



**1970**  
**TECHNICAL DATA**  
**COMPANION**

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NAME

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STREET

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CITY

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STATE

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PHONE

**GENERAL**  **ELECTRIC**

**ELECTRONIC COMPONENTS DIVISION**

## **As A Valued Customer . . .**

. . . your continued success in 1970 bears our most sincere wishes. We are anxious to serve you in every way possible—to our mutual interests and in the interests of the entire electronics industry.

It is a pleasure to present to you this new 1970 Pocket Planner with its convenient reference information and useful tables. As a leader in electronics, the General Electric Company makes available to you extensive research, development and production facilities.

It is our aim to bring to you the products you need—quickly and efficiently.

Sincerely,

L. C. MAIER, JR., *General Manager*

### **ELECTRONIC COMPONENTS DIVISION**

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The Electronic Components Division of the General Electric Company offers a wide line of products and a diversity of application and service assistance. The Electronic Components Division includes the following departments and operations:

**Electronic Capacitor and Battery Department  
Electronic Component Sales Operation  
Industrial and Power Capacitor Department  
Integrated Circuits Project  
Semiconductor Products Department  
Tube Department**

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A guide to products and services and an ECSO sales offices listing are shown on the back cover.

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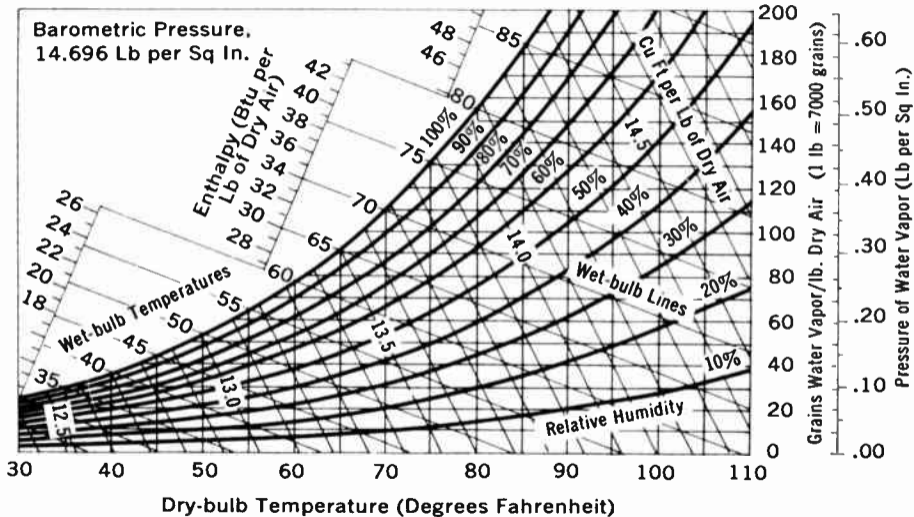
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General information and technical data is contained in the center section of this book. A comprehensive Index to this section is contained on page 18.

2A



# G-E PSYCHROMETRIC CHART

# AIR CONDITIONING DATA

## Basis for Estimating Operating Cost

Outdoor design temperatures and estimated hours of operation for properly sized residential cooling and heating equipment in typical cities. (From ASHRAE Guide, NWAHACA Data and others).

Winter Design DB Temp. °F	Heating Hours*	City	Cooling Hours**	Summer Design DB Temp. °F	Design Wet Bulb Temp. °F
-10	2250	....Albany, N.Y. ....	200	90	75
10	1500	....Albuquerque, N.M. ....	600	96	70
10	1250	....Atlanta, Ga. ....	750	93	77
8	1750	....Baltimore, Md. ....	700	91	78
12	1125	....Birmingham, Ala. ....	1200	95	78
-2	2200	....Boston, Mass. ....	200	89	74
-10	2000	....Chicago, Ill. ....	400	92	76
-1	1750	....Cincinnati, Ohio ....	850	94	78
-2	2100	....Cleveland, Ohio ....	450	90	75
-3	1750	....Columbus, Ohio ....	600	91	76
14	1000	....Dallas, Texas ....	1400	99	78
-10	1750	....Denver, Colo. ....	350	91	64
-5	2175	....Detroit, Mich. ....	450	89	75
20	1200	....El Paso, Texas ....	950	95	69
-5	2000	....Ft. Wayne, Ind. ....	650	91	76
22	650	....Houston, Texas ....	1450	94	80
-10	1750	....Indianapolis, Ind. ....	800	91	77
15	1000	....Jackson, Miss. ....	1150	96	79
30	750	....Jacksonville, Fla. ....	1600	94	79
-10	1675	....Kansas City, Mo. ....	900	96	77
10	1250	....Little Rock, Ark. ....	1200	97	79
0	1675	....Louisville, Ky. ....	900	95	78
5	1500	....Memphis, Tenn. ....	1050	96	79
45	200	....Miami, Florida ....	1700	90	79
-15	2175	....Milwaukee, Wisc. ....	350	87	75
-22	2250	....Minneapolis, Minn. ....	350	90	76
20	750	....Mobile, Ala. ....	1300	94	80
0	1875	....Newark, N.J. ....	350	91	76
25	675	....New Orleans, La. ....	1500	92	80
15	1500	....Norfolk, Va. ....	1500	92	78
2	1875	....New York, N.Y. ....	350	91	76
0	1275	....Oklahoma City, Okla. ..	1050	97	77
-15	1875	....Omaha, Neb. ....	800	94	78
5	1875	....Philadelphia, Pa. ....	400	91	77
28	1000	....Phoenix, Arizona ....	1300	107	76
-5	1800	....Pittsburgh, Pa. ....	400	87	74
15	1375	....Raleigh, N.C. ....	1050	95	78
-5	2300	....Rochester, N.Y. ....	350	88	74
-5	1675	....St. Louis, Mo. ....	1000	95	78
0	2250	....Salt Lake City, Utah....	600	93	66
21	750	....San Antonio, Texas ....	1300	97	77
0	1375	....Tulsa, Oklahoma ....	1050	97	78
10	1000	....Tyler, Texas ....	1350	100	78
6	1750	....Washington, D.C. ....	900	92	77

\*Approximate number of hours a heating plant will operate throughout the season. Based on 70°F indoor temperature.

\*\*Estimated hours requiring cooling. Based on indoor temperature of 80°F for a typical home without excessive solar exposure unless protected by overhang, shades, awnings, etc.

# AIR CONDITIONING DATA

## Refrigerant Pressure vs. Temperature

In last four columns, figures in bold face are inches vacuum those in roman type are gage pressure in lb per sq in.

ASHRAE Std. Refrigerant

Temp. (Deg F)	R12	R22	R500	R502	(Ammonia) R-717
-25	2.3*	7.4	1.2	12.3	1.3
-20	0.6	10.1	3.1	15.5	3.6
-15	2.4	13.2	5.3	13.1	6.1
-10	4.5	16.4	7.8	22.8	9.0
- 5	6.8	20.0	10.4	26.8	12.2
0	9.2	23.9	13.3	31.2	15.7
5	11.8	28.1	16.4	36.0	19.6
10	14.6	32.7	19.8	41.1	23.8
15	17.7	37.7	23.4	46.5	28.5
20	21.0	43.03	27.3	52.4	33.5
25	24.7	48.7	31.3	58.7	39.0
30	28.5	54.9	36.1	65.4	45.0
35	32.6	61.5	41.0	72.6	52.6
40	37.0	68.5	46.2	80.2	58.6
45	41.7	76.0	51.9	88.3	66.3
50	46.7	84.0	57.8	96.9	74.5
55	52.0	92.6	63.3	106.0	83.4
60	57.7	101.6	70.9	115.6	92.9
65	63.8	111.2	78.1	125.8	103.1
70	70.2	121.4	85.8	136.6	114.1
75	77.0	132.2	93.8	147.9	125.8
80	84.1	143.6	102.5	159.9	138.3
85	91.8	155.6	111.5	172.5	151.7
90	99.8	168.4	121.2	185.8	165.9
95	108.3	181.8	131.2	199.7	181.1
100	117.2	195.9	141.9	214.4	197.2
105	126.6	210.7	153.5	229.9	214.2
110	136.4	226.3	164.9	245.8	232.3
115	146.8	242.7	178.3	262.1	251.5
120	157.7	259.9	190.3	280.3	271.7
125	169.1	277.9	203.0	298.7	293.1
130	181.0	296.8	218.2	318.0	
135	193.5	316.5	233.2	338.2	
140	206.6	337.2	248.8	359.2	

\*Inches mercury below one atmosphere

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## 1970 Technical Data Companion STANDARD DATA

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# CONVERSION

TO CONVERT FROM	TO	MULTIPLY BY #
Angstrom unit	centimeters	1.000 E - 08
Atmospheres	mm of mercury	
	at 0° C	7.600 E + 02
	pounds/sq. in.	1.470 E + 01
	kilograms/sq. m.	1.033 E + 04
Atomic mass unit	mass of electron	5.486 E - 04
	mass of proton	1.0073 E + 00
	mass of neutron	1.0087 E + 00
	mass of A particle	4.0029 E + 00
	H <sub>1</sub> atom mass	1.0081 E + 00
Bars	dynes/cm.	1.000 E + 06
Btu*	foot-pounds	7.776 E + 02
	horsepower-hours	3.928 E - 04
	kilopond-meters	1.075 E + 02
	kilogram-calories*	2.520 E - 01
	kilowatt-hours	2.929 E - 04
	horsepower	3.928 E - 04
Btu*/hour	horsepower	3.928 E - 04
Btu*/(hour-sq. ft.)/ (°F/in.)	(gram-cal.*/sec.-sq. cm.)/ (°C/cm.)	3.445 E - 04
Btu*/minute	foot-pounds/sec.	1.296 E + 01
	horsepower	2.357 E - 02
	kilowatts	1.757 E - 02
Btu*/second	kilopond-meters/sec.	1.075 E + 02
	kilowatts	1.054 E + 00
Btu*/sq. ft.	gram-cal.*/sq. cm.	2.712 E - 01
Centimeters Hg (0°C)	pounds/sq. inch	1.9337 E - 01
	inches of water	5.353 E + 00
Centipoises	pound/foot-hours	2.420 E + 00
Circular mils	square mils	7.854 E - 01
Cubic feet/minute	gallons/second	1.247 E - 01
	cubic cm/sec.	4.720 E + 02
Cubic feet/pound	cu. cm/g	6.243 E + 01
Cubic feet/second	gallons/minute	4.488 E + 02
Cubic meters	cubic feet	3.531 E + 01
Degrees	radians	1.745 E - 02
Degrees/second	revolutions/minute	1.667 E - 01

# E is the power of 10 by which the number must be multiplied, i.e., 4.047 E + 03 = 4.047 × 10<sup>3</sup>.

\*Thermochemical.



