second
feet per day	1	1.27×10^{-5}	1.157×10^{-5}	7.891×10^{-6}	3.528×10^{-6}
kilometers per hour	7.874×10^4	1	0.9113	0.6214	0.2778
feet per second	8.64×10^4	1.097	1	0.6818	0.3048
miles per hour	1.267×10^5	1.609	1.467	1	0.447
meters per second	2.835×10^5	3.6	3.281	2.237	1

Mass

Unit	Equivalent ^{1,2}							
	ounce	pound	kilogram	metric slug	slug	short ton	metric ton	long ton
ounce	1	6.25×10^{-2}	2.835×10^{-2}	2.891×10^{-3}	1.943×10^{-3}	3.125×10^{-3}	2.835×10^{-3}	2.79×10^{-3}
pound	16	1	0.4536	4.625×10^{-2}	5×10^{-2}	5×10^{-4}	4.536×10^{-4}	4.464×10^{-4}
kilogram	35.28	2.205	1	0.102	6.852×10^{-2}	1.102×10^{-3}	0.001	9.842×10^{-4}
metric slug	345.9	21.62	9.807	1	0.6721	92.51	9.807×10^{-3}	9.651×10^{-3}
slug	514.7	32.17	14.59	1.49	1	62.17	1.459×10^{-2}	1.436×10^{-2}
short ton	3.2×10^4	2,000	907.2	92.51	62.16	1	0.907	0.8929
metric ton	3.528×10^4	2,205	1,000	102	68.52	1.103	1	0.9842
long ton	3.584×10^4	2,240	1,016	103.7	69.63	1.12	1.016	1

Force

Unit	Equivalent ^{1,2}			
	dyne	newton	pound _{force}	kilogram _{force}
dynes	1	1×10^{-5}	2.248×10^{-6}	1.02×10^{-6}
newtons	1×10^5	1	0.2248	0.102
pound _{force}	4.448×10^5	4.448	1	0.4536
kilogram _{force}	9.807×10^5	9.807	2.205	1

Density

Unit	Equivalent ^{1,2}				
	pounds per cubic inch	pounds per cubic foot	pounds per gallon	grams per cubic centimeter	grams per liter
pounds per cubic inch	1	1,728	231	27.68	2.768×10^4
pounds per cubic foot	5.787×10^{-4}	1	0.1337	1.6×10^{-2}	16.02
pounds per gallon	4.33×10^{-3}	7.481	1	0.1198	119.8
grams per cubic centimeter	3.61×10^{-3}	62.43	8.345	1	1,000
grams per liter	3.61×10^{-5}	6.24×10^{-2}	8.35×10^{-3}	0.001	1

APPENDIX 9.A. Conversion Tables

Length

Unit	Equivalent ^{1,2}					
	millimeters	inches	feet	meters	kilometers	miles
millimeters	1	3.937×10^{-2}	3.281×10^{-3}	1×10^{-3}	1×10^{-6}	6.214×10^{-7}
inches	25.4	1	8.33×10^{-2}	2.54×10^{-2}	2.54×10^{-5}	1.578×10^{-5}
feet	304.8	12	1	0.3048	3.048×10^{-4}	1.894×10^{-4}
meters	1,000	39.37	3.281	1	1×10^{-3}	6.214×10^{-4}
kilometers	1×10^6	3.937×10^4	3,281	1,000	1	0.6214
miles	1.609×10^6	6.336×10^4	5,280	1,609	1.609	1

Area

Unit	Equivalent ^{1,2}						
	square inches	square feet	square meters	acres	hectares	square kilometers	square miles
square inches	1	6.944×10^{-3}	6.452×10^{-4}	1.594×10^{-8}	6.452×10^{-8}	6.452×10^{-10}	2.491×10^{-10}
square feet	144	1	9.29×10^{-2}	2.296×10^{-5}	9.29×10^{-9}	9.29×10^{-8}	3.587×10^{-8}
square meters	1,550	10.76	1	2.471×10^{-4}	1×10^{-4}	1×10^{-6}	3.861×10^{-7}
acres	6.273×10^4	4.356×10^4	4,047	1	0.4047	4.047×10^{-3}	1.563×10^{-3}
hectares	1.55×10^5	1.076×10^5	1×10^4	2,471	1	0.01	3.861×10^{-3}
square kilometers	1.55×10^9	1.076×10^9	1×10^6	247.1	100	1	0.3861
square miles	4.014×10^9	2.788×10^9	2.59×10^6	640	259	2.59	1

Volume

Unit	Equivalent ^{1,2}						
	cubic inches	liters	gallons	cubic feet	cubic yards	cubic meters	acre-ft
cubic inches	1	1.639×10^{-2}	4.329×10^{-3}	5.787×10^{-4}	2.143×10^{-5}	1.639×10^{-5}	1.329×10^{-8}
liters	61.02	1	0.2642	3.531×10^{-2}	1.308×10^{-3}	0.001	8.106×10^{-7}
gallons	231.0	3.785	1	0.1337	4.951×10^{-3}	3.785×10^{-3}	3.068×10^{-6}
cubic feet	1,728	28.32	7.481	1	3.704×10^{-2}	2.832×10^{-3}	2.296×10^{-5}
cubic yards	4.666×10^4	764.6	202.0	27	1	0.7846	6.198×10^{-4}
cubic meters	6.102×10^4	1,000	264.2	35.31	1.308	1	8.106×10^{-4}
acre-ft	7.527×10^7	1.233×10^6	3.259×10^5	4.356×10^4	1,613	1,233	1

Discharge (flow rate, volume/time)

Unit	Equivalent ^{1,2}				
	gallons per minute	liters per second	acre-feet per day	cubic feet per second	cubic meters per day
gallons per minute	1	6.309×10^{-2}	4.419×10^{-3}	2.228×10^{-3}	5.45
liters per second	15.85	1	7.005×10^{-2}	3.531×10^{-2}	86.4
acre-feet per day	226.3	14.28	1	0.5042	1,234
cubic feet per second	448.8	28.32	1.983	1	2,447
cubic meters per day	1.369×10^9	8.64×10^7	6.051×10^6	3.051×10^6	1