GL01353

SI UNITS AND U.S. CUSTOMARY EQUIVALENTS

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SI unit		U.S. customary equivalent	
Length			
millimeter (mm)	=	0.039 37	inch (in)
meter (m)	=	3.281	feet (ft)
	=	1.094	yards (yd)
kilometer (km)	=	0.621 4	mile (mi)
	=	0.540 0	mile, nautical (nmi)
Area			
centimeter² (cm^2)	=	0.155 0	inch² (in^2)
meter² (m^2)	=	10.76	feet² (ft^2)
	=	1.196	yards² (yd^2)
	=	0.000 247 1	acre
hectometer² (hm^2)	=	2.471	acres
	=	0.003 861	section (640 acres or 1 mi^2)
kilometer² (km^2)	=	0.386 1	mile² (mi^2)
Volume			
centimeter³ (cm^3)	=	0.061 02	inch³ (in^3)
decimeter³ (dm^3)	=	61.02	inches³ (in^3)
	=	2.113	pints (pt)
	=	1.057	quarts (qt)
	=	0.264 2	gallon (gal)
	=	0.035 31	foot³ (ft^3)
meter³ (m^3)	=	35.31	feet³ (ft^3)
	=	1.308	yards³ (yd^3)
	=	264.2	gallons (gal)
	=	6.290	barrels (bbl) (petroleum, 1 bbl=42 gal)
	=	0.000 810 7	acre-foot (acre-ft)
hectometer³ (hm^3)	=	810.7	acre-feet (acre-ft)
kilometer³ (km^3)	=	0.239 9	mile³ (mi^3)
Volume per unit time (includes flow)			
decimeter³ per second (dm^3/s)	=	0.035 31	foot³ per second (ft^3/s)
	=	2.119	feet³ per minute (ft^3/min)
decimeter³ per second (dm^3/s)	=	15.85	gallons per minute (gal/min)
	=	543.4	barrels per day (bbl/d) (petroleum, 1 bbl=42 gal)
meter³ per second (m^3/s)	=	35.31	feet³ per second (ft^3/s)
	=	15 850	gallons per minute (gal/min)
Mass			
gram (g)	=	0.035 27	ounce avoirdupois (oz avdp)
kilogram (kg)	=	2.205	pounds avoirdupois (lb avdp)
megagram (Mg)	=	1.102	tons, short (2 000 lb)
	=	0.984 2	ton, long (2 240 lb)
Mass per unit volume (includes density)			
kilogram per meter³ (kg/m^3)	=	0.062 43	pound per foot³ (lb/ft^3)
Pressure			
kilopascal (kPa)	=	0.145 0	pound-force per inch² (lbf/in^2)
	=	0.009 869	atmosphere, standard (atm)
	=	0.01	bar
	=	0.296 1	inch of mercury at 60°F (in Hg)
Temperature			
temp kelvin (K)	=	[temp deg Fahrenheit (°F)+459.67]/1.8	
temp deg Celsius (°C)	=	[temp deg Fahrenheit (°F)−32]/1.8	

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$centimeter^2$ (cm^2)	=	0.155 0	$inch^2$ (in^2)
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	=	1.196	$yards^2$ (yd^2)
	=	0.000 247 1	acre
$hectometer^2$ (hm^2)	=	2.471	acres
	=	0.003 861	section (640 acres or 1 mi^2)
$kilometer^2$ (km^2)	=	0.386 1	$mile^2$ (mi^2)
Volume			
$centimeter^3$ (cm^3)	=	0.061 02	$inch^3$ (in^3)
$decimeter^3$ (dm^3)	=	61.02	$inches^3$ (in^3)
	=	2.113	pints (pt)
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1 QUAD = 10^{15} BTU

= 3.345×10^{4} Mw-yr

= 1.724×10^{8} bbl oil

Table 2.—Metric units used in this volume, conversion factors to other units, and some assumed values for physical parameters.

Length: 1 meter (m) = 3.281 ft; 1 kilometer (km) = 3,281 ft = 0.6214 mi; 1 centimeter (cm) = 0.3937 in. = 6.214×10^{-6} mi.