# FACTORS

TO CONVERT FROM	TO	MULTIPLY BY #
Dynes	grams	1.0197 E - 03
	poundals	7.233 E - 05
Dyne-centimeters	pounds-feet	7.380 E - 08
Dynes/sq. centimeter	atmospheres	9.869 E - 07
Electron volts	gram-calories*	3.829 E - 20
	gram-cal*/mole	2.305 E + 04
	cm <sup>-1</sup> (wave no.)	8.06 E + 03
	kwh	4.45 E - 26
	microns wavelength	1.240 E + 00
Feet of H <sub>2</sub> O at 39.2°F	inches of Hg at 32°F	8.825 E - 01
Foot-pounds	Btu*	1.286 E - 03
	kilowatt-hours	3.766 E - 07
Foot-pounds/sec.	Btu*/min	7.716 E - 02
Gallons (U.S. Liquid)	cubic inches	2.310 E + 02
	cubic feet	1.337 E - 01
Gal/min (of water)	pound/hr of water	5.008 E + 02
Gram-calories*	Btu	3.968 E - 03
Gram-cal*/sq. cm	Btu*/sq. ft.	3.687 E + 00
Gram-cm	Btu*	9.301 E - 08
	ergs	9.807 E + 02
Gram-mole Gas	cubic cm. gas (0°C & 760mm)	2.240 E + 04
Grams	dynes	9.807 E + 02
	pounds	2.205 E - 03
Grams of matter	electron volt	5.61 E + 32
Grams/cu cm	pounds/cu inch	3.613 E - 02
	pounds/cu foot	6.243 E + 01
Grams/sq cm	centimeters of Hg	7.356 E - 02
	atmosphere	9.678 E - 04
	pounds/sq ft	2.048 E + 00
Horsepower (mech)	foot-pounds/sec	5.500 E + 02
	kilowatts	7.457 E - 01
Horsepower hours	Btu*	2.546 E + 03
	joule (abs)	2.685 E + 06
	kilogram-cal*	6.416 E + 02
In of Hg. at 32°F	pounds/sq. in.	4.912 E - 01

# E is the power of 10 by which the number must be multiplied, i.e., 4.047 E + 03 = 4.047 × 10<sup>3</sup>.

\*Thermochemical.

## CONVERSION FACTORS

TO CONVERT FROM	TO	MULTIPLY BY #
In of H <sub>2</sub> O at 39.2°F (4°C) .....	centimeters of Hg .....	1.868 E - 01
	pounds/sq. ft. ....	5.202 E + 00
Joules (abs) .....	kilogram-calories* .....	2.390 E - 04
Kilogram-cal* .....	horsepower-hours .....	1.559 E - 03
Kilopond-meter .....	Btu* .....	9.301 E - 03
	ergs .....	9.807 E + 07
Kilowatt hours .....	average noon sunlight on 1 sq. m. ....	1.000 E + 00
	Btu* .....	3.414 E + 03
Kilowatt hours .....	horsepower hours .....	1.341 E + 00
Kilowatts .....	kilogram-cal.* / minute ..	1.434 E + 01
Liter-atmospheres ...	Btu* .....	9.610 E - 02
Liters/kilogram .....	cubic ft./pound .....	1.602 E - 02
Liters/minute .....	cubic feet/sec .....	5.885 E - 04
	gallons/hour .....	1.585 E + 01
Lumens .....	watts+ .....	1.470 E - 03
Newtons .....	dynes .....	1.000 E + 05
Newton-meters .....	joules (abs.) .....	1.000 E + 00
Pound-Celsius (Centigrade) Unit ...	Btu* .....	1.800 E + 00
Pound-mol gas .....	cubic feet of gas (60°F at 1 atm) .....	3.794 E + 02
Pounds of H <sub>2</sub> O (4°C)....	gallons of H <sub>2</sub> O .....	1.198 E - 01
Pounds of H <sub>2</sub> O at 64°F .....	cubic feet of H <sub>2</sub> O .....	1.603 E - 02
Pounds/gallon .....	grams/cu. cm. ....	1.198 E - 01
Pounds/sq. in. ....	atmospheres .....	6.805 E - 02
Radian .....	degrees .....	5.730 E + 01
Radians/sec .....	revolutions/sec .....	1.592 E - 01
Torr (Torr) .....	mm of Hg (0°C) .....	1.000 E + 00
Volt-coulomb .....	joules .....	1.000 E + 00
Watt-hour .....	Btu* .....	3.414 E + 00
Watts+ .....	foot-lb/minute .....	4.425 E + 01
	horsepower .....	1.341 E - 03
	lumens .....	6.800 E + 02

# E is the power of 10 by which the number must be multiplied, i.e., 4.047 E + 03 = 4.047 × 10<sup>3</sup>.

\*Thermochemical. + Radiant watts at 5550 Å°

# FACTORS FOR CONVERSION TO INTERNATIONAL SYSTEM (SI) UNITS

Conversion Factors—International System (SI) Units  
(from National Bureau of Standards Handbook 102)

**TO CONVERT FROM                      TO                      MULTIPLY BY #**

### Acceleration

Ft/sec <sup>2</sup> .....	meter/sec <sup>2</sup> .....	3.048 E-01
In/sec <sup>2</sup> .....	meter/sec <sup>2</sup> .....	2.540 E-02

### Area

Acre .....	meter <sup>2</sup> .....	4.047 E+03
Ft <sup>2</sup> .....	meter <sup>2</sup> .....	9.290 E-02
In <sup>2</sup> .....	meter <sup>2</sup> .....	6.452 E-04
Mile <sup>2</sup> (statute) .....	meter <sup>2</sup> .....	2.590 E+06
Yard <sup>2</sup> .....	meter <sup>2</sup> .....	8.361 E-01

### Torque

dyne-cm .....	newton meter .....	1.000 E-07
kgf-meter .....	newton meter .....	9.807 E+00
lbf-inch .....	newton meter .....	1.130 E-01
lbf-foot .....	newton meter .....	1.356 E+00
ozf-inch .....	newton meter .....	7.062 E-03

### Torque/Length

lbf-ft/in .....	newton-m/m .....	5.338 E+01
lbf-in/in .....	newton-m/m .....	4.448 E+00

### Electricity and Magnetism

amp hr .....	coulomb .....	3.600 E+03
faraday (chem) .....	coulomb .....	9.650 E+04
gauss .....	tesla .....	1.000 E-04
gilbert .....	amp-turn .....	7.958 E-01
maxwell .....	weber .....	1.000 E-08
oersted .....	amp/meter .....	7.958 E+01
unit pole .....	weber .....	1.257 E-07

### Energy (Includes Work)

Btu* .....	joule .....	1.054 E+03
calorie* .....	joule .....	4.184 E+00
electron volt .....	joule .....	1.602 E-19
erg .....	joule .....	1.000 E-07
ft-lb-force .....	joule .....	1.356 E+00
kilowatt-hr .....	joule .....	3.600 E+06
watt-sec .....	joule .....	1.000 E+00

### Energy/Area Time

Btu*/ft <sup>2</sup> min .....	watt/meter <sup>2</sup> .....	1.891 E+02
Btu*/ft <sup>2</sup> hr .....	watt/meter <sup>2</sup> .....	3.152 E+00
cal*/cm <sup>2</sup> min .....	watt/meter <sup>2</sup> .....	6.973 E+02

\* Thermochemical. # E indicates the power of 10 by which the number must be multiplied, i.e., 4.047 + 03 = 4.047 × 10<sup>3</sup>.

TO CONVERT FROM	TO	MULTIPLY BY #
<b>Force</b>		
dyne .....	newton .....	1.000 E-05
kg-force .....	newton .....	9.807 E+00
oz-force (av) .....	newton .....	2.780 E-01
lb-force (av) .....	newton .....	4.448 E+00
lb-force (av) .....	kilogram-force .....	4.536 E-01
<b>Force/Length</b>		
lb-force/in .....	newton/meter .....	1.751 E+02
lb-force/ft .....	newton/meter .....	1.459 E+01
<b>Heat</b>		
Btu* in/sec ft <sup>2</sup> deg F .....	watt/meter deg K .....	5.189 E+02
Btu* in/hr ft <sup>2</sup> deg F .....	watt/meter deg K .....	1.441 E-01
Btu*/ft <sup>2</sup> .....	joule/meter <sup>2</sup> .....	1.135 E+04
Btu*/hr ft <sup>2</sup> deg F .....	watt/meter <sup>2</sup> deg K .....	5.674 E+00
Btu*/lbm deg F .....	joule/kg deg K .....	4.184 E+03
Btu*/sec ft <sup>2</sup> deg F .....	watt/meter <sup>2</sup> deg K .....	2.043 E+04
cal/cm <sup>2</sup> .....	joule/meter <sup>2</sup> .....	4.184 E+04
cal/cm <sup>2</sup> sec .....	watt/meter <sup>2</sup> .....	4.184 E+04
cal/cm sec deg C .....	watt/meter deg K .....	4.184 E+02
cal*/g .....	joule/kg .....	4.184 E+03
cal*/g deg C .....	joule/kg deg K .....	4.184 E+03
<b>Length</b>		
astronomical unit .....	meter .....	1.496 E+11
foot .....	meter .....	3.048 E-01
inch .....	meter .....	2.540 E-02
light year .....	meter .....	9.461 E+15
mil .....	meter .....	2.540 E-05
mile (statute) .....	meter .....	1.609 E+03
yard .....	meter .....	9.144 E-01
<b>Light</b>		
ft-candle .....	lumen/meter <sup>2</sup> .....	1.076 E+01
ft-candle .....	lux .....	1.076 E+01
ft-lambert .....	candela/meter <sup>2</sup> .....	3.426 E+00
lux .....	lumen/meter <sup>2</sup> .....	1.000 E+00
<b>Mass</b>		
oz mass (av) .....	kilogram .....	2.835 E-02
lb-mass (av) .....	kilogram .....	4.536 E-01
ton (2000 lbm) .....	kilogram .....	9.072 E+02
<b>Mass/Volume (Includes Density)</b>		
lbm/ft <sup>3</sup> .....	kilogram/meter <sup>3</sup> .....	1.602 E+01
lbm/in <sup>3</sup> .....	kilogram/meter <sup>3</sup> .....	2.768 E+04
oz mass (av)/in <sup>3</sup> .....	kilogram/meter <sup>3</sup> .....	1.730 E+03
lb-mass (av)/gal .....	kilogram/meter <sup>3</sup> .....	1.198 E+02
<b>Power</b>		
Btu*/sec .....	watt .....	1.054 E+03
Btu*/min .....	watt .....	1.757 E+01
Btu*/hr .....	watt .....	2.929 E-01

\* Thermochemical. # E indicates the power of 10 by which the number must be multiplied, i.e., 4.047 + 03 = 4.047 × 10<sup>3</sup>.

