PHYSICAL PROPERTIES OF MATERIALS

6T: Metals and non-Metallic Solids

SUBSTANCE	Specific Heat	Heat of Fusion Btu/lb.	Melting Point °F	Density— Weight in lbs./cu, ft.
Aluminum 2024-T3 Aluminum 1100-0 Antimony Asbestos Cement	.24 .24 .23	167 169 25	935 1190 1166	173 169 423
Board Asphalt	.25 ±	40	250	121 131
Bakelite Resin, Pure Barium Beeswax Beryllium	.34 .068 .052	75	1562 144 2345	74-81 225 60.5 113.5
Bismuth Boron	.031	23	520 4172	612 144
Brass, 70% Brickwork & Masonry Bronze (75%Cu;	.096 .220		1750	532 131
25%Sn) Cadmium	.082 .055	75 23.8	1832 610	541 540
Calcium Calcium Chloride Carbon Cement, Portland,	.149 .17 .280	140	1564 1422 6700	96.7 157 138
Loose	.19 .25			94
Cerafelt Insulation Ceramic Fiber Chalk Chromium Clay	.25		2822 3160	3 4-10 112-175 450 90
Coal Coal Tar Cobalt Coke Concrete, Cinder	.32 .3545 .099 .265 .16	115.2	2696	80 78 554 62-88 100
Concrete, Stone Copper Cork Cotton (Flax, Hemp) Delrin	.156 .095 .36 .31 .350	91.1 	1981	144 556 13.5 92.4 88.1
Firebrick, Fireclay Firebrick, Silica Glass Gold Granite	.243 .258 .20 .032 .192	29.0	2900 3000 2200 ± 1945	137-150 144-162 164 1206 160-175
Graphite Ice Incoloy 800 Inconel 600 Invar (36%Ni)	.20 .53 .13 .126 .126	144 	32 2475-2525 2500 2600	130 56.0 501 525 506
Iron, Cast Iron, Wrought Isoprene, Rubber Lead, Solid Limestone	.12 .12 .48 .032 .217	11.3	2150 2800 620	449 480 58 708 130-175
Lithium Manganese Magnesium Magnesia, 85% Mg O (Compacted)	.79 .115 .27 .222 .209	59 116 160	367 2268 1202 5070	367 463 109 19 194
Mercury Mica Molybdenum	.033 ,21 .061	5 126	- 38 4750	844 176 638

SUBSTANCE	Specific Heat	Heat of Fusion Btu/lb.	Melting Point °F	Density— Weight in lbs./cu. ft.
Monel 400 Nickel 200 Nichrome	.11 .12	133	2370 2615	551 555
(80% Ni20% Cr.) Paper Paraffin Pitch (Hard)	.11 .45 .69	63 63	2550 133 300 ±	522 58.8 55.3 83
Plastics: ABS Acrylic Cellulose Acetate Cellulose Acetate	.35 .34 .35			69-76 69-74 76-83
Butyrate Epoxy Fluoroplastics Nylon Phenolic Polycarbonate Polyester Polyethylene Polyimides Polypropylene Polystyrene Polystyrene Polyvinyl Chloride	.3·,4 .25·.3 .28 .3·.5 .35 .3 .2·.35 .54 .27·.31 .46 .32			74 66-88 131-150 67-72 85-124 74-78 66-92 57-60 90 55-57 66
Acetate Platinum Porcelain Potassium Potassium Chloride Potassium Nitrate	.23 .035 .26 .058 .17 .26	49	3225 146 1454 633	72-99 1339 145-155 750 124 132
Quartz Rhodium Rubber Rubber, Synthetic Silicone Rubber	.26 .059 .44 .40 .45		3570 	138 776 76.0 58 78
Silicon Silver Sodlum Solder (50% Pb-50% Sn.)	.162 .057 .295	38 49.5	2570 1760 207 361	14.5 665 60 558
Steatite Steel Mild Steel S. 304 Steel S. 430 Sulfur	.20 .122 .12 .11 .175		2760 2550 2650 246	162 491 494 475 130
Sugar Tallow Tantalum Teflon Tin, Solid	.30 .035 .25 .065	261	320 90 ± 5425 450	105 60.0 104 135 454
Titanium 99.0% Tungsten Type Metal	.13 .032	79 14 +	3035 6170 500	283 1200 669
(85% Pb13% Sb.) Uranium Vinyl	.040 .028 .35	14+	3075	1170 79.5
Wood (Pine) Wood (Oak) Zirconium Zinc	.45 ± .57 .066 .096	108 43.3	3350 787	34 50 400 445

