Technical Data - Physical Constants

TABLE 1 Properties of Metals

Material	Average Specific Heat Btu/(lb)(°F)	Latent Heat of Fusion Btu/lb	Density lbs/in³	Melting Point (Lowest) °C	Melting Point (Lowest) °F	Thermal Conductivity K (Btu)(in)/(hr)(sq. ft)(°F)	Thermal Expansion in/in/°F x10⁻⁶
Aluminum	.24	169	.098	643	1190	1540	13.1
Anitmony	.049	69	.239	627	1166	131	
Babbit - lead base	.039		.370	243	470	165.6	
Babbit - tin base	.071		.267	341	465	278.4	
Barium	.068		.130	850	1562		
Beryllium	.052		.066	1285	2345	1121.0	
Bismuth	.031	22.4	.353	271	520	59	
Boron	.309		.083	2300	4172		
Brass (80-20)	.091		.310	927	1700	82	
Brass (70-30)	.10		.304	927	1700	672	
Brass (yellow)	.096		.306	932	1710	830	11.2
Bronze (75/25)	.082	75	.313	1000	1832	180	
Cadmium	.055	23.8	.313	321	640	660	
Calcium	.149	140	.056	851	1564	912	
Carbon	.165		.080	3550	6422	173	
Chromium	.11		.260	1550	2822	484	
Cobalt	.099	115.2	.321	1480	2696	499	
Constantan	.098		.321				
Copper	.095	91.1	.322	1083	1981	2680	9.38
German Silver	.109		.311	961	1761	168	
Gold	.032	29.0	.698	1063	1945	2030	7.9
Incoloy® 800	.13		.290	1371	2500	80	7.9
Incoloy® 600	.126		.304	1371	2500	103	5.8
Incolol 600	.11		.304	1354	2470	109	5.8
Iron, Cast	.12		.260	1177	2150	346	6.0
Iron, wrought	.12		.278	1538	2800	432	
Lead, solid	.032	11.3	.410	327	620	240	16.4
Lead, liquid	.037		.387			108	
Linotype	.04		.363	249	480		
Lithium	.79	59	.212	186	367	516	
Magnesium	.27	160	.063	650	1202	1106	14
Manganese	.115	116	.268	1242	2268	80.6	
Mercury	.033	5.0	.488	-39	-38	60.8	
Molybdenum	.071	126	.369	2621	4750	980	2.94
Monel 400	.11		.319	1316	240	151	6.4
Nickel 200	.12	133	.321	1435	2615	520	5.8
Nichrome	.11		.302	1399	2550	104	7.3
Platinum	.035	49	.775	1774	3225	480	4.9
Potassium	.058	26.2	.434	63	146	720	
Rhodium	.059		.449	1966	3570	636	
Silicon	.162		.008	1410	2570	600	
Silver	.057	38	.379	960	1760	2900	10.8
Sodium	.295	49.5	.035	97	207	972	
Solder	.051	17	.323	183	361	310	13.1
Steel, mild	.122		.284	1516	2760	460	6.7
Stn. Stl. 304	.12		.286	1399	2550	105	9.6
Stn. Stl 430	.11		.275	1454	2650	155	6.0
Tantalum	.035		.60	2996	5425	375	3.57
Tin, liquid	.052		.253			218	
Tin, solid	.065	26.1	.263	232	450	455	13
Titanium 99.0%	.13		.164	1668	3035	112	4.7
Tungsten	.040	79	.697	3410	6170	1130	2.45
Type Metal	.040	14	.388	260	500	180	
Uranium	.028		.677	1691	3075	193.2	
Zinc	.096	43.3	.258	419	787	740	22.1
Zirconium	.067	108	.234	1843	3350	145	3.22

TABLE 2 Properties of Non-Metallic Solids

Material	Average Specific Heat Btu/(lb)(°F)	Latent Heat of Fusion Btu/lb	Average Density lbs/in³	Melting Point (Lowest) °C	Melting Point (Lowest) °F	Thermal Conductivity K (Btu)(in)/(hr)(sq. ft)(°F)	Thermal Expansion in/in/°F x10⁻⁶
ABS Plastic	.35		.042				1.32
Acrylic	.34		.041				2.28
Alumina			.087				1.0
Aluminum Silicate	.2		.086	2032	3690	9.1	
Asbestos	.25		.021			.44	
Ashes	.2		.025			.49	
Asphalt	.40		.046			5.3	

TABLE 2 Properties of Non-Metallic Solids (cont...)

