DENSITIES OF AQUEOUS INORGANIC SOLUTIONS

UNITS AND UNITS CONVERSIONS

Densities are given in grams per cubic centimeter. To convert to pounds per cubic foot, multiply by 62.43. °F = ⅘ °C + 32.

ADDITIONAL REFERENCES

For more detailed data on densities see *International Critical Tables:* tabular index, vol. 3, p. 1; abrasives, vol. 2, p. 87; air, moist, vol. 1, p. 71; building stones, vol. 2, p. 52; clays, vol. 2, p. 56; coals, vol. 2, p. 135; compounds, vol. 1. pp. 106, 176, 313, 341; elements, vol. 1, pp. 102, 340; fibers, vol. 2, p. 237; gases and vapors, vol. 3, pp. 3, 345; glass, vol. 2, p. 93; liquids and vitreous solids, vol. 3, p. 22; vol. 1, pp. 102, 340; vol. 2, pp. 456, 463; vol. 3, pp. 20, 35; liquid coolants and saturated vapors are available from WADC-TR-59-598, 1959; plastics are collected in the *Handbook of Chemistry and Physics,* Chemical Rubber Publishing Co.: solid helium, neon, argon, fluorine, and methane data are given by Johnson (ed.), WADD-TR-60-56, 1960; temperatures of maximum solubility, vol. 3, p. 107; metals, vol. 2, p. 463; oils, fats, and waxes, vol. 2, p. 201; orthobaric, vol. 3, pp. 202, 228, 237, 244; petroleums, vol. 2, pp. 137, 144; plastics, vol. 2, p. 296; porcelains, vol. 2, pp. 68, 75; refrigerating brines, vol. 2, p. 327; rubber, vol. 2, pp. 255, 259; soaps, vol. 5, p. 447; metallic solid solutions, vol. 2, p. 358; solids, vol. 3, pp. 43, 45; vol. 2, p. 456; vol. 3, p. 21; solutions and mixtures, vol. 3, pp. 17, 51, 95, 104, 107, 111, 125, 130; woods, vol. 2, p. 1. Also see the *Handbook of Chemistry and Physics,* Chemical Rubber Publishing Co., 40th ed., etc.

TABLE 2-31 Aluminum Sulfate [$Al_2(SO_4)_3$]

%	d_4^{15}	%	d_4^{15}
1	1.0093	16	1.1770
2	1.0195	20	1.2272
4	1.0404	24	1.2803
8	1.0837	26	1.3079
12	1.1293		

TABLE 2-32 Ammonia (NH_3)

%	–15°C	–10°C	–5°C	0°C	5°C	10°C	20°C	25°C	%	d_4^{15}
1		0.9943	0.9954	0.9959	0.9958	0.9955	0.9939	0.993	32	0.889
2		.9906	.9915	.9919	.9917	.9913	.9895	.988	36	.877
4		.9834	.9840	.9842	.9837	.9832	.9811	.980	40	.865
8	0.970	.9701	.9701	.9695	.9686	.9677	.9651	.964	45	.849
12	.958	.9576	.9571	.9561	.9548	.9534	.9501	.948	50	.832
16	.947	.9461	.9450	.9435	.9420	.9402	.9362	.934	60	.796
20		.9353	.9335	.9316	.9296	.9275	.9229		70	.755
24		.9249	.9226	.9202	.9179	.9155	.9101		80	.711
28		.9150	.9122	.9094	.9067	.9040	.8980		90	.665
30		.9101	.9070	.9040	.9012	.8983	.8920		100	.618

TABLE 2-33 Ammonium Acetate* (CH_3COONH_4)

%	d_4^{25}
1	0.9992
2	1.0013
4	1.0055
8	1.0136
12	1.0216
16	1.0294
20	1.0368
24	1.0439
28	1.0507
30	1.0540
35	1.0618
40	1.0691
45	1.0760

*For data at 16°C for 3(1)52 percent see Atack *Handbook of Chemical Data,* p. 33, Reinhold, New York, 1957.

TABLE 2-34 Ammonium Bichromate [$(NH_4)_2Cr_2O_7$]

%	d_4^{12}
1	1.0051
2	1.0108
4	1.0223
8	1.0463
12	1.0715
16	1.0981
20	1.1263

TABLE 2-35 Ammonium Chloride (NH_4Cl)

%	0°C	10°C	20°C	30°C	50°C	80°C	100°C
1	1.0033	1.0029	1.0013	0.9987	0.9910	0.9749	0.9617
2	1.0067	1.0062	1.0045	1.0018	.9940	.9780	.9651
4	1.0135	1.0126	1.0107	1.0077	.9999	.9842	.9718
8	1.0266	1.0251	1.0227	1.0195	1.0116	.9963	.9849
12	1.0391	1.0370	1.0344	1.0310	1.0231	1.0081	.9975
16	1.0510	1.0485	1.0457	1.0422	1.0343	1.0198	1.0096
20	1.0625	1.0596	1.0567	1.0532	1.0454	1.0312	1.0213
24	1.0736	1.0705	1.0674	1.0641	1.0564	1.0426	1.0327

TABLE 2-36 Ammonium Chromate [$(NH_4)_2CrO_4$]

%	°C	d_4^t
3.80	20	1.0219
10.52	13	1.0627
19.75	13.7	1.1189
28.04	19.6	1.1707

TABLE 2-37 Ammonium Nitrate (NH_4NO_3)

%	0°C	10°C	25°C	40°C	60°C	80°C
1.0	1.0043	1.0039	1.0011	0.9961	0.9870	0.9755
2.0	1.0088	1.0082	1.0051	1.0000	.9908	.9793
4.0	1.0178	1.0168	1.0132	1.0079	.9985	.9869
8.0	1.0358	1.0340	1.0297	1.0238	1.0142	1.0024
12.0	1.0539	1.0515	1.0464	1.0400	1.0301	1.0181
16.0	1.0721	1.0691	1.0633	1.0565	1.0462	1.0342
20.0	1.0905	1.0870	1.0806	1.0734	1.0627	1.0506
24.0	1.1090	1.1051	1.0982	1.0907	1.0796	1.0673
28.0	1.1277	1.1234	1.1161	1.1082	1.0968	1.0844
30.0	1.1371	1.1327	1.1252	1.1171	1.1055	1.0931
40.0	1.1862	1.1810	1.1727	1.1640	1.1515	1.1385
50.0	1.2380	1.2320	1.2229	1.2136	1.2006	1.1868

TABLE 2-38 Ammonium Sulfate [$(NH_4)_2SO_4$]

%	0°C	20°C	40°C	80°C	100°C
1	1.0061	1.0041	0.9980	0.9777	0.9644
2	1.0124	1.0101	1.0039	.9836	.9705
4	1.0248	1.0220	1.0155	.9953	.9826
8	1.0495	1.0456	1.0387	1.0187	1.0066
12	1.0740	1.0691	1.0619	1.0421	1.0303
16	1.0980	1.0924	1.0849	1.0653	1.0539
20	1.1215	1.1154	1.1077	1.0883	1.0772
24	1.1448	1.1383	1.1304	1.1111	1.1003
28	1.1677	1.1609	1.1529	1.1338	1.1232
35	1.2072	1.2800	1.1919	1.1731	1.1629
40	1.2350	1.2277	1.2196	1.2011	1.1910
50	1.2899	1.2825	1.2745	1.2568	1.2466

TABLE 2-39 Arsenic Acid ($H_3A_3O_4$)

%	d_4^{15}	%	d_4^{15}
1	1.0057	20	1.1447
2	1.0124	30	1.2331
6	1.0398	40	1.3370
10	1.0681	50	1.4602
16	1.1128	60	1.6070
		70	1.7811

TABLE 2-40 Barium Chloride ($BaCl_2$)

%	0°C	20°C	40°C	60°C	80°C	100°C
2	1.0181	1.0159	1.0096	1.0004	0.9890	0.9755
4	1.0368	1.0341	1.0275	1.0181	1.0066	.9931
8	1.0760	1.0721	1.0648	1.0551	1.0434	1.0299
12	1.1178	1.1128	1.1047	1.0948	1.0827	1.0692
16	1.1627	1.1564	1.1478	1.1373	1.1249	1.1113
20	1.2105	1.2031	1.1938	1.1828	1.1702	1.1563
24		1.2531	1.2430	1.2316	1.2186	1.2045
26		1.2793	1.2688	1.2571	1.2440	1.2298

TABLE 2-41 Cadmium Nitrate [$Cd(NO_3)_2$]

%	d_4^{18}	%	d_4^{18}
2	1.0154	20	1.1904
4	1.0326	25	1.2488
8	1.0683	30	1.3124
12	1.1061	40	1.4590
16	1.1468	50	1.6356

TABLE 2-42 Calcium Chloride ($CaCl_2$)

%	–5°C	0°C	20°C	30°C	40°C	60°C	80°C	100°C	120°C*	140°C
2		1.0171	1.0148	1.0120	1.0084	0.9994	0.9881	0.9748	0.9596	0.9428
4		1.0346	1.0316	1.0286	1.0249	1.0158	1.0046	.9915	.9765	.9601
8	1.0708	1.0703	1.0659	1.0626	1.0586	1.0492	1.0382	1.0257	1.0111	.9954
12	1.1083	1.1072	1.1015	1.0978	1.0937	1.0840	1.0730	1.0610	1.0466	1.0317
16	1.1471	1.1454	1.1386	1.1345	1.1301	1.1202	1.1092	1.0973	1.0835	1.0691
20	1.1874	1.1853	1.1775	1.1730	1.1684	1.1581	1.1471	1.1352	1.1219	1.1080
25		1.2376	1.2284	1.2236	1.2186	1.2079	1.1965	1.1846		
30		1.2922	1.2816	1.2764	1.2709	1.2597	1.2478	1.2359		
35			1.3373	1.3316	1.3255	1.3137	1.3013	1.2893		
40			1.3957	1.3895	1.3826	1.3700	1.3571	1.3450		

*Corrected to atmospheric pressure.

TABLE 2-43 Calcium Hydroxide [$Ca(OH)_2$]

%	d_4^{15}	d_4^{25}
0.05	0.99979	0.99773
.10	1.00044	.99838
.15	1.00110	.99904

TABLE 2-44 Calcium Hypochlorite* ($CaOCl_2$)

% total salt	d_4^{15}
2	1.0169
4	1.0345
6	1.0520
8	1.0697
10	1.0876
12	1.1060

*$CaOCl_2$ = 89.15%
$CaCl_2$ = 7.31%
$Ca(ClO_3)_2$ = 0.26%
$Ca(OH)_2$ = 2.92%.

TABLE 2-45 Calcium Nitrate [$Ca(NO_3)_2$]

%	6°C	18°C	25°C	30°C
2*	1.0157	1.0137	1.0120	1.0105
4	1.0316	1.0291	1.0272	1.0256
8	1.0641	1.0608	1.0585	1.0565
12	1.0979	1.0937	1.0911	1.0887
16	1.1330	1.1279	1.1250	1.1224
20	1.1694	1.1636	1.1602	1.1575
25	1.2168	1.2106	1.2065	1.2032
30		1.260		
35		1.311		
40		1.365		
45		1.422		
68*		1.747	1.741	1.736

*Supercooled tetrahydrate (m.p. 41.4°C).

TABLE 2-46 Chromic Acid (CrO_3)

%	d_4^{15}	%	d_4^{15}
1	1.006	20	1.163
2	1.014	26	1.220
6	1.045	30	1.260
10	1.076	40	1.371
16	1.127	50	1.505
		60	1.663

TABLE 2-47 Chromium Chloride ($CrCl_3$)

	d_4^{18}		
%	Violet	Green	Equilibrium mixture of violet and green
1	1.0076	1.0071	1.0075
2	1.0166	1.0157	1.0165
4	1.0349	1.0332	1.0347
8	1.0724	1.0691	1.0722
12	1.1114	1.1065	1.1111
14	1.1316		

TABLE 2-48 Copper Nitrate [$Cu(NO_3)_2$]

%	d_4^{20}	%	d_4^{20}
1	1.007	12	1.107
2	1.015	16	1.147
4	1.032	20	1.189
8	1.069	25	1.248

TABLE 2-49 Copper Sulfate ($CuSO_4$)

%	0°C	20°C	40°C
1	1.0104	1.0086	1.0024
4	1.0429	1.0401	1.0332
8	1.0887	1.084	1.0764
12	1.1379	1.1308	1.1222
16		1.180	
18		1.206	

TABLE 2-50 Cuprous Chloride (Cu_2Cl_2)

%	0°C	20°C	40°C
1	1.0095	1.0072	1.002
4	1.0387	1.036	1.0305
8	1.0788	1.0754	1.0682
12	1.1208	1.1165	1.107
16	1.1653	1.1595	1.151
20	1.2121	1.2052	1.1953

TABLE 2-51 Ferric Chloride ($FeCl_3$)

%	0°C	10°C	20°C	30°C
1	1.0086	1.0084	1.0068	1.0040
2	1.0174	1.0168	1.0152	1.0122
4	1.0347	1.0341	1.0324	1.0292
8	1.0703	1.0692	1.0669	1.0636
12	1.1088	1.1071	1.1040	1.1006
16	1.1475	1.1449	1.1418	1.1386
20	1.1870	1.1847	1.1820	1.1786
25	1.2400	1.2380	1.2340	1.2290
30	1.2970	1.2950	1.2910	1.2850
35	1.3605	1.3580	1.3530	1.3475
40	1.4280	1.4235	1.4175	1.4115
45		1.4920	1.4850	
50		1.5610	1.5510	

TABLE 2-52 Ferric Sulfate [$Fe_2(SO_4)_3$]

%	$d_4^{17.5}$
1	1.0072
2	1.0157
4	1.0327
8	1.0670
12	1.1028
16	1.1409
20	1.1811
30	1.3073
40	1.4487
50	1.6127
60	1.7983

TABLE 2-53 Ferric Nitrate [$Fe(NO_3)_3$]

%	d_4^{18}
1	1.0065
2	1.0144
4	1.0304
8	1.0636
12	1.0989
16	1.1359
20	1.1748
25	1.2281

TABLE 2-54 Ferrous Sulfate ($FeSO_4$)

%	15°C	18°C	20°C
0.2		1.00068	1.0002
0.4		1.00275	1.0022
0.8		1.00645	1.0062
1.0	1.0090	1.0085	1.0082
4.0	1.0380	1.0375	
8.0	1.0790	1.0785	
12.0	1.1235	1.1220	
16.0	1.1690	1.1675	
20.0	1.2150	1.2135	

TABLE 2-55 Hydrogen Bromide (HBr)

%	d_4^4	d_4^{10}	d_4^{25}
1.0	1.0073	1.0068	1.0041
2.0	1.0146	1.0139	1.0111
4.0	1.0295	1.0285	1.0255
6.0	1.0448	1.0435	1.0402
8.0	1.0604	1.0589	1.0552
10.0	1.0764	1.0747	1.0707
12.0	1.0928	1.0910	1.0867
14.0	1.1097	1.1078	1.1032
16.0	1.1272	1.1251	1.1202
18.0	1.1453	1.1430	1.1377
20.0	1.1640	1.1615	1.1557
22.0	1.1832	1.1806	1.1743
24.0	1.2030	1.2003	1.1935
26.0	1.2235	1.2206	1.2134
28.0	1.2446	1.2415	1.2340
30.0	1.2663	1.2630	1.2552
40.0	1.3877	1.3838	1.3736
50.0	1.5305	1.5257	1.5127
60.0	1.6950	1.6892	1.6731
65.0	1.7854	1.7792	1.7613

TABLE 2-56 Hydrogen Cyanide (HCN)

%	d_4^{15}
1	0.998
2	.996
4	.993
8	.984
12	.971
16	.956
82	.752
90	.724
100	.691

TABLE 2-57 Hydrogen Chloride (HCl)

%	–5°C	0°C	10°C	20°C	40°C	60°C	80°C	100°C
1	1.0048	1.0052	1.0048	1.0032	0.9970	0.9881	0.9768	0.9636
2	1.0104	1.0106	1.0100	1.0082	1.0019	.9930	0.9819	.9688
4	1.0213	1.0213	1.0202	1.0181	1.0116	1.0026	0.9919	.9791
6	1.0321	1.0319	1.0303	1.0279	1.0211	1.0121	1.0016	.9892
8	1.0428	1.0423	1.0403	1.0376	1.0305	1.0215	1.0111	.9992
10	1.0536	1.0528	1.0504	1.0474	1.0400	1.0310	1.0206	1.0090
12	1.0645	1.0634	1.0607	1.0574	1.0497	1.0406	1.0302	1.0188
14	1.0754	1.0741	1.0711	1.0675	1.0594	1.0502	1.0398	1.0286
16	1.0864	1.0849	1.0815	1.0776	1.0692	1.0598	1.0494	1.0383
18	1.0975	1.0958	1.0920	1.0878	1.0790	1.0694	1.0590	1.0479
20	1.1087	1.1067	1.1025	1.0980	1.0888	1.0790	1.0685	1.0574
22	1.1200	1.1177	1.1131	1.1083	1.0986	1.0886	1.0780	1.0668
24	1.1314	1.1287	1.1238	1.1187	1.1085	1.0982	1.0874	1.0761
26	1.1426	1.1396	1.1344	1.1290	1.1183	1.1076	1.0967	1.0853
28	1.1537	1.1505	1.1449	1.1392	1.1280	1.1169	1.1058	1.0942
30	1.1648	1.1613	1.1553	1.1493	1.1376	1.1260	1.1149	1.1030
32				1.1593				
34				1.1691				
36				1.1789				
38				1.1885				
40				1.1980				

TABLE 2-58 Hydrogen Fluoride (HF)

%	d_4^{20}	d_4^0
5	1.020	1.017
10	1.040	1.035
20	1.080	1.070
30	1.119	1.101
40	1.159	1.130
50	1.198	1.155
60	1.235	
70	1.258	
80	1.259	
90	1.178	
95	1.089	
100	1.0005	

TABLE 2-59 Hydrogen Peroxide (H_2O_2)

%	d_4^{18}	%	d_4^{18}
1	1.0022	26	1.0959
2	1.0058	28	1.1040
4	1.0131	30	1.1122
6	1.0204	35	1.1327
8	1.0277	40	1.1536
10	1.0351	45	1.1749
12	1.0425	50	1.1966
14	1.0499	55	1.2188
16	1.0574	60	1.2416
18	1.0649	70	1.2897
20	1.0725	80	1.3406
22	1.0802	90	1.3931
24	1.0880	100	1.4465

TABLE 2-60 Hydrofluosilic Acid (H_2SiF_6)

%	$d_4^{17.5}$	%	$d_4^{17.5}$
1	1.0080	16	1.1373
2	1.0161	20	1.1748
4	1.0324	25	1.2235
8	1.0661	30	1.2742
12	1.1011	34	1.3162

TABLE 2-61 Magnesium Chloride ($MgCl_2$)

%	0°C	20°C	40°C	60°C	80°C	100°C
2	1.0168	1.0146	1.0084	0.9995	0.9883	0.9753
4	1.0338	1.0311	1.0248	1.0159	1.0050	.9923
8	1.0683	1.0646	1.0580	1.0493	1.0388	1.0269
12	1.1035	1.0989	1.0921	1.0836	1.0735	1.0622
16	1.1395	1.1342	1.1272	1.1188	1.1092	1.0984
20	1.1764	1.1706	1.1635	1.1552	1.1460	1.1359
25	1.2246	1.2184	1.2111	1.2031	1.1942	1.1847
30	1.2754	1.2688	1.2614	1.2535	1.2451	1.2360

TABLE 2-62 Magnesium Sulfate ($MgSO_4$)

%	0°C	20°C	30°C	40°C	50°C	60°C	80°C
2	1.0210	1.0186	1.0158	1.0123	1.0081	1.0032	0.9916
4	1.0423	1.0392	1.0362	1.0326	1.0283	1.0234	1.0118
8	1.0858	1.0816	1.0782	1.0743	1.0700	1.0650	1.0534
12	1.1309	1.1256	1.1220	1.1179	1.1135	1.1083	1.0968
16	1.1777	1.1717	1.1679	1.1637	1.1592		
20	1.2264	1.2198	1.2159	1.2117	1.2072		
26	1.3032	1.2961	1.2922	1.2879	1.2836		

TABLE 2-63 Nickel Chloride ($NiCl_2$)

%	d_4^{18}
1	1.0082
2	1.0179
4	1.0375
8	1.0785
12	1.1217
16	1.1674
20	1.2163
30	1.353

TABLE 2-64 Nickel Nitrate [$Ni(NO_3)_2$]

%	d_4^{20}
1	1.0065
2	1.0150
4	1.0325
8	1.0688
12	1.1070
16	1.1480
20	1.191
30	1.311
35	1.377