Area: 1 km^2 = $10^6 m^2$ = 0.3861 mi^2 = 247.1 acres.

Volume: 1 km^3 = 0.239 mi^3 = 10^{12} ℓ; 1 liter (ℓ) = 0.2642 gal; 1 ℓ/min = 5.886×10^{-4} ft^3/sec.

Temperature: °C = 5/9 (°F - 32); 0°C = 235.15°K.

Temperature gradient: 1°C/km = 10^{-3}°C/m rate of increase in temperature with depth: conductive gradient is directly proportional to heat flow and inversely proportional to thermal conductivity of the rocks.

Pressure: 1 bar = 0.9869 atm = 1.020 kg/cm^2 = 14.50 psi = 10^6 dynes/cm^2 = 0.1 meganewtons/m^2. All pressures absolute, with 1.01 bar added to gage pressure at sea level and geothermal areas at low altitudes.

Heat/power: 1 cal = 4.186 joules = 3.9685×10^{-3} BTU = 0.001 kcal = 0.00116 watt h; 1 cal/g = 1.80 BTU/lb. 1 MW (electric)·century = 7.53×10^{14} cal (thermal)/e_c, where e_c is conversion efficiency.

Coal assumed to have a potential heat content of 7.2×10^3 cal/g. A barrel of petroleum (42 gal) assumed to have potential heat of combustion of 1.45×10^9 cal = 5.8×10^6 BTU = 0.223 short tons coal. In this volume, heat contents stated in units of 10^{18} cal, with each unit equivalent in heat content of 690 million barrels of petroleum or 154 million short tons of coal.

Heat flow: 1×10^{-6} cal/cm^2 sec = 4.19×10^{-2} W/m^2 (watts per sq. meter); the world-wide average conductive heat flow is approximately 1.5×10^{-6} cal/cm^2 sec.

Thermal conductivity: 1×10^{-3} cal/cm sec °C = 0.418 W/m°K.

Mass: 1 g = 10^{-3} kg = 10^{-6} metric ton = 2.20×10^{-3} lb = 1.103×10^{-6} short ton.

Volumetric specific heat of pure water at standard temperature and pressure is 1.0 cal/cm^3°C and of average rocks, assumed 0.6 cal/cm^3/°C. Heat in granite magma at 900°C, crystallizing and cooling to ~15°C assumed to release ~300 cal/g or ~7 x 10^{17} cal/km^3; equivalent heat in molten basalt at 1,100°C is ~375 cal/g.

1 bbl = 5.8×10^6 BTU

1 QUAD = 3.345×10^4 MW-yr

NATIONAL GOALS FOR GEOTHERMAL POWER

A. ELECTRIC POWER GENERATION

1985	3000 — 4000 MWe	0.1 to 0.2 QUADS
2000	20,000 — 40000 MWe	0.5 to 2.0 "
2020	70,000 — 140000 MWe	6.0 to 50 "

B DIRECT HEAT

1985	0.2 to 0.3 QUADS/
2000	1.5 to 3.5 "
2020	50 to 100 "