TO CONVERT FROM	TO	MULTIPLY BY #
Cal*/sec .....	watt .....	4.184 E+00
Cal*/min .....	watt .....	6.973 E-02
erg/sec .....	watt .....	1.000 E-07
ft-lb force/hr .....	watt .....	3.766 E-04
ft-lb force/min .....	watt .....	2.260 E-02
ft-lb force/sec .....	watt .....	1.356 E+00
hp (elec) .....	watt .....	7.460 E+02

#### Pressure (Force/Area)

atm (760 torr) .....	newton/meter <sup>2</sup> .....	1.013 E+05
bar .....	newton/meter <sup>2</sup> .....	1.000 E+05
dyne/cm <sup>2</sup> .....	newton/meter <sup>2</sup> .....	1.000 E-01
gram (force)/cm <sup>2</sup> .....	newton/meter <sup>2</sup> .....	9.807 E+01
in of Hg (60 F) .....	newton/meter <sup>2</sup> .....	3.377 E+03
in of water (60 F) .....	newton/meter <sup>2</sup> .....	2.488 E+02
mm of Hg (0 C) .....	newton/meter <sup>2</sup> .....	1.333 E+02
lb-force/ft <sup>2</sup> .....	newton/meter <sup>2</sup> .....	4.788 E+01
lbf/in <sup>2</sup> (psi) .....	newton/meter <sup>2</sup> .....	6.895 E+03
lbf/in <sup>2</sup> (psi) .....	kgf/mm <sup>2</sup> .....	7.031 E-04
torr (mm Hg, 0 C) .....	newton/meter <sup>2</sup> .....	1.333 E+02

#### Velocity (Includes Speed)

ft/hr .....	meter/sec .....	8.467 E-05
ft/min .....	meter/sec .....	5.080 E-03
ft/sec .....	meter/sec .....	3.048 E-01
in/sec .....	meter/sec .....	2.540 E-02
mile/hr .....	meter/sec .....	4.470 E-01
mile/min .....	meter/sec .....	2.682 E+01
mile/sec .....	meter/sec .....	1.609 E+03
mile/hr .....	km/hr .....	1.609 E+00

#### Viscosity

ft <sup>2</sup> /sec .....	meter <sup>2</sup> /sec .....	9.290 E-02
poise .....	newton sec/m <sup>2</sup> .....	1.000 E-01
lbm/ft sec .....	newton sec/m <sup>2</sup> .....	1.488 E+00
lbf sec/ft <sup>2</sup> .....	newton sec/m <sup>2</sup> .....	4.788 E+01
stoke .....	meter <sup>2</sup> /sec .....	1.000 E-04

#### Volume (Includes Capacity)

bushel (US) .....	meter <sup>3</sup> .....	3.524 E-02
ft <sup>3</sup> .....	meter <sup>3</sup> .....	2.832 E-02
gallon (US) .....	meter <sup>3</sup> .....	3.785 E-03
inch <sup>3</sup> .....	meter <sup>3</sup> .....	1.639 E-05
liter (new) .....	meter <sup>3</sup> .....	1.000 E-03
oz (US fluid) .....	meter <sup>3</sup> .....	2.957 E-05
stere .....	meter <sup>3</sup> .....	1.000 E+00
yd <sup>3</sup> .....	meter <sup>3</sup> .....	7.646 E-01

#### Volume/Time (Includes Flow)

ft <sup>3</sup> /min .....	meter <sup>3</sup> /sec .....	4.719 E-04
ft <sup>3</sup> /sec .....	meter <sup>3</sup> /sec .....	2.832 E-02
in <sup>3</sup> /min .....	meter <sup>3</sup> /sec .....	2.731 E-07
gal/min .....	meter <sup>3</sup> /sec .....	6.309 E-05

\* Thermochemical. # E indicates the power of 10 by which the number must be multiplied, i.e., 4.047 + 03 = 4.047 × 10<sup>3</sup>.

## GREEK-ENGLISH ALPHABET

	Greek	English		Greek	English	
	α	A alpha	a	ν	N nu	n
	β	B beta	b	ξ	Ξ xi	x
	γ	Γ gamma	g	ο	Ο omicron	o
	δ	Δ delta	d	π	Π pi	p
	ε	Ε epsilon	e	ρ	Ρ rho	r
	ζ	Ζ zeta	z	σ	Σ sigma	s
	η	Η eta	e	τ	Τ tau	t
	θ	Θ theta	th	υ	Υ upsilon	n
	ι	Ι iota	i	φ	Φ phi	ph
	κ	Κ kappa	k	χ	Χ chi	ch
	λ	Λ lambda	l	ψ	Ψ psi	ps
	μ	Μ mu	m	ω	Ω omega	o

## NUCLEAR CONVERSION FACTORS

- 1 Atomic Mass Unit (AMU) =  $1.66042 \times 10^{-24}$  g  
= 931.48 Mev
- 1 Fission = 200 Mev =  $3.2 \times 10^{-11}$  watt-sec.
- 1 g  $U^{235}$  =  $2.56 \times 10^{21}$  fissionable nuclei  
= 20 tons of TNT = 9 tons coal (high efficiency  
central station plant)
- 1 g  $U^{235}$  in fission =  $8.2 \times 10^{10}$  watt-sec.
- 1 kw-hr. =  $4.2 \times 10^{-5}$  g  $U^{235}$  in fission
- 1 Megawatt Day (MWD) = 1.05 g  $U^{235}$  in fission  
= 1.25 g  $U^{235}$  destroyed\*
- 1 percent fuel burnup =  $7.3 \times 10^3$  MWD/ton\*\*
- 1 Fermi = 1 Barn (cross section) =  $10^{-24}$  cm<sup>2</sup>
- 1 Rutherford =  $10^6$  Disintegrations/sec.
- 1 Curie =  $3.7 \times 10^{10}$  Disintegrations/sec.
- 1 Roentgen (r) = X or  $\gamma$  radiation producing 1esu/cm<sup>3</sup>  
charge of either sign in STP air  
= 85 ergs/g of air absorbed energy
- 1 rad = 100 ergs/g absorbed energy\*\*\*

\*For a typical thermal reactor, taking into account conversion of  $U^{235}$  to  $U^{234}$ .

\*\*In mixture of fissionable and fertile isotopes.

\*\*\*Any type of radiation in any material.

# SOLAR SYSTEM TERRESTRIAL PLANET DATA

MERCURY VENUS EARTH MOON MARS

## Orbital Data,

	MERCURY	VENUS	EARTH	MOON	MARS
10 <sup>6</sup> mi .....					
Mean to Sun .....	36.2	67.2	93.0	0.239*	141.6
Max to Sun .....	43.6	67.7	94.6		155
Min to Sun .....	28.7	66.7	91.4		128
Max from Earth ...	137	160		0.253	249
Min from Earth ...	49	26		0.221	35
Eccentricity .....	0.206	0.007	0.017	0.055	0.093
Inclination, deg ...	7.00*	3.39*	0	5.15*	1.85*
Period, days					
Sidereal (star)....	88	224.7	365.3	27.32	687
Synodic (Earth)..	116	583.9		29.53	780
Velocity, mi/sec....	30	21.8	18.5	0.635	15.0
Max angular diaΔ..	12.5s	65m		31m	25s

## Rotational Data

Period, days .....	59	243	0.997	27.32	1.026
Velocity, mi/sec#	0.001	0.001	0.29	1.04	0.16
Inclination, deg#..	7	6	23.45	1.53	25.0

## General Data

Diameter, mi .....	3020	7600	7918	2160	4180
Volume* .....	0.055	0.879	1.0	0.020	0.149
Mass* .....	0.054	0.816	1.0	0.012	0.108
Density, g/cm <sup>3</sup> .....	5.4	5.1	5.57	3.34	4.05
Gravity, ft/sec <sup>2</sup> ...	12	28.6	32.2	5.32	12.5
Escape vel, mi/sec	2.6	6.4	6.96	1.48	3.1
Escape vel, mi/hr..	9400	23000	25100	5320	11200

## Environment

Solar constant+ ..	16.0	3.69	1.92		0.83
Atm press, mb .....	<3	90‡	1013	<0.001	<20
Avg temp, F .....			41		
Max temp, F# .....	700	900	171	230	100
Min temp, F# .....	-440		59	-260	-90

\* Relative to Earth

# Equatorial

+ cal/cm<sup>2</sup>min

‡ atmospheres

Δ arc sec(s) or arc min(m)

# NATURAL TRIGONOMETRIC FUNCTIONS

Angle	Sin	Tan	Cot	Cos	Deg
0	0.0000	0.0000	$\infty$	1.0000	90
1	0.0175	0.0175	57.2900	0.9998	89
2	0.0349	0.0349	28.6363	0.9994	88
3	0.0523	0.0524	19.0811	0.9986	87
4	0.0698	0.0699	14.3007	0.9976	86
5	0.0872	0.0875	11.4300	0.9962	85
6	0.1045	0.1051	9.5144	0.9945	84
7	0.1219	0.1228	8.1443	0.9925	83
8	0.1392	0.1405	7.1154	0.9903	82
9	0.1564	0.1584	6.3138	0.9877	81
10	0.1736	0.1763	5.6713	0.9848	80
11	0.1908	0.1944	5.1446	0.9816	79
12	0.2079	0.2126	4.7046	0.9781	78
13	0.2250	0.2309	4.3315	0.9744	77
14	0.2419	0.2493	4.0108	0.9703	76
15	0.2588	0.2679	3.7321	0.9659	75
16	0.2756	0.2867	3.4874	0.9613	74
17	0.2924	0.3057	3.2709	0.9563	73
18	0.3090	0.3249	3.0777	0.9511	72
19	0.3256	0.3443	2.9042	0.9455	71
20	0.3420	0.3640	2.7475	0.9397	70
21	0.3584	0.3839	2.6051	0.9336	69
22	0.3746	0.4040	2.4751	0.9272	68
23	0.3907	0.4245	2.3559	0.9205	67
24	0.4067	0.4452	2.2460	0.9135	66
25	0.4226	0.4663	2.1445	0.9063	65
26	0.4384	0.4877	2.0503	0.8988	64
27	0.4540	0.5095	1.9626	0.8910	63
28	0.4695	0.5317	1.8807	0.8829	62
29	0.4848	0.5543	1.8040	0.8746	61
30	0.5000	0.5774	1.7321	0.8660	60
31	0.5150	0.6009	1.6643	0.8572	59
32	0.5299	0.6249	1.6003	0.8480	58
33	0.5446	0.6494	1.5399	0.8387	57
34	0.5592	0.6745	1.4826	0.8290	56
35	0.5736	0.7002	1.4281	0.8192	55
36	0.5878	0.7265	1.3764	0.8090	54
37	0.6018	0.7536	1.3270	0.7986	53
38	0.6157	0.7813	1.2799	0.7880	52
39	0.6293	0.8098	1.2349	0.7771	51
40	0.6428	0.8391	1.1918	0.7660	50
41	0.6561	0.8693	1.1504	0.7547	49
42	0.6691	0.9004	1.1106	0.7431	48
43	0.6820	0.9325	1.0724	0.7314	47
44	0.6947	0.9657	1.0355	0.7193	46
45	0.7071	1.0000	1.0000	0.7071	45
Deg	Cos	Cot	Tan	Sin	Angle