TABLE 2-65 Nickel Sulfate ($NiSO_4$)

%	d_4^{18}
1	1.0091
2	1.0198
4	1.0415
8	1.0852
12	1.1325
16	1.1825
18	1.2090

TABLE 2-66 Nitric Acid (HNO_3)

%	0°C	5°C	10°C	15°C	20°C	25°C	30°C	40°C	50°C	60°C	80°C	100°C
1	1.0058	1.00572	1.00534	1.00464	1.00364	1.00241	1.0009	0.9973	0.9931	0.9882	0.9767	0.9632
2	1.0117	1.01149	1.01099	1.01018	1.00909	1.00778	1.0061	1.0025	.9982	.9932	.9816	.9681
3	1.0176	1.01730	1.01668	1.01576	1.01457	1.01318	1.0114	1.0077	1.0033	.9982	.9865	.9730
4	1.0236	1.02315	1.02240	1.02137	1.02008	1.01861	1.0168	1.0129	1.0084	1.0033	.9915	.9779
5	1.0296	1.02904	1.02816	1.02702	1.02563	1.02408	1.0222	1.0182	1.0136	1.0084	.9965	.9829
6	1.0357	1.03497	1.03397	1.03272	1.03122	1.02958	1.0277	1.0235	1.0188	1.0136	1.0015	.9879
7	1.0418	1.0410	1.0399	1.0385	1.0369	1.0352	1.0333	1.0289	1.0241	1.0188	1.0066	.9929
8	1.0480	1.0471	1.0458	1.0443	1.0427	1.0409	1.0389	1.0344	1.0295	1.0241	1.0117	.9980
9	1.0543	1.0532	1.0518	1.0502	1.0485	1.0466	1.0446	1.0399	1.0349	1.0294	1.0169	1.0032
10	1.0606	1.0594	1.0578	1.0561	1.0543	1.0523	1.0503	1.0455	1.0403	1.0347	1.0221	1.0083
11	1.0669	1.0656	1.0639	1.0621	1.0602	1.0581	1.0560	1.0511	1.0458	1.0401	1.0273	1.0134
12	1.0733	1.0718	1.0700	1.0681	1.0661	1.0640	1.0618	1.0567	1.0513	1.0455	1.0326	1.0186
13	1.0797	1.0781	1.0762	1.0742	1.0721	1.0699	1.0676	1.0624	1.0568	1.0509	1.0379	1.0238
14	1.0862	1.0845	1.0824	1.0803	1.0781	1.0758	1.0735	1.0681	1.0624	1.0564	1.0432	1.0289
15	1.0927	1.0909	1.0887	1.0865	1.0842	1.0818	1.0794	1.0739	1.0680	1.0619	1.0485	1.0341
16	1.0992	1.0973	1.0950	1.0927	1.0903	1.0879	1.0854	1.0797	1.0737	1.0675	1.0538	1.0393
17	1.1057	1.1038	1.1014	1.0989	1.0964	1.0940	1.0914	1.0855	1.0794	1.0731	1.0592	1.0444
18	1.1123	1.1103	1.1078	1.1052	1.1026	1.1001	1.0974	1.0913	1.0851	1.0787	1.0646	1.0496
19	1.1189	1.1168	1.1142	1.1115	1.1088	1.1062	1.1034	1.0972	1.0908	1.0843	1.0700	1.0547
20	1.1255	1.1234	1.1206	1.1178	1.1150	1.1123	1.1094	1.1031	1.0966	1.0899	1.0754	1.0598
21	1.1322	1.1300	1.1271	1.1242	1.1213	1.1185	1.1155	1.1090	1.1024	1.0956	1.0808	1.0650
22	1.1389	1.1366	1.1336	1.1306	1.1276	1.1247	1.1217	1.1150	1.1083	1.1013	1.0862	1.0701
23	1.1457	1.1433	1.1402	1.1371	1.1340	1.1310	1.1280	1.1210	1.1142	1.1070	1.0917	1.0753
24	1.1525	1.1501	1.1469	1.1437	1.1404	1.1374	1.1343	1.1271	1.1201	1.1127	1.0972	1.0805
25	1.1594	1.1569	1.1536	1.1503	1.1469	1.1438	1.1406	1.1332	1.1260	1.1185	1.1027	1.0857
26	1.1663	1.1638	1.1603	1.1569	1.1534	1.1502	1.1469	1.1394	1.1320	1.1244	1.1083	1.0910
27	1.1733	1.1707	1.1670	1.1635	1.1600	1.1566	1.1533	1.1456	1.1381	1.1303	1.1139	1.0963
28	1.1803	1.1777	1.1738	1.1702	1.1666	1.1631	1.1597	1.1519	1.1442	1.1362	1.1195	1.1016
29	1.1874	1.1847	1.1807	1.1770	1.1733	1.1697	1.1662	1.1582	1.1503	1.1422	1.1251	1.1069
30	1.1945	1.1917	1.1876	1.1838	1.1800	1.1763	1.1727	1.1645	1.1564	1.1482	1.1307	1.1122
31	1.2016	1.1988	1.1945	1.1906	1.1867	1.1829	1.1792	1.1708	1.1625	1.1542	1.1363	1.1175
32	1.2088	1.2059	1.2014	1.1974	1.1934	1.1896	1.1857	1.1772	1.1687	1.1602	1.1419	1.1228
33	1.2160	1.2131	1.2084	1.2043	1.2002	1.1963	1.1922	1.1836	1.1749	1.1662	1.1476	1.1281
34	1.2233	1.2203	1.2155	1.2113	1.2071	1.2030	1.1988	1.1901	1.1812	1.1723	1.1533	1.1335
35	1.2306	1.2275	1.2227	1.2183	1.2140	1.2098	1.2055	1.1966	1.1876	1.1784	1.1591	1.1390
36	1.2375	1.2344	1.2294	1.2249	1.2205	1.2163	1.2119	1.2028	1.1936	1.1842	1.1645	1.1440
37	1.2444	1.2412	1.2361	1.2315	1.2270	1.2227	1.2182	1.2089	1.1995	1.1899	1.1699	1.1490
38	1.2513	1.2479	1.2428	1.2381	1.2335	1.2291	1.2245	1.2150	1.2054	1.1956	1.1752	1.1540
39	1.2581	1.2546	1.2494	1.2446	1.2399	1.2354	1.2308	1.2210	1.2112	1.2013	1.1805	1.1589
40	1.2649	1.2613	1.2560	1.2511	1.2463	1.2417	1.2370	1.2270	1.2170	1.2069	1.1858	1.1638
41	1.2717	1.2680	1.2626	1.2576	1.2527	1.2480	1.2432	1.2330	1.2229	1.2126	1.1911	1.1687
42	1.2786	1.2747	1.2692	1.2641	1.2591	1.2543	1.2494	1.2390	1.2287	1.2182	1.1963	1.1735
43	1.2854	1.2814	1.2758	1.2706	1.2655	1.2606	1.2556	1.2450	1.2345	1.2238	1.2015	1.1783
44	1.2922	1.2880	1.2824	1.2771	1.2719	1.2669	1.2618	1.2510	1.2403	1.2294	1.2067	1.1831
45	1.2990	1.2947	1.2890	1.2836	1.2783	1.2732	1.2680	1.2570	1.2461	1.2350	1.2119	1.1879
46	1.3058	1.3014	1.2955	1.2901	1.2847	1.2795	1.2742	1.2630	1.2519	1.2406	1.2171	1.1927
47	1.3126	1.3080	1.3021	1.2966	1.2911	1.2858	1.2804	1.2690	1.2577	1.2462	1.2223	1.1976
48	1.3194	1.3147	1.3087	1.3031	1.2975	1.2921	1.2867	1.2750	1.2635	1.2518	1.2275	1.2024
49	1.3263	1.3214	1.3153	1.3096	1.3040	1.2984	1.2929	1.2811	1.2693	1.2575	1.2328	1.2073
50	1.3327	1.3277	1.3215	1.3157	1.3100	1.3043	1.2987	1.2867	1.2748	1.2628	1.2377	1.2118
51	1.3391	1.3339	1.3277	1.3218	1.3160	1.3102	1.3045	1.2923	1.2802	1.2680	1.2425	1.2163
52	1.3454	1.3401	1.3338	1.3278	1.3219	1.3160	1.3102	1.2978	1.2856	1.2731	1.2473	1.2208
53	1.3517	1.3462	1.3399	1.3338	1.3278	1.3218	1.3159	1.3033	1.2909	1.2782	1.2521	1.2252
54	1.3579	1.3523	1.3459	1.3397	1.3336	1.3275	1.3215	1.3087	1.2961	1.2833	1.2568	1.2296
55	1.3640	1.3583	1.3518	1.3455	1.3393	1.3331	1.3270	1.3141	1.3013	1.2883	1.2615	1.2339
56	1.3700	1.3642	1.3576	1.3512	1.3449	1.3386	1.3324	1.3194	1.3064	1.2932	1.2661	1.2382
57	1.3759	1.3700	1.3634	1.3569	1.3505	1.3441	1.3377	1.3246	1.3114	1.2981	1.2706	1.2424
58	1.3818	1.3757	1.3691	1.3625	1.3560	1.3495	1.3430	1.3298	1.3164	1.3029	1.2751	1.2466
59	1.3875	1.3813	1.3747	1.3680	1.3614	1.3548	1.3482	1.3348	1.3213	1.3077	1.2795	1.2507
60	1.3931	1.3868	1.3801	1.3734	1.3667	1.3600	1.3533	1.3398	1.3261	1.3124	1.2839	1.2547
61	1.3986	1.3922	1.3855	1.3787	1.3719	1.3651	1.3583	1.3447	1.3308	1.3169	1.2881	1.2587
62	1.4039	1.3975	1.3907	1.3838	1.3769	1.3700	1.3632	1.3494	1.3354	1.3213	1.2922	1.2625
63	1.4091	1.4027	1.3958	1.3888	1.3818	1.3748	1.3679	1.3540	1.3398	1.3255	1.2962	1.2661
64		1.4078	1.4007	1.3936	1.3866	1.3795	1.3725					

TABLE 2-66 Nitric Acid (HNO_3) (*Concluded*)

%	0°C	5°C	10°C	15°C	20°C	25°C	30°C	40°C	50°C	60°C	80°C	100°C
65		1.4128	1.4055	1.3984	1.3913	1.3841	1.3770					
66		1.4177	1.4103	1.4031	1.3959	1.3887	1.3814					
67		1.4224	1.4150	1.4077	1.4004	1.3932	1.3857					
68		1.4271	1.4196	1.4122	1.4048	1.3976	1.3900					
69		1.4317	1.4241	1.4166	1.4091	1.4019	1.3942					
70		1.4362	1.4285	1.4210	1.4134	1.4061	1.3983					
71		1.4406	1.4328	1.4252	1.4176	1.4102	1.4023					
72		1.4449	1.4371	1.4294	1.4218	1.4142	1.4063					
73		1.4491	1.4413	1.4335	1.4258	1.4182	1.4103					
74		1.4532	1.4454	1.4376	1.4298	1.4221	1.4142					
75		1.4573	1.4494	1.4415	1.4337	1.4259	1.4180					
76		1.4613	1.4533	1.4454	1.4375	1.4296	1.4217					
77		1.4652	1.4572	1.4492	1.4413	1.4333	1.4253					
78		1.4690	1.4610	1.4529	1.4450	1.4369	1.4288					
79		1.4727	1.4647	1.4565	1.4486	1.4404	1.4323					
80		1.4764	1.4683	1.4601	1.4521	1.4439	1.4357					
81		1.4800	1.4718	1.4636	1.4555	1.4473	1.4391					
82		1.4835	1.4753	1.4670	1.4589	1.4507	1.4424					
83		1.4869	1.4787	1.4704	1.4622	1.4540	1.4456					
84		1.4903	1.4820	1.4737	1.4655	1.4572	1.4487					
85		1.4936	1.4852	1.4769	1.4686	1.4603	1.4518					
86		1.4968	1.4883	1.4799	1.4716	1.4633	1.4548					
87		1.4999	1.4913	1.4829	1.4745	1.4662	1.4577					
88		1.5029	1.4942	1.4858	1.4773	1.4690	1.4605					
89		1.5058	1.4970	1.4885	1.4800	1.4716	1.4631					
90		1.5085	1.4997	1.4911	1.4826	1.4741	1.4656					
91		1.5111	1.5023	1.4936	1.4850	1.4766	1.4681					
92		1.5136	1.5048	1.4960	1.4873	1.4789	1.4704					
93		1.5156	1.5068	1.4979	1.4892	1.4807	1.4722					
94		1.5177	1.5088	1.4999	1.4912	1.4826	1.4741					
95		1.5198	1.5109	1.5019	1.4932	1.4846	1.4761					
96		1.5220	1.5130	1.5040	1.4952	1.4867	1.4781					
97		1.5244	1.5152	1.5062	1.4974	1.4889	1.4802					
98		1.5278	1.5187	1.5096	1.5008	1.4922	1.4835					
99		1.5327	1.5235	1.5144	1.5056	1.4969	1.4881					
100		1.5402	1.5310	1.5217	1.5129	1.5040	1.4952					

TABLE 2-67 Perchloric Acid ($HClO_4$)

%	d_4^{15}	d_4^{20}	d_4^{25}	d_4^{50}	%	d_4^{15}	d_4^{20}	d_4^{50}
1	1.0050		1.0020	0.9933	28	1.1900	1.1851	1.1645
2	1.0109		1.0070	0.9986	30	1.2067	1.2013	1.1800
4	1.0228		1.0169	0.9906	32	1.2239	1.2183	1.1960
6	1.0348		1.0270	1.0205	34	1.2418	1.2359	1.2130
8	1.0471		1.0372	1.0320	36	1.2603	1.2542	1.2310
10	1.0597		1.0475	1.0440	38	1.2794	1.2732	1.2490
12	1.0726			1.0560	40	1.2991	1.2927	1.2680
14	1.0589			1.0680	45	1.3521	1.3450	1.3180
16	1.0995			1.0810	50	1.4103	1.4018	1.3730
18	1.1135			1.0940	55	1.4733	1.4636	1.4320
20	1.1279			1.1070	60	1.5389	1.5298	1.4950
22	1.1428			1.1205	65	1.6059	1.5986	1.5620
24	1.1581			1.1345	70	1.6736	1.6680	1.6290
26	1.1738	1.1697		1.1490				

TABLE 2-68 Phosphoric Acid (H_3PO_4)

°C	2%	6%	14%	20%	26%	35%	50%	75%	100%
0	1.0113	1.0339	1.0811	1.1192					
10	1.0109	1.0330	1.0792	1.1167	1.1567	1.221	1.341		
20	1.0092	1.0309	1.0764	1.1134	1.1529	1.216	1.335	1.579	1.870
30	1.0065	1.0279	1.0728	1.1094	1.1484	1.211	1.329	1.572	1.862
40	1.0029	1.0241	1.0685	1.1048					

TABLE 2-69 Potassium Bicarbonate ($KHCO_3$)

°C	1%	2%	4%	6%	8%	10%
0	1.0066	1.0134	1.0270			
10	1.0064	1.0132	1.0268			
15	1.0058	1.0125	1.0260	1.0396	1.0534	1.0674
20	1.0049	1.0117	1.0252			
30	1.0024	1.0092	1.0228			
40	0.9990	1.0058	1.0195			
50	.9949	1.0017	1.0154			
60	.9901	0.9969	1.0106			
80	.9786	.9855	0.9993			
100	.9653	.9722	.9860			

TABLE 2-70 Potassium Bromide (KBr)

%	d_4^{20}
1	1.0054
2	1.0127
6	1.0426
12	1.0903
20	1.1601
30	1.2593
40	1.3746

TABLE 2-71 Potassium Carbonate (K_2CO_3)

%	0°C	10°C	20°C	40°C	60°C	80°C	100°C
1	1.0094	1.0089	1.0072	1.0010	0.9919	0.9803	0.9670
2	1.0189	1.0182	1.0163	1.0098	1.0005	.9889	.9756
4	1.0381	1.0369	1.0345	1.0276	1.0180	1.0063	.9951
8	1.0768	1.0746	1.0715	1.0640	1.0538	1.0418	1.0291
12	1.1160	1.1131	1.1096	1.1013	1.0906	1.0786	1.0663
16	1.1562	1.1530	1.1490	1.1399	1.1290	1.1170	1.1049
20	1.1977	1.1941	1.1898	1.1801	1.1690	1.1570	1.1451
24	1.2405	1.2366	1.2320	1.2219	1.2106	1.1986	1.1869
28	1.2846	1.2804	1.2756	1.2652	1.2538	1.2418	1.2301
30	1.3071	1.3028	1.2979	1.2873	1.2759	1.2640	1.2522
35	1.3646	1.3600	1.3548	1.3440	1.3324	1.3206	1.3089
40	1.4244	1.4195	1.4141	1.4029	1.3913	1.3795	1.3678
45	1.4867	1.4815	1.4759	1.4644	1.4528	1.4408	1.4290
50	1.5517	1.5462	1.5404	1.5285	1.5169	1.5048	1.4928

TABLE 2-72 Potassium Chromate (K_2CrO_4)

%	d_4^{15}	d_4^{18}
1	1.0073	1.0066
2	1.0155	1.0147
4	1.0321	1.0311
8	1.0659	1.0647
12	1.1009	1.0999
16		1.1366
20		1.1748
24		1.2147
28		1.2566
30		1.2784

TABLE 2-73 Potassium Chlorate ($KClO_3$)

°C	1%	2%	3%	4%
0	1.0061	1.0124	1.0189	1.0256
10	1.0059	1.0122	1.0187	1.0254
20	1.0045	1.0109	1.0174	1.0241
30	1.0020	1.0085	1.0151	1.0218
40	0.9986	1.0051	1.0116	1.0183
60	.9895	0.9959	1.0024	1.0091
80	.9781	.9845	0.9910	0.9977
100	.9646	.9709	.9774	.9840

TABLE 2-74 Potassium Chloride (KCl)

%	0°C	20°C	25°C	40°C	60°C	80°C	100°C
1.0	1.00661	1.00462	1.00342	0.99847	0.9894	0.9780	0.9646
2.0	1.01335	1.01103	1.00977	1.00471	.9956	.9842	.9708
4.0	1.02690	1.02391	1.02255	1.01727	1.0080	.9966	.9634
8.0	1.05431	1.05003	1.04847	1.04278	1.0333	1.0219	1.0888
12.0	1.08222	1.07679	1.07506	1.06897	1.0592	1.0478	1.0350
16.0	1.11068	1.10434	1.10245	1.09600	1.0861	1.0746	1.0619
20.0	1.13973	1.13280	1.13072	1.12399	1.1138	1.1024	1.0897
24.0		1.16226	1.15995	1.15299	1.1425	1.1311	1.1185
28.0				1.18304	1.1723	1.1609	1.1483

%	110°C	120°C	130°C	140°C
3.79	0.9733	0.9663	0.9583	0.9502
7.45	.9978	.9899	.9827	.9745
13.62	1.0388	1.0313	1.0238	1.0159

TABLE 2-75 Potassium Chrome Alum [$K_2Cr_2(SO_4)_4$]

%	d_4^{15}
1	1.007
2	1.016
6	1.052
10	1.089
14	1.129
20	1.193
30	1.315
40	1.456
50	1.615

TABLE 2-76 Potassium Hydroxide (KOH)

%	d_4^{15}
1.0	1.0083
2.0	1.0175
4.0	1.0359
6.0	1.0544
8.0	1.0730
10.0	1.0918
15.0	1.1396
20.0	1.1884
25.0	1.2387
30.0	1.2905
35.0	1.3440
40.0	1.3991
45.0	1.4558
50.0	1.5143
51.7	1.5355 (sat'd. soln.)