1 QUAD = 10^{15} BTU ~ 170 MILLION BARRELS OF O
~ 35 MILLION TONS OF C

42 GAL. BARREL PETROLEUM POT'L HEAT OF COMBUSTION = 5.8×10^6 BTU

0.223 SHORT TONS OF COAL = 5.8×10^6 BTU.

1 @

1000 MWe ~ ONE NUCLEAR POWERPLANT ~ 1 MILLION PEOPLE

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Length:	1 meter (m) = 3.281 ft; 1 kilometer (km) = 3,291 ft = 0.6214 mi; 1 centimeter (cm) = 0.3937 in. = 6.214×10^{-6} mi.
Area:	1 km^2 = $10^6 m^2$ = 0.3861 mi^2 = 247.1 acres.
Volume:	1 km^3 = 0.239 mi^3 = 10^{12} ℓ; 1 liter (ℓ) = 0.2642 gal; 1 ℓ/min = 5.886×10^{-4} ft^3/sec.
Temperature:	°C = 5/9 (°F - 32); 0°C = 235.15°K.
Temperature gradient:	1°C/km = 10^{-3}°C/m rate of increase in temperature with depth: conductive gradient is directly proportional to heat flow and inversely proportional to thermal conductivity of the rocks.
Pressure:	1 bar = 0.9869 atm = 1.020 kg/cm^2 = 14.50 psi = 10^6 $dynes/cm^2$ = 0.1 meganewtons/m^2. All pressures absolute, with 1.01 bar added to gage pressure at sea level and geothermal areas at low altitudes.
Heat/power:	1 cal = 4.186 joules = 3.9685×10^{-3} BTU = 0.001 kcal = 0.00116 watt h; 1 cal/g = 1.80 BTU/lb. 1 MW (electric)-century = 7.53×10^{14} cal (thermal)/e_c, where e_c is conversion efficiency. Coal assumed to have a potential heat content of 7.2×10^3 cal/g. A barrel of petroleum (42 gal) assumed to have potential heat of combustion of 1.45×10^9 cal = 5.8×10^6 BTU = 0.223 short tons coal. In this volume, heat contents stated in units of 10^{18} cal, with each unit equivalent in heat content of 690 million barrels of petroleum or 154 million short tons of coal.
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Thermal conductivity:	1×10^{-3} cal/cm sec °C = 0.418 W/m°K.
Mass:	1 g = 10^{-3} kg = 10^{-6} metric ton = 2.20×10^{-3} lb = 1.103×10^{-6} short ton.

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Heat/power:	1 cal = 4.186 joules = 3.9685×10^{-3} BTU = 0.001 kcal = 0.00116 watt h; 1 cal/g = 1.80 BTU/lb. 1 MW (electric)-century = 7.53×10^{14} cal (thermal)/e_c, where e_c is conversion efficiency. Coal assumed to have a potential heat content of 7.2×10^3 cal/g. A barrel of petroleum (42 gal) assumed to have potential heat of combustion of 1.45×10^9 cal = 5.8×10^6 BTU = 0.223 short tons coal. In this volume, heat contents stated in units of 10^{18} cal, with each unit equivalent in heat content of 690 million barrels of petroleum or 154 million short tons of coal.
Heat flow:	1×10^{-6} cal/cm^2 sec = 4.19×10^{-2} W/m^2 (watts per sq. meter); the world-wide average conductive heat flow is approximately 1.5×10^{-6} cal/cm^2 sec
Thermal conductivity:	1×10^{-3} cal/cm sec °C = 0.418 W/m°K.
Mass:	1 g = 10^{-3} kg = 10^{-6} metric ton = 2.20×10^{-3} lb = 1.103×10^{-6} short ton.

Volumetric specific heat of pure water at standard temperature and pressure is 1.0 cal/cm^3°C and of average rocks, assumed 0.6 cal/cm^3/°C. Heat in granite magma at 900°C, crystallizing and cooling to ~15°C assumed to release ~300 cal/g or ~7 x 10^{17} cal/km^3; equivalent heat in molten basalt at 1,100°C is ~375 cal/g.

METRIC CONVERSION

DECIMAL INCHES = MILLIMETERS					
DECIMAL INCHES		MILLIMETERS	DECIMAL INCHES		MILLIMETERS
.001	=	.0254	.06	=	1.524
.002	=	.0508	.07	=	1.778
.003	=	.0762	.08	=	2.032
.004	=	.1016	.09	=	2.286
.005	=	.127	.1	=	2.54
.006	=	.1524	.2	=	5.08
.007	=	.1778	.3	=	7.62
.008	=	.2032	.4	=	10.16
.009	=	.2286	.5	=	12.7
.01	=	.254	.6	=	15.24
.02	=	.508	.7	=	17.78
.03	=	.762	.8	=	20.23
.04	=	1.016	.9	=	22.86
.05	=	1.27	1	=	25.4