[±] Estimated

7T: Metals in Liquid State

SUBSTANCE	Specific Heat	Heat of Fusion Btu/lb.	Melting Point °F	Temperature °F	Density— Weight in Ibs./cu. ft.
Aluminum	.26 .26 .26	173 	1220.4	1220 1292 1454	148.6 147.7
Bismuth	.034 @ 520° F .0354 .0376	21.6	520 	572 752 1112	626.2 618.7 603.1
Cadmium	.0632 .0632 .0632 .0632	23.8	609	626 662 680 752	500 498.8 495
Gold	.0355	26.9	1945	2012	1076
Lead	.038 .037	10.6	621	700 932	655.5 648.7
Lithium	1,0 1.0	284.4	354	392 752	31.7 31
Magnesium	.317 .321	148	1204	1204 1328 1341	98. 94.3

		Heat of	Melting		Density
SUBSTANCE	Specific Heat	Fusion Btu/lb.	Point °F	Temperature °F	Weight in lbs./cu. ft.
Mercury	.03334 .03279 	5 	-38 	32 212 320 392	833.6 818.8
Potassium	.1901 .1826	26.3	147	300 752	50.6 46.6
Silver	.0692 .0692 .0692	44.8	1761	1761 1832 2000	580.6 578.1 574.4
Sodium	.331 .320 .301	48.7 	208	212 400 752	57.9 56.2 53.3
Solder .5 Sn, .5 Pb .6 Sn, .4 Pb	.0556 .0584	17 28	421 375		
Tin	.058	26.1	449 	482 768 783	426.6
Zinc	.12 .117	43.9 	787 	787 932 1112	432 425

8T: Liquids

		Heat of		Density-	
	Specific	Vaporiza- tion	Boiling Point	Weight in	Weight
SUBSTANCE	Heat	Btu/lb.	°F	In lbs./cu.ft.	in lbs./gal.
Acetic Acid, 100%	.48	175	245	65.4	8.74
Acetone, 100%	.514	225	133	49	6.5
Allyl Alcohol	.665	293	207	55	7.35
Ammonia, 100%	1.1	589	-27	47.9	6.4
Amyl Alcohol	.65	216	280	55	7.35
Aniline	.514	198	63	64.6	8.63
Arochier Oil	.28		650	89.7	12.00
Brine Sodium Chloride, 25%	.786	730	220	74.1	9,9
Butly Alcohol	.687	254	244	45.3	6.0
Butyric Acid	.515		345	50.4	6.73
Carbon Tetrachloride	.21		170	98.5	13.16
Corn Syrup, Dextrose	.65 ±		231	87.8	11.73
Cottonseed Oil	.47			59.2	7.9
Ether	.503	160	95	46	6.14
Ethyl Acetate	.475	183.5	180	51.5	6.88
Ethyl Alcohol, 95%	.60	370		50.4	6.74
Ethyl Bromide	.215	108	101	90.5	12.1
Ethyl Chloride	.367	166.5	54	57	7.62
Ethyl lodide	.161	81.3	160	113	15.1
Ethylene Bromide	.172	83	270	120	16.0
Ethylene Chloride	.299	139	240	71.7	9.58
Ethylene Glycol	.555		387	70.0	9.36
Fatty Acid-Aleic	.7 ±		547	55.4	7.4
Fatty Acid-Palmitic	.653		520	53.1	7.1
Fatty Acid Stearic	.550		721	52.8	7.06
Formic Acid	.525	216	213	69.2	9.25
Freon 11	.208		74.9	92.1	12.3
Freon 12	.232	62	-21.6	81.8	10.93
Freon 22	.300		-41.36	74.53	9.96
Fruit, Fresh, Avg.	.88			50-60	6.7-8.0
Glycerine	.58		556	78.7	10.5
Heptane	.49	137.1	210	38.2	5.1
Hexane	.6	142.5	155	38.2	5.1
Honey	.34				
Hydrochloric Acid, 10%	.93		221	66.5	8.89
Lard	.64			57.4	7.67
Linseed Oil	44		552	57.9	7.74
Maple Syrup	.48				
Mercury	.033	117	675	845	113.0
Methyl Acetate	.47	176.5	133	54.8	7.3
Methyl Chloroform	.26	95	165	82.7	11.0
Methylene Chloride	.288	142	104	82.6	11.0
Milk, 3.5%	.90			64.2	8.58
Molasses	.60		220 ±	87.4	11.68
Nitric Acid, 7%	.92	918	220	64.7	8.65
Nitric Acid, 95%	.5	207	187	93.5	12.5
Nitrobenzene	.35	142.2	412		
Olive Oil	.47		570	58	7.75
Perchlorethylene	.21	90	250	101.3	13.54