Material	Average Specific Heat Btu/(lb)(°F)	Latent Heat of Fusion Btu/lb	Average Density lbs/in³	Melting Point (Lowest) °C	Melting Point (Lowest) °F	Thermal Conductivity K (Btu)(in)/(hr)(sq. ft)(°F)	Thermal Expansion in/in/°F x10⁻⁶
Bakelight, Pure Resin	.3 - .4		.045				
Barium Chloride	.10		.139	925	1697		
Beeswax		75	.035	144	62	1.67	
Boron Nitride	.33		.082	5430	2999	125	1 - 4
Brickwork	.22		.076			3 - 7	3 - 6
Calcium Chloride	.17	72	.091	772	1422		
Carbon	.28		.080	3704	6700	165	0.3 - 2.4
Canauba Wax	.8		.036				
Cellulose Acetate	.3 - .5		.047			1.2 - 2.3	61 - 83
Cement	.19		.054			2.04	
Ceramic Fiber	.27		.007				
Chalk	.215		.083			5.76	
Clay	.224		.052	1738	3160	9	
Coal (Coarse Anthercite)	.32		.046			11	
Coal Tars	.35 - .45		.045				
Coke	.265		.043				
Concrete (Cinder)	.16		.058			5.3	
Concrete (Stone)	.156		.083			9.5	
Cork	.5		.008			.36	
Cotton (Flax, Hemp)	.31		.053			.41	
Delrin	.35		.051			1.6	45
Diamond	.147		.127			13872	
Earth, Dry & Packed	.44		.054			.9	
Epoxy	.25 - .3		.045			1.2 - 2.4	
Ethyl Cellulose	.32 - .46		.041				
Fiberglass			.0004			.28	
Firebrick, Fireclay	.243		.083	1593	2900	6.6	
Firebrick, Silica	.258		.089	1649	3000	7.2	
Flourspar	.21						
Fluoroplastics	.28		.081			1.68	
Glass, crown	.161		.101			7.5	5
Granite	.192		.097			13 - 28	
Graphite	.20		.075			1.25	
Ice	.53	144	.0324	0	32	11	28.3
Isoprene	.48		.034			1.0	
Limestone	.217		.088			3.6 - 9	
Magnesia	.234		.130	2799	5070	.48	
Magnesite Brick	.222		.092			10.8 - 30	
Magnesium Silicate			.101			15.6	
Marble	.21		.097			14.4	
Marinite I @ 204°C (400°F)	.29		.027			.89	
Mica	.21		.102			3.0	18
MgO (Before Compacted)	.21		.085			3.6	
MgO (Compacted)	.209		.112			20	7.7
Nylon	.4		.040			1.5	61 - 63
Paper	.45		.034			.82	
Paraffin	.70	63	.032	56	133	1.6	
Phenolic Plastic	.35		.060			1.02	
Phenolic Resin, Cast	.3 - .4		.049			1.1	
Phenolic Sheet or Tube Laminated	.3 - .5		.045			2.4	
Pitch, Hard			.048	149	300		
Polycarbonate	.3		.044			1.38	
Polyester	.2 - .35		.046			3.96 - 5	
Polyethylene	.55		.035			2.3	94
Polypropylene	.46		.032			1.72	
Polystyrene	.32		.038			.7 - .10	33 - 44
Polyvinyl Chloride Acetate	.2 - .3		.049			.84 - 1.2	
Porcelain	.26		.087			6 - 10	

Physical Constants

TABLE 2 Properties of Non-Metallic Solids (cont...)