## DECIMAL AND METRIC EQUIVALENTS OF COMMON FRACTIONS OF AN INCH

Fraction	Decimal	Mm	Fraction	Decimal	Mm		
	$\frac{1}{64}$	0.01562	0.397	$\frac{33}{64}$	0.51562	13.097	
$\frac{1}{32}$		0.03125	0.794	$\frac{17}{32}$		0.53125	13.494
	$\frac{3}{64}$	0.04688	1.191	$\frac{35}{64}$		0.54688	13.891
$\frac{1}{16}$		0.06250	1.588	$\frac{9}{16}$		0.56250	14.288
	$\frac{5}{64}$	0.07812	1.984	$\frac{37}{64}$		0.57812	14.684
$\frac{3}{32}$		0.09375	2.381	$\frac{19}{32}$		0.59375	15.081
	$\frac{7}{64}$	0.10938	2.778	$\frac{39}{64}$		0.60938	15.478
$\frac{1}{8}$		0.12500	3.175	$\frac{5}{8}$		0.62500	15.875
	$\frac{9}{64}$	0.14062	3.572	$\frac{41}{64}$		0.64062	16.272
$\frac{5}{32}$		0.15625	3.969	$\frac{21}{32}$		0.65625	16.669
	$\frac{11}{64}$	0.17188	4.366	$\frac{43}{64}$		0.67188	17.066
$\frac{3}{16}$		0.18750	4.763	$\frac{11}{16}$		0.68750	17.463
	$\frac{13}{64}$	0.20312	5.159	$\frac{45}{64}$		0.70312	17.859
$\frac{7}{32}$		0.21875	5.556	$\frac{23}{32}$		0.71875	18.256
	$\frac{15}{64}$	0.23438	5.953	$\frac{47}{64}$		0.73438	18.653
$\frac{1}{4}$		0.25000	6.350	$\frac{3}{4}$		0.75000	19.050
	$\frac{17}{64}$	0.26562	6.747	$\frac{49}{64}$		0.76562	19.447
$\frac{9}{32}$		0.28125	7.144	$\frac{25}{32}$		0.78125	19.844
	$\frac{19}{64}$	0.29688	7.541	$\frac{51}{64}$		0.79688	20.241
$\frac{5}{16}$		0.31250	7.938	$\frac{13}{16}$		0.81250	20.638
	$\frac{21}{64}$	0.32812	8.334	$\frac{53}{64}$		0.82812	21.034
$\frac{11}{32}$		0.34375	8.731	$\frac{27}{32}$		0.84375	21.431
	$\frac{23}{64}$	0.35938	9.128	$\frac{55}{64}$		0.85938	21.828
$\frac{3}{8}$		0.37500	9.525	$\frac{7}{8}$		0.87500	22.225
	$\frac{25}{64}$	0.39062	9.922	$\frac{57}{64}$		0.89062	22.622
$\frac{13}{32}$		0.40625	10.319	$\frac{29}{32}$		0.90625	23.019
	$\frac{27}{64}$	0.42188	10.716	$\frac{59}{64}$		0.92188	23.416
$\frac{7}{16}$		0.43750	11.113	$\frac{15}{16}$		0.93750	23.813
	$\frac{29}{64}$	0.45312	11.509	$\frac{61}{64}$		0.95312	24.209
$\frac{15}{32}$		0.46875	11.906	$\frac{31}{32}$		0.96875	24.606
	$\frac{31}{64}$	0.48438	12.303	$\frac{63}{64}$		0.98438	25.003
$\frac{1}{2}$		0.50000	12.700	$\frac{1}{1}$		1.00000	25.400

# PROPERTIES OF THE ELEMENTS

Element	Symbol	Atomic Number	Atomic Weight	Density*	M.P. °C	B.P. °C	Chemical** Valence	First Ioniz. Pot. (ev.)
Actinium	Ac	89	(227)	---	1050	---	3	6.9
Aluminum	Al	13	26.98	2.70	660	2450	3	5.98
Americium	Am	95	(243)	11.7	995	---	3,4,5,6	6.0
Antimony	Sb	51	121.75	6.62	630.5	1380	3,5	8.64
Argon	Ar	18	39.95	1.78	-189	-186	0	15.75
Arsenic	As	33	74.92	5.72	---	613	±3,5	9.81
Astatine	At	85	(210)	---	---	---	---	---
Barium	Ba	56	137.34	3.5	714	1640	2	5.21
Berkelium	Bk	97	(249)	---	---	---	3,4	---
Beryllium	Be	4	9.01	1.85	1277	2770	2	9.32
Bismuth	Bi	83	208.98	9.80	271	1560	3,5	7.29
Boron	B	5	10.81	2.34	2030	2550	3	8.30
Bromine	Br	35	79.91	3.12	-7	58	±1,5	11.81
Cadmium	Cd	48	112.40	8.65	320.9	765	2	8.99
Calcium	Ca	20	40.08	1.55	838	1440	2	6.11
Californium	Cf	98	(251)	---	---	---	3	---
Carbon	C	6	12.01	2.25 <sup>1</sup>	3727 <sup>2</sup>	4830	±4,2	11.26
Cerium	Ce	58	140.12	6.77 <sup>3</sup>	804	3257	3,4	5.60

## PROPERTIES OF THE ELEMENTS (Cont'd.)

Element	Symbol	Atomic Number	Atomic Weight	Density*	M.P. °C	B.P. °C	Chemical** Valence	First Ioniz. Pot. (ev.)
Promethium	Pm	61	(147)	---	1027	---	3	---
Proactinium	Pa	91	(231)	15.4	1230	---	5,4	---
Radium	Ra	88	(226)	5.0	700	1140	2	5.28
Radon	Rn	86	(222)	9.96	-71	-62	0	10.75
Rhenium	Re	75	186.2	21.04	3180	5900	7,4,-1	7.87
Rhodium	Rh	45	102.90	12.44	1966	4500	3,4	7.46
Rubidium	Rb	37	85.47	1.53	39	688	1	4.18
Ruthenium	Ru	44	101.07	12.2	2500	4900	3,4,6,8	7.36
Samarium	Sm	62	150.35	7.54	1072	1752	---	---
Scandium	Sc	21	44.96	3.02 <sup>1</sup>	1539	2832	3	6.54
Selenium	Se	34	78.96	4.79 <sup>2</sup>	217 <sup>2</sup>	685 <sup>2</sup>	4,6,-2	9.75
Silicon	Si	14	28.09	2.33	1410	2680	4	8.51
Silver	Ag	47	107.87	10.49	960.8	2210	1	7.57
Sodium	Na	11	22.99	0.97	98	892	1	5.14
Strontium	Sr	38	87.62	2.60	768	1380	2	5.69
Sulfur	S	16	32.06	2.07 <sup>3</sup>	113 <sup>4</sup>	444.6	6,4,-2	10.36
Tantalum	Ta	73	180.95	16.6	2996	5425	5	7.88
Technetium	Tc	43	(99)	11.46	2130	---	7	7.28
Tellurium	Te	52	127.60	6.24 <sup>2</sup>	450	990	4,6,-2	9.01
Terbium	Tb	65	158.92	8.25	1356	3041	3	5.98
Thallium	Tl	81	204.37	11.85	303	1457	1,3	6.11
Thorium	Th	90	232.04	11.66	1750	3850	4	6.95
Thulium	Tm	69	168.93	9.31	1545	1732	3	5.81
Tin	Sn	50	118.69	7.30 <sup>3</sup>	231.9	2270	4,2	7.34
Titanium	Ti	22	47.90	4.51	1668	3260	4,3	6.82
Tungsten	W	74	183.85	19.3	3410	5930	6	7.98
Uranium	U	92	238.03	19.07	1132	3818	6,5,4,3	6.08
Vanadium	V	23	50.94	6.1	1900	3400	5,4,2	6.74
Xenon	Xe	54	131.30	5.90	-112	-108	0	12.13
Ytterbium	Yb	70	173.04	6.96	824	1193	3,2	6.22
Yttrium	Y	39	88.90	4.47 <sup>1</sup>	1509	3337	3	6.38
Zinc	Zn	30	65.37	7.13	419.5	906	2	9.39
Zirconium	Zr	40	91.22	6.49	1852	3580	4	6.84

NOTES: <sup>1</sup>12C=12

\*Solids & Liquids: g/cm<sup>3</sup>, 20°C. Gases: g/liter (STP).

\*\*Useful valences, most stable stated first.

( ) Integral mass of longest lived isotope.

<sup>1</sup>Close-packed hexagonal

<sup>2</sup>Hexagonal

<sup>3</sup>Orthorhombic, Monoclinic=1.96

<sup>4</sup>Orthorhombic, Monoclinic=119°C

<sup>5</sup>Normal tetragonal (β or white)

# PROPERTIES OF VARIOUS METALS AND ALLOYS\*

	Material & Identification #		Resistivity Microhm-cm	Temp. coeff. of Resis./°C	Density g/cm <sup>3</sup>	Specific Heat cal/g/°C	Thermal Cond. w/cm-°C	Thermal Expansion ppm/°C†	Melting Point °C
188	Aluminum, pure .....		2.65	0.00429	2.70	0.215	2.22	23.6	660
	Aluminum, conductor (99.45 Al).....		2.8		2.70		2.34	23.6	657
	Beryllium .....		4	0.025	1.85	0.45	1.46	11.6	1277
	Bismuth .....		<sup>106.8</sup>	0.004	9.80	0.029	0.08	13.3	271
	Brass, yellow (65 Cu, 35 Zn) .....		6.4		8.47	0.09	1.17	20.3	930
	Bronze, commercial (90 Cu, 10 Zn) .....		3.9	0.00186	8.80	0.09	1.88	18.4	1045
	Bronze, phosphor (95 Cu, 5 Sn) .....		11		8.86	0.09	0.71	17.8	1049
	Cadmium .....		<sup>36.83</sup>	<sup>0.0042</sup>	8.65	0.055	0.92	29.8	321
	Chromium .....		13.0	<sup>0.003</sup>	7.19	0.11	0.67	6.2	1875
	Cobalt .....		6.24	0.00604	<sup>8.85</sup>	0.099	0.69	13.8	1495
	Constantan (45 Ni, 55 Cu) .....		50	$\pm 0.00002$	8.9	0.094	0.21	14.9	1290
	Copper, annealed (IACS) .....		1.72	0.00393	8.89	0.092	3.94	16.5	1083
	Copper, beryllium (97.9 Cu, 1.9 Be) .....		<sup>9</sup>		8.23	0.1	<sup>0.8</sup>	17.8	955
	Copper, electrolytic (99.95 Cu, .040)....		1.71	0.00397	8.89	0.092	3.90	16.8	1083
	Gallium .....		<sup>53.4</sup>		5.91	0.079	0.33	18	30
	Germanium .....		<sup>46</sup>		5.32	0.073	0.58	5.7	937
	Gold .....		2.35	<sup>0.004</sup>	19.32	0.031	2.97	14.2	1063
	Inconel (78 Ni, 15 Cr, 7 Fe) .....		98.1		8.51	0.109	0.15	11.5	1425
	Indium .....		8.37		7.31	0.057	0.24	33	156
	Invar (64 Fe, 36 Ni) .....		80	0.0012	8.0	0.123	0.11	<0.1	
Iron, pure .....		9.71	0.0065	7.87	0.11	0.75	11.8	1536	
Iron, gray (3.16 Tc, 1.54 Si, 0.57 Mu)....				7.15		0.47	10.5		
Molybdenum	Mo	42	95.94	10.22	2610	5560	6,3,5	7.10	
Neodymium	Nd	60	144.24	7.00 <sup>2</sup>	1019	3127	3	5.46	
Neon	Ne	10	20.18	0.90	-249	-246	0	21.56	
Neptunium	Np	93	(237)	19.5	637	---	5,6,4,3	---	
Nickel	Ni	28	58.71	8.90	1453	2730	2,3	7.63	
Niobium	Nb	41	92.91	8.57	2468	4927	5,3	6.88	
Nitrogen	N	7	14.01	1.25	-210	-196	-3,5,2	14.53	
Nobelium	No	102	(254)	---	---	---	---	---	
Osmium	Os	76	190.2	22.57	2700	5500	4,6,8	8.5	
Oxygen	O	8	16.00	1.43	-219	-183	-2	13.61	
Palladium	Pd	46	106.4	12.02	1552	3980	2,4	8.33	
Phosphorus	P	15	30.97	1.83 <sup>3</sup>	44	280	5,±3	10.48	
Platinum	Pt	78	195.09	21.45	1769	4530	4,2	9.0	
Plutonium	Pu	94	(242)	19.0	640	3235	4,6,5,3	5.8	
Polonium	Po	84	(210)	(9.24)	254	---	2,4	8.43	
Potassium	K	19	39.10	0.86	64	760	1	4.34	
Praseodymium	Pr	59	140.91	6.77 <sup>2</sup>	919	3212	3	5.48	

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NOTES: †<sup>12</sup>C=12

\*Solids & Liquids: g/cm<sup>3</sup>, 20°C. Gases: g/liter (STP).