	Specific		Point	in	Weight in
SUBSTANCE	Heat	Btu/lb.	°F	lbs./cu.ft.	lbs./gal.
Petroleum Products:					
Asphalt	,42			62.3	8.33
Benzene	.42	170	175	56	7.48
Fuel Oils:					
Fuel Oil #1 (Kerosene)	.47	86	**440 ±	50.5	6.75
Fuel Oil #2	.44			53.9	7.2
Fuel Oil Medium #3, #4	.425	67	**580 ±		7.44
Fuel Oil Heavy #5, #6	.41			58.9	7.87
Gasoline	.53	116	**280 ±	41-43	5.5-5.75
Machine/Lube Oils:					
SAE 10-30	.43			55.4	7.4
SAE 40-50	.43			55.4	7.4
Napthalene	.396	103	424 ±	54.1	7.23
Paraffin, Melted (150°F+)		70	572	56	7.5
Propane (Compressed)	.576		-48.1	.13	.02
Toluene	.42			53.7	7.18
Transformer Oils	.42			56.3	7.5
Phenol (Carbolic Acid)	.56		346	66.6	8.9
Phosphoric Acid, 10%	.93			65.4	8.74
Phosphoric Acid, 20%	.85			69.1	9.24
Polyurethane Foam Com-					
ponents:					
Part A Isocyanate	.6			77	10.3
Part B Polyoil Resin	.7_			74.8	10.0
Potassium (1000°F)	.18	893	1400	44.6	5.96
Propionic Acid	.56	177.8	286	61.8	8.26
Propyl Alcohol	.57	295.2	208	50.2	6.7
Sea Water	.94			64.2	8.58
Sodium (1000°F)	.30	1810	1638	51.2	6.84
Sodium Hydroxide (Caustic					
Soda)					
30% Sol.	.84			82.9	11.08
50% Sol.	.78			95.4	12.75
Soybean Oil	.2433			57.4	7.67
Starch				95.4	12.75
Sucrose, 40% Sugar Syrup	.66		214	73.5	9.8
Sucrose, 60% Sugar Syrup	.74		218	80.4	10.75
Sulfur, Melted (500"F)	.24	120	832	112	14,97
Sulfuric Acid, 20%	.84		218	71	9.5
Sulfuric Acid, 60%	.52		282	93.5	12.5
Sulfuric Acid, 98%	.35	219	625	114.7	15.33
Trichloroethylene	.23	103	188	91.3	12.2
Trichloro-Trifluoroethane	.21	63	118	94.6	12.64
Turpentine	.42	133	319	54.0	7.2
Vegetable Oil	.43	, 30	"	57.5	7.69
Water	1.00	965	212	62.5	8.34
Xylene	.411	149.2	288	53.8	7.2

9T: Gases and Vapors

SUBSTANCE	Chemical Formula or Symbol	Specific Heat at Constant Pressure	Density— Weight in Ibs./cu. ft. at 70°F and Atmospheric Pressure	Specific Gravity Relative to Air
Acetylene				
(ethyne)	C₂H₂	.35	.0682	.907
Air		.24	.075	1.00
Ammonia	NH ₃	.523	.0448	.596
Argon	Α	.124	.1037	1.379
Butane	C₄H ₁₀	.395	.1554	2.067
Carbon Dioxide	CO,	.199	.115	1.529
Carbon Monoxide	CO	.248	.0727	.967
Chlorine	CI ₂	115	.1869	2.486
Ethane	C ₂ H ₆	.386	.0789	1.049
Ethylene	C₂H₄	.40	.0733	.975
Helium	He	1.25	.0104	.1381
Hydrogen				
Chloride	HCI	.191	.0954	1.268
Hydrogen	H ₂	3.42	.0052	.0695
Hydrogen				
Sulphide	H₂S	.243	.0895	1.19