TABLE 2-77 Potassium Nitrate (KNO_3)

%	0°C	10°C	20°C	40°C	60°C	80°C	100°C
1	1.00654	1.00615	1.00447	0.99825	0.9890	0.9776	0.9641
2	1.01326	1.01262	1.01075	1.00430	.9949	.9834	.9699
4	1.02677	1.02566	1.02344	1.01652	1.0068	.9951	.9816
8	1.05419	1.05226	1.04940	1.04152	1.0313	1.0192	1.0056
12	1.08221	1.07963	1.07620	1.06740	1.0567	1.0442	1.0304
16			1.10392	1.09432	1.0831	1.0703	1.0562
20			1.13261	1.12240	1.1106	1.0974	1.0831
24			1.16233	1.15175	1.1391	1.1256	1.1110

TABLE 2-78 Potassium Dichromate ($K_2Cr_2O_7$)

%	d_4^{20}
1	1.0052
2	1.0122
4	1.0264
6	1.0408
8	1.0554
10	1.0703

TABLE 2-79 Potassium Sulfate (K_2SO_4)

%	d_4^{20}
1	1.0063
2	1.0145
4	1.0310
6	1.0477
8	1.0646
10	1.0817

TABLE 2-80 Potassium Sulfite (K_2SO_3)

%	d_4^{15}
1	1.0073
2	1.0155
4	1.0322
8	1.0667
12	1.1026
16	1.1402
20	1.1793
24	1.2197
26	1.2404

TABLE 2-81 Sodium Acetate ($NaC_2H_3O_2$)

%	d_4^{20}
1	1.0033
2	1.0084
4	1.0186
8	1.0392
12	1.0598
18	1.0807
20	1.1021
26	1.1351
28	1.1462

TABLE 2-82 Sodium Arsenate (Na_3AsO_4)

%	d_4^{17}
1	1.0097
2	1.0207
4	1.0431
8	1.0892
10	1.1130
12	1.1373

TABLE 2-83 Sodium Bichromate ($Na_2Cr_2O_7$)

%	d_4^{15}
1	1.006
2	1.013
4	1.027
8	1.056
12	1.084
16	1.112
20	1.140
24	1.166
28	1.193
30	1.207
35	1.244
40	1.279
45	1.312
50	1.342

TABLE 2-84 Sodium Bromide (NaBr)

%	d_4^{17}
1	1.0060
2	1.0139
4	1.0298
8	1.0631
10	1.0803
12	1.0981
20	1.1745
30	1.2841
40	1.4138

TABLE 2-85 Sodium Formate (HCOONa)

%	d_4^{25}
1	1.003
2	1.009
4	1.022
8	1.048
12	1.074
16	1.100
20	1.127
24	1.155
28	1.184
30	1.199
35	1.236
40	1.274

TABLE 2-86 Sodium Carbonate (Na_2CO_3)

%	0°C	10°C	20°C	30°C	40°C	60°C	80°C	100°C
1	1.0109	1.0103	1.0086	1.0058	1.0022	0.9929	0.9814	0.9683
2	1.0219	1.0210	1.0190	1.0159	1.0122	1.0027	.9910	.9782
4	1.0439	1.0423	1.0398	1.0363	1.0323	1.0223	1.0105	.9980
8	1.0878	1.0850	1.0816	1.0775	1.0732	1.0625	1.0503	1.0380
12	1.1319	1.1284	1.1244	1.1200	1.1150	1.1039	1.0914	1.0787
14	1.1543	1.1506	1.1463	1.1417	1.1365	1.1251	1.1125	1.0996
16				1.1636				
18				1.1859				
20				1.2086				
24				1.2552				
28				1.3031				
30				1.3274				

TABLE 2-87 Sodium Chlorate ($NaClO_3$)

%	d_4^{18}	%	d_4^{18}
1	1.0053	18	1.1288
2	1.0121	20	1.1449
4	1.0258	22	1.1614
6	1.0397	24	1.1782
8	1.0538	26	1.1953
10	1.0681	28	1.2128
12	1.0827	30	1.2307
14	1.0977	32	1.2491
16	1.1131	34	1.2680

TABLE 2-88 Sodium Chloride (NaCl)

%	0°C	10°C	25°C	40°C	60°C	80°C	100°C
1	1.00747	1.00707	1.00409	0.99908	0.9900	0.9785	0.9651
2	1.01509	1.01442	1.01112	1.00593	.9967	.9852	.9719
4	1.03038	1.02920	1.02530	1.01977	1.0103	.9988	.9855
8	1.06121	1.05907	1.05412	1.04798	1.0381	1.0264	1.0134
12	1.09244	1.08946	1.08365	1.07699	1.0667	1.0549	1.0420
16	1.12419	1.12056	1.11401	1.10688	1.0962	1.0842	1.0713
20	1.15663	1.15254	1.14533	1.13774	1.1268	1.1146	1.1017
24	1.18999	1.18557	1.17776	1.16971	1.1584	1.1463	1.1331
26	1.20709	1.20254	1.19443	1.18614	1.1747	1.1626	1.1492

TABLE 2-89 Sodium Chromate (Na_2CrO_4)

%	d_4^{18}
1	1.0074
2	1.0164
4	1.0344
8	1.0718
12	1.1110
16	1.1518
20	1.1942
24	1.2383
26	1.2611

TABLE 2-90 Sodium Hydroxide (NaOH)

%	0°C	15°C	20°C	40°C	60°C	80°C	100°C
1	1.0124	1.01065	1.0095	1.0033	0.9941	0.9824	0.9693
2	1.0244	1.02198	1.0207	1.0139	1.0045	.9929	.9797
4	1.0482	1.04441	1.0428	1.0352	1.0254	1.0139	1.0009
8	1.0943	1.08887	1.0869	1.0780	1.0676	1.0560	1.0432
12	1.1399	1.13327	1.1309	1.1210	1.1101	1.0983	1.0855
16	1.1849	1.17761	1.1751	1.1645	1.1531	1.1408	1.1277
20	1.2296	1.22183	1.2191	1.2079	1.1960	1.1833	1.1700
24	1.2741	1.26582	1.2629	1.2512	1.2388	1.2259	1.2124
28	1.3182	1.3094	1.3064	1.2942	1.2814	1.2682	1.2546
32	1.3614	1.3520	1.3490	1.3362	1.3232	1.3097	1.2960
36	1.4030	1.3933	1.3900	1.3768	1.3634	1.3498	1.3360
40	1.4435	1.4334	1.4300	1.4164	1.4027	1.3889	1.3750
44	1.4825	1.4720	1.4685	1.4545	1.4405	1.4266	1.4127
48	1.5210	1.5102	1.5065	1.4922	1.4781	1.4641	1.4503
50	1.5400	1.5290	1.5253	1.5109	1.4967	1.4827	1.4690

TABLE 2-91 Sodium Nitrate ($NaNO_3$)

%	0°C	20°C	40°C	60°C	80°C	100°C
1	1.0071	1.0049	0.9986	0.9894	0.9779	0.9644
2	1.0144	1.0117	1.0050	.9956	.9840	.9704
4	1.0290	1.0254	1.0180	1.0082	.9964	.9826
8	1.0587	1.0532	1.0447	1.0340	1.0218	1.0078
12	1.0891	1.0819	1.0724	1.0609	1.0481	1.0340
16	1.1203	1.1118	1.1013	1.0892	1.0757	1.0614
20	1.1526	1.1429	1.1314	1.1187	1.1048	1.0901
24	1.1860	1.1752	1.1629	1.1496	1.1351	1.1200
28	1.2204	1.2085	1.1955	1.1816	1.1667	1.1513
30	1.2380	1.2256	1.2122	1.1980	1.1830	1.1674
35	1.2834	1.2701	1.2560	1.2413	1.2258	1.2100
40	1.3316	1.3175	1.3027	1.2875	1.2715	1.2555
45		1.3683	1.3528	1.3371	1.3206	1.3044

TABLE 2-92 Sodium Nitrite ($NaNO_2$)

%	d_4^{15}
1	1.0058
2	1.0125
4	1.0260
8	1.0535
12	1.0816
16	1.1103
20	1.1394

TABLE 2-93 Sodium Silicates

	Concentration, %												
	1	2	4	8	10	14	20	24	30	36	40	45	50
Formula	d_4^{20}												
$Na_2O/3.9SiO_2$	1.006	1.014	1.030	1.063	1.080	1.116	1.172	1.211	1.275				
$Na_2O/3.36SiO_2$	1.006	1.014	1.030	1.065	1.083	1.120	1.179	1.222	1.290	1.365			
$Na_2O/2.40SiO_2$	1.007	1.016	1.034	1.071	1.090	1.130							
$Na_2O/2.44SiO_2$									1.309	1.387	1.445		
$Na_2O/2.06SiO_2$	1.007	1.016	1.035	1.073	1.093	1.134	1.200	1.247	1.321	1.397	1.450	1.520	1.594
$Na_2O/1.69SiO_2$	1.007	1.017	1.036	1.077	1.098	1.141	1.210	1.259	1.337	1.424			

TABLE 2-94 Sodium Sulfate (Na_2SO_4)

%	0°C	20°C	30°C	40°C	60°C	80°C	100°C
1	1.0094	1.0073	1.0046	1.0010	0.9919	0.9805	0.9671
2	1.0189	1.0164	1.0135	1.0098	1.0007	.9892	.9758
4	1.0381	1.0348	1.0315	1.0276	1.0184	1.0068	.9934
8	1.0773	1.0724	1.0682	1.0639	1.0544	1.0426	1.0292
12	1.1174	1.1109	1.1062	1.1015	1.0915	1.0795	1.0661
16	1.1585	1.1586	1.1456	1.1406	1.1299	1.1176	1.1042
20	1.2008	1.1915	1.1865	1.1813	1.1696	1.1569	
24	1.2443	1.2336	1.2292	1.2237			

TABLE 2-95 Sodium Sulfide (Na_2S)

%	d_4^{18}
1	1.0098
2	1.0211
4	1.0440
8	1.0907
12	1.1388
16	1.1885
18	1.2140

TABLE 2-96 Sodium Sulfite (Na_2SO_3)

%	d_4^{19}
1	1.0078
2	1.0172
4	1.0363
8	1.0751
12	1.1146
16	1.1549
18	1.1755

TABLE 2-97 Sodium Thiosulfate ($Na_2S_2O_3$)

%	d_4^{20}
1	1.0065
2	1.0148
4	1.0315
8	1.0654
12	1.1003
16	1.1365
20	1.1740
24	1.2128
28	1.2532
30	1.2739
35	1.3273
40	1.3827

TABLE 2-98 Sodium Thiosulfate Pentahydrate ($Na_2S_2O_3 \cdot 5H_2O$)

%	d_4^{19}
1	1.0052
2	1.0105
4	1.0211
8	1.0423
12	1.0639
16	1.0863
20	1.1087
24	1.1322
28	1.1558
30	1.1676
40	1.2297
50	1.2954

TABLE 2-99 Stannic Chloride ($SnCl_4$)

%	d_4^{15}
1	1.007
2	1.015
4	1.031
8	1.064
12	1.099
16	1.135
20	1.173
24	1.212
28	1.255
30	1.278
35	1.337
40	1.403
45	1.475
50	1.555
55	1.644
60	1.742
65	1.851
70	1.971

TABLE 2-100 Stannous Chloride ($SnCl_2$)

%	d_4^{15}
1	1.0068
2	1.0146
4	1.0306
8	1.0638
12	1.0986
16	1.1353
20	1.1743
24	1.2159
28	1.2603
30	1.2837
35	1.3461
40	1.4145
45	1.4897
50	1.5729
55	1.6656
60	1.7695
65	1.8865

TABLE 2-101 Sulfuric Acid (H_2SO_4)

%	0°C	10°C	15°C	20°C	25°C	30°C	40°C	50°C	60°C	80°C	100°C
1	1.0074	1.0068	1.0060	1.0051	1.0038	1.0022	0.9986	0.9944	0.9895	0.9779	0.9645
2	1.0147	1.0138	1.0129	1.0118	1.0104	1.0087	1.0050	1.0006	.9956	.9839	.9705
3	1.0219	1.0206	1.0197	1.0184	1.0169	1.0152	1.0113	1.0067	1.0017	.9900	.9766
4	1.0291	1.0275	1.0264	1.0250	1.0234	1.0216	1.0176	1.0129	1.0078	.9961	.9827
5	1.0364	1.0344	1.0332	1.0317	1.0300	1.0281	1.0240	1.0192	1.0140	1.0022	.9888
6	1.0437	1.0414	1.0400	1.0385	1.0367	1.0347	1.0305	1.0256	1.0203	1.0084	.9950
7	1.0511	1.0485	1.0469	1.0453	1.0434	1.0414	1.0371	1.0321	1.0266	1.0146	1.0013
8	1.0585	1.0556	1.0539	1.0522	1.0502	1.0481	1.0437	1.0386	1.0330	1.0209	1.0076
9	1.0660	1.0628	1.0610	1.0591	1.0571	1.0549	1.0503	1.0451	1.0395	1.0273	1.0140
10	1.0735	1.0700	1.0681	1.0661	1.0640	1.0617	1.0570	1.0517	1.0460	1.0338	1.0204
11	1.0810	1.0773	1.0753	1.0731	1.0710	1.0686	1.0637	1.0584	1.0526	1.0403	1.0269
12	1.0886	1.0846	1.0825	1.0802	1.0780	1.0756	1.0705	1.0651	1.0593	1.0469	1.0335
13	1.0962	1.0920	1.0898	1.0874	1.0851	1.0826	1.0774	1.0719	1.0661	1.0536	1.0402
14	1.1039	1.0994	1.0971	1.0947	1.0922	1.0897	1.0844	1.0788	1.0729	1.0603	1.0469
15	1.1116	1.1069	1.1045	1.1020	1.0994	1.0968	1.0914	1.0857	1.0798	1.0671	1.0537
16	1.1194	1.1145	1.1120	1.1094	1.1067	1.1040	1.0985	1.0927	1.0868	1.0740	1.0605
17	1.1272	1.1221	1.1195	1.1168	1.1141	1.1113	1.1057	1.0998	1.0938	1.0809	1.0674
18	1.1351	1.1298	1.1271	1.1243	1.1215	1.1187	1.1129	1.1070	1.1009	1.0879	1.0744
19	1.1430	1.1375	1.1347	1.1318	1.1290	1.1261	1.1202	1.1142	1.1081	1.0950	1.0814
20	1.1510	1.1453	1.1424	1.1394	1.1365	1.1335	1.1275	1.1215	1.1153	1.1021	1.0885
21	1.1590	1.1531	1.1501	1.1471	1.1441	1.1410	1.1349	1.1288	1.1226	1.1093	1.0957
22	1.1670	1.1609	1.1579	1.1548	1.1517	1.1486	1.1424	1.1362	1.1299	1.1166	1.1029
23	1.1751	1.1688	1.1657	1.1626	1.1594	1.1563	1.1500	1.1437	1.1373	1.1239	1.1102
24	1.1832	1.1768	1.1736	1.1704	1.1672	1.1640	1.1576	1.1512	1.1448	1.1313	1.1176
25	1.1914	1.1848	1.1816	1.1783	1.1750	1.1718	1.1653	1.1588	1.1523	1.1388	1.1250
26	1.1996	1.1929	1.1896	1.1862	1.1829	1.1796	1.1730	1.1665	1.1599	1.1463	1.1325
27	1.2078	1.2010	1.1976	1.1942	1.1909	1.1875	1.1808	1.1742	1.1676	1.1539	1.1400
28	1.2160	1.2091	1.2057	1.2023	1.1989	1.1955	1.1887	1.1820	1.1753	1.1616	1.1476
29	1.2243	1.2173	1.2138	1.2104	1.2069	1.2035	1.1966	1.1898	1.1831	1.1693	1.1553
30	1.2326	1.2255	1.2220	1.2185	1.2150	1.2115	1.2046	1.1977	1.1909	1.1771	1.1630
31	1.2409	1.2338	1.2302	1.2267	1.2232	1.2196	1.2126	1.2057	1.1988	1.1849	1.1708
32	1.2493	1.2421	1.2385	1.2349	1.2314	1.2278	1.2207	1.2137	1.2068	1.1928	1.1787
33	1.2577	1.2504	1.2468	1.2432	1.2396	1.2360	1.2289	1.2218	1.2148	1.2008	1.1866
34	1.2661	1.2588	1.2552	1.2515	1.2479	1.2443	1.2371	1.2300	1.2229	1.2088	1.1946
35	1.2746	1.2672	1.2636	1.2599	1.2563	1.2526	1.2454	1.2383	1.2311	1.2169	1.2027
36	1.2831	1.2757	1.2720	1.2684	1.2647	1.2610	1.2538	1.2466	1.2394	1.2251	1.2109
37	1.2917	1.2843	1.2805	1.2769	1.2732	1.2695	1.2622	1.2550	1.2477	1.2334	1.2192
38	1.3004	1.2929	1.2891	1.2855	1.2818	1.2780	1.2707	1.2635	1.2561	1.2418	1.2276
39	1.3091	1.3016	1.2978	1.2941	1.2904	1.2866	1.2793	1.2720	1.2646	1.2503	1.2361
40	1.3179	1.3103	1.3065	1.3028	1.2991	1.2953	1.2880	1.2806	1.2732	1.2589	1.2446
41	1.3268	1.3191	1.3153	1.3116	1.3079	1.3041	1.2967	1.2893	1.2819	1.2675	1.2532
42	1.3357	1.3280	1.3242	1.3205	1.3167	1.3129	1.3055	1.2981	1.2907	1.2762	1.2619
43	1.3447	1.3370	1.3332	1.3294	1.3256	1.3218	1.3144	1.3070	1.2996	1.2850	1.2707
44	1.3538	1.3461	1.3423	1.3384	1.3346	1.3308	1.3234	1.3160	1.3086	1.2939	1.2796
45	1.3630	1.3553	1.3515	1.3476	1.3437	1.3399	1.3325	1.3251	1.3177	1.3029	1.2886
46	1.3724	1.3646	1.3608	1.3569	1.3530	1.3492	1.3417	1.3343	1.3269	1.3120	1.2976
47	1.3819	1.3740	1.3702	1.3663	1.3624	1.3586	1.3510	1.3435	1.3362	1.3212	1.3067
48	1.3915	1.3835	1.3797	1.3758	1.3719	1.3680	1.3604	1.3528	1.3455	1.3305	1.3159
49	1.4012	1.3931	1.3893	1.3854	1.3814	1.3775	1.3699	1.3623	1.3549	1.3399	1.3253
50	1.4110	1.4029	1.3990	1.3951	1.3911	1.3872	1.3795	1.3719	1.3644	1.3494	1.3348
51	1.4209	1.4128	1.4088	1.4049	1.4009	1.3970	1.3893	1.3816	1.3740	1.3590	1.3444
52	1.4310	1.4228	1.4188	1.4148	1.4109	1.4069	1.3991	1.3914	1.3837	1.3687	1.3540
53	1.4412	1.4329	1.4289	1.4248	1.4209	1.4169	1.4091	1.4013	1.3936	1.3785	1.3637
54	1.4515	1.4431	1.4391	1.4350	1.4310	1.4270	1.4191	1.4113	1.4036	1.3884	1.3735
55	1.4619	1.4535	1.4494	1.4453	1.4412	1.4372	1.4293	1.4214	1.4137	1.3984	1.3834
56	1.4724	1.4640	1.4598	1.4557	1.4516	1.4475	1.4396	1.4317	1.4239	1.4085	1.3934
57	1.4830	1.4746	1.4703	1.4662	1.4621	1.4580	1.4500	1.4420	1.4342	1.4187	1.4035
58	1.4937	1.4852	1.4809	1.4768	1.4726	1.4685	1.4604	1.4524	1.4446	1.4290	1.4137
59	1.5045	1.4959	1.4916	1.4875	1.4832	1.4791	1.4709	1.4629	1.4551	1.4393	1.4240
60	1.5154	1.5067	1.5024	1.4983	1.4940	1.4898	1.4816	1.4735	1.4656	1.4497	1.4344
61	1.5264	1.5177	1.5133	1.5091	1.5048	1.5006	1.4923	1.4842	1.4762	1.4602	1.4449
62	1.5375	1.5287	1.5243	1.5200	1.5157	1.5115	1.5031	1.4950	1.4869	1.4708	1.4554
63	1.5487	1.5398	1.5354	1.5310	1.5267	1.5225	1.5140	1.5058	1.4977	1.4815	1.4660
64	1.5600	1.5510	1.5465	1.5421	1.5378	1.5335	1.5250	1.5167	1.5086	1.4923	1.4766

TABLE 2-101 Sulfuric Acid (H_2SO_4) (*Concluded*)