\*\*Useful valences, most stable stated first.

( )Integral mass of longest lived isotope.

<sup>1</sup>Close-packed hexagonal

<sup>2</sup>Hexagonal

<sup>3</sup>White; Red=2.20

## PROPERTIES OF THE ELEMENTS (Cont'd.)

Element	Symbol	Atomic Number	Atomic Weight	Density*	M.P. °C	B.P. °C	Chemical** Valence	First Ioniz. Pot. (ev.)	
Hafnium	Hf	72	178.49	13.09	2222	5400	4	6.8	
Helium	He	2	4.00	0.18	-270	-269	0	24.58	
Holmium	Ho	67	164.93	8.79 <sup>1</sup>	1461	2572	3	—	
Hydrogen	H	1	1.01	0.09	-259	-253	1	13.59	
Indium	In	49	114.82	7.31	156	2000	3	5.78	
Iodine	I	53	126.90	4.94	114	183	-1,5,7	10.45	
Iridium	Ir	77	192.22	22.5	2454	5300	4,3,6	9.1	
Iron	Fe	26	55.85	7.87	1536	3000	3,2	7.87	
Krypton	Kr	36	83.80	3.74	-157	-152	0	14.00	
Lanthanum	La	57	138.91	6.19 <sup>2</sup>	920	3454	3	5.61	
Lawrencium	Lw	103	(257)	—	—	—	—	—	
Lead	Pb	82	207.19	11.36	327.4	1725	2,4	7.41	
Lithium	Li	3	6.94	0.53	181	1336	1	5.39	
Lutetium	Lu	71	174.97	9.85	1652	3315	3	6.15	
Magnesium	Mg	12	24.31	1.74	650	1107	2	7.64	
Manganese	Mn	25	54.94	7.43	1245	2150	2,7,4,6,3	7.43	
Mendelevium	Md	101	(256)	—	—	—	—	—	
Mercury	Hg	80	200.59	13.55	-38.4	357	2,1	10.43	
Lead .....			20.65	0.00336	11.36	0.031	0.35	29.3	327
Magnesium .....			4.45	0.0165	1.74	0.245	1.62	27.1	650
Mercury .....			98.4		13.55	0.033	0.08		-38
Molybdenum .....			5.2	0.005	10.22	0.066	1.42	4.9	2610
Monel (67 Ni, 30 Cu) .....			48.2		8.84	0.127	0.26	14.0	1325
Nichrome (80 Ni, 20 Cr) .....			107.9	0.00009	8.4	0.107	0.134	17.3	1400
Nickel .....			6.84	0.0069	8.90	0.105	0.92	13.3	1453
Niobium (Columbium) .....			12.5		8.57	0.065	0.52	7.3	2468
Palladium .....			10.8	0.00377	12.02	0.058	0.70	11.8	1552
Platinum .....			10.64	0.00393	21.45	0.031	0.69	8.9	1769
Silicon .....			10 <sup>5</sup>		2.33	0.162	0.84	2.8-7.3	1410
Silver .....			1.59	0.0041	10.49	0.056	4.18	19.7	961
Steel, carbon (0.4-0.5 C, bal. Fe) .....			7-12		7.8		0.5	11	1480
Steel, silicon (3 Si, oriented) .....			50		7.65		0.18		
Steel, stainless, 304 .....			72		7.9	0.12	0.15	9.6	>1150
Steel, stainless, 347 .....			73		8.0	0.12	0.16	9.3	>1400
Steel, stainless, 410 .....			57		7.7	0.11	0.24	6.1	>1480
Tantalum .....			12.45	0.0038	16.6	0.034	0.54	6.5	2996
Thorium .....			13	0.0038	11.66	0.034	0.38	12.5	1750
Tin .....			11.0	0.0047	7.30	0.054	0.63	23	232
Titanium .....			42		4.51	0.124	0.11	8.4	1668
Tungsten .....			5.65	0.0045	19.3	0.033	1.66	4.6	3410
Uranium .....			30		19.07	0.028	0.27	7-14	1132
Zinc .....			5.92	0.0042	7.13	0.091	1.13	39.7	419
Zirconium .....			40.0	0.0044	16.49	0.067	0.88	5.8	1852

\* at 20 °C or ambient  
 # pure metals if alloy is not stated  
 † parts per million/°C

<sup>1</sup> close packed hexagonal  
<sup>2</sup> at 0 °C

<sup>3</sup> ohm-cm  
<sup>4</sup> 20-1000 C; 13 at 20 C

<sup>5</sup> depends on processing  
<sup>6</sup> at -240 °C  
<sup>7</sup> at 50 °C

# PROPERTIES OF ENGINEERING PLASTICS

NOTE: All properties shown are typical of standard grade resins. In most instances additional grades are available.

MATERIAL	Specific Gravity	Cost cents/in. <sup>3</sup>	Impact Strength Notched Izod (Ft. lb./in., 1/8")	Tensile Strength psi x 10 <sup>3</sup>	Tensile Modulus psi x 10 <sup>3</sup>	Heat Distortion Temp. °F at 264 psi	Dielectric Strength ST 1/8" thick (V/mil)	Water Absorption % in 24 hrs.
Polycarbonates* (LEXAN®) .....	1.20	3.47	16	8.5	345	270	410	.15
Nylon 6/6 .....	1.14	3.6	1-2	11.5	425	200	350	1.3
NORYL® Polyphenylene Oxide based thermoplastic resins* .....	1.06	2.66	2.5	9.6	355	265	550	.06
Acetal .....	1.42	3.34	1.3	10	520	255	500	.25
ABS .....	1.04	1.48	3-6	5.9	310	190	400	.30
Polysulfone .....	1.24	4.50	1.3	10.2	360	345	425	.22
Phenolic* .....	1.36	1.1	0.3	6.5	1200	350	270	.4
Acrylic .....	1.18	1.96	0.5	10	450	180	400	.30
Polypropylene (G.P.) .....	.91	.68	0.4	5.0	170	140	650	.02
Vinyl (Type I) .....	1.45	1.23	1-2	7.5	415	169	360	.05
Cellulosics (CAB) .....	1.2	2.7	3-8	5.0	150	180	350	1.8
Silicone Molding Resins* .....	1.9	15-20	<0.3	4.8	—	610	480	0.5
Chlorinated Polyether .....	1.4	22.8	0.4	3.5	150	200	500	.01

\*Manufactured and sold by the General Electric Company

Cesium	Cs	55	132.90	1.90	29	690	1	3.89
Chlorine	Cl	17	35.45	3.21	-101	-35	±1,7,5	13.01
Chromium	Cr	24	52.00	7.19	1875	2665	3,6,2	6.76
Cobalt	Co	27	58.93	8.85 <sup>4</sup>	1495	2900	2,3	7.86
Copper	Cu	29	63.54	8.96	1083	2595	2,1	7.72
Curium	Cm	96	(247)	—	1340	—	3	—
Dysprosium	Dy	66	162.50	8.55	1407	2335	3	—
Einsteinium	Es	99	(254)	—	—	—	—	—
Erbium	Er	68	167.26	9.15	1497	2510	3	6.08
Europium	Eu	63	151.96	5.24	826	1597	3,2	5.67
Fermium	Fm	100	(253)	—	—	—	—	—
Fluorine	F	9	19.00	1.70	-220	-188	-1	17.42
Francium	Fr	87	(223)	—	—	—	1	—
Gadolinium	Gd	64	157.25	7.89	1312	3233	3	6.16
Gallium	Ga	31	69.72	5.91	30	2237	3	6.00
Germanium	Ge	32	72.59	5.32	937	2830	4	7.90
Gold	Au	79	196.97	19.32	1063.0	2970	3,1	9.22

NOTES: <sup>1</sup>12C=12

<sup>2</sup>Solids & Liquids: g/cm<sup>3</sup>, 20°C. Gases: g/liter (STP).

<sup>3</sup>Useful valences, most stable stated first.

( ) Integral mass of longest lived isotope.

<sup>1</sup>Graphite. Diamond 3.51.

<sup>2</sup>Sublimes

<sup>3</sup>Face-centered cubic

<sup>4</sup>Close-packed hexagonal

# POPULATION OF IMPORTANT U.S. CITIES

United States (Total Population)—202,549,000

Populations are based upon final 1960 Census figures and later estimates derived from the Census Bureau and state agencies.

( ) Indicates State Population \* Indicates State Capital

‡ Indicates City in which General Electric plant or major facility is located

† Indicates Metropolitan Area Population

<b>ALABAMA</b> (3,540,000)	Fullerton .....	81,700
Birmingham† ..	Garden Grove....	115,500
Birmingham ....	Glendale .....	135,600
Gadsden .....	Hayward .....	93,400
Huntsville‡ .....	Huntington Bch.	86,646
Mobile .....	Inglewood .....	91,000
Montgomery* ..	Lakewood .....	81,401
Tuscaloosa .....	Long Beach .....	387,600
<b>ALASKA</b> (273,000)	Los Angeles† ....	6,675,000
Anchorage .....	Los Angeles .....	2,881,700
Fairbanks .....	No. Hollywood‡ (Met. L.A.)	
Juneau* .....	Merced‡ .....	23,800
<b>ARIZONA</b> (1,635,000)	Norwalk .....	91,600
Phoenix† .....	Oakland‡ .....	385,700
Phoenix*‡ .....	Ontario‡ .....	61,000
Tucson .....	Pasadena .....	125,000
<b>ARKANSAS</b> (1,969,000)	Pomona .....	85,979
Fort Smith‡ .....	Richmond .....	81,900
Jonesboro‡ .....	Riverside .....	136,800
Little Rock* ....	Sacramento† ....	737,000
No. Little Rock..	Sacramento* ....	263,237
	San Bernardino	102,934
<b>CALIFORNIA</b> (19,300,000)	San Diego† .....	1,136,000
Alameda .....	San Diego .....	670,000
Anaheim .....	San Francisco-	
Berkeley .....	Oakland† .....	2,918,000
Burbank .....	San Francisco ..	756,900
Compton .....	San Jose† .....	885,000
Concord .....	San Jose‡ .....	359,602
Downey .....	San Leandro‡ ..	74,400
Fremont .....	San Mateo .....	78,600
Fresno .....	Santa Ana .....	142,739
	Santa Barbara ..	71,400

Santa Clara .....	83,500
Santa Monica ..	88,900
So. San Francisco	78,600
Stockton .....	97,754
Sunnyvale .....	84,824
Torrance .....	139,000
Vallejos† (Met. San Jose)	
Whittier .....	79,131