INCHES = CENTIMETERS					
INCHES		CENTIMETERS	INCHES		CENTIMETERS
1	=	2.54	16	=	40.64
2	=	5.08	17	=	43.18
3	=	7.62	18	=	45.72
4	=	10.16	19	=	48.26
5	=	12.7	20	=	50.8
6	=	15.24	25	=	63.5
7	=	17.78	30	=	76.2
8	=	20.32	40	=	101.6
9	=	22.86	50	=	127
10	=	25.4	60	=	152.4
11	=	27.94	70	=	177.8
12	=	30.48	75	=	190.5
13	=	33.02	80	=	203.2
14	=	35.56	90	=	228.6
15	=	38.1	100	=	254

MILLIMETERS = DECIMAL INCHES		
MILLIMETERS		DECIMAL INCHES
1	=	.03937
2	=	.07874
3	=	.11811
4	=	.15748
5	=	.19685
6	=	.23622
7	=	.27559
8	=	.31496
9	=	.35433
10	=	.3937
25	=	.98425
50	=	1.9685
75	=	2.95276
100	=	3.937

To Convert To Metric		
To Convert From	To	Multiply By
	Length	
inches	centimeters	2.54
inches	meters	0.0254
feet	centimeters	30.48
yards	meters	0.9144
miles	kilometers	1.609

To Convert From Metric		
To Convert From	To	Multiply By
	Length	
millimeters	inches	0.03937
centimeters	inches	0.3937
meters	feet	3.2808
meters	yards	1.094
kilometers	miles	0.62137

CONVERSION TABLE OF TEMPERATURES

Locate temperature to be converted in center column. Read centigrade (Celsius) equivalents to left, Fahrenheit equivalents to right.