%	0°C	10°C	15°C	20°C	25°C	30°C	40°C	50°C	60°C	80°C	100°C
65	1.5714	1.5623	1.5578	1.5533	1.5490	1.5446	1.5361	1.5277	1.5195	1.5031	1.4873
66	1.5828	1.5736	1.5691	1.5646	1.5602	1.5558	1.5472	1.5388	1.5305	1.5140	1.4981
67	1.5943	1.5850	1.5805	1.5760	1.5715	1.5671	1.5584	1.5499	1.5416	1.5249	1.5089
68	1.6059	1.5965	1.5920	1.5874	1.5829	1.5785	1.5697	1.5611	1.5528	1.5359	1.5198
69	1.6176	1.6081	1.6035	1.5989	1.5944	1.5899	1.5811	1.5724	1.5640	1.5470	1.5307
70	1.6293	1.6198	1.6151	1.6105	1.6059	1.6014	1.5925	1.5838	1.5753	1.5582	1.5417
71	1.6411	1.6315	1.6268	1.6221	1.6175	1.6130	1.6040	1.5952	1.5867	1.5694	1.5527
72	1.6529	1.6433	1.6385	1.6338	1.6292	1.6246	1.6155	1.6067	1.5981	1.5806	1.5637
73	1.6648	1.6551	1.6503	1.6456	1.6409	1.6363	1.6271	1.6182	1.6095	1.5919	1.5747
74	1.6768	1.6670	1.6622	1.6574	1.6526	1.6480	1.6387	1.6297	1.6209	1.6031	1.5857
75	1.6888	1.6789	1.6740	1.6692	1.6644	1.6597	1.6503	1.6412	1.6322	1.6142	1.5966
76	1.7008	1.6908	1.6858	1.6810	1.6761	1.6713	1.6619	1.6526	1.6435	1.6252	1.6074
77	1.7128	1.7026	1.6976	1.6927	1.6878	1.6829	1.6734	1.6640	1.6547	1.6361	1.6181
78	1.7247	1.7144	1.7093	1.7043	1.6994	1.6944	1.6847	1.6751	1.6657	1.6469	1.6286
79	1.7365	1.7261	1.7209	1.7158	1.7108	1.7058	1.6959	1.6862	1.6766	1.6575	1.6390
80	1.7482	1.7376	1.7323	1.7272	1.7221	1.7170	1.7069	1.6971	1.6873	1.6680	1.6493
81	1.7597	1.7489	1.7435	1.7383	1.7331	1.7279	1.7177	1.7077	1.6978	1.6782	1.6594
82	1.7709	1.7599	1.7544	1.7491	1.7437	1.7385	1.7281	1.7180	1.7080	1.6882	1.6692
83	1.7815	1.7704	1.7649	1.7594	1.7540	1.7487	1.7382	1.7279	1.7179	1.6979	1.6787
84	1.7916	1.7804	1.7748	1.7693	1.7639	1.7585	1.7479	1.7375	1.7274	1.7072	1.6878
85	1.8009	1.7897	1.7841	1.7786	1.7732	1.7678	1.7571	1.7466	1.7364	1.7161	1.6966
86	1.8095	1.7983	1.7927	1.7872	1.7818	1.7763	1.7657	1.7552	1.7449	1.7245	1.7050
87	1.8173	1.8061	1.8006	1.7951	1.7897	1.7842	1.7736	1.7632	1.7529	1.7324	1.7129
88	1.8243	1.8132	1.8077	1.8022	1.7968	1.7914	1.7809	1.7705	1.7602	1.7397	1.7202
89	1.8306	1.8195	1.8141	1.8087	1.8033	1.7979	1.7874	1.7770	1.7669	1.7464	1.7269
90	1.8361	1.8252	1.8198	1.8144	1.8091	1.8038	1.7933	1.7829	1.7729	1.7525	1.7331
91	1.8410	1.8302	1.8248	1.8195	1.8142	1.8090	1.7986	1.7883	1.7783	1.7581	1.7388
92	1.8453	1.8346	1.8293	1.8240	1.8188	1.8136	1.8033	1.7932	1.7832	1.7633	1.7439
93	1.8490	1.8384	1.8331	1.8279	1.8227	1.8176	1.8074	1.7974	1.7876	1.7681	1.7485
94	1.8520	1.8415	1.8363	1.8312	1.8260	1.8210	1.8109	1.8011	1.7914		
95	1.8544	1.8439	1.8388	1.8337	1.8286	1.8236	1.8137	1.8040	1.7944		
96	1.8560	1.8457	1.8406	1.8355	1.8305	1.8255	1.8157	1.8060	1.7965		
97	1.8569	1.8466	1.8414	1.8364	1.8314	1.8264	1.8166	1.8071	1.7977		
98	1.8567	1.8463	1.8411	1.8361	1.8310	1.8261	1.8163	1.8068	1.7976		
99	1.8551	1.8445	1.8393	1.8342	1.8292	1.8242	1.8145	1.8050	1.7958		
100	1.8517	1.8409	1.8357	1.8305	1.8255	1.8205	1.8107	1.8013	1.7922		

%	$d_4^{5.96}$	%	$d_4^{13.00}$	$d_4^{18.00}$
0.005	1.000 0140	0.05	0.999 810	0.999 028
.01	1.000 0576	.1	1.000 185	.999 400
.02	1.000 1434	.2	1.000 912	1.000 119
.03	1.000 2276	.3	1.001 623	1.000 820
.04	1.000 3104	.4	1.002 326	1.001 512
.05	1.000 3920	.5	1.003 023	1.002 197
.06	1.000 4726	.6	1.003 716	1.002 877
.07	1.000 5523	.8	1.005 090	1.004 227
.08	1.000 6313	1.0	1.006 452	1.005 570
.09	1.000 7098	1.2	1.007 807	1.006 909
.10	1.000 7880	1.4	1.009 159	1.008 247
.15	1.001 1732	1.6	1.010 510	1.009 583
.20	1.001 5514	1.8	1.011 860	1.010 918
.25	1.001 9254	2.0	1.013 209	1.012 252
.30	1.002 2961	2.2	1.014 557	1.013 586
.35	1.002 6639	2.4	1.015 904	1.014 919
.40	1.003 0292			
.45	1.003 3923			
.50	1.003 7534			

TABLE 2-102 Zinc Bromide ($ZnBr_2$)

%	0°C	20°C	40°C	60°C	80°C	100°C
2	1.0188	1.0167	1.0102	1.0008	0.9890	0.9751
4	1.0381	1.0354	1.0285	1.0187	1.0065	0.9921
8	1.0777	1.0738	1.0660	1.0554	1.0422	1.0270
12	1.1186	1.1135	1.1046	1.0932	1.0789	1.0629
16	1.1609	1.1544	1.1445	1.1320	1.1169	1.1000
20	1.2043	1.1965	1.1855	1.1720	1.1560	1.1382
30	1.3288	1.3170	1.3030	1.2868	1.2688	1.2489
40	1.477	1.462	1.445	1.427	1.406	1.385
50	1.661	1.643	1.623	1.602	1.579	1.555
60	1.891	1.869	1.845	1.822	1.797	1.771
65	2.026	2.002	1.976	1.951	1.924	1.898

TABLE 2-103 Zinc Chloride ($ZnCl_2$)

%	0°C	20°C	40°C	60°C	80°C	100°C
2	1.0192	1.0167	1.0099	1.0003	0.9882	0.9739
4	1.0384	1.0350	1.0274	1.0172	1.0044	.9894
8	1.0769	1.0715	1.0624	1.0508	1.0369	1.0211
12	1.1159	1.1085	1.0980	1.0853	1.0704	1.0541
16	1.1558	1.1468	1.1350	1.1212	1.1055	1.0888
20	1.1970	1.1866	1.1736	1.1590	1.1428	1.1255
30	1.3062	1.2928	1.2778	1.2614	1.2438	1.2252
40	1.4329	1.4173	1.4003	1.3824	1.3637	1.3441
50	1.5860	1.5681	1.5495	1.5300	1.5097	1.4892
60		1.749				
70		1.962				

TABLE 2-104 Zinc Nitrate [$Zn(NO_3)_2$]

%	18°C	%	18°C
2	1.0154	18	1.1652
4	1.0322	20	1.1865
6	1.0496	25	1.2427
8	1.0675	30	1.3029
10	1.0859	35	1.3678
12	1.1048	40	1.4378
14	1.1244	45	1.5134
16	1.1445	50	1.5944

TABLE 2-105 Zinc Sulfate ($ZnSO_4$)

%	20°C
2	1.019
4	1.0403
6	1.0620
8	1.0842
10	1.1071
12	1.1308
14	1.1553
16	1.1806

DENSITIES OF AQUEOUS ORGANIC SOLUTIONS*

UNITS AND UNITS CONVERSIONS

Unless otherwise noted, densities are given in grams per cubic centimeter. To convert to pounds per cubic foot, multiply by 62.43.

$$°F = \tfrac{9}{5}\,°C + 32$$

From *International Critical Tables,* vol. 3, pp. 115–129. All compositions are in weight percent in vacuo. All density values are d_4^t = g/mL in vacuo.

*For gasoline and aircraft fuels see Hibbard, NACA Res. Mem. E56I21 (declassified 1958).

TABLE 2-106 Formic Acid (HCOOH)

%	0°C	15°C	20°C	30°C	%	0°C	15°C	20°C	30°C	%	0°C	15°C	20°C	30°C	%	0°C	15°C	20°C	30°C
0	0.9999	0.9991	0.9982	0.9957	25	1.0706	1.0627	1.0609	1.0540	50	1.1349	1.1225	1.1207	1.1098	75	1.1953	1.1794	1.1769	1.1636
1	1.0028	1.0019	1.0019	0.9980	26	1.0733	1.0652	1.0633	1.0564	51	1.1374	1.1248	1.1223	1.1120	76	1.1976	1.1816	1.1785	1.1656
2	1.0059	1.0045	1.0044	1.0004	27	1.0760	1.0678	1.0656	1.0587	52	1.1399	1.1271	1.1244	1.1142	77	1.1999	1.1837	1.1801	1.1676
3	1.0090	1.0072	1.0070	1.0028	28	1.0787	1.0702	1.0681	1.0609	53	1.1424	1.1294	1.1269	1.1164	78	1.2021	1.1859	1.1818	1.1697
4	1.0120	1.0100	1.0093	1.0053	29	1.0813	1.0726	1.0705	1.0632	54	1.1448	1.1318	1.1295	1.1186	79	1.2043	1.1881	1.1837	1.1717
5	1.0150	1.0124	1.0115	1.0075	30	1.0839	1.0750	1.0729	1.0654	55	1.1472	1.1341	1.1320	1.1208	80	1.2065	1.1902	1.1806	1.1737
6	1.0179	1.0151	1.0141	1.0101	31	1.0866	1.0774	1.0753	1.0676	56	1.1497	1.1365	1.1342	1.1230	81	1.2088	1.1924	1.1876	1.1758
7	1.0207	1.0177	1.0170	1.0125	32	1.0891	1.0798	1.0777	1.0699	57	1.1523	1.1388	1.1361	1.1253	82	1.2110	1.1944	1.1896	1.1778
8	1.0237	1.0204	1.0196	1.0149	33	1.0916	1.0821	1.0800	1.0721	58	1.1548	1.1411	1.1381	1.1274	83	1.2132	1.1965	1.1914	1.1798
9	1.0266	1.0230	1.0221	1.0173	34	1.0941	1.0844	1.0823	1.0743	59	1.1573	1.1434	1.1401	1.1295	84	1.2154	1.1985	1.1929	1.1817
10	1.0295	1.0256	1.0246	1.0197	35	1.0966	1.0867	1.0847	1.0766	60	1.1597	1.1458	1.1424	1.1317	85	1.2176	1.2005	1.1953	1.1837
11	1.0324	1.0281	1.0271	1.0221	36	1.0993	1.0892	1.0871	1.0788	61	1.1621	1.1481	1.1448	1.1338	86	1.2196	1.2025	1.1976	1.1856
12	1.0351	1.0306	1.0296	1.0244	37	1.1018	1.0916	1.0895	1.0810	62	1.1645	1.1504	1.1473	1.1360	87	1.2217	1.2045	1.1994	1.1875
13	1.0379	1.0330	1.0321	1.0267	38	1.1043	1.0940	1.0919	1.0832	63	1.1669	1.1526	1.1493	1.1382	88	1.2237	1.2064	1.2012	1.1893
14	1.0407	1.0355	1.0345	1.0290	39	1.1069	1.0964	1.0940	1.0854	64	1.1694	1.1549	1.1517	1.1403	89	1.2258	1.2084	1.2028	1.1910
15	1.0435	1.0380	1.0370	1.0313	40	1.1095	1.0988	1.0963	1.0876	65	1.1718	1.1572	1.1543	1.1425	90	1.2278	1.2102	1.2044	1.1927
16	1.0463	1.0405	1.0393	1.0336	41	1.1122	1.1012	1.0990	1.0898	66	1.1742	1.1595	1.1565	1.1446	91	1.2297	1.2121	1.2059	1.1945
17	1.0491	1.0430	1.0417	1.0358	42	1.1148	1.1036	1.1015	1.0920	67	1.1766	1.1618	1.1584	1.1467	92	1.2316	1.2139	1.2078	1.1961
18	1.0518	1.0455	1.0441	1.0381	43	1.1174	1.1060	1.1038	1.0943	68	1.1790	1.1640	1.1604	1.1489	93	1.2335	1.2157	1.2099	1.1978
19	1.0545	1.0480	1.0464	1.0404	44	1.1199	1.1084	1.1062	1.0965	69	1.1813	1.1663	1.1628	1.1510	94	1.2354	1.2174	1.2117	1.1994
20	1.0571	1.0505	1.0488	1.0427	45	1.1224	1.1109	1.1085	1.0987	70	1.1835	1.1685	1.1655	1.1531	95	1.2372	1.2191	1.2140	1.2008
21	1.0598	1.0532	1.0512	1.0451	46	1.1249	1.1133	1.1108	1.1009	71	1.1858	1.1707	1.1677	1.1552	96	1.2390	1.2208	1.2158	1.2022
22	1.0625	1.0556	1.0537	1.0473	47	1.1274	1.1156	1.1130	1.1031	72	1.1882	1.1729	1.1702	1.1573	97	1.2408	1.2224	1.2170	1.2036
23	1.0652	1.0580	1.0561	1.0496	48	1.1299	1.1179	1.1157	1.1053	73	1.1906	1.1751	1.1728	1.1595	98	1.2425	1.2240	1.2183	1.2048
24	1.0679	1.0604	1.0585	1.0518	49	1.1324	1.1202	1.1185	1.1076	74	1.1929	1.1773	1.1752	1.1615	99	1.2441	1.2257	1.2202	1.2061
															100	1.2456	1.2273	1.2212	1.2073

TABLE 2-107 Acetic Acid (CH_3COOH)

%	0°C	10°C	15°C	20°C	25°C	30°C	40°C	%	0°C	10°C	15°C	20°C	25°C	30°C	40°C
0	0.9999	0.9997	0.9991	0.9982	0.9971	0.9957	0.9922	50	1.0729	1.0654	1.0613	1.0575	1.0534	1.0492	1.0408
1	1.0016	1.0013	1.0006	.9996	.9987	.9971	.9934	51	1.0738	1.0663	1.0622	1.0582	1.0542	1.0499	1.0414
2	1.0033	1.0029	1.0021	1.0012	1.0000	.9984	.9946	52	1.0748	1.0671	1.0629	1.0590	1.0549	1.0506	1.0421
3	1.0051	1.0044	1.0036	1.0025	1.0013	.9997	.9958	53	1.0757	1.0679	1.0637	1.0597	1.0555	1.0512	1.0427
4	1.0070	1.0060	1.0051	1.0040	1.0027	1.0011	.9970	54	1.0765	1.0687	1.0644	1.0604	1.0562	1.0518	1.0432
5	1.0088	1.0076	1.0066	1.0055	1.0041	1.0024	.9982	55	1.0774	1.0694	1.0651	1.0611	1.0568	1.0525	1.0438
6	1.0106	1.0092	1.0081	1.0069	1.0055	1.0037	.9994	56	1.0782	1.0701	1.0658	1.0618	1.0574	1.0531	1.0443
7	1.0124	1.0108	1.0096	1.0083	1.0068	1.0050	1.0006	57	1.0790	1.0708	1.0665	1.0624	1.0580	1.0536	1.0448
8	1.0142	1.0124	1.0111	1.0097	1.0081	1.0063	1.0018	58	1.0798	1.0715	1.0672	1.0631	1.0586	1.0542	1.0453
9	1.0159	1.0140	1.0126	1.0111	1.0094	1.0076	1.0030	59	1.0805	1.0722	1.0678	1.0637	1.0592	1.0547	1.0458
10	1.0177	1.0156	1.0141	1.0125	1.0107	1.0089	1.0042	60	1.0813	1.0728	1.0684	1.0642	1.0597	1.0552	1.0462
11	1.0194	1.0171	1.0155	1.0139	1.0120	1.0102	1.0054	61	1.0820	1.0734	1.0690	1.0648	1.0602	1.0557	1.0466
12	1.0211	1.0187	1.0170	1.0154	1.0133	1.0115	1.0065	62	1.0826	1.0740	1.0696	1.0653	1.0607	1.0562	1.0470
13	1.0228	1.0202	1.0184	1.0168	1.0146	1.0127	1.0077	63	1.0833	1.0746	1.0701	1.0658	1.0612	1.0566	1.0473
14	1.0245	1.0217	1.0199	1.0182	1.0159	1.0139	1.0088	64	1.0838	1.0752	1.0706	1.0662	1.0616	1.0571	1.0477
15	1.0262	1.0232	1.0213	1.0195	1.0172	1.0151	1.0099	65	1.0844	1.0757	1.0711	1.0666	1.0621	1.0575	1.0480
16	1.0278	1.0247	1.0227	1.0209	1.0185	1.0163	1.0110	66	1.0850	1.0762	1.0716	1.0671	1.0624	1.0578	1.0483
17	1.0295	1.0262	1.0241	1.0223	1.0198	1.0175	1.0121	67	1.0856	1.0767	1.0720	1.0675	1.0628	1.0582	1.0486
18	1.0311	1.0276	1.0255	1.0236	1.0210	1.0187	1.0132	68	1.0860	1.0771	1.0725	1.0678	1.0631	1.0585	1.0489
19	1.0327	1.0291	1.0269	1.0250	1.0223	1.0198	1.0142	69	1.0865	1.0775	1.0729	1.0682	1.0634	1.0588	1.0491
20	1.0343	1.0305	1.0283	1.0263	1.0235	1.0210	1.0153	70	1.0869	1.0779	1.0732	1.0685	1.0637	1.0590	1.0493
21	1.0358	1.0319	1.0297	1.0276	1.0248	1.0222	1.0164	71	1.0874	1.0783	1.0736	1.0687	1.0640	1.0592	1.0495
22	1.0374	1.0333	1.0310	1.0288	1.0260	1.0233	1.0174	72	1.0877	1.0786	1.0738	1.0690	1.0642	1.0594	1.0496
23	1.0389	1.0347	1.0323	1.0301	1.0272	1.0244	1.0185	73	1.0881	1.0789	1.0741	1.0693	1.0644	1.0595	1.0497
24	1.0404	1.0361	1.0336	1.0313	1.0283	1.0256	1.0195	74	1.0884	1.0792	1.0743	1.0694	1.0645	1.0596	1.0498
25	1.0419	1.0375	1.0349	1.0326	1.0295	1.0267	1.0205	75	1.0887	1.0794	1.0745	1.0696	1.0647	1.0597	1.0499
26	1.0434	1.0388	1.0362	1.0338	1.0307	1.0278	1.0215	76	1.0889	1.0796	1.0746	1.0698	1.0648	1.0598	1.0499
27	1.0449	1.0401	1.0374	1.0349	1.0318	1.0289	1.0225	77	1.0891	1.0797	1.0747	1.0699	1.0648	1.0598	1.0499
28	1.0463	1.0414	1.0386	1.0361	1.0329	1.0299	1.0234	78	1.0893	1.0798	1.0747	1.0700	1.0648	1.0598	1.0498
29	1.0477	1.0427	1.0399	1.0372	1.0340	1.0310	1.0244	79	1.0894	1.0798	1.0747	1.0700	1.0648	1.0597	1.0497
30	1.0491	1.0440	1.0411	1.0384	1.0350	1.0320	1.0253	80	1.0895	1.0798	1.0747	1.0700	1.0647	1.0596	1.0495
31	1.0505	1.0453	1.0423	1.0395	1.0361	1.0330	1.0262	81	1.0895	1.0797	1.0745	1.0699	1.0646	1.0594	1.0493
32	1.0519	1.0465	1.0435	1.0406	1.0372	1.0341	1.0272	82	1.0895	1.0796	1.0743	1.0698	1.0644	1.0592	1.0490
33	1.0532	1.0477	1.0446	1.0417	1.0382	1.0351	1.0281	83	1.0895	1.0795	1.0741	1.0696	1.0642	1.0589	1.0487
34	1.0545	1.0489	1.0458	1.0428	1.0392	1.0361	1.0289	84	1.0893	1.0793	1.0738	1.0693	1.0638	1.0585	1.0483
35	1.0558	1.0501	1.0469	1.0438	1.0402	1.0371	1.0298	85	1.0891	1.0790	1.0735	1.0689	1.0635	1.0582	1.0479
36	1.0571	1.0513	1.0480	1.0449	1.0412	1.0380	1.0306	86	1.0887	1.0787	1.0731	1.0685	1.0630	1.0576	1.0473
37	1.0584	1.0524	1.0491	1.0459	1.0422	1.0390	1.0314	87	1.0883	1.0783	1.0726	1.0680	1.0626	1.0571	1.0467
38	1.0596	1.0535	1.0501	1.0469	1.0432	1.0399	1.0322	88	1.0877	1.0778	1.0721	1.0675	1.0620	1.0564	1.0460
39	1.0608	1.0546	1.0512	1.0479	1.0441	1.0408	1.0330	89	1.0872	1.0773	1.0715	1.0668	1.0613	1.0557	1.0453
40	1.0621	1.0557	1.0522	1.0488	1.0450	1.0416	1.0338	90	1.0865	1.0766	1.0708	1.0661	1.0605	1.0549	1.0445
41	1.0633	1.0568	1.0532	1.0498	1.0460	1.0425	1.0346	91	1.0857	1.0758	1.0700	1.0652	1.0597	1.0541	1.0436
42	1.0644	1.0578	1.0542	1.0507	1.0469	1.0433	1.0353	92	1.0848	1.0749	1.0690	1.0643	1.0587	1.0530	1.0426
43	1.0656	1.0588	1.0551	1.0516	1.0477	1.0441	1.0361	93	1.0838	1.0739	1.0680	1.0632	1.0577	1.0518	1.0414
44	1.0667	1.0598	1.0561	1.0525	1.0486	1.0449	1.0368	94	1.0826	1.0727	1.0667	1.0619	1.0564	1.0506	1.0401
45	1.0679	1.0608	1.0570	1.0534	1.0495	1.0456	1.0375	95	1.0813	1.0714	1.0652	1.0605	1.0551	1.0491	1.0386
46	1.0689	1.0618	1.0579	1.0542	1.0503	1.0464	1.0382	96	1.0798		1.0632	1.0588	1.0535	1.0473	1.0368
47	1.0699	1.0627	1.0588	1.0551	1.0511	1.0471	1.0389	97	1.0780		1.0611	1.0570	1.0516	1.0454	1.0348
48	1.0709	1.0636	1.0597	1.0559	1.0518	1.0479	1.0395	98	1.0759		1.0590	1.0549	1.0495	1.0431	1.0325
49	1.0720	1.0645	1.0605	1.0567	1.0526	1.0486	1.0402	99	1.0730		1.0567	1.0524	1.0468	1.0407	1.0299
								100	1.0697		1.0545	1.0498	1.0440	1.0380	1.0271