Material	Average Specific Heat Btu/(lb)(°F)	Latent Heat of Fusion Btu/lb	Average Density lbs/in³	Melting Point (Lowest) °C	Melting Point (Lowest) °F	Thermal Conductivity K (Btu)(in)/(hr)(sq. ft)(°F)	Thermal Expansion in/in/°F x10⁻⁶
Potassium Chloride	.17		.072	790	1454		
Potassium Nitrate	.26		.076	334	633		
Quartz	.26		.080			9.6	
Rock Salt	.219			813	1495		
Rubber	.44		.044			1.1	340
Sand, Dry	.191		.191			2.26	
Sandstone	.22		.081				
Silica (Fused)	.316					10.0	
Silicon Carbide	.20 - .23		.069			105	
Silicone Rubber	.45		.045			1.5	
Soapstone	.22		.097			11.3	
Sodium Carbonate	.30		.078	271	520		
Sodium Chloride	.22		.078	801	1474		
Sodium Cyanide	.30		.054	564	1047		
Sodium Nitrate	.29		.082	307	584		
Sodium Nitrite	.30		.078	271	520		
Soil, Dry							
Steatite	.20		.094			17.5 - 23	4.5 - 5.5
Stone	.20						
Sugar	.30		.061	160	320		
Sulfur	.175	17	.075	119	246	1.9	36
Tallow			.035	32	90		
Teflon	.25		.078			1.7	55
Urea, Formaldehyde	.4		.056				
Vinyl	.3 - .5		.046			.8 - 2.0	28 - 100
Wood, Oak	.57		.029			1.1	