°C	°F or °C	°F
−56.7	−70	−94
−51.1	−60	−76
−45.6	−50	−58
−40.0	−40	−40
−34.4	−30	−22
−28.9	−20	−4
−23.3	−10	14
−17.8	0	32
−17.2	1	33.8
−16.7	2	35.6
−16.1	3	37.4
−15.6	4	39.2
−15.0	5	41
−14.4	6	42.8
−13.9	7	44.6
−13.3	8	46.4
−12.8	9	48.2
−12.2	10	50
−11.7	11	51.8
−11.1	12	53.6
−10.6	13	55.4
−10.0	14	57.2
−9.44	15	59
−8.89	16	60.8
−8.33	17	62.6
−7.78	18	64.4
−7.22	19	66.2
−6.67	20	68
−6.11	21	69.8
−5.56	22	71.6
−5.00	23	73.4
−4.44	24	75.2
−3.89	25	77
−3.33	26	78.8
−2.78	27	80.6
−2.22	28	82.4
−1.67	29	84.2
−1.11	30	86
−0.56	31	87.8
0	32	89.6
0.56	33	91.4
1.11	34	93.2
1.67	35	95
2.22	36	96.8
2.78	37	98.6
3.33	38	100.4
3.89	39	102.2
4.44	40	104
5.00	41	105.8
5.56	42	107.6
6.11	43	109.4
6.67	44	111.2
7.22	45	113
7.78	46	114.8
8.33	47	116.6
8.89	48	118.4
9.44	49	120.2
10.0	50	122
10.6	51	123.8
11.1	52	125.6
11.7	53	127.4
12.2	54	129.2
12.8	55	131
13.3	56	132.8
13.9	57	134.6
14.4	58	136.4
15.0	59	138.2
15.6	60	140
16.1	61	141.8
16.7	62	143.6
17.2	63	145.4
17.8	64	147.2
18.3	65	149
18.9	66	150.8
19.4	67	152.6
20.0	68	154.4
20.6	69	156.2
21.1	70	158
21.7	71	159.8
22.2	72	161.6
22.8	73	163.4
23.3	74	165.2
23.9	75	167
24.4	76	168.8
25.0	77	170.6
25.6	78	172.4
26.1	79	174.2
26.7	80	176
27.2	81	177.8
27.8	82	179.6
28.3	83	181.4
28.9	84	183.2
29.4	85	185
30.0	86	186.8
30.6	87	188.6
31.1	88	190.4
31.7	89	192.2
32.2	90	194
32.8	91	195.8
33.3	92	197.6
33.9	93	199.4
34.4	94	201.2
35.0	95	203
35.6	96	204.8
36.1	97	206.6
36.7	98	208.4
37.2	99	210.2
37.8	100	212
38.3	101	213.8
38.9	102	215.6
39.4	103	217.4
40.0	104	219.2
40.6	105	221
41.1	106	222.8
41.7	107	224.6
42.2	108	226.4
42.8	109	228.2
43.3	110	230
43.9	111	231.8
44.4	112	233.6
45.0	113	235.4
45.6	114	237.2
46.1	115	239
46.7	116	240.8
47.2	117	242.6
47.8	118	244.4
48.3	119	246.2
48.9	120	248
49.4	121	249.8
50.0	122	251.6
50.6	123	253.4
51.1	124	255.2
51.7	125	257
52.2	126	258.8
52.8	127	260.6
53.3	128	262.4
54.0	129	264.2
54.4	130	266
55.0	131	267.8
55.6	132	269.6
56.1	133	271.4
56.7	134	273.2
57.2	135	275
57.8	136	276.8
58.3	137	278.6
58.9	138	280.4
59.4	139	282.2
60.0	140	284
60.6	141	285.8
61.1	142	287.6
61.7	143	289.4
62.2	144	291.2
62.8	145	293
63.3	146	294.8
63.9	147	296.6
64.4	148	298.4
65.0	149	300.2
65.6	150	302
66.1	151	303.8
66.7	152	305.6
67.2	153	307.4
67.8	154	309.2
68.3	155	311
68.9	156	312.8
69.4	157	314.6
70.0	158	316.4
70.6	159	318.2
71.1	160	320
71.7	161	321.8
72.2	162	323.6
72.8	163	325.4
73.3	164	327.2
73.9	165	329
74.4	166	330.8
75.0	167	332.6
75.6	168	334.4
76.1	169	336.2
76.7	170	338
77.2	171	339.8
77.8	172	341.6
78.3	173	343.4
78.9	174	345.2
79.4	175	347
80.0	176	348.8
80.6	177	350.6
81.1	178	352.4
81.7	179	354.2
82.2	180	356
82.8	181	357.8
83.3	182	359.6
84.0	183	361.4
84.4	184	363.2
85.0	185	365
85.6	186	366.8
86.1	187	368.6
86.7	188	370.4
87.2	189	372.2
87.8	190	374
88.3	191	375.8
89.0	192	377.6
89.4	193	379.4
90.0	194	381.2
90.6	195	383
91.1	196	384.8
91.7	197	386.6
92.2	198	388.4
92.8	199	390.2
93.3	200	392
94.0	201	393.8
94.4	202	395.6
95.0	203	397.4
95.6	204	399.2
96.1	205	401
96.7	206	402.8
97.2	207	404.6
97.8	208	406.4
98.3	209	408.2
99.0	210	410
99.4	211	411.8
100.0	212	413.6
100.6	213	415.4
101.1	214	417.2
101.7	215	419
102.2	216	420.8
102.8	217	422.6
103.3	218	424.4
103.9	219	426.2
104.4	220	428
105.0	221	429.8
105.6	222	431.6
106.1	223	433.4
106.7	224	435.2
107.2	225	437
107.8	226	438.8
108.3	227	440.6
108.9	228	442.4
109.4	229	444.2
110.0	230	446
110.6	231	447.8
111.1	232	449.6
111.7	233	451.4
112.2	234	453.2
112.8	235	455
113.3	236	456.8
113.9	237	458.6
114.4	238	460.4
115.0	239	462.2
115.6	240	464
116.1	241	465.8
116.7	242	467.6
117.2	243	469.4
117.8	244	471.2
118.3	245	473
118.9	246	474.8
119.4	247	476.6
120.0	248	478.4
120.6	249	480.2
121.1	250	482
126.7	260	500
132.2	270	518
137.8	280	536
143.3	290	554
149	300	572
154.4	310	590
160	320	608
165.6	330	626
171	340	644
176.7	350	662