TABLE 2-108 Oxalic Acid ($H_2C_2O_4$)

%	$d_4^{17.5}$	%	$d_4^{17.5}$
1	1.0035	8	1.0280
2	1.0070	10	1.0350
4	1.0140	12	1.0420

TABLE 2-109 Methyl Alcohol (CH_3OH)*

%	0°C	10°C	15.56°C	20°C	15°C	%	0°C	10°C	15.56°C	20°C	15°C	%	0°C	10°C	15.56°C	20°C	15°C
0	0.9999	0.9997	0.9990	0.9982	0.99913	35	0.9534	0.9484	0.9456	0.9433	0.94570	70	0.8869	0.8794	0.8748	0.8715	0.87507
1	.9981	.9980	.9973	.9965	.99727	36	.9520	.9469	.9440	.9416	.94404	71	.8847	.8770	.8726	.8690	.87271
2	.9963	.9962	.9955	.9948	.99543	37	.9505	.9453	.9422	.9398	.94237	72	.8824	.8747	.8702	.8665	.87033
3	.9946	.9945	.9938	.9931	.99370	38	.9490	.9437	.9405	.9381	.94067	73	.8801	.8724	.8678	.8641	.86792
4	.9930	.9929	.9921	.9914	.99198	39	.9475	.9420	.9387	.9363	.93894	74	.8778	.8699	.8653	.8616	.86546
5	.9914	.9912	.9904	.9896	.99029	40	.9459	.9403	.9369	.9345	.93720	75	.8754	.8676	.8629	.8592	.86300
6	.9899	.9896	.9889	.9880	.98864	41	.9443	.9387	.9351	.9327	.93543	76	.8729	.8651	.8604	.8567	.86051
7	.9884	.9881	.9872	.9863	.98701	42	.9427	.9370	.9333	.9309	.93365	77	.8705	.8626	.8579	.8542	.85801
8	.9870	.9865	.9857	.9847	.98547	43	.9411	.9352	.9315	.9290	.93185	78	.8680	.8602	.8554	.8518	.85551
9	.9856	.9849	.9841	.9831	.98394	44	.9395	.9334	.9297	.9272	.93001	79	.8657	.8577	.8529	.8494	.85300
10	.9842	.9834	.9826	.9815	.98241	45	.9377	.9316	.9279	.9252	.92815	80	.8634	.8551	.8503	.8469	.85048
11	.9829	.9820	.9811	.9799	.98093	46	.9360	.9298	.9261	.9234	.92627	81	.8610	.8527	.8478	.8446	.84794
12	.9816	.9805	.9796	.9784	.97945	47	.9342	.9279	.9242	.9214	.92436	82	.8585	.8501	.8452	.8420	.84536
13	.9804	.9791	.9781	.9768	.97802	48	.9324	.9260	.9223	.9196	.92242	83	.8560	.8475	.8426	.8394	.84274
14	.9792	.9778	.9766	.9754	.97660	49	.9306	.9240	.9204	.9176	.92048	84	.8535	.8449	.8400	.8366	.84009
15	.9780	.9764	.9752	.9740	.97518	50	.9287	.9221	.9185	.9156	.91852	85	.8510	.8422	.8374	.8340	.83742
16	.9769	.9751	.9738	.9725	.97377	51	.9269	.9202	.9166	.9135	.91653	86	.8483	.8394	.8347	.8314	.83475
17	.9758	.9739	.9723	.9710	.97237	52	.9250	.9182	.9146	.9114	.91451	87	.8456	.8367	.8320	.8286	.83207
18	.9747	.9726	.9709	.9696	.97096	53	.9230	.9162	.9126	.9094	.91248	88	.8428	.8340	.8294	.8258	.82937
19	.9736	.9713	.9695	.9681	.96955	54	.9211	.9142	.9106	.9073	.91044	89	.8400	.8314	.8267	.8230	.82667
20	.9725	.9700	.9680	.9666	.96814	55	.9191	.9122	.9086	.9052	.90839	90	.8374	.8287	.8239	.8202	.82396
21	.9714	.9687	.9666	.9651	.96673	56	.9172	.9101	.9065	.9032	.90631	91	.8347	.8261	.8212	.8174	.82124
22	.9702	.9673	.9652	.9636	.96533	57	.9151	.9080	.9045	.9010	.90421	92	.8320	.8234	.8185	.8146	.81849
23	.9690	.9660	.9638	.9622	.96392	58	.9131	.9060	.9024	.8988	.90210	93	.8293	.8208	.8157	.8118	.81568
24	.9678	.9646	.9624	.9607	.96251	59	.9111	.9039	.9002	.8968	.89996	94	.8266	.8180	.8129	.8090	.81285
25	.9666	.9632	.9609	.9592	.96108	60	.9090	.9018	.8980	.8946	.89781	95	.8240	.8152	.8101	.8062	.80999
26	.9654	.9618	.9595	.9576	.95963	61	.9068	.8998	.8958	.8924	.89563	96	.8212	.8124	.8073	.8034	.80713
27	.9642	.9604	.9580	.9562	.95817	62	.9046	.8977	.8936	.8902	.89341	97	.8186	.8096	.8045	.8005	.80428
28	.9629	.9590	.9565	.9546	.95668	63	.9024	.8955	.8913	.8879	.89117	98	.8158	.8068	.8016	.7976	.80143
29	.9616	.9575	.9550	.9531	.95518	64	.9002	.8933	.8890	.8856	.88890	99	.8130	.8040	.7987	.7948	.79859
30	.9604	.9560	.9535	.9515	.95366	65	.8980	.8911	.8867	.8834	.88662	100	.8102	.8009	.7959	.7917	.79577
31	.9590	.9546	.9521	.9499	.95213	66	.8958	.8888	.8844	.8811	.88433						
32	.9576	.9531	.9505	.9483	.95056	67	.8935	.8865	.8820	.8787	.88203						
33	.9563	.9516	.9489	.9466	.94896	68	.8913	.8842	.8797	.8763	.87971						
34	.9549	.9500	.9473	.9450	.94734	69	.8891	.8818	.8771	.8738	.87739						

*It should be noted that the values for 100 percent do not agree with some data available elsewhere, *e.g., American Institute of Physics Handbook,* McGraw-Hill, New York, 1957. Also, see Atack, *Handbook of Chemical Data,* Reinhold, New York, 1957.

TABLE 2-110 Ethyl Alcohol (C_2H_5OH)*

%	10°C	15°C	20°C	25°C	30°C	35°C	40°C	%	10°C	15°C	20°C	25°C	30°C	35°C	40°C
0	0.99973	0.99913	0.99823	0.99708	0.99568	0.99406	0.99225	50	0.92126	0.91776	0.91384	0.90985	0.90580	0.90168	0.89750
1	785	725	636	520	379	217	034	51	.91943	555	160	760	353	.89940	519
2	602	542	453	336	194	031	.98846	52	723	333	.90936	534	125	710	288
3	426	365	275	157	014	.98849	663	53	502	110	711	307	.89896	479	056
4	258	195	103	.98984	.98839	672	485	54	279	.90885	485	079	667	248	.88823
5	098	032	.98938	817	670	501	311	55	055	659	258	.89850	437	016	589
6	.98946	.98877	780	656	507	335	142	56	.90831	433	031	621	206	.88784	356
7	801	729	627	500	347	172	.97975	57	607	207	.89803	392	.88975	552	122
8	660	584	478	346	189	009	808	58	381	.89980	574	162	744	319	.87888
9	524	442	331	193	031	.97846	641	59	154	752	344	.88931	512	085	653
10	393	304	187	043	.97875	685	475	60	.89927	523	113	699	278	.87851	417
11	267	171	047	.97897	723	527	312	61	698	293	.88882	446	044	615	180
12	145	041	.97910	753	573	371	150	62	468	062	650	233	.87809	379	.86943
13	026	.97914	775	611	424	216	.96989	63	237	.88830	417	.87998	574	142	705
14	.97911	790	643	472	278	063	829	64	006	597	183	763	337	.86905	466
15	800	669	514	334	133	.96911	670	65	.88774	364	.87948	527	100	667	227
16	692	552	387	199	.96990	760	512	66	541	130	713	291	.86863	429	.85987
17	583	433	259	062	844	607	352	67	308	.87895	477	054	625	190	747
18	473	313	129	.96923	697	452	189	68	074	660	241	.86817	387	.85950	407
19	363	191	.96997	782	547	294	023	69	.87839	424	004	579	148	710	266
20	252	068	864	639	395	134	.95856	70	602	187	.86766	340	.85908	470	025
21	139	.96944	729	495	242	.95973	687	71	365	.86949	527	100	667	228	.84783
22	024	818	592	348	087	809	516	72	127	710	287	.85859	426	.84986	540
23	.96907	689	453	199	.95929	643	343	73	.86888	470	047	618	184	743	297
24	787	558	312	048	769	476	168	74	648	229	.85806	376	.84941	500	053
25	665	424	168	.95895	607	306	.94991	75	408	.85988	564	134	698	257	.83809
26	539	287	020	738	442	133	810	76	168	747	322	.84891	455	013	564
27	406	144	.95867	576	272	.94955	625	77	.85927	505	079	647	211	.83768	319
28	268	.95996	710	410	098	774	438	78	685	262	.84835	403	.83966	523	074
29	125	844	548	241	.94922	590	248	79	442	018	590	158	720	277	.82827
30	.95977	686	382	067	741	403	055	80	197	.84772	344	.83911	473	029	578
31	823	524	212	.94890	557	214	.93860	81	.84950	525	096	664	224	.82780	329
32	665	357	038	709	370	021	662	82	702	277	.83848	415	.82974	530	079
33	502	186	.94860	525	180	.93825	461	83	453	028	599	164	724	279	.81828
34	334	011	679	337	.93986	626	257	84	203	.83777	348	.82913	473	027	576
35	162	.94832	494	146	790	425	051	85	.83951	525	095	660	220	.81774	322
36	.94986	650	306	.93952	591	221	.92843	86	697	271	.82840	405	.81965	519	067
37	805	464	114	756	390	016	634	87	441	014	583	148	708	262	.80811
38	620	273	.93919	556	186	.92808	422	88	181	.82754	323	.81888	448	003	552
39	431	079	720	353	.92979	597	208	89	.82919	492	062	626	186	.80742	291
40	238	.93882	518	148	770	385	.91992	90	654	227	.81797	362	.80922	478	028
41	042	682	314	.92940	558	170	774	91	386	.81959	529	094	655	211	.79761
42	.93842	478	107	729	344	.91952	554	92	114	688	257	.80823	384	.79941	491
43	639	271	.92897	516	128	733	332	93	.81839	413	.80983	549	111	669	220
44	433	062	685	301	.91910	513	108	94	561	134	705	272	.79835	393	.78947
45	226	.92852	472	085	692	291	.90884	95	278	.80852	424	.79991	555	114	670
46	017	640	257	.91868	472	069	660	96	.80991	566	138	706	271	.78831	388
47	.92806	426	041	649	250	.90845	434	97	698	274	.79846	415	.78981	542	100
48	593	211	.91823	429	028	621	207	98	399	.79975	547	117	684	247	.77806
49	379	.91995	604	208	.90805	396	.89979	99	094	670	243	.78814	382	.77946	507
								100	.79784	360	.78934	506	075	641	203

*For data from –78° to 78°C, see p. 2-142, Table 2N-5, *American Institute of Physics Handbook,* McGraw-Hill, New York, 1957.

TABLE 2-111 Densities of Mixtures of C_2H_5OH and H_2O at 20°C

g/mL

% alcohol by weight	Tenths of %										% alcohol by weight	Tenths of %									
	0	1	2	3	4	5	6	7	8	9		0	1	2	3	4	5	6	7	8	9
0	0.99823	804	785	766	748	729	710	692	673	655	50	0.91384	361	339	317	295	272	250	228	206	183
1	636	618	599	581	562	544	525	507	489	471	51	160	138	116	093	071	049	026	004	°981	°959
2	453	435	417	399	381	363	345	327	310	292	52	.90936	914	891	869	846	824	801	779	756	734
3	275	257	240	222	205	188	171	154	137	120	53	711	689	666	644	621	598	576	553	531	508
4	103	087	070	053	037	020	003	°987	°971	°954	54	485	463	440	417	395	372	349	327	304	281
5	.98938	922	906	890	874	859	843	827	811	796	55	258	236	213	190	167	145	122	099	076	054
6	780	765	749	734	718	703	688	673	658	642	56	031	008	°985	°962	°939	°917	°894	°871	°848	°825
7	627	612	597	582	567	553	538	523	508	493	57	.89803	780	757	734	711	688	665	643	620	597
8	478	463	449	434	419	404	389	374	360	345	58	574	551	528	505	482	459	436	413	390	367
9	331	316	301	287	273	258	244	229	215	201	59	344	321	298	275	252	229	206	183	160	137
10	187	172	158	144	130	117	103	089	075	061	60	113	090	067	044	021	°998	°975	°951	°928	°905
11	047	033	019	006	°992	°978	°964	°951	°937	°923	61	.88882	859	836	812	789	766	743	720	696	673
12	.97910	896	883	869	855	842	828	815	801	788	62	650	626	603	580	557	533	510	487	463	440
13	775	761	748	735	722	709	696	683	670	657	63	417	393	370	347	323	300	277	253	230	206
14	643	630	617	604	591	578	565	552	539	526	64	183	160	136	113	089	066	042	019	°995	°972
15	514	501	488	475	462	450	438	425	412	400	65	.87948	925	901	878	854	831	807	784	760	737
16	387	374	361	349	336	323	310	297	284	272	66	713	689	666	642	619	595	572	548	524	501
17	259	246	233	220	207	194	181	168	155	142	67	477	454	430	406	383	359	336	312	288	265
18	129	116	103	089	076	063	050	037	024	010	68	241	218	194	170	147	123	099	075	052	028
19	.96997	984	971	957	944	931	917	904	891	877	69	004	°981	°957	°933	°909	°885	°862	°838	°814	°790
20	864	850	837	823	810	796	783	769	756	742	70	.86766	742	718	694	671	647	623	599	575	551
21	729	716	702	688	675	661	647	634	620	606	71	527	503	479	455	431	407	383	339	335	311
22	592	578	564	551	537	523	509	495	481	467	72	287	263	239	215	191	167	143	119	095	071
23	453	439	425	411	396	382	368	354	340	326	73	047	022	°998	°974	°950	°926	°902	°878	°854	°830
24	312	297	283	269	254	240	225	211	196	182	74	.85806	781	757	733	709	685	661	636	612	588
25	168	153	139	124	109	094	080	065	050	035	75	564	540	515	491	467	443	419	394	370	346
26	020	005	°990	°975	°959	°944	°929	°914	°898	°883	76	322	297	273	249	225	200	176	152	128	103
27	.95867	851	836	820	805	789	773	757	742	726	77	079	055	031	006	°982	°958	°933	°909	°884	°860
28	710	694	678	662	646	630	613	597	581	565	78	.84835	811	787	762	738	713	689	664	640	615
29	548	532	516	499	483	466	450	433	416	400	79	590	566	541	517	492	467	443	418	393	369
30	382	365	349	332	315	298	281	264	247	230	80	344	319	294	270	245	220	196	171	146	121
31	212	195	178	161	143	126	108	091	074	056	81	096	072	047	022	°997	°972	°947	°923	°898	°873
32	038	020	003	°985	°967	°950	°932	°914	°896	°878	82	.83848	823	798	773	748	723	698	674	649	624
33	.94860	842	824	806	788	770	752	734	715	697	83	599	574	549	523	498	473	448	423	398	373
34	679	660	642	624	605	587	568	550	531	512	84	348	323	297	272	247	222	196	171	146	120
35	494	475	456	438	419	400	382	363	344	325	85	095	070	044	019	°994	°968	°943	°917	°892	°866
36	306	287	268	249	230	211	192	172	153	134	86	.82840	815	789	763	738	712	686	660	635	609
37	114	095	075	056	036	017	°997	°978	°958	°939	87	583	557	531	505	479	453	427	401	375	349
38	.93919	899	879	859	840	820	800	780	760	740	88	323	297	271	245	219	193	167	140	114	088
39	720	700	680	660	640	620	599	579	559	539	89	062	035	009	°983	°956	°930	°903	°877	°850	°824
40	518	498	478	458	437	417	396	376	356	335	90	.81797	770	744	717	690	664	637	610	583	556
41	314	294	273	253	232	212	191	170	149	129	91	529	502	475	448	421	394	366	339	312	285
42	107	086	065	044	023	002	°981	°960	°939	°918	92	257	230	203	175	148	120	093	066	038	010
43	.92897	876	855	834	812	791	770	749	728	707	93	.80983	955	928	900	872	844	817	789	761	733
44	685	664	642	621	600	579	557	536	515	493	94	705	677	649	621	593	565	537	509	480	452
45	472	450	429	408	386	365	343	322	300	279	95	424	395	367	338	310	281	253	224	195	166
46	257	236	214	193	171	150	128	106	085	063	96	138	109	080	051	022	°993	°963	°934	°905	°875
47	041	019	°997	°976	°954	°932	°910	°889	°867	°845	97	.79846	816	787	757	727	698	668	638	608	578
48	.91823	801	780	758	736	714	692	670	648	626	98	547	517	487	456	426	396	365	335	305	274
49	604	582	560	538	516	494	472	450	428	406	99	243	213	182	151	120	089	059	028	°997	°966
											100	.78934									

°Indicates change in the first two decimal places.