TABLE 3 Properties of Liquids

Material	Average Specific Heat Btu/(lb)(°F)	Heat of Vaporization Btu/hr	Density lbs/ U.S. Gal.	Boiling Point °C	Boiling Point °F	Thermal Conductivity K (Btu)(in)/(hr)(sq. ft)(°F)
Acetic Acid, 20%	.91	810	8.6	101	214	3.7
Acetic Acid, 100%	.48	175	8.7	118	245	1.14
Acetone, 100%	.514	225	6.5	56	133	1.15
Alcohol (allyl)	.665	293	7.4	97	207	
Alcohol (amyl)	.65	216	7.4	138	280	
Alcohol (butyl)	.687	254	6.1	118	244	
Alcohol (ethyl)	.60	367	6.6	78	173	1.3
Alcohol (propyl)	.57	295.2	6.7	98	208	
Ammonia, 100%	1.1	589	6.4	-33	-27	3.48
Asphalt	.42		8.3			5.04
Benzene	.42	170	7.5	79	175	1.04
Brine (25% CaCl)	.689		10.2			3.36
Brine (25% NaCl)	.786	730	9.9	104	220	2.88
Brine (25% NiCi)	.81	728	9.9	105	221	4.0
Carbon Tetrachloride	.21		13.2	77	170	
Caustic soda (18%)	.84	795	10.0	105	221	3.9
Corn Syrup, Dextrose	.65		11.7	111	231	
Cottonseed Oil	.47		7.9			1.2
Dowtherm A	.44	42.2	8.8	258	496	.96
Ether	.503	160	6.1	35	95	.95
Ethyl Acetate	.475	183.5	6.9	82	180	
Ethyl Bromide	.215	108	12.1	38	101	
Ethyl Chloride	.367	166.5	7.6	12	54	
Ethyl Iodide	.161	81.3	15.1	71	160	
Ethylene Bromide	.172	83	16.0	132	270	
Ethylene Chloride	.299	139	9.6	116	240	
Ethylene Glycol	.555		9.4	197	387	
Formic Acid	.525	216	9.3	101	213	
Freon 11	.208		12.3	24	74.9	.600
Freon 12	.232	62	10.9	-30	-21.6	.492
Freon 22	.300		10.0	-41	-41.36	.624
Fuel Oil #1	.47	86	6.8	227	440	1.008
Fuel Oil #2	.44		7.2			.96
Fuel Oil #3, #4	.425	67	7.4	304	580	.918
Fuel Oil #5, #6	.41		7.9			.852
Gasoline	.53	116	5.5 - 5.7	138	280	.936
Glycerine	.61		10.5	291	556	2.0
Heptane	.49	137.1	5.1	99	210	
Hexane	.60	142.5	5.1	63	155	
Hydrochloric 10%	.93		8.9	105	221	3.9
Ice	.50		7.5			3.96
Lard	.64		7.7			
Linseed Oil	.44		7.7	289	552	59.64
Mercury	.033	117	113.0	357	675	
Methyl Acetate	.47	176.5	7.3	56	133	
Methyl Chloroform	.26	95	11.1	74	165	
Methylene Chloride	.288	142	11.0	40	104	
Molasses	.60		11.7	104	220	
NaK (78% K)	.21		6.2	786	1446	167.0
Napthalene	.396	103	7.2	218	424	
Nitric Acid, 7%	.92	918	8.6	104	220	3.8
Nitric Acid, 95%	.50	207	12.5	86	187	
Nitrobenzene	.35	142.2		211	412	
Oil (SAE10-30)	.43		7.4			
Oil (SAE40-50)	.43		7.4			
Olive Oil	.47		7.8	299	570	
Paraffin (Melted)	.71		6.3			1.0
Perchlorethylene	.21	90	13.5	121	250	
Phenol	.56		8.9	174	346	
Phosphoric 10%	.93.		8.7			
Phosphoric 20%	.85		9.2			
Potassium (K)	.18	893	6.0	760	1400	320.0
Propane (Comp)	.576		0.02	45	-48.1	1.81
Sea Water	.94		8.6			
Sodium (Na)	.30	1810	6.8	883	1621	580.0
Sodium Hydroxide						
30% Solution	.84		11.1			
50% Solution	.78		12.8			
Soybean Oil	.24 - .33		7.7			
Starch			12.8			
Sucrose, 40% Sugar	.66		9.8	101	214	
Sucrose, 60% Sugar	.74		10.8	103	218	
Sulfur, Melted 260°C (500°F)	.24	120	15.0	444	832	
Sulfuric Acid, 10%	.92		9.9	102	216	4.0
Sulfuric Acid, 20%	.84		9.5	103	218	
Sulfuric Acid, 60%	.52		12.5	139	282	2.88
Sulfuric Acid 98%	.35	219	15.3	329	625	1.8
Therminol FR-2	.30		12.1	342	648	.70
Toluene	.42.		7.2			1.032
Trichloroethylene	.23	103	12.2	87	188	.84
Transformer Oils	.42		7.5			.9
Turpentine	.41	123	7.6	159	318	.90
Vegetable Oil	.43		7.7			1.1
Water	1.0	970	8.3	100	212	4.2
Xylene	.411	149.2	7.2	142	288	

TABLE 4 Properties of Gases

Gas	Specific Heat Btu/lb(°F)	Density lbs/ft³	Thermal Conductivity K (Btu)(in)/(hr)(sq. ft)(°F)
Acetylene	.35	.073	.129
Air at 27°C (80°F)	.240	.073	.18
Air at 204°C (400°F)	.245	.046	.27
Alcohol, Ethyl (Vapor)	.4534		
Alcohol, Methyl (Vapor)	.4580		
Ammonia	.523	.044	.16
Argon	.125	.102	.12
Butane		.1623	.0876
Butylene		.148	
Carbon Dioxide	.199	.113	.12
Carbon Monoxide	.248	.072	.18
Chlorine	.115	.184	.06
Chloroform	.1441		.046
Chloromethane	.24	.1309	.0636
Ethyl Chloride		.1703	.066
Ethyl Ether	.4380		.0924
Ethylene	.40	.0728	.1212
Helium	1.25	.011	1.10
Hydrochloric Acid	.191	.0946	
Hydrogen	3.39	.0052	.13
Hydrogen Sulfide	.2451	.096	.091
Methane	.528	.041	.25
Nitric Oxide	.231	.0779	.1656
Nitrogen	.248	.072	.19
Nitrous Oxide	.221	.1143	.1056
Oxygen	.218	.082	.18
Sulphur Dioxide	.152	.172	.07
Water Vapor 100°C (212°F)	.482	.0372	.16