**COLORADO (1,975,000)**

Colorado	
Springs .....	103,000
Denver† .....	1,073,000
Denver* .....	540,000
Pueblo .....	103,000

**CONN. (2,925,000)**

Bridgeport† .....	155,200
Greenwich .....	64,500
Hartford† .....	549,249
Hartford* .....	161,000
Meriden .....	55,100
New Britain ....	85,300
New Haven .....	148,200
Norfolk† .....	2,000
Norwalk .....	75,400
Plainville† .....	15,900
Stamford .....	108,400
Waterbury .....	107,900
West Hartford ..	73,400

**DELAWARE (523,000)**

Dover* .....	12,150
Wilmington .....	86,920

**DISTRICT OF COLUMBIA (809,000)**

Washington† ....	2,408,000
Washington* ....	798,000

**FLORIDA (5,996,000)**

Cape Canaveral <sup>1</sup>	4,000
Daytona Beach†	37,395
Fort Lauderdale	125,000

Gainesville† ....	29,701
Hialeah .....	66,972
Hollywood .....	87,000
Jacksonville† ..	497,000
Jacksonville .....	201,030
Miami† .....	1,061,000
Miami .....	291,688
Miami Beach ....	63,145
Orlando .....	88,135
Pensacola .....	56,752
St. Petersburg†	181,298
Tallahassee* ....	48,174
Tampa .....	274,970
W. Palm Beach..	56,208

**GEORGIA (4,511,000)**

Albany .....	64,700
Atlanta† .....	1,216,000
Atlanta* .....	498,200
Augusta .....	85,000
Chamblee† .....	11,100
Columbus .....	127,100
Macon .....	126,700
Rome† .....	33,500
Savannah .....	135,200

**HAWAII (741,000)**

Hilo .....	26,828
Honolulu† .....	571,000
Honolulu* .....	353,676

**IDAHO (699,000)**

Boise* .....	63,518
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**ILLINOIS (10,894,000)**

Aurora .....	68,000
Berwyn .....	55,100
Bloomington† ..	38,300
Champaign .....	55,500
Chicago† .....	6,689,000
Chicago† .....	3,550,404
Chicago Hts.† ..	41,100
Cicero† .....	73,700
Danville† .....	42,900

<sup>1</sup>Facility at nearby Cape Kennedy



Decatur†	38,500
De Kalb†	30,000
East St. Louis ..	75,300
Evanston	82,600
Joliet	74,800
Mattoon†	20,300
Morris†	7,935
Morrison†	4,159
Oak Park	61,700
Peoria	130,500
Rockford†	135,000
Skokie	70,200
Springfield*	90,400
Waukegan	65,500

**INDIANA (4,999,000)**

Bloomington†	42,600
Decatur†	9,200
Evansville	144,400
Fort Wayne†	178,300
Gary	182,200
Hammond	110,400
Indianapolis†	984,000
Indianapolis*	505,700
Linton†	5,300
Mount Vernon†	6,000
Muncie	70,800
Shelbyville†	14,700
South Bend	135,700
Tell City†	7,800
Terre Haute	72,200

**IOWA (2,753,000)**

Burlington†	31,300
Cedar Rapids ..	101,550
Council Bluffs ..	59,350
Davenport	90,850
Des Moines*	212,400
Dubuque	65,200
Sioux City	79,300
Waterloo	82,500

**KANSAS (2,275,000)**

Kansas City	169,750
Topeka*	120,467

Wichita	281,110
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**KENTUCKY (3,191,000)**

Covington	55,500
Frankfort*	19,400
Lexington†	79,400
Louisville†	771,000
Louisville†	389,900
Owensboro†	45,900
Somerset†	7,112

**LOUISIANA (3,660,000)**

Baton Rouge* ..	169,788
Lafayette	47,671
Lake Charles	71,344
Monroe	59,348
New Orleans†	1,027,000
New Orleans	680,968
Shreveport†	181,634

**MAINE (973,000)**

Auburn†	24,449
Augusta*	21,680
Bangor†	43,763
Portland	72,566
So. Portland†	80,000

**MARYLAND (3,685,000)**

Annapolis*	23,385
Baltimore†	1,854,000
Baltimore†	939,024
Bethesda	72,333
Dundalk	82,428
Silver Spring	78,973
Wheaton	61,016

**MASS. (5,421,000)**

Ashland†	8,698
Boston†	3,205,000
Boston*	616,326
Brockton	83,499
Brookline	53,608
Cambridge	92,677
Chelsea†	27,098
Everett†	43,410
Fall River	98,053
Fitchburg†	43,087

Holyoke .....	52,636
Lawrence .....	69,070
Lowell† .....	86,535
Lynn† .....	92,653
Malden .....	56,142
Medford .....	60,429
New Bedford ...	100,176
Newton .....	88,514
Pittsfield† .....	56,511
Quincy .....	87,158
Somerville .....	86,332
Springfield† ...	165,520
Waltham .....	57,134
Watertown† ...	40,115
Worcester .....	180,341

**MICHIGAN (8,584,000)**

Ann Arbor .....	75,613
Bay City .....	53,529
Dearborn .....	115,761
Detroit† .....	3,987,000
Detroit‡ .....	1,743,242
Edmore‡ .....	1,234
Flint .....	216,611
Grand Rapids ..	188,120
Holland‡ .....	23,252
Jackson .....	56,151
Kalamazoo .....	82,089
Lansing* .....	131,147
Lincoln Park ...	53,933
Livonia .....	62,006
Pontiac .....	81,688
Roseville .....	50,195
Royal Oak .....	80,612
Saginaw .....	105,978
St. Clair Shores	76,657
Warren .....	133,032
Wyoming .....	49,327

**MINNESOTA (3,582,000)**

Bloomington ...	50,498
Duluth .....	106,884
Minneapolis† ..	1,612,000
Minneapolis ...	483,872
St. Paul* .....	313,411

**MISSISSIPPI (2,348,000)**

Bay St. Louis‡ ..	8,000
Jackson*‡ .....	161,500
Meridian .....	58,000

**MISSOURI (4,605,000)**

Independence ..	84,771
Jefferson City*	28,228
Kansas City† ...	1,183,000
Kansas City .....	475,539
St. Joseph .....	79,673
St. Louis† .....	2,249,000
St. Louis‡ .....	657,259
Springfield .....	95,865
University City..	51,249

**MONTANA (701,000)**

Billings .....	56,000
Great Falls .....	58,000
Helena* .....	21,000

**NEBRASKA (1,435,000)**

Lincoln* .....	142,717
Omaha† .....	516,000
Omaha .....	339,494

**NEVADA (444,000)**

Carson City* ...	5,163
Las Vegas .....	64,405
Reno .....	51,470

**NEW HAMP. (685,000)**

Concord* .....	26,230
Hooksett‡ .....	6,111
Manchester .....	88,282
Somersworth‡ ..	8,989

**NEW JERSEY (7,004,000)**

Atlantic City ...	61,940
Bayonne .....	74,100
Bloomfield .....	54,200
Camden .....	116,050
Clifton .....	85,190
East Orange ...	77,860
Elizabeth .....	117,570
Fair Lawn‡ .....	38,520

Irvington ..... 63,010  
 Jersey City† .... 619,000  
 Jersey City ..... 270,440  
 Newark† .....1,851,000  
 Newark‡ ..... 397,650  
 Nutley‡ ..... 31,940  
 Passaic ..... 57,270  
 Paterson‡ ..... 148,110  
 Springfield‡ ... 16,210  
 Trenton\*‡ ..... 110,640  
 Union ..... 56,040  
 Union City ..... 52,500  
 Woodbridge ..... 99,090  
**NEW MEXICO (1,003,000)**  
 Albuquerque‡ .. 288,000  
 Sante Fe\* ..... 34,676  
**NEW YORK (18,078,000)**  
 Albany\* ..... 122,938  
 Auburn‡ ..... 31,691  
 Binghamton‡ .... 65,492  
 Brockport‡ .... 6,058  
 Buffalo† .....1,320,000  
 Buffalo‡ ..... 465,686  
 Elmira‡ ..... 40,878  
 Fort Edward‡ .. 3,737  
 Hicksville ..... 50,405  
 Hudson Falls‡ .. 7,752  
 Levittown ..... 65,276  
 Mt. Vernon ..... 71,063  
 New Rochelle .. 74,105  
 New York† ....11,366,000  
 New York .....8,040,000  
 Niagara Falls .... 98,238  
 Rochester† ..... 804,000  
 Rochester ..... 291,692  
 Rome ..... 45,996  
 Schenectady‡ .. 71,162  
 Selkirk‡ ..... 350  
 Syracuse† ..... 606,000  
 Syracuse‡ ..... 209,172  
 Troy ..... 62,984  
 Utica‡ ..... 95,557  
 Waterford‡ ..... 2,749

White Plains .... 49,702  
 Yonkers ..... 205,700  
**NO. CAROLINA (5,027,000)**  
 Asheboro‡ ..... 9,449  
 Asheville ..... 65,405  
 Charlotte ..... 250,516  
 Durham ..... 83,370  
 Goldsboro‡ ..... 34,253  
 Greensboro ..... 152,337  
 Hendersonville‡ 5,911  
 Hickory‡ ..... 22,647  
 High Point ..... 78,078  
 Raleigh\* ..... 114,418  
 Wilmington‡ ... 43,266  
 Winston-Salem.. 128,042  
**NO. DAKOTA (639,000)**  
 Bismarck\* ..... 30,584  
 Fargo ..... 49,572  
**OHIO (10,462,000)**  
 Akront ..... 650,000  
 Akron ..... 299,658  
 Andover‡ ..... 1,150  
 Barberton‡ ..... 35,222  
 Bedford‡ ..... 17,755  
 Bellevue‡ ..... 9,044  
 Blue Ash‡ ..... 9,142  
 Bucyrus‡ ..... 13,681  
 Canton ..... 116,539  
 Cincinnati† .....1,347,000  
 Cincinnati‡ ..... 500,496  
 Circleville‡ ..... 12,657  
 Cleveland† .....2,000,000  
 Cleveland‡ ..... 825,436  
 Cleveland Hts. .. 62,634  
 Columbus† ..... 847,000  
 Columbus\* ..... 544,016  
 Conneaut‡ ..... 15,157  
 Coshocton‡ ..... 14,494  
 Cuyahoga Falls.. 52,541  
 Dayton† ..... 791,000  
 Dayton ..... 267,403  
 Dover‡ ..... 12,295  
 Elyria ..... 53,207

Euclid†	72,537
Evendale† (Metro Cinn.)	
Hamilton	79,846
Jefferson†	2,137
Kettering	67,381
Lakewood	72,687
Lima	56,890
Logan†	6,752
Lorain	79,943
Mansfield	52,060
Niles†	20,873
Parma	95,873
Springfield	85,183
Tiffin†	22,737
Toledo†	657,000
Toledo	391,453
Warren†	65,303
Willoughby†	19,753
Worthington†	9,239
Youngstown†	164,821

**OKLAHOMA (2,496,000)**

Lawton	69,047
Okla. City†	585,000
Okla. City*†	350,419
Tulsa†	433,000
Tulsa	279,101