TABLE 2-112 Specific Gravity (60°/60°F [(15.56°/15.56°C)]) of Mixtures by Volume of C_2H_5OH and H_2O

% alcohol by volume at 60°F	Tenths of %									
	0	1	2	3	4	5	6	7	8	9
0	1.00000	°985	°970	°955	°940	°925	°910	°895	°880	865
1	0.99850	835	820	806	791	776	761	747	732	717
2	703	688	674	659	645	630	616	602	587	573
3	559	545	531	516	502	488	474	460	446	432
4	419	405	391	378	364	350	336	323	309	296
5	282	269	255	242	228	215	202	189	176	163
6	150	137	124	111	098	085	073	060	047	035
7	022	009	°997	°984	°972	°960	°947	°935	°923	°911
8	.98899	887	875	863	851	838	826	814	803	791
9	779	767	755	743	731	720	708	696	684	672
10	661	649	637	625	614	602	590	579	567	556
11	544	532	521	509	498	487	475	464	452	441
12	430	419	408	396	385	374	363	352	341	330
13	319	308	297	286	275	264	254	243	232	221
14	210	200	190	179	168	157	147	136	125	115
15	104	093	083	072	062	051	040	030	019	009
16	.97998	988	977	967	956	946	936	925	915	905
17	895	885	875	864	854	844	834	824	814	804
18	794	784	774	764	754	744	734	724	714	704
19	694	684	674	664	654	645	635	625	615	605
20	596	586	576	566	556	546	536	526	516	506
21	496	486	476	466	456	446	436	425	415	405
22	395	385	375	365	354	344	334	324	313	303
23	293	283	272	262	252	241	231	221	210	200
24	189	179	168	158	147	137	126	116	105	095
25	084	073	063	052	042	031	020	010	°999	°988
26	.96978	967	957	946	935	924	914	903	892	881
27	870	859	848	837	826	815	804	793	782	771
28	760	749	738	727	715	704	693	682	671	659
29	648	637	625	614	603	591	580	568	557	546
30	534	522	511	499	488	476	464	453	441	429
31	418	406	394	382	370	358	346	334	321	309
32	296	284	271	259	246	234	221	209	196	183
33	170	157	144	132	119	106	093	080	067	054
34	041	028	015	002	°988	°975	°962	°948	°935	°921
35	.95908	894	881	867	854	840	826	812	798	784
36	770	756	742	728	714	700	685	671	657	643
37	628	614	599	585	570	556	541	526	512	497
38	482	467	452	437	423	408	393	378	362	347
39	332	317	302	286	271	256	240	225	209	194
40	178	162	147	131	115	100	084	068	052	036
41	020	004	°988	°972	°956	°940	°923	°907	°891	°875
42	.94858	842	825	809	792	776	759	743	726	710
43	693	676	660	643	626	609	592	575	558	541
44	524	507	490	473	455	438	421	403	386	369
45	351	334	316	298	281	263	245	228	210	192
46	174	156	138	120	102	084	066	048	030	011
47	.93993	975	956	938	920	901	883	864	845	827
48	808	789	771	752	733	714	695	676	657	638
49	619	600	581	562	543	523	504	485	465	446

% alcohol by volume at 60°F	Tenths of %									
	0	1	2	3	4	5	6	7	8	9
50	0.93426	407	387	368	348	328	309	289	270	250
51	230	210	190	171	151	131	111	091	071	051
52	031	011	°991	°971	°951	°931	°911	°890	°870	°850
53	.92830	810	789	769	749	728	708	688	667	647
54	626	605	585	564	544	523	502	482	461	440
55	419	398	377	357	336	315	294	273	252	231
56	210	189	168	147	126	105	084	062	041	020
57	.91999	978	956	935	914	892	871	849	827	806
58	784	762	741	719	697	675	653	631	610	588
59	565	543	521	499	477	455	433	410	388	366
60	344	322	299	277	255	232	210	188	165	143
61	120	097	075	052	030	007	°984	°962	°939	°916
62	.90893	870	847	825	802	779	756	733	710	687
63	664	641	618	595	572	549	526	503	480	457
64	434	411	388	365	341	318	295	272	249	225
65	202	179	155	132	108	085	061	038	014	°991
66	.89967	943	920	896	872	848	825	801	777	753
67	729	705	681	657	633	609	585	561	537	513
68	489	465	441	416	392	368	343	319	295	270
69	245	220	196	171	147	122	098	073	048	024
70	.88999	974	950	925	900	875	850	825	801	776
71	751	725	700	675	650	625	600	574	549	524
72	499	474	448	423	397	372	346	321	296	270
73	244	218	193	167	141	116	090	064	039	013
74	.87987	961	935	910	884	858	832	806	780	754
75	728	702	676	650	623	597	571	545	518	492
76	465	439	412	386	359	332	306	279	252	226
77	199	172	145	118	092	065	038	011	°984	°957
78	.86929	902	875	847	820	793	766	738	711	684
79	656	629	601	574	546	518	491	463	435	408
80	380	352	324	296	269	241	213	185	157	129
81	100	072	044	015	°987	°959	°931	°902	°874	°846
82	.85817	789	760	732	703	674	646	617	588	560
83	531	502	473	444	415	386	357	328	299	270
84	240	211	181	152	122	093	063	033	004	°974
85	.84944	914	884	854	824	794	764	734	703	673
86	642	612	581	551	520	490	459	428	398	367
87	336	305	274	243	212	181	150	119	088	056
88	025	°994	°962	°930	°899	°867	°835	°803	°771	°739
89	.83707	675	643	610	578	545	513	480	447	415
90	382	349	315	282	249	216	183	150	116	083
91	049	015	°981	°947	°913	°879	°845	°810	°776	°741
92	.82705	670	635	600	565	529	494	458	423	387
93	351	315	279	243	206	170	133	096	059	022
94	.81984	947	909	871	834	796	757	719	681	642
95	603	564	525	486	446	407	367	327	287	247
96	206	165	125	084	042	001	°960	°918	°876	°834
97	.80792	750	707	664	620	577	533	489	445	401
98	356	311	265	219	173	127	080	033	°985	°937
99	.79889	841	792	743	693	643	593	543	492	441
100	389									

°Indicates change in first two decimal places.

TABLE 2-113 *n*-Propyl Alcohol (C_3H_7OH)

%	0°C	15°C	30°C	%	0°C	15°C	30°C	%	0°C	15°C	30°C	%	0°C	15°C	30°C	%	0°C	15°C	30°C
0	0.9999	0.9991	0.9957	20	0.9789	0.9723	0.9643	40	0.9430	0.9331	0.9226	60	0.9033	0.8922	0.8807	80	0.8634	0.8516	0.8394
1	.9982	.9974	.9940	21	.9776	.9705	.9622	41	.9411	.9310	.9205	61	.9013	.8902	.8786	81	.8614	.8496	.8373
2	.9967	.9960	.9924	22	.9763	.9688	.9602	42	.9391	.9290	.9184	62	.8994	.8882	.8766	82	.8594	.8475	.8352
3	.9952	.9944	.9908	23	.9748	.9670	.9583	43	.9371	.9269	.9164	63	.8974	.8861	.8745	83	.8574	.8454	.8332
4	.9939	.9929	.9893	24	.9733	.9651	.9563	44	.9352	.9248	.9143	64	.8954	.8841	.8724	84	.8554	.8434	.8311
5	.9926	.9915	.9877	25	.9717	.9633	.9543	45	.9332	.9228	.9122	65	.8934	.8820	.8703	85	.8534	.8413	.8290
6	.9914	.9902	.9862	26	.9700	.9614	.9522	46	.9311	.9207	.9100	66	.8913	.8800	.8682	86	.8513	.8393	.8269
7	.9904	.9890	.9848	27	.9682	.9594	.9501	47	.9291	.9186	.9079	67	.8894	.8779	.8662	87	.8492	.8372	.8248
8	.9894	.9877	.9834	28	.9664	.9576	.9481	48	.9272	.9165	.9057	68	.8874	.8759	.8641	88	.8471	.8351	.8227
9	.9883	.9864	.9819	29	.9646	.9556	.9460	49	.9252	.9145	.9036	69	.8854	.8739	.8620	89	.8450	.8330	.8206
10	.9874	.9852	.9804	30	.9627	.9535	.9439	50	.9232	.9124	.9015	70	.8835	.8719	.8600	90	.8429	.8308	.8185
11	.9865	.9840	.9790	31	.9608	.9516	.9418	51	.9213	.9104	.8994	71	.8815	.8700	.8580	91	.8408	.8287	.8164
12	.9857	.9828	.9775	32	.9589	.9495	.9396	52	.9192	.9084	.8973	72	.8795	.8680	.8559	92	.8387	.8266	.8142
13	.9849	.9817	.9760	33	.9570	.9474	.9375	53	.9173	.9064	.8952	73	.8776	.8659	.8539	93	.8364	.8244	.8120
14	.9841	.9806	.9746	34	.9550	.9454	.9354	54	.9153	.9044	.8931	74	.8756	.8639	.8518	94	.8342	.8221	.8098
15	.9833	.9793	.9730	35	.9530	.9434	.9333	55	.9132	.9023	.8911	75	.8736	.8618	.8497	95	.8320	.8199	.8077
16	.9825	.9780	.9714	36	.9511	.9413	.9312	56	.9112	.9003	.8890	76	.8716	.8598	.8477	96	.8296	.8176	.8054
17	.9817	.9768	.9698	37	.9491	.9392	.9289	57	.9093	.8983	.8869	77	.8695	.8577	.8456	97	.8272	.8153	.8031
18	.9808	.9752	.9680	38	.9471	.9372	.9269	58	.9073	.8963	.8849	78	.8675	.8556	.8435	98	.8248	.8128	.8008
19	.9800	.9739	.9661	39	.9450	.9351	.9247	59	.9053	.8942	.8828	79	.8655	.8536	.8414	99	.8222	.8104	.7984
																100	.8194	.8077	.7958

TABLE 2-114 Isopropyl Alcohol (C_3H_7OH)

%	0°C	15°C*	15°C*	20°C	30°C	%	0°C	15°C*	15°C*	20°C	30°C	%	0°C	15°C*	15°C*	20°C	30°C
0	0.9999	0.9991	0.99913	0.9982	0.9957	35	0.9557		0.9446	0.9419	0.9338	70	0.8761	0.8639	0.86346	0.8584	0.8511
1	.9980	.9973	.9972	.9962	.9939	36	.9536		.9424	.9399	.9315	71	.8738	.8615	.8611	.8560	.8487
2	.9962	.9956	.9954	.9944	.9921	37	.9514		.9401	.9377	.9292	72	.8714	.8592	.8588	.8537	.8464
3	.9946	.9938	.9936	.9926	.9904	38	.9493		.9379	.9355	.9269	73	.8691	.8568	.8564	.8513	.8440
4	.9930	.9922	.9920	.9909	.9887	39	.9472		.9356	.9333	.9246	74	.8668	.8545	.8541	.8489	.8416
5	.9916	.9906	.9904	.9893	.9871	40	.9450		.93333	.9310	.9224	75	.8644	.8521	.8517	.8464	.8392
6	.9902	.9892	.9890	.9877	.9855	41	.9428		.9311	.9287	.9201	76	.8621	.8497	.8493	.8439	.8368
7	.9890	.9878	.9875	.9862	.9839	42	.9406		.9288	.9264	.9177	77	.8598	.8474	.8470	.8415	.8344
8	.9878	.9864	.9862	.9847	.9824	43	.9384		.9266	.9239	.9154	78	.8575	.8450	.8446	.8391	.8321
9	.9866	.9851	.9849	.9833	.9809	44	.9361		.9243	.9215	.9130	79	.8551	.8426	.8422	.8366	.8297
10	.9856	.9838	.98362	.9820	.9794	45	.9338		.9220	.9191	.9106	80	.8528	.8403	.83979	.8342	.8273
11	.9846	.9826	.9824	.9808	.9778	46	.9315		.9197	.9165	.9082	81	.8503	.8379	.8374	.8317	.8248
12	.9838	.9813	.9812	.9797	.9764	47	.9292		.9174	.9141	.9059	82	.8479	.8355	.8350	.8292	.8224
13	.9829	.9802	.9800	.9876	.9750	48	.9270		.9150	.9117	.9036	83	.8456	.8331	.8326	.8268	.8200
14	.9821	.9790	.9788	.9776	.9735	49	.9247		.9127	.9093	.9013	84	.8432	.8307	.8302	.8243	.8175
15	.9814	.9779	.9777	.9765	.9720	50	.9224		.91043	.9069	.8990	85	.8408	.8282	.8278	.8219	.8151
16	.9806	.9768	.9765	.9754	.9705	51	.9201		.9081	.9044	.8966	86	.8384	.8259	.8254	.8194	.8127
17	.9799	.9756	.9753	.9743	.9690	52	.9178		.9058	.9020	.8943	87	.8360	.8234	.8229	.8169	.8201
18	.9792	.9745	.9741	.9731	.9675	53	.9155		.9035	.8996	.8919	88	.8336	.8209	.8205	.8145	.8078
19	.9784	.9730	.9728	.9717	.9658	54	.9132		.9011	.8971	.8895	89	.8311	.8184	.8180	.8120	.8053
20	.9777	.9719	.97158	.9703	.9642	55	.9109		.8988	.8946	.8871	90	.8287	.8161	.81553	.8096	.8029
21	.9768	.9704	.9703	.9688	.9624	56	.9086		.8964	.8921	.8847	91	.8262	.8136	.8130	.8072	.8004
22	.9759	.9690	.9689	.9669	.9606	57	.9063		.8940	.8896	.8823	92	.8237	.8110	.8104	.8047	.7979
23	.9749	.9675	.9674	.9651	.9587	58	.9040		.8917	.8874	.8800	93	.8212	.8085	.8079	.8023	.7954
24	.9739	.9660	.9659	.9634	.9569	59	.9017		.8893	.8850	.8777	94	.8186	.8060	.8052	.7998	.7929
25	.9727	.9643	.9642	.9615	.9549	60	.8994		.88690	.8825	.8752	95	.8160	.8034	.8026	.7973	.7904
26	.9714	.9626	.9624	.9597	.9529	61	.8970		.8845	.8800	.8728	96	.8133	.8008	.7999	.7949	.7878
27	.9699	.9608	.9605	.9577	.9509	62	.8947	0.8829	.8821	.8776	.8704	97	.8106	.7981	.7972	.7925	.7852
28	.9684	.9590	.9586	.9558	.9488	63	.8924	.8805	.8798	.8751	.8680	98	.8078	.7954	.7945	.7901	.7826
29	.9669	.9570	.9568	.9540	.9467	64	.8901	.8781	.8775	.8727	.8656	99	.8048	.7926	.7918	.7877	.7799
30	.9652	.9551	.95493	.9520	.9446	65	.8878	.8757	.8752	.8702	.8631	100	.8016	.7896	.78913	.7854	.7770
31	.9634		.9530	.9500	.9426	66	.8854	.8733	.8728	.8679	.8607						
32	.9615		.9510	.9481	.9405	67	.8831	.8710	.8705	.8656	.8583						
33	.9596		.9489	.9460	.9383	68	.8807	.8686	.8682	.8632	.8559						
34	.9577		.9468	.9440	.9361	69	.8784	.8662	.8658	.8609	.8535						

*Two different observers; see *International Critical Tables*, vol. 3, p. 120.

TABLE 2-115 Glycerol*

Glycerol, %	Density 15°C	15.5°C	20°C	25°C	30°C	Glycerol, %	Density 15°C	15.5°C	20°C	25°C	30°C	Glycerol, %	Density 15°C	15.5°C	20°C	25°C	30°C
100	1.26415	1.26381	1.26108	1.15802	1.25495	65	1.17030	1.17000	1.16750	1.16475	1.16195	30	1.07455	1.07435	1.07270	1.07070	1.06855
99	1.26160	1.26125	1.25850	1.25545	1.25235	64	1.16755	1.16725	1.16475	1.16200	1.15925	29	1.07195	1.07175	1.07010	1.06815	1.06605
98	1.25900	1.25865	1.25590	1.25290	1.24975	63	1.16480	1.16445	1.16205	1.15925	1.15650	28	1.06935	1.06915	1.06755	1.06560	1.06355
97	1.25645	1.25610	1.25335	1.25030	1.24710	62	1.16200	1.16170	1.15930	1.15655	1.15375	27	1.06670	1.06655	1.06495	1.06305	1.06105
96	1.25385	1.25350	1.25080	1.24770	1.24450	61	1.15925	1.15895	1.15655	1.15380	1.15100	26	1.06410	1.06390	1.06240	1.06055	1.05855
95	1.25130	1.25095	1.24825	1.24515	1.24190	60	1.15650	1.15615	1.15380	1.15105	1.14830	25	1.06150	1.06130	1.05980	1.05800	1.05605
94	1.24865	1.24830	1.24560	1.24250	1.23930	59	1.15370	1.15340	1.15105	1.14835	1.14555	24	1.05885	1.05870	1.05720	1.05545	1.05350
93	1.24600	1.24565	1.24300	1.23985	1.23670	58	1.15095	1.15065	1.14830	1.14560	1.14285	23	1.05625	1.05610	1.05465	1.05290	1.05100
92	1.24340	1.24305	1.24035	1.23725	1.23410	57	1.14815	1.14785	1.14555	1.14285	1.14010	22	1.05365	1.05350	1.05205	1.05035	1.04850
91	1.24075	1.24040	1.23770	1.23460	1.23150	56	1.14535	1.14510	1.14280	1.14015	1.13740	21	1.05100	1.05090	1.04950	1.04780	1.04600
90	1.23810	1.23775	1.23510	1.23200	1.22890	55	1.14260	1.14230	1.14005	1.13740	1.13470	20	1.04840	1.04825	1.04690	1.04525	1.04350
89	1.23545	1.23510	1.23245	1.22935	1.22625	54	1.13980	1.13955	1.13730	1.13465	1.13195	19	1.04590	1.04575	1.04440	1.04280	1.04105
88	1.23280	1.23245	1.22975	1.22665	1.22360	53	1.13705	1.13680	1.13455	1.13195	1.12925	18	1.04335	1.04325	1.04195	1.04035	1.03860
87	1.23015	1.22980	1.22710	1.22400	1.22095	52	1.13425	1.13400	1.13180	1.12920	1.12650	17	1.04085	1.04075	1.03945	1.03790	1.03615
86	1.22750	1.22710	1.22445	1.22135	1.21830	51	1.13150	1.13125	1.12905	1.12650	1.12380	16	1.03835	1.03825	1.03695	1.03545	1.03370
85	1.22485	1.22445	1.22180	1.21870	1.21565	50	1.12870	1.12845	1.12630	1.12375	1.12110	15	1.03580	1.03570	1.03450	1.03300	1.03130
84	1.22220	1.22180	1.21915	1.21605	1.21300	49	1.12600	1.12575	1.12360	1.12110	1.11845	14	1.03330	1.03320	1.03200	1.03055	1.02885
83	1.21955	1.21915	1.21650	1.21340	1.21035	48	1.12325	1.12305	1.12090	1.11840	1.11580	13	1.03080	1.03070	1.02955	1.02805	1.02640
82	1.21690	1.21650	1.21380	1.21075	1.20770	47	1.12055	1.12030	1.11820	1.11575	1.11320	12	1.02830	1.02820	1.02705	1.02560	1.02395
81	1.21425	1.21385	1.21115	1.20810	1.20505	46	1.11780	1.11760	1.11550	1.11310	1.11055	11	1.02575	1.02565	1.02455	1.02315	1.02150
80	1.21160	1.21120	1.20850	1.20545	1.20240	45	1.11510	1.11490	1.11280	1.11040	1.10795	10	1.02325	1.02315	1.02210	1.02070	1.01905
79	1.20885	1.20845	1.20575	1.20275	1.19970	44	1.11235	1.11215	1.11010	1.10775	1.10530	9	1.02085	1.02075	1.01970	1.01835	1.01670
78	1.20610	1.20570	1.20305	1.20005	1.19705	43	1.10960	1.10945	1.10740	1.10510	1.10265	8	1.01840	1.01835	1.01730	1.01600	1.01440
77	1.20335	1.20300	1.20030	1.19735	1.19435	42	1.10690	1.10670	1.10470	1.10240	1.10005	7	1.01600	1.01590	1.01495	1.01360	1.01205
76	1.20060	1.20025	1.19760	1.19465	1.19170	41	1.10415	1.10400	1.10200	1.09975	1.09740	6	1.01360	1.01350	1.01255	1.01125	1.00970
75	1.19785	1.19750	1.19485	1.19195	1.18900	40	1.10145	1.10130	1.09930	1.09710	1.09475	5	1.01120	1.01110	1.01015	1.00890	1.00735
74	1.19510	1.19480	1.19215	1.18925	1.18635	39	1.09875	1.09860	1.09665	1.09445	1.09215	4	1.00875	1.00870	1.00780	1.00655	1.00505
73	1.19235	1.19205	1.18940	1.18650	1.18365	38	1.09605	1.09590	1.09400	1.09180	1.08955	3	1.00635	1.00630	1.00540	1.00415	1.00270
72	1.18965	1.18930	1.18670	1.18380	1.18100	37	1.09340	1.09320	1.09135	1.08915	1.08690	2	1.00395	1.00385	1.00300	1.00180	1.00035
71	1.18690	1.18655	1.18395	1.18110	1.17830	36	1.09070	1.09050	1.08865	1.08655	1.08430	1	1.00155	1.00145	1.00060	0.99945	0.99800
70	1.18415	1.18385	1.18125	1.17840	1.17565	35	1.08800	1.08780	1.08600	1.08390	1.08165	0	0.99913	0.99905	0.99823	0.99708	0.99568
69	1.18135	1.18105	1.17850	1.17565	1.17290	34	1.08530	1.08515	1.08335	1.08125	1.07905						
68	1.17860	1.17830	1.17575	1.17295	1.17020	33	1.08265	1.08245	1.08070	1.07860	1.07645						
67	1.17585	1.17555	1.17300	1.17020	1.16745	32	1.07995	1.07975	1.07800	1.07600	1.07380						
66	1.17305	1.17275	1.17025	1.16745	1.16470	31	1.07725	1.07705	1.07535	1.07335	1.07120						

*Bosart and Snoddy, *Ind. Eng. Chem.*, **20,** (1928): 1378.