SUBSTANCE	Chemical Formula or Symbol	Specific Heat at Constant Pressure	Density— Weight in Ibs./cu. ft. at 70°F and Atmospheric Pressure	Specific Gravity Relative to Air
Methane	CH₄	.593	.0417	.554
Methyl Chloride	CH ₃ CI	.24	.1342	1.785
Natural Gas		.56	.0502	.667
Nitric Oxide	NO	.231	.078	1.037
Nitrogen	N ₂	.247	.0727	.967
Nitrous Oxide	N ₂ O	.221	.1151	1.53
Oxygen	02	.217	.0831	1.105
Propane	C ₃ H _H	.393	.1175	1.562
Propene				
(propylene)	C ₃ H ₆	.358	.1091	1.451
Sulpher Dioxide Water Vapor at	SO ₂	.154	.1703	2.264
212 deg. F	H₂O	.482	.037	.489

Natural Gas values are representative. Specific contents of samplings are required for exact characteristics.

 ^{*} At or near room temperature.
 * Average value shown. Boils at various temperatures within the distillation range for the material.

10T: Air Densities and Properties at Various Temperatures and Pressures

The density of gases and vapors other than air can be determined by multiplying the figure chosen from below,

by the Specific Gravity Relative to Air column for the substance required from **9T.**