**OREGON (1,999,000)**

Eugene	76,200
Portland†	897,000
Portland	384,000
Salem*	66,300

**PENN. (11,626,000)**

Allentown†	108,600
Altoona	71,000
Bethlehem	72,700
Bridgeville†	7,112
Bristol	59,298
Chester	63,200
Erie†	139,400
Harrisburg*	79,100

Haverford	54,019
Lancaster	56,900
Levittown	68,793
Lower Merion	59,420
Penn Hills	59,317
Philadelphiat	4,664,000
Philadelphia†	2,079,000
Pittsburgh†	2,372,000
Pittsburgh	555,300
Reading	98,400
Scranton	105,400
Upper Darby	93,158
Valley Forge† (Met. Phila.)	
Wilkes-Barre	61,600
York	54,300

**PUERTO RICO (2,702,000)**

Caguas†	32,015
Juana Diaz†	4,618
Mayagüez	50,147
Palmer†	1,196
Ponce	114,286
San Juan†	588,805
San Juan*†	432,377
Vega Alta†	3,182

**RHOODE ISLAND (901,000)**

Cranston	71,913
Newport†	35,901
Pawtucket	77,538
Providence†	739,000
Providence*†	187,061
Warwick	77,637

**SO. CAROLINA (2,603,000)**

Charleston†	75,940
Columbia*	97,433
Greenville†	66,188
Irmo†	359

**SO. DAKOTA (674,000)**

Pierre*	10,088
Sioux Falls	65,466

<b>TENNESSEE</b>	<b>(3,888,000)</b>
Chattanooga ....	132,247
Hndrsnvl (Metro Nash)	
Knoxville .....	179,973
Memphis† .....	536,585
Murfreesboro†	21,441
Nashville* .....	250,887
<b>TEXAS</b>	<b>(10,873,000)</b>
Abilene .....	90,368
Amarillo .....	137,969
Austin* .....	186,545
Beaumont .....	119,175
Corpus Christi ..	167,690
Dallas† .....	1,334,101
Dallas .....	679,684
El Paso .....	276,687
Fort Worth† .....	640,414
Fort Worth .....	356,268
Galveston .....	67,175
Houston† .....	1,717,116
Houston† .....	938,219
Laredo .....	60,678
Lubbock .....	128,691
Midland .....	62,625
Odessa .....	80,338
Port Arthur .....	66,676
San Angelo .....	58,815
San Antonio† ....	838,572
San Antonio .....	587,718
Tyler† .....	51,230
Waco .....	103,462
Wichita Falls ....	101,724
<b>UTAH</b>	<b>(1,022,000)</b>
Ogden .....	70,197
Salt Lake City* ..	189,454
<b>VERMONT</b>	<b>(416,000)</b>
Burlington† ....	35,531
Ludlow† .....	1,658
Montpelier* ....	8,782
Rultand† .....	18,325
<b>VIRGINIA</b>	<b>(4,533,000)</b>
Alexandria .....	106,505

Arlington .....	182,910
Charlottesville†	37,717
Chesapeake ....	88,597
Hampton .....	110,579
Lynchburg† .....	56,375
Newport News ..	128,402
Norfolk-	
Portsmouth†	650,731
Norfolk .....	321,770
Portsmouth† ..	117,662
Richmond† .....	484,996
Richmond*† ....	219,065
Roanoke .....	101,832
Salem† .....	16,058
Virginia Beach..	122,702
Waynesboro† ..	17,286
<b>WASHINGTON</b>	<b>(3,089,000)</b>
Everett .....	52,000
Olympia* .....	20,880
Richland .....	26,500
Seattle† .....	1,179,000
Seattle† .....	580,000
Spokane .....	187,000
Tacoma .....	156,000
<b>WEST VIRGINIA</b>	<b>(1,798,000)</b>
Charleston* ....	85,796
Huntington .....	83,627
Wheeling .....	53,400
<b>WISCONSIN</b>	<b>(4,188,000)</b>
Green Bay .....	62,888
Kenosha .....	67,899
Madison* .....	126,706
Milwaukee† ....	1,275,000
Milwaukee† ....	741,324
Racine .....	89,144
Wauwatosa .....	56,923
West Allis .....	68,157
<b>WYOMING</b>	<b>(315,000)</b>
Casper .....	41,500
Cheyenne* .....	45,000

FROM	Boston	Chicago	Cincinnati	New Orleans	New York	Philadelphia	Pittsburgh	St. Louis	San Francisco	Seattle	Washington
TO	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles	Miles
Akron, O. ....	547	322	209	906	394	344	91	492	2,163	2,047	283
Atlanta, Ga. ....	937	587	369	424	748	666	521	467	2,139	2,182	543
Birmingham, Ala. ....	1,052	578	406	312	864	783	608	400	2,013	2,082	661
Boston, Mass. ....	.....	851	740	1,359	188	271	483	1,038	2,699	2,493	393
Buffalo, N. Y. ....	400	454	393	1,086	292	279	178	662	2,300	2,117	292
Charleston, S. C. ....	820	757	506	630	641	562	528	704	2,405	2,428	453
Cheyenne, Wyo. ....	1,735	891	1,082	1,131	1,604	1,556	1,298	795	967	973	1,477
Chicago, Ill. ....	851	.....	252	833	713	666	410	262	1,858	1,737	597
Cincinnati, O. ....	740	252	.....	706	570	503	257	309	2,043	1,972	404
Cleveland, O. ....	551	308	222	924	405	360	115	492	2,166	2,026	306
Dallas, Tex. ....	1,551	803	814	443	1,374	1,299	1,070	547	1,483	1,681	1,185
Denver, Colo. ....	1,769	920	1,094	1,082	1,631	1,579	1,320	796	949	1,021	1,494
Des Moines, Iowa ....	1,159	309	510	827	1,022	973	715	273	1,550	1,467	896
Detroit, Mich. ....	613	238	235	939	482	443	205	455	2,091	1,938	396
El Paso, Tex. ....	2,072	1,252	1,335	983	1,905	1,836	1,590	1,034	995	1,376	1,728
Fargo, N. D. ....	1,300	569	820	1,222	1,210	1,184	949	660	1,446	1,197	1,140
Flint, Mich. ....	644	216	273	968	524	490	261	456	2,055	1,889	450
Hartford, Conn. ....	93	771	650	1,267	98	180	393	950	2,625	2,436	302
Helena, Mont. ....	2,024	1,248	1,481	1,646	1,929	1,897	1,652	1,236	807	490	1,842
Houston, Tex. ....	1,605	940	892	318	1,420	1,341	1,137	679	1,645	1,891	1,220
Indianapolis, Ind. ....	807	165	100	712	646	585	330	231	1,949	1,872	494
Jacksonville, Fla. ....	1,017	863	626	504	838	758	703	751	2,374	2,455	647

AIR DISTANCES BETWEEN CITIES

Kansas City, Mo. ....	1,251	414	541	680	1,097	1,038	781	238	1,506	1,506	945
Little Rock, Ark. ....	1,259	552	524	355	1,081	1,007	779	291	1,688	1,785	892
Los Angeles, Cal. ....	2,596	1,745	1,897	1,673	2,451	2,394	2,136	1,589	347	959	2,300
Louisville, Ky. ....	826	269	90	623	652	582	344	242	1,986	1,943	476
Memphis, Tenn. ....	1,137	482	410	358	957	881	660	240	1,802	1,867	765
Miami, Fla. ....	1,255	1,188	952	669	1,092	1,019	1,010	1,061	2,594	2,734	923
Milwaukee, Wis. ....	858	67	331	911	730	692	433	323	1,865	1,696	635
Minneapolis, Minn. ....	1,123	355	605	1,051	1,018	985	743	466	1,584	1,395	934
Nashville, Tenn. ....	943	397	238	469	761	685	472	254	1,963	1,975	569
New Orleans, La. ....	1,359	833	706		1,171	1,089	919	598	1,926	2,101	966
New York, N. Y. ....	188	713	570	1,171		83	317	875	2,571	2,408	205
Oklahoma City ....	1,495	692	758	577	1,328	1,260	1,014	459	1,388	1,524	1,153
Omaha, Neb. ....	1,282	432	622	847	1,144	1,094	836	354	1,429	1,369	1,014
Philadelphia, Pa. ....	271	666	503	1,089	83		259	811	2,523	2,380	123
Phoenix, Ariz. ....	2,300	1,453	1,581	1,316	2,145	2,083	1,828	1,272	653	1,114	1,983
Pittsburgh, Pa. ....	483	410	257	919	317	259		559	2,264	2,138	192
Portland, Me. ....	99	891	803	1,442	277	360	548	1,094	2,723	2,490	481
Portland, Ore. ....	2,540	1,758	1,985	2,063	2,445	2,412	2,165	1,723	534	145	2,354
St. Louis, Mo. ....	1,038	262	309	598	875	811	559		1,744	1,724	712
Salt Lake City, Utah ....	2,099	1,260	1,453	1,434	1,972	1,925	1,668	1,162	600	701	1,848
San Francisco, Cal. ....	2,699	1,858	2,043	1,926	2,571	2,523	2,264	1,744		678	2,442
Seattle, Wash. ....	2,493	1,737	1,972	2,101	2,408	2,380	2,138	1,724	678		2,329
Texarkana, Ark. ....	1,393	680	660	335	1,214	1,138	914	418	1,619	1,767	1,022
Tucson, Ariz. ....	2,284	1,444	1,556	1,247	2,124	2,059	1,807	1,249	753	1,218	1,956
Washington, D. C. ....	393	597	404	966	205	123	192	712	2,442	2,329	
Wichita, Kansas ....	1,424	591	706	677	1,266	1,204	950	394	1,369	1,437	1,106
Wilmington, Del. ....	296	650	475	1,064	108	25	241	790	2,506	2,368	98

## POPULATION OF THE LARGEST FOREIGN CITIES (OVER 975,000)

Population figures are derived from latest official foreign government and published United Nations statistical material. \*Indicates Metropolitan Area

City	Country	Population
Ahmadabad*	India	1,414,000
Alexandria	U.A.R. (Egypt)	1,801,000
Algiers*	Algeria	1,800,000
Ankara*	Turkey	971,000
Athens*	Greece	1,853,000
Baghdad	Iraq	1,745,000
Baku*	U.S.S.R.	1,196,000
Bangalore*	India	1,473,000
Bangkok*	Thailand	2,000,000
Barcelona*	Spain	1,697,000
Berlin (East)	Germany	1,081,000
Berlin (West)	Germany	2,191,000
Birmingham* (West Midlands area)	England	2,425,000
Bogota	Colombia	2,066,000
Bombay	India	4,903,000
Brussels*	Belgium	1,528,000
Bucharest*	Rumania	1,519,000
Budapest	Hungary	1,990,000
Buenos Aires*	Argentina	7,000,000
Cairo	U.A.R. (Egypt)	4,220,000
Calcutta*	India	4,765,000
Canton	China	1,994,000
Caracas*	Venezuela	1,764,000
Casablanca	Morocco	1,350,000
Changchun	China	1,000,000
Chengtu	China	1,030,000
Chungking	China	1,970,000
Copenhagen*	Denmark	1,400,000
Delhi-New Delhi*	India	2,874,000
Djakarta	Indonesia	2,973,000
Fushun	China	1,050,000