TABLE 2-116 Hydrazine (N_2H_4)

%	d_4^{15}	%	d_4^{15}
1	1.0002	30	1.0305
2	1.0013	40	1.038
4	1.0034	50	1.044
8	1.0077	60	1.047
12	1.0121	70	1.046
16	1.0164	80	1.040
20	1.0207	90	1.030
24	1.0248	100	1.011
28	1.0286		

TABLE 2-117 Densities of Aqueous Solutions of Miscellaneous Organic Compounds*

d (resp., d_w, d_s) = density of the solution (resp., water; resp., the pure liquid solute) in g/mL; p_s (resp., p_w) = wt % of solute (resp., water) in the solution; range = range of applicability of the equation.

Section A $d = d_w + Ap_s + Bp_s^2 + Cp_s^3$

Name	Formula	t, °C	Range, p_s	A	B	C
Acetaldehyde	C_2H_4O	18	0– 30	$+0.0_3255$	-0.0_516	
Acetamide	C_2H_5NO	15	0– 6	$+0.0_3639$	$+0.0_4171$	
		0	0–100	-0.0_3856	-0.0_5449	-0.0_7588
		4	0–100	-0.0_27648	-0.0_41193	$+0.0_8272$
Acetone	C_3H_6O	15	0–100	-0.0_21009	-0.0_59682	-0.0_8624
		20	0–100	-0.0_21233	-0.0_53529	-0.0_75327
		25	0–100	-0.0_21171	-0.0_5904	-0.0_856
Acetonitrile	C_2H_3N	15	0– 16	-0.0_21175	-0.0_42024	
Allyl alcohol	C_3H_6O	0	0– 89	-0.0_33729	-0.0_41232	$+0.0_72984$
Benzenepentacarboxylic acid	$C_{11}H_6O_{10}$	25	0– 0.6	$+0.0_25615$	-0.0_2117	
Butyl alcohol (*n*-)	$C_4H_{10}O$	20	0– 7.9	-0.0_21651	$+0.0_4285$	
		18	0– 10	$+0.0_3414$	$+0.0_4131$	
Butyric acid (*n*-)	$C_4H_8O_2$	25	0– 62	$+0.0_35135$	-0.0_4166	$+0.0_611$
		0	0– 70	$+0.0_24489$	$+0.0_42802$	-0.0_71291
Chloral hydrate	$C_2H_3Cl_3O_2$	15	0– 78	$+0.0_24455$	$+0.0_42198$	$+0.0_74366$
		30	0– 90	$+0.0_24401$	$+0.0_41887$	$+0.0_76549$
		20	0– 32	$+0.0_23648$	$+0.0_5302$	
Chloroacetic acid	$C_2H_3ClO_2$	25	0– 86	$+0.0_23602$	$+0.0_5552$	$+0.0_722$
Citric acid (hydrate)	$C_6H_3O_7 + H_2O$	18	0– 50	$+0.0_23824$	$+0.0_41141$	$+0.0_717$
		20	0– 30	$+0.0_24427$	$+0.0_5537$	$+0.0_77534$
Dichloroacetic acid	$C_2H_2Cl_2O_2$	25	0– 97	$+0.0_24427$	$+0.0_5537$	$+0.0_77534$
Diethylamine hydrochloride	$C_4H_{12}ClN$	21	0– 36	$+0.0_334$	$+0.0_676$	
Ethylamine hydrochloride	C_2H_8ClN	21	0– 65	$+0.0_21193$	-0.0_5307	-0.0_747
		0	0–100	$+0.0_21483$	$+0.0_52992$	-0.0_75248
Ethylene glycol	$C_2H_6O_2$	15	0– 6	$+0.0_2133$	-0.0_5108	
		20	0– 5	-0.0_2221	$+0.0_448$	
Ethyl ether	$C_4H_{10}O$	25	0– 4.5	-0.0_2221	$+0.0_435$	
tartrate	$C_8H_{14}O_6$	15	0– 95	$+0.0_22367$	$+0.0_5358$	-0.0_76005
Formaldehyde	CH_2O	15	0– 40	$+0.0_22518$	-0.0_5658	$+0.0_6542$
Formamide	CH_3NO	25	22– 96	$+0.0_21217$	$+0.0_53199$	-0.0_72529
		20	0– 8	$+0.0_21827$	$+0.0_5366$	
Furfural	$C_5H_4O_2$	25	0– 8	$+0.0_21664$	$+0.0_421$	
Isoamyl alcohol	$C_5H_{12}O$	20	0– 2.5	$+0.0_2155$	$+0.0_43$	
		15	0– 8	-0.0_2146	$+0.0_56$	
Isobutyl alcohol	$C_4H_{10}O$	20	0– 8	-0.0_2169	$+0.0_438$	
		15	0– 9	$+0.0_352$		
Isobutyric acid	$C_4H_8O_2$	18	0– 9	$+0.0_345$		
		25	0– 12	$+0.0_337$		
Isovaleric acid	$C_5H_{10}O_2$	25	0– 5	$+0.0_3253$	-0.0_4282	
Lactic acid	C_3H_6O	25	0– 9	$+0.0_2231$	$+0.0_5186$	
Maleic acid	$C_4H_4O_4$	25	0– 40	$+0.0_234$	$+0.0_575$	
		20	0– 40	$+0.0_33933$	$+0.0_5957$	
Malic acid	$C_4H_6O_5$	25	0– 40	$+0.0_33736$	$+0.0_4175$	
Malonic acid	$C_3H_4O_4$	20	0– 40	$+0.0_3389$	$+0.0_41066$	
Methyl acetate	$C_3H_6O_2$	20	0– 20	$+0.0_340$	-0.0_574	
glucoside (α-)	$C_7H_{14}O_6$	0	26– 51	$+0.0_33336$	$+0.0_5996$	$+0.01544$
		30	26– 51	$+0.0_33151$	$+0.0_5975$	$+0.0_8978$
Nicotine	$C_{10}H_{14}N_2$	20	0– 60	$+0.0_3642$	$+0.0_5454$	-0.0_7687
Nitrophenol (*p*-)	$C_6H_5NO_3$	15	0– 1.5	$+0.0_33216$	-0.0_455	
		0	0– 4	$+0.0_25898$	-0.0_33185	$+0.0_441$
		15	0– 4	$+0.0_2494$	-0.0_58	
Oxalic acid	$C_2H_2O_4$	17.5	0– 9	$+0.0_2494$	-0.0_58	
		20	0– 4	$+0.0_25264$	-0.0_31996	$+0.0_4254$
		25	0– 4	$+0.0_25108$	-0.0_31607	$+0.0_4208$
		15	0– 5	$+0.0_2111$	-0.0_4283	
Phenol	C_6H_6O	80	0– 65	$+0.0_3462$	-0.0_686	
Phenylglycolic acid	$C_8H_8O_3$	25	0– 11	$+0.0_3207$	$+0.0_423$	
Picoline (α-)	C_6H_7N	25	0– 70	-0.0_4386	-0.0_51405	-0.0_74167
(β-)	C_6H_7N	25	0– 60	-0.0_4683	-0.0_513	
		18	0– 10	$+0.0_395$	-0.0_4172	
Propionic acid	$C_3H_6O_2$	25	0– 40	$+0.0_39245$	-0.0_599	$+0.0_7361$
Pyridine	C_5H_5N	25	0– 60	$+0.0_3229$	-0.0_5204	-0.0_828
Resorcinol	$C_6H_6O_2$	18	0– 52	$+0.0_3201$	$+0.0_5519$	-0.0_819
Succinic acid	$C_4H_6O_4$	25	0– 5.5	$+0.0_3304$		
		15	0– 15	$+0.0_24482$	$+0.0_4185$	
		17.5	0– 50	$+0.0_24455$	$+0.0_4185$	
		20	0– 50	$+0.0_24432$	$+0.0_41837$	
Tartaric acid (*d*, *l*, or *dl*)	$C_4H_6O_6$	30	0– 50	$+0.0_24335$	$+0.0_4185$	
		40	0– 50	$+0.0_24265$	$+0.0_4185$	
		50	0– 50	$+0.0_24205$	$+0.0_4185$	
		60	0– 50	$+0.0_24155$	$+0.0_4185$	

*From "International Critical Tables," vol. 3, pp. 111–114.

TABLE 2-117 Densities of Aqueous Solutions of Miscellaneous Organic Compounds (*Concluded*)

Section A $d = d_w + Ap_s + Bp_s^2 + Cp_s^3$ (*Cont.*)

Name	Formula	t, °C	Range, p_s	A	B	C
Tetraethyl ammonium chloride	$C_8H_{20}ClN$	21	0– 63	$+0.0_31884$	$+0.0_56$	$+0.0_7122$
Thiourea	CH_4N_2S	15	0– 7	$+0.0_32995$	$+0.0_5374$	
Trichloroacetic acid	$C_2HCl_3O_2$	12.5	0– 61	$+0.0_3499$	$+0.0_4153$	
		20	10– 30	$+0.0_35053$	$+0.0_41387$	
		25	0– 94	$+0.0_35051$	$+0.0_56119$	$+0.0_61038$
Triethylamine hydrochloride	$C_6H_{16}ClN$	21	0– 54	$+0.0_46$	$+0.0_5558$	-0.0_869
Trimethyl carbinol	$C_4H_{10}O$	20	0–100	-0.0_3117	-0.0_41908	$+0.0_7957$
		25	0–100	-0.0_31286	-0.0_4176	$+0.0_7887$
Urea	CH_4N_2O	14.8	0– 12	$+0.0_33213$	-0.0_44802	$+0.0_51216$
		18	0– 51	$+0.0_32718$	$+0.0_51552$	$+0.0_72573$
		20	0– 35	$+0.0_32702$	$+0.0_53712$	-0.0_72285
		25	0– 10	$+0.0_32728$	-0.0_41817	$+0.0_51379$
Urethane	$C_3H_7NO_2$	20	0– 56	$+0.0_21278$	-0.0_5245	-0.0_73437
Valeric acid (*n*-)	$C_5H_{10}O_2$	25	0– 3	$+0.0_334$	-0.0_427	

Section B $d = d_s + Ap_w + Bp_w^2 + Cp_w^3$

Name	Formula	d_s	t, °C	Range, p_w	A	B	C
Butyl alcohol (*n*-)	$C_4H_{10}O$	0.8097	20	0–20	$+0.0_22103$	-0.0_4113	
Butyric acid (*n*-)	$C_4H_8O_2$	0.9534	25	0–38	$+0.0_21854$	-0.0_42314	
Ethyl ether	$C_4H_{10}O$	0.7077	25	0– 1.1	$+0.0_334$	$+0.0_336$	
Isobutyl alcohol	$C_4H_{10}O$	0.8170	0	0–14	$+0.0_22437$	-0.0_4285	
		0.8055	15	0–16	$+0.0_2224$	-0.0_4129	
Isobutyric acid	$C_4H_8O_2$	0.9425	26	0–80	$+0.0_21808$	-0.0_42358	$+0.0_61253$
Nicotine	$C_{10}H_{14}N_2$	1.0093	20	0–40	$+0.0_2199$	-0.0_4331	$+0.0_7315$
Picoline (α-)	C_6H_7N	0.9404	25	0–30	$+0.0_22715$	-0.0_4393	
(β-)	C_6H_7N	0.9515	25	0–40	$+0.0_21925$	-0.0_4352	$+0.0_625$
Pyridine	C_5H_5N	0.9776	25	0–40	$+0.0_21157$	-0.0_5536	-0.0_62
Trimethyl carbinol	$C_4H_{10}O$	0.7856	20	0–20	$+0.0_22287$	$+0.0_5275$	

Section C $d_t = d_o + At + Bt^2$

Name	Formula	p_s	d_o	Range, °C	A	B
Allyl alcohol	C_3H_6O	76.60	0.9122	0–45	-0.0_38	-0.0_527
Butyl alcohol (*n*-)	$C_4H_{10}O$	80.95	0.8614	0–43	-0.0_37292	-0.0_675
Chloral hydrate	$C_2H_3Cl_3O_2$	2.00	1.0094	7–80	-0.0_42597	-0.0_54313
		10.00	1.0476	7–80	-0.0_47955	-0.0_54253
Ethyl tartrate	$C_7H_{14}O_6$	5.00	1.0150	15–80	-0.0_32103	-0.0_52544
		10.00	1.0270	15–80	-0.0_32116	-0.0_62929
		25.00	1.0665	15–80	-0.0_3401	-0.0_523
Furfural	$C_5H_4O_2$	4.62	1.0125	22–74	-0.0_3232	-0.0_5254
		5.69	1.0140	22–74	-0.0_3221	-0.0_5268
		6.56	1.0155	22–74	-0.0_3211	-0.0_5290
Pyridine	C_5H_5N	9.34	1.0055	11–73	-0.0_3171	-0.0_53615
		21.20	1.0115	14–73	-0.0_3378	-0.0_5248
		29.50	1.0145	12–72	-0.0_3463	-0.0_5235
		40.40	1.0182	9–74	-0.0_3605	-0.0_5167

DENSITIES OF MISCELLANEOUS MATERIALS

TABLE 2-118 Approximate Specific Gravities and Densities of Miscellaneous Solids and Liquids*

Water at 4°C and normal atmospheric pressure taken as unity. For more detailed data on any material, see the section dealing with the properties of that material.

Substance	Sp. gr.	Aver. weight lb/ft³
Metals, Alloys, Ores		
Aluminum, cast-hammered	2.55–2.80	165
bronze	7.7	481
Brass, cast-rolled	8.4–8.7	534
Bronze, 7.9 to 14% Sn	7.4–8.9	509
phosphor	8.88	554
Copper, cast-rolled	8.8–8.95	556
ore, pyrites	4.1–4.3	262
German silver	8.58	536
Gold, cast-hammered	19.25–19.35	1205
coin (U.S.)	17.18–17.2	1073
Iridium	21.78–22.42	1383
Iron, gray cast	7.03–7.13	442
cast, pig	7.2	450
wrought	7.6–7.9	485
spiegeleisen	7.5	468
ferro-silicon	6.7–7.3	437
ore, hematite	5.2	325
ore, limonite	3.6–4.0	237
ore, magnetite	4.9–5.2	315
slag	2.5–3.0	172
Lead	11.34	710
ore, galena	7.3–7.6	465
Manganese	7.42	475
ore, pyrolusite	3.7–4.6	259
Mercury	13.6	849
Monel metal, rolled	8.97	555
Nickel	8.9	537
Platinum, cast-hammered	21.5	1330
Silver, cast-hammered	10.4–10.6	656
Steel, cold-drawn	7.83	489
machine	7.80	487
tool	7.70–7.73	481
Tin, cast-hammered	7.2–7.5	459
cassiterite	6.4–7.0	418
Tungsten	19.22	1200
Zinc, cast-rolled	6.9–7.2	440
blende	3.9–4.2	253
Various Solids		
Cereals, oats, bulk	0.51	26
barley, bulk	0.62	39
corn, rye, bulk	0.73	45
wheat, bulk	0.77	48
Cork	0.22–0.26	15
Cotton, flax, hemp	1.47–1.50	93
Fats	0.90–0.97	58
Flour, loose	0.40–0.50	28
pressed	0.70–0.80	47
Glass, common	2.40–2.80	162
plate or crown	2.45–2.72	161
crystal	2.90–3.00	184
dint	3.2–4.7	247
Hay and straw, bales	0.32	20
Leather	0.86–1.02	59
Paper	0.70–1.15	58
Potatoes, piled	0.67	44
Rubber, caoutchouc	0.92–0.96	59
goods	1.0–2.0	94
Salt, granulated, piled	0.77	48
Saltpeter	1.07	67
Starch	1.53	96
Sulfur	1.93–2.07	125
Wool	1.32	82

Substance	Sp. gr.	Aver. weight lb/ft³
Timber, Air-dry		
Apple	0.66–0.74	44
Ash, black	0.55	34
white	0.64–0.71	42
Birch, sweet, yellow	0.71–0.72	44
Cedar, white, red	0.35	22
Cherry, wild red	0.43	27
Chestnut	0.48	30
Cypress	0.45–0.48	29
Elm, white	0.56	35
Fir, Douglas	0.48–0.55	32
balsam	0.40	25
Hemlock	0.45–0.50	29
Hickory	0.74–0.80	48
Locust	0.67–0.77	45
Mahogany	0.56–0.85	44
Maple, sugar	0.68	43
white	0.53	33
Oak, chestnut	0.74	46
live	0.87	54
red, black	0.64–0.71	42
white	0.77	48
Pine, Norway	0.55	34
Oregon	0.51	32
red	0.48	30
Southern	0.61–0.67	38–42
white	0.43	27
Poplar	0.43	27
Redwood, California	0.42	26
Spruce, white, red	0.45	28
Teak, African	0.99	62
Indian	0.66–0.88	48
Walnut, black	0.59	37
Willow	0.42–0.50	28
Various Liquids		
Alcohol, ethyl (100%)	0.789	49
methyl (100%)	0.796	50
Acid, muriatic, 40%	1.20	75
nitric, 91%	1.50	94
sulfuric, 87%	1.80	112
Chloroform	1.500	95
Ether	0.736	46
Lye, soda, 66%	1.70	106
Oils, vegetable	0.91–0.94	58
mineral, lubricants	0.88–0.94	57
Turpentine	0.861–0.867	54
Water, 4°C max. density	1.0	62.428
100°C	0.9584	59.830
ice	0.88–0.92	56
snow, fresh fallen	0.125	8
sea water	1.02–1.03	64
Ashlar Masonry		
Bluestone	2.3–2.6	153
Granite, syenite, gneiss	2.4–2.7	159
Limestone	2.1–2.8	153
Marble	2.4–2.8	162
Sandstone	2.0–2.6	143
Rubble Masonry		
Bluestone	2.2–2.5	147
Granite, syenite, gneiss	2.3–2.6	153
Limestone	2.0–2.7	147
Marble	2.3–2.7	156
Sandstone	1.9–2.5	137

Substance	Sp. gr.	Aver. weight lb/ft³
Dry Rubble Masonry		
Granite, syenite, gneiss	1.9–2.3	130
Limestone, marble	1.9–2.1	125
Sandstone, bluestone	1.8–1.9	110
Brick Masonry		
Hard brick	1.8–2.3	128
Medium brick	1.6–2.0	112
Soft brick	1.4–1.9	103
Sand-lime brick	1.4–2.2	112
Concrete Masonry		
Cement, stone, sand	2.2–2.4	144
slag, etc.	1.9–2.3	130
cinder, etc.	1.5–1.7	100
Various Building Materials		
Ashes, cinders	0.64–0.72	40–45
Cement, Portland, loose	1.5	94
Lime, gypsum, loose	0.85–1.00	53–64
Mortar, lime, set	1.4–1.9	103
Portland cement	2.08–2.25	94–135
Portland cement	3.1–3.2	196
Slags, bank slag	1.1–1.2	67–72
bank screenings	1.5–1.9	98–117
machine slag	1.5	96
slag sand	0.8–0.9	49–55
Earth, etc., Excavated		
Clay, dry	1.0	63
damp plastic	1.76	110
and gravel, dry	1.6	100
Earth, dry, loose	1.2	76
dry, packed	1.5	95
moist, loose	1.3	78
moist, packed	1.6	96
mud, flowing	1.7	108
mud, packed	1.8	115
Riprap, limestone	1.3–1.4	80–85
Riprap, sandstone	1.4	90
Riprap, shale	1.7	105
Sand, gravel, dry, loose	1.4–1.7	90–105
gravel, dry, packed	1.6–1.9	100–120
gravel, wet	1.89–2.16	126
Excavations in Water		
Clay	1.28	80
River mud	1.44	90
Sand or gravel	0.96	60
and clay	1.00	65
Soil	1.12	70
Stone riprap	1.00	65
Minerals		
Asbestos	2.1–2.8	153
Barytes	4.50	281
Basalt	2.7–3.2	184
Bauxite	2.55	159
Bluestone	2.5–2.6	159
Borax	1.7–1.8	109
Chalk	1.8–2.8	143
Clay, marl	1.8–2.6	137
Dolomite	2.9	181
Feldspar, orthoclase	2.5–2.7	162
Gneiss	2.7–2.9	175
Granite	2.6–2.7	165
Greenstone, trap	2.8–3.2	187
Gypsum, alabaster	2.3–2.8	159
Hornblende	3.0	187
Limestone	2.1–2.86	155
Marble	2.6–2.86	170
Magnesite	3.0	187
Phosphate rock, apatite	3.2	200
Porphyry	2.6–2.9	172

*From Marks, *Mechanical Engineers' Handbook,* McGraw-Hill.