detern	etermined by multiplying the figure chosen from below, substance required from 9T.																			
Temp.	Specific Heat						G	lauge F	ressui	e, PSI	at 1 Atr	nospho	еге							
۰F	Btu/lb./°F	0	5	10	20	30	40	50	60	80	100	120	140	160	180	200	230	250	275	300
0 10 20 30 40 50	.240 .240 .240 .240 .240 .240	.086 .085 .083 .081 .079	.116 .113 .111 .109 .106 .104	.145 .142 .139 .136 .133 .131	.204 .199 .195 .191 .187	.263 .257 .252 .246 .242 .237	.321 .314 .308 .302 .296 .290	.380 .372 .364 .357 .350 .343	.439 .429 .420 .412 .404 .396	.556 .544 .533 .522 .512 .502	.674 .659 .646 .632 .620	.791 .774 .758 .743 .728 .714	.909 .889 .871 .853 .836	1.026 1.004 .983 .963 .944 .925	1.144 1.119 1.096 1.073 1.052 1.031	1.261 1.234 1.208 1.184 1.160 1.137	1.437 1.407 1.377 1.349 1.322 1.296	1.555 1.522 1.490 1.459 1.430 1.402	1.701 1.665 1.631 1.597 1.565 1.535	1.848 1.808 1.771 1.735 1.700 1.667
60	.240	.076	.102	.128	.180	.232	.284	.336	.388	.492	.596	.700	.804	.908	1.012	1.115	1.271	1.375	1.505	1.635
70	.240	.075	.100	.126	.177	.228	.279	.330	.381	.483	.585	.687	.789	.890	.992	1.094	1.247	1.349	1.447	1.600
80	.240	.074	.099	.124	.174	.224	.274	.324	.374	.474	.574	.674	.774	.874	.974	1.074	1.224	1.324	1.449	1.574
90	.240	.072	.097	.121	.170	.220	.269	.318	.367	.465	.563	.662	.760	.858	.956	1.055	1.202	1.300	1.423	1.546
100	.240	.071	.095	.119	.167	.216	.264	.312	.360	.457	.553	.650	.746	.842	.939	1.036	1.181	1.277	1.398	1.518
120	.240	.068	.092	.115	.162	.208	.255	.301	.348	.441	.534	.627	.721	.814	.907	1.000	1.140	1.233	1.349	1.466
140	.240	.066	.089	.111	.156	.201	.247	.291	.336	.426	.516	.607	.697	.787	.877	.967	1.102	1.192	1.304	1.417
160	.241	.064	.086	.108	.151	.195	.239	.282	.326	.413	.500	.587	.674	.761	.848	.936	1.067	1.153	1.262	1.371
180	.241	.062	.083	.104	.146	.189	.231	.273	.315	.400	.484	.570	.653	.737	.822	.906	1.033	1.117	1.223	1.328
200	.242	.060	.081	.101	.142	.183	.224	.265	.306	.388	.170	.551	.633	.715	.797	.879	1.002	1.084	1.186	1.288
220 240 260 280 300	.242 .242 .243 .243 .244	.058 .057 .055 .054 .052	.078 .076 .074 .072 .070	.098 .095 .093 .090	.138 .134 .130 .127 .123	.178 .173 .168 .163 .159	.217 .211 .205 .200 .194	.257 .250 .243 .236 .230	.297 .288 .280 .273 .266	.376 .365 .355 .346 .337	.456 .443 .430 .419 .408	.535 .520 .505 .492 .479	.615 .597 .580 .564 .550	.694 .674 .656 .638 .621	.774 .751 .731 .711 .692	.853 .829 .806 .784 .763	.972 .944 .918 .893 .870	1.052 1.022 .993 .966 .941	1.151 1.118 1.087 1.058 1.030	1.250 1.215 1.181 1.149 1.119
320	.244	.051	.068	.086	.120	.155	.189	.224	.259	.328	.397	.467	.536	.605	.674	.744	.848	.917	1,003	1.090
340	.244	.050	.067	.083	.117	.151	.185	.219	.252	.320	.387	.455	.522	.590	.658	.725	.826	.894	.978	1.063
360	.246	.048	.065	.081	.114	.147	.180	.213	.246	.312	.378	.444	.510	.576	.641	.707	.806	.872	.954	1.037
380	.246	.047	.063	.079	.112	.144	.176	.208	.240	.305	.369	.433	.498	.562	.626	.691	.787	.851	.932	1.012
400	.247	.046	.062	.078	.109	.140	.172	.203	.235	.298	.360	.423	.486	.549	.612	.674	.769	.832	.910	.989
420	.247	.045	.060	.076	.107	.137	.168	.199	.229	.291	.352	.414	475	.536	.598	.659	.751	.813	.889	.966
440	.247	.044	.059	.074	.104	.134	.164	.194	.224	.284	.344	.404	464	.524	.584	.644	.735	.795	.870	.945
460	.248	.043	.058	.073	.102	.131	.161	.190	.220	.278	.337	.396	454	.513	.572	.630	.719	.777	.851	.924
480	.248	.042	.057	.071	.100	.128	.157	.186	.215	.272	.330	.387	445	.502	.560	.617	.703	.761	.833	.905
500	.249	.041	.055	.070	.098	.126	.154	.182	.210	.267	.323	.379	435	.492	.548	.604	.689	.745	.815	.886
520	.249	.041	.054	.068	.096	.123	.151	.178	.206	.261	.316	.371	.426	.482	.537	.592	.675	.730	.799	.868