City	Country	Population
Glasgow* (Central Clydeside area)	Scotland	1,764,000
Gorkiy	U.S.S.R.	1,120,000
Guadalajara	Mexico	1,183,000
Hamburg	Germany	1,826,000
Harbin	China	1,800,000
Havana*	Cuba	1,760,000
Hyderabad*	India	1,328,000
Istanbul*	Turkey	2,052,000
Johannesburg*	South Africa	1,305,000
Kanpur* (Cawnpore)	India	1,139,000
Karachi*	Pakistan	2,721,000
Kharkov	U.S.S.R.	1,125,000
Kiev	U.S.S.R.	1,413,000
Kitakyushu	Japan	1,100,000
Kobe	Japan	1,200,000
Kyoto	Japan	1,400,000
Lahore*	Pakistan	1,674,000
Leeds* (West Yorkshire area)	England	1,730,000
Leningrad*	U.S.S.R.	3,706,000
Lima*	Peru	1,884,000
Liverpool* (Merseyside area)	England	1,351,000
London*	England	12,943,000
Lüta	China	1,590,000
Madras	India	1,927,000
Madrid*	Spain	2,867,000
Manchester* (S.E. Lancashire area)	England	2,441,000
Manila*	Philippine Is.	2,369,000
Melbourne*	Australia	2,108,000
Mexico City*	Mexico	4,666,000
Milan*	Italy	1,670,000
Montevideo*	Uruguay	1,159,000
Montreal*	Canada	2,527,000
Moscow*	U.S.S.R.	6,507,000
Mukden (Shenyang)	China	3,200,000

City	Country	Population
Munich	Germany	1,261,000
Nagoya*	Japan	1,954,000
Nanking	China	1,670,000
Naples*	Italy	1,228,000
Novosibirsk	U.S.S.R.	1,064,000
Osaka	Japan	3,100,000
Paris*	France	7,369,000
Peking	China	6,800,000
Prague	Czechoslovakia	1,025,000
Pusan	South Korea	1,425,000
Pyongyang	North Korea	1,221,000
Rangoon*	Burma	1,530,000
Recife*	Brazil	1,056,000
Rio de Janeiro*	Brazil	5,700,000
Rome*	Italy	2,600,000
Saigon	South Vietnam	1,640,000
Santiago*	Chile	2,459,000
Sao Paulo*	Brazil	5,383,000
Seoul	South Korea	4,100,000
Shanghai	China	6,000,000
Sian	China	1,500,000
Singapore*	Singapore	1,914,000
Stockholm*	Sweden	1,262,000
Surabaja	Indonesia	1,008,000
Sydney*	Australia	2,445,000
Taipei	China	1,164,000
Taiyüan	China	1,500,000
Tashkent	U.S.S.R.	1,239,000
Tehran	Iran	2,695,000
Tientsin	China	3,000,000
Tokyo-Yokohama*	Japan	13,788,000
Toronto*	Canada	2,280,000
Tsingtao*	China	1,050,000
Turin*	Italy	1,112,000
Victoria*	Hong Kong	1,034,000
Vienna	Austria	1,637,000
Warsaw*	Poland	2,106,000
Wuhan	China	2,500,000

# BROADCASTING FREQUENCY ASSIGNMENTS

AM Radio.....535-1605 kc.....107 channels.....10 kc wide

FM Radio.....88-108 MC .....100 channels.....200 kc wide

## VHF Television

Channel Number	Frequency (Mc)	Channel Number	Frequency (Mc)
2	54-60	8	180-186
3	60-66	9	186-192
4	66-72	10	192-198
5	76-82	11	198-204
6	82-88	12	204-210
7	174-180	13	210-216

## UHF Television

470-890 Mc      70 channels      6 Mc wide numbered 14-83

## Radio Frequency Band Designation

Designation		Frequency (Gc)	Wavelength (cm)
EIA	JAN		
WR284	RG-48/U	2.60— 3.95	11.53—7.59
WR187	RG-49/U	3.95— 5.85	7.59—5.12
WR137	RG-50/U	5.85— 8.20	5.12—3.66
WR112	RG-51/U	7.05—10.00	4.25—2.99
WR90	RG-52/U	8.2 —12.4	3.66—2.42
WR62	RG-91/U	12.4 —18.0	2.42—1.66
WR42	RG-53/U	18.0 —26.5	1.66—1.13
WR28	RG-96/U	26.5 —40.0	1.13—0.75
WR22	RG-97/U	33 —50	0.91—0.60
WR15	RG-98/U	50 —75	0.60—0.40
WR12	RG-99/U	60 —90	0.50—0.33

## REPRESENTATIVE WATTAGE RATINGS AND ANNUAL OPERATING COSTS, HOME APPLIANCES

Dates are approximate. Actual values will vary with appliance size, geographical area, individual usage. Cost base is 2 cents per kilowatt hour (kwh). Local rates vary from 1 to 3 cents per kwh.

Sources: Edison Electric Institute, Jan. 1965, except for asterisked data. \*G.E. Appliance Departments

Appliance	Average Watts	Hours for 10 Cents	Annual	
			kwh	Cost
Air Conditioner (window) .....	1,325	4	1,315	\$26.30
*Air Conditioner (central, 3 ton)** ..	5,560	1	—	—
*Baby Food Warmer ..	160	31	85	1.70
Carving knife .....	95	53	3	0.06
Clock .....	2	2500	18	0.36
Clothes Dryer .....	4,350	1	960	19.20
Coffee Maker .....	740	7	87	1.74
Coffee Urn .....	1,190	4	150	3.00
Dehumidifier .....	250	20	400	8.00
Dishwasher .....	1,180	4	345	6.90
Fan (attic) .....	365	14	325	6.50
Fan (circulating) .....	145	34	77	1.54
Fan (window) .....	200	25	175	3.50
Floor Polisher .....	275	18	12	0.25
Food Blender .....	700	7	15	0.30
Food Freezer, 15 cu. ft. ....	350	14	1,050	21.00
Food Freezer, frostless .....	440	11	1,525	30.50
Food Mixer .....	115	43	10	0.21
Food Waste Disposer	400	12	25	0.50
Frying Pan .....	1,160	4	195	3.90
Germicidal Lamp .....	20	250	140	2.80
*Griddle .....	1,500	3	125	2.50
Grill (sandwich) .....	1,180	4	30	0.60
Hair Dryer .....	260	19	10	0.38
Hair Dryer (Portable)	400	13	15	0.58
Hair Dryer (Semi-Pr.)	900	6	30	1.19
Hair Setter .....	400	13	15	0.58
Heat Lamp (Infrared)	250	20	10	0.20

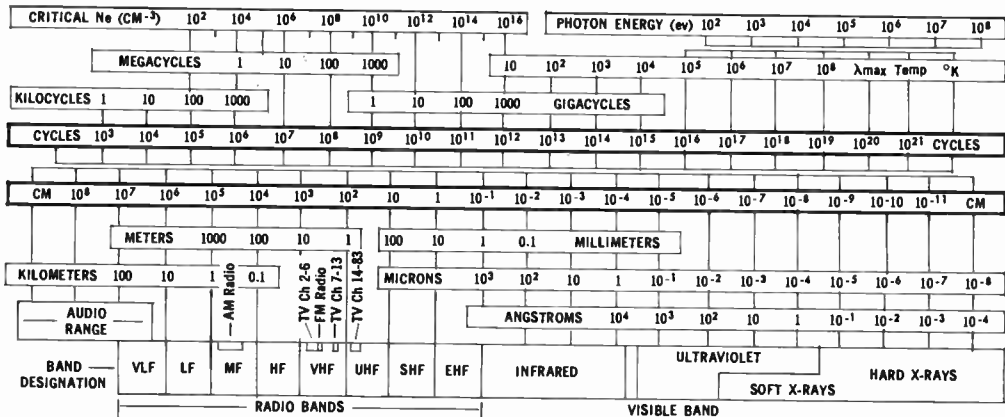
\*\*Hours are shown on page 3A

Appliance	Average Watts	Hours for 10 Cents	Annual	
			kwh	Cost
*Heat Pump (3-ton) ..	4,650	1	—	—
Heater (radiant) .....	1,375	4	184	\$ 3.67
Heating Pad .....	60	83	10	0.20
Humidifier .....	70	71	155	3.10
Iron (hand) .....	1,100	5	147	2.93
Oil Burner .....	255	20	390	7.80
*Phonograph (stereo, portable) .....	30	165	—	—
*Phonograph (stereo, console) .....	75	67	—	—
Radio .....	75	67	90	1.80
Range .....	12,000	½	1,200	24.00
Refrigerator (12 cu. ft.) .....	265	19	855	17.10
Refrigerator (frostless) .....	295	17	950	19.00
Refrigerator-Freezer (14 cu. ft.) .....	290	17	1,195	23.90
Refrigerator-Freezer (frostless, 14 cu. ft.) .....	435	11	1,575	31.50
Roaster .....	1,325	4	205	4.10
*Rotisserie .....	1,500	3	300	6.00
*Shoe Polisher .....	75	67	2	0.04
Sun Lamp .....	280	18	15	0.30
*TV (portable, B&W) ..	110	45	165	3.30
TV (console, B&W) ...	255	20	350	7.00
Television (color) ...	315	16	460	9.20
Toaster .....	1,350	4	42	0.84
Toothbrush .....	2	2500	6	0.12
*Vacuum Cleaner (portable) .....	300	17	16	0.31
Vacuum Cleaner .....	800	6	46	0.91
Waffle Iron .....	1,180	4	20	0.40
*Warming Tray .....	325	15	16	0.32
Washing Machine (automatic) .....	600	13	80	1.60
Washing Machine (non-automatic) ...	280	18	60	1.20
Water Heater (quick recovery) ..	4,500	1	4,400	88.00
Water Pump .....	450	11	200	4.00

# FREQUENCY SPECTRUM & CONVERSION CHART

$f$  = frequency in cycles per second  
 $\lambda$  (wavelength) =  $c/f = 3 \times 10^{10}/f$  (cm)  
 $h\nu$  (photon energy) =  $4.135 \times 10^{15} f$  (ev)

Critical Ne (electron density for refractive index  $\mu = 0$ ) =  $1.24 \times 10^8 f^2$  (cm<sup>-3</sup>)  
 $\lambda$  max Temp (temperature whose black body curve peaks here) =  $0.967 \times 10^{11} / f$  (°K)



4C

## **ELECTRONIC COMPONENTS SALES OPERATION**

● The Electronic Components Sales Operation is an integrated sales operation offering a complete "market basket" of electronic components. ECSO sells a complete line of tube, capacitor and semiconductor products including transistors, diodes, microelectronics, controlled rectifiers plus a large assortment of recording and indicating instruments, a-c and d-c motors and generators, control, switchgear and circuit protective devices. A variety of other products such as relays, ballasts, sealed relays, specialty transformers, thermistors, etc. are included in this "market basket."

In the electronic parts distributor market, ECSO sells a broad product list of replacement and industrial electronic components. In addition to products of the Tube, Semiconductor and Capacitor Departments, the following are available through authorized distributors. Nickel Cadmium Batteries and Chargers, Panel Meters, Miniature Lamps, General Purpose and Voltage Regulation Control Devices, Miniature Sealed Relays, and Metallurgical Products.

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