540	.249	.040	.053	.067	.094	.121	.148	.175	.202	.256	.310	.364	.418	.472	.526	.580	.661	.715	.783	.850
560	.250	.039	.052	.065	.092	.118	.145	.171	.198	.251	.304	.357	.410	.463	.516	.569	.648	.701	.767	.834
580	.251	.038	.051	.064	.090	.116	.142	.168	.194	.246	.298	.350	.402	.454	.506	.558	.636	.688	.753	.818
600	.252	.037	.050	.063	.088	.114	.139	.165	.190	.241	.292	.343	.394	.445	.496	.547	.624	.675	.739	.802
620	.252	.037	.049	.062	.087	.112	.137	.162	.187	.237	.287	.337	.387	.437	.487	.537	.612	.662	.725	.787
640	.252	.036	.048	.061	.085	.110	.134	.159	.183	.233	.281	.331	.380	.429	.478	.527	.601	.650	.712	.773
660	.253	.035	.048	.060	.084	.108	.132	.156	.180	.228	.277	.325	.373	.421	.470	.518	.590	.639	.699	.759
680	.252	.035	.047	.059	.082	.106	.130	.153	.177	.224	.272	.319	.367	.414	.461	.509	.580	.627	.687	.746
700	.254	.034	.046	.058	.081	.104	.127	.151	.174	.221	.267	.314	.360	.407	.453	.500	.570	.616	.675	.733
720	.254	.034	.045	.057	.079	.102	.125	.148	.171	.217	.263	.308	.354	.400	.446	.492	.560	.606	.663	.721
740	.255	.033	,044	.056	.078	.101	.123	.146	.168	.213	.258	.303	.348	.393	.438	.483	.551	.596	.652	.709
760	.256	.033	.044	.055	.077	.100	.121	.143	.165	.210	.254	.298	.343	.387	.431	.475	.542	.586	.642	.697
780	.256	.032	.043	.054	.076	.097	.119	.141	.163	.206	.250	.298	.337	.381	.424	.468	.533	.577	.631	.686
800	.257	.032	.042	.053	.074	.096	.117	.139	.160	.203	.246	.289	.332	.375	.417	.460	.525	.568	.621	.675
820	.257	.031	.042	.052	.073	.094	.115	.137	.158	.200	.242	.284	.327	.369	.411	.453	.517	.559	.611	.664
840	.257	.031	.041	.051	.072	.093	.114	.134	.155	.197	.238	.280	.322	.363	.405	.446	.508	.550	.602	.654
860	.258	.030	.040	.051	.071	.091	.112	.132	.153	.194	.235	.276	.317	.358	.399	.439	.501	.542	.593	.644
880	.259	.030	.039	.050	.070	.090	.110	.130	.151	.191	.231	.272	.312	.352	.393	.433	.494	.534	.584	.634
900	.260	.029	.039	.049	.069	.089	.109	.129	.148	.188	.228	.268	.307	.347	.387	.427	.486	.526	.575	.625
920	.260	.029	.039	.048	.068	.088	.107	.127	.146	.185	.225	.264	.303	.342	.381	.420	.479	.518	.567	.616
940	.260	.028	.038	.048	.067	.086	.106	.125	.144	.183	.221	.260	.299	.337	.376	.414	.472	.511	.559	.607
960	.261	.028	.037	.047	.066	.085	.104	.123	.142	.180	.218	.256	.294	.332	.370	.408	.466	.504	.551	.599
980	.261	.028	.037	.046	.065	.084	.103	.121	.140	.178	.215	.253	.290	.328	.365	.403	.459	.497	.544	.590
1000	.262	.027	.036	.046	.064	.083	.101	.120	.138	.175	.212	.249	.286	.323	.360	.397	.453	.490	.536	.582
1020	.262	.027	.036	.045	.063	.082	.100	.118	.136	.173	.209	.245	.282	.319	.355	.392	.477	.483	.529	.574
1040	.263	.026	.035	.044	.063	.081	.099	.117	.135	.171	.207	.243	.279	.315	.351	.387	.441	.477	.522	.567
1060	.264	.026	.035	.044	.062	.079	.097	.115	.133	.168	.204	.239	.275	.311	.346	.382	.435	.470	.515	.559
1080	.264	.026	.035	.043	.060	.078	.096	.114	.131	.166	.201	.236	.271	.306	.342	.377	.429	.464	.508	.552
1100	.265	.025	.034	.043	.060	.077	.095	.112	.129	.164	.199	.233	.268	.303	.337	.372	.424	.458	.502	.545
1120	.265	.025	.034	.042	.059	.076	.094	.111	.128	.162	.196	.230	.265	.299	.333	.367	.418	.453	.495	.538
1140	.265	.025	.033	.042	.059	.075	.092	.109	.126	.160	.194	.227	.261	.295	.329	.363	.413	.447	.489	.531
1160	.266	.025	.033	.041	.058	.075	.091	.108	.125	.158	.191	.225	.258	.291	.325	.358	.408	.441	.483	.525
1180	.266	.024	.032	.041	.057	.074	.090	.107	.123	.156	.189	.222	.255	.288	.321	.354	.403	.436	.477	.518
1200	.267	.024	.032	.040	.056	.073	.089	.105	.122	.154	.187	.219	.252	.284	.317	.349	.398	.431	.471	.512

Weight in pounds per cubic foot