TABLE 2-118 Approximate Specific Gravities and Densities of Miscellaneous Solids and Liquids (*Concluded*)

Water at 4°C and normal atmospheric pressure taken as unity. For more detailed data on any material, see the section dealing with the properties of that material.

Substance	Sp. gr.	Aver. weight lb/ft³	Substance	Sp. gr.	Aver. weight lb/ft³	Substance	Sp. gr.	Aver. weight lb/ft³
Minerals (*Cont.*)			Bituminous Substances			Bituminous Substances (*Cont.*)		
Pumice, natural	0.37–0.90	40	Asphaltum	1.1–1.5	81	Petroleum	0.87	54
Quartz, flint	2.5–2.8	165	Coal, anthracite	1.4–1.8	97	refined (kerosene)	0.78–0.82	50
Sandstone	2.0–2.6	143	bituminous	1.2–1.5	84	benzine	0.73–0.75	46
Serpentine	2.7–2.8	171	lignite	1.1–1.4	78	gasoline	0.70–0.75	45
Shale, slate	2.6–2.9	172	peat, turf, dry	0.65–0.85	47	Pitch	1.07–1.15	69
						Tar, bituminous	1.20	75
Soapstone, talc	2.6–2.8	169	charcoal, pine	0.28–0.44	23			
Syenite	2.6–2.7	165	charcoal, oak	0.47–0.57	33	Coal and Coke, Piled		
			coke	1.0–1.4	75	Coal, anthracite	0.75–0.93	47–58
Stone, Quarried, Piled			Graphite	1.64–2.7	135	bituminous, lignite	0.64–0.87	40–54
Basalt, granite, gneiss	1.5	96	Paraffin	0.87–0.91	56	peat, turf	0.32–0.42	20–26
Greenstone, hornblende	1.7	107				charcoal	0.16–0.23	10–14
Limestone, marble, quartz	1.5	95				coke	0.37–0.51	23–32
Sandstone	1.3	82						
Shale	1.5	92						

NOTE: To convert pounds per cubic foot to kilograms per cubic meter, multiply by 16.02. °F = ⅘ °C + 32.

TABLE 2-119 Density (kg/m³) of Selected Elements as a Function of Temperature

Temperature, K°	Element symbol												
	Al	Be†	Cr	Cu	Au	Ir	Fe	Pb	Mo	Ni	Pt	Ag	Zn†
50	2736	3650	7160	9019	19,490	22,600	7910	11,570	10,260	8960	21,570	10,620	7280
100	2732	3640	7155	9009	19,460	22,580	7900	11,520	10,260	8950	21,550	10,600	7260
150	2726	3630	7150	8992	19,420	22,560	7890	11,470	10,250	8940	21,530	10,575	7230
200	2719	3620	7145	8973	19,380	22,540	7880	11,430	10,250	8930	21,500	10,550	7200
250	2710	3610	7140	8951	19,340	22,520	7870	11,380	10,250	8910	21,470	10,520	7170
300	2701	3600	7135	8930	19,300	22,500	7860	11,330	10,240	8900	21,450	10,490	7135
400	2681	3580	7120	8885	19,210	22,450	7830	11,230	10,220	8860	21,380	10,430	7070
500	2661	3555	7110	8837	19,130	22,410	7800	11,130	10,210	8820	21,330	10,360	7000
600	2639	3530	7080	8787	19,040	22,360	7760	11,010	10,190	8780	21,270	10,300	6935
800	2591		7040	8686	18,860	22,250	7690	10,430	10,160	8690	21,140	10,160	6430
1000	2365	——	7000	8568	18,660	22,140	7650	10,190	10,120	8610	21,010	10,010	6260
1200	2305		6945	8458	18,440	22,030	7620	9,940	10,080	8510	20,870	9,850	
1400	2255		6890	7920	17,230	21,920	7520		10,040	8410	20,720	9,170	
1600			6760	7750	16,950	21,790	7420		10,000	8320	20,570	8,980	
1800			6700	7600		21,660	7320		9,950	7690	20,400		
2000				7460		21,510	7030		9,900	7450	20,220		

NOTE: Above the horizontal line the condensed phase is solid; below the line, it is liquid.
°°R = ⅘ K.
†Polycrystalline form tabulated. Similar tables for an additional 45 elements appear in the *Handbook of Heat Transfer,* 2d ed., McGraw-Hill, New York, 1984.

SOLUBILITIES

UNITS CONVERSIONS

For this subsection, the following units conversions are applicable:

$$°F = \tfrac{9}{5}\,°C + 32.$$

To convert cubic centimeters to cubic feet, multiply by 3.532×10^{-5}.

To convert millimeters of mercury to pounds-force per square inch, multiply by 0.01934.

To convert grams per liter to pounds per cubic foot, multiply by 6.243×10^{-2}.

TABLE 2-120 Solubilities of Inorganic Compounds in Water at Various Temperatures*

This table shows the amount of anhydrous substance that is soluble in 100 g of water at the temperature in degrees Celsius as indicated; when the name is followed by †, the value is expressed in grams of substance in 100 cm^3 of saturated solution. Solid phase gives the hydrated form in equilibrium with the saturated solution.

	Substance	Formula	Solid phase	0°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C	80°C	90°C	100°C	
1	Aluminum chloride	$AlCl_3$	$6H_2O$			69.86^{15o}									1
2	sulfate	$Al_2(SO_4)_3$	$18H_2O$	31.2	33.5	36.4	40.4	46.1	52.2	59.2	66.1	73.0	80.8	89.0	2
3	Ammonium aluminum sulfate	$(NH_4)_2Al_2(SO_4)_4$	$24H_2O$	2.1	4.99	7.74	10.94	14.88	20.10	26.70				109.7^{96o}	3
4	bicarbonate	NH_4HCO_3		11.9	15.8	21	27								4
5	bromide	NH_4Br		60.6	68	75.5	83.2	91.1	99.2	107.8	116.8	126	135.6	145.6	5
6	chloride	NH_4Cl		29.4	33.3	37.2	41.4	45.8	50.4	55.2	60.2	65.6	71.3	77.3	6
7	chloroplatinate	$(NH_4)_2PtCl_6$			0.7									1.25	7
8	chromate	$(NH_4)_2CrO_4$					40.4								8
9	chromium sulfate	$(NH_4)_2Cr_2(SO_4)_4$	$24II_2O$			10.78^{25o}									9
10	dichromate	$(NH_4)_2Cr_2O_7$					47.17								10
11	dihydrogen phosphite	$NH_4H_2PO_3$		171		$190^{14.5o}$	260^{31o}								11
12	hydrogen phosphate	$(NH_4)_2HPO_4$				131^{15}									12
13	iodide	NH_4I		154.2	163.2	172.3	181.4	190.5	199.6	208.9	218.7	228.8		250.3	13
14	magnesium phosphate	NH_4MgPO_4	$6H_2O$	0.023		0.052		0.036	0.030	0.040	0.016	0.019			14
15	manganese phosphate	NH_4MnPO_4	$7H_2O$			0		0		0	0.005	0.007			15
16	nitrate	NH_4NO_3		118.3		192	241.8	297.0	344.0	421.0	499.0	580.0	740.0	871.0	16
17	oxalate	$(NH_4)_2C_2O_4$	$1H_2O$	2.2	3.1	4.4	5.9	8.0	10.3						17
18	perchlorate†	NH_4ClO_4†		11.56		20.85		30.58		39.05		48.19		57.01	18
19	persulfate	$(NH_4)_2S_2O_8$		58.2											19
20	sulfate	$(NH_4)_2SO_4$		70.6	73.0	75.4	78.0	81.0		88.0		95.3		103.3	20
21	thiocyanate	NH_4CNS		119.8	144	170	207.7								21
22	vanadate (meta)	NH_4VO_3				0.48	0.84	1.32	1.78		3.05				22
23	Antimonious fluoride	SbF_3		384.7		444.7	563.6								23
24	sulfide	Sb_2S_3				0.000175^{18o}									24
25	Arsenic oxide	As_2O_5		59.5	62.1	65.8	69.5	71.2		73.0		75.1		76.7	25
26	Arsenious sulfide	As_2S_3		5.17×10^{-5} at 18°											26
27	Barium acetate	$Ba(C_2H_3O_2)_2$	$3H_2O$	59	63	71									27
28	acetate	$Ba(C_2H_3O_2)_2$	$1H_2O$				75	79	77	74	74			75	28
29	carbonate	$BaCO_3$			0.0016^{8o}	0.0022^{18o}	0.0024 at 24.2°								29
30	chlorate	$Ba(ClO_3)_2$	$1H_2O$	20.34	26.95	33.80	41.70	49.61		66.81		84.84		104.9	30
31	chloride	$BaCl_2$	$2H_2O$	31.6	33.3	35.7	38.2	40.7	43.6	46.4	49.4	52.4		58.8	31
32	chromate	$BaCrO_4$		0.0002	0.00028	0.00037	0.00046								32
33	hydroxide	$Ba(OH)_2$	$8H_2O$	1.67	2.48	3.89	5.59	8.22	13.12	20.94		101.4			33
34	iodide	BaI_2	$6H_2O$	170.2	185.7	203.1	219.6								34
35	iodide	BaI_2	$2H_2O$					231.9		247.3		261.0		271.7	35
36	nitrate	$Ba(NO_3)_2$		5.0	7.0	9.2	11.6	14.2	17.1	20.3		27.0		34.2	36
37	nitrite	$Ba(NO_2)_2$	$1H_2O$			67.5						205.8		300	37
38	oxalate	BaC_2O_4			0.0016^{8o}	0.0022^{18o}	0.0024 at 24.2°								38
39	perchlorate	$Ba(ClO_4)_2$	$3H_2O$	205.8		289.1		358.7	426.3		495.2		562.3		39
40	sulfate	$BaSO_4$		1.15×10^{-4}	2.0×10^{-4}	2.4×10^{-4}	2.85×10^{-4}								40
41	Beryllium sulfate	$BeSO_4$	$6H_2O$				52		60.67						41
42	sulfate	$BeSO_4$	$4H_2O$				43.78	46.74			62		83	100	42
43	sulfate	$BeSO_4$	$2H_2O$									84.76	98	110	43
44	Boric acid	H_3BO_3		2.66	3.57	5.04	6.60	8.72	11.54	14.81	16.73	23.75	30.38	40.25	44
45	Boron oxide	B_2O_3		1.1	1.5	2.2		4.0		6.2		9.5		15.7	45
46	Bromine	Br_2		4.22	3.4	3.20	3.13								46
47	Cadmium chloride	$CdCl_2$	$4H_2O$	97.59	125.1										47
48	chloride	$CdCl_2$	$2½H_2O$	90.01			132.1								48
49	chloride	$CdCl_2$	$1H_2O$		135.1	134.5		135.3		136.5		140.4		147.0	49
50	cyanide	$Cd(CN)_2$				1.7^{15o}									50
51	hydroxide	$Cd(OH)_2$					2.6×10^{-4} at 25°								51
52	sulfate	$CdSO_4$		76.48	76.00	76.60		78.54		83.68			63.13	60.77	52
53	Calcium acetate	$Ca(C_2H_3O_2)_2$	$2H_2O$	37.4	36.0	34.7	33.8	33.2		32.7		33.5			53
54	acetate	$Ca(C_2H_3O_2)_2$	$1H_2O$										31.1	29.7	54

*By N. A. Lange. Abridged from "Table of Solubilities of Inorganic Compounds in Water at Various Temperatures" in Lange, *Handbook of Chemistry,* 10th ed., McGraw-Hill, New York, 1961. For tables of the solubility of gases in water at various temperatures, Atack (*Handbook of Chemical Data,* Reinhold, New York, 1957) gives values at closer temperature intervals, usually 1 or 5°C, than are tabulated here. For materials marked by ‡, additional data are given in tables subsequent to this one. For the solubility of various hydrocarbons in water at high pressures see *J. Chem. Eng. Data,* **4,** 212 (1959).

TABLE 2-120 Solubilities of Inorganic Compounds in Water at Various Temperatures (*Continued*)

	Substance	Formula	Solid phase	0°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C	80°C	90°C	100°C	
1	Calcium bicarbonate	$Ca(HCO_3)_2$		16.15		16.60		17.05		17.50		17.95		18.40	1
2	chloride	$CaCl_2$	$6H_2O$	59.5	65.0	74.5	102								2
3	chloride	$CaCl_2$	$2H_2O$							136.8	141.7	147.0	152.7	159	3
4	fluoride	CaF_2				$0.0016^{18\circ}$	$0.0017^{26\circ}$								4
5	hydroxide	$Ca(OH)_2$		0.185	0.176	0.165	0.153	0.141	0.128	0.116	0.106	0.094	0.085	0.077	5
6	nitrate	$Ca(NO_3)_2$	$4H_2O$	102.0	115.3	129.3	152.6	195.9							6
7	nitrate	$Ca(NO_3)_2$	$3H_2O$					237.5	281.5						7
8	nitrate	$Ca(NO_3)_2$										358.7		363.6	8
9	nitrite	$Ca(NO_2)_2$	$4H_2O$	62.07		76.68									9
10	nitrite	$Ca(NO_2)_2$	$2H_2O$							132.6	151.9		244.8		10
11	oxalate	CaC_2O_4			6.7×10^{-4} at 13°	6.8×10^{-4} at 25°	9.5×10^{-4} at 50°	14×10^{-4} at 95°							11
12	sulfate	$CaSO_4$	$2H_2O$	0.1759	0.1928		0.2090	0.2097		0.2047	0.1966			0.1619	12
13	Carbon dioxide, 760 mm ‡	CO_2		0.3346	0.2318	0.1688	0.1257	0.0973	0.0761	0.0576				0	13
14	monoxide, 760 mm ‡	CO		0.0044	0.0035	0.0028	0.0024	0.0021	0.0018	0.0015	0.0013	0.0010	0.0006	0	14
15	Cesium chloride	CsCl		161.4	174.7	186.5	197.3	208.0	218.5	229.7	239.5	250.0	260.1	270.5	15
16	nitrate	$CsNO_3$		9.33	14.9	23.0	33.9	47.2	64.4	83.8	107.0	134.0	163.0	197.0	16
17	sulfate	Cs_2SO_4		167.1	173.1	178.7	184.1	189.9	194.9	199.9	205.0	210.3	214.9	220.3	17
18	Chlorine, 760 mm ‡	Cl_2		1.46	0.980	0.716	0.562	0.451	0.386	0.324	0.274	0.219	0.125	0	18
19	Chromic anhydride	CrO_3		164.9				174.0	182.1				217.5	206.8	19
20	Cuprio chloride	$CuCl_2$	$2H_2O$	70.7	73.76	77.0	80.34	83.8	87.44	91.2		99.2		107.9	20
21	nitrate	$Cu(NO_3)_2$	$6H_2O$	81.8	95.28	125.1									21
22	nitrate	$Cu(NO_3)_2$	$3H_2O$					159.8		178.8		207.8			22
23	sulfate	$CuSO_4$	$5H_2O$	14.3	17.4	20.7	25	28.5	33.3	40		55		75.4	23
24	sulfide	CuS				3.3×10^{-5} at 18°									24
25	Cuprous chloride	CuCl				$1.52^{25\circ}$									25
26	Ferric chloride	$FeCl_3$		74.4	81.9	91.8			315.1			525.8		535.7	26
27	Ferrous chloride	$FeCl_2$	$4H_2O$		64.5		73.0	77.3	82.5	88.7		100			27
28	chloride	$FeCl_2$											105.3	105.8	28
29	nitrate	$Fe(NO_3)_2$	$6H_2O$	71.02		83.8				165.6					29
30	sulfate	$FeSO_4$	$7H_2O$	15.65	20.51	26.5	32.9	40.2	48.6						30
31	sulfate	$FeSO_4$	$1H_2O$								50.9	43.6	37.3		31
32	Hydrobromic acid, 760 mm	HBr		221.2	210.3	198			171.5					130	32
33	Hydrochloric acid, 760 mm	HCl		82.3			67.3	63.3	59.6	56.1					33
34	Iodine	I_2				0.029	0.04	0.056	0.078						34
35	Lead acetate	$Pb(C_2H_3O_2)_2$	$3H_2O$				$55.04^{25\circ}$								35
36	bromide	$PbBr_2$		0.4554		0.85	1.15	1.53	1.94	2.36		3.34		4.75	36
37	carbonate	$PbCO_3$				0.00011									37
38	chloride	$PbCl_2$		0.6728		0.99	1.20	1.45	1.70	1.98		2.62		3.34	38
39	chromate	$PbCrO_4$				7×10^{-6}									39
40	fluoride	PbF_2			0.060	0.064	0.068								40
41	nitrate	$Pb(NO_3)_2$		38.8	48.3	56.5	66	75	85	95		115		38.8	41
42	sulfate	$PbSO_4$		0.0028	0.0035	0.0041	0.0049	0.0056							42
43	Magnesium bromide	$MgBr_2$	$6H_2O$	91.0	94.5	96.5	99.2	101.6	104.1	107.5		113.7		120.2	43
44	chloride	$MgCl_2$	$6H_2O$	52.8	53.5	54.5		57.5		61.0		66.0		73.0	44
45	hydroxide	$Mg(OH)_2$				$0.0009^{18\circ}$									45
46	nitrate	$Mg(NO_3)_2$	$6H_2O$	66.55				84.74					137.0		46
47	sulfate	$MgSO_4$	$7H_2O$		30.9	35.5	40.8	45.6							47
48	sulfate	$MgSO_4$	$6H_2O$	40.8	42.2	44.5	45.3		50.4	53.5	59.5	64.2	69.0	74.0	48
49	sulfate	$MgSO_4$	$1H_2O$									62.9		68.3	49
50	Manganous sulfate	$MnSO_4$	$7H_2O$	53.23	60.01										50
51	sulfate	$MnSO_4$	$5H_2O$		59.5	62.9	67.76								51
52	sulfate	$MnSO_4$	$4H_2O$			64.5	66.44	68.8	72.6						52
53	sulfate	$MnSO_4$	$1H_2O$						58.17	55.0	52.0	48.0	42.5	34.0	53
54	Mercurous chloride	HgCl		0.00014		0.0002		0.0007							54
55	Molybdic oxide	MoO_3	$2H_2O$			0.138	0.264	0.476	0.687	1.206	2.055	2.106			55
56	Nickel chloride	$NiCl_2$	$6H_2O$	53.9	59.5	64.2	68.9	73.3	78.3	82.2	85.2			87.6	56
57	nitrate	$Ni(NO_3)_2$	$6H_2O$	79.58		96.31		122.2							57
58	nitrate	$Ni(NO_3)_2$	$3H_2O$							163.1	169.1		235.1		58
59	sulfate	$NiSO_4$	$7H_2O$	27.22	32		42.46								59
60	sulfate	$NiSO_4$	$6H_2O$						50.15	54.80	59.44	63.17		76.7	60
61	Nitric oxide, 760 mm	NO		0.00984	0.00757	0.00618	0.00517	0.00440	0.00376	0.00324	0.00267	0.00199	0.00114	0	61
62	Nitrous oxide	N_2O			0.1705	0.1211									62

1	Potassium acetate	$KC_2H_3O_2$	$1½H_2O$	216.7	233.9	255.6	283.8	323.3							1
2	acetate	$KC_2H_3O_2$	$½H_2O$						337.3	350	364.8	380.1	396.3		2
3	alum	$K_2SO_4{\cdot}Al_2(SO_4)_3$	$24H_2O$	3.0	4.0	5.9	8.39	11.70	17.00	24.75	40.0	71.0	109.0		3
4	bicarbonate	$KHCO_3$		22.4	27.7	33.2	39.1	45.4		60.0					4
5	bisulfate	$KHSO_4$		36.3		51.4		67.3						121.6	5
6	bitartrate	$KHC_4H_4O_6$		0.32	0.40	0.53	0.90	1.32	1.83	2.46		4.6		6.95	6
7	carbonate	K_2CO_3	$2H_2O$	105.5	108	110.5	113.7	116.9	121.2	126.8	133.1	139.8	147.5	155.7	7
8	chlorate	$KClO_3$		3.3	5	7.4	10.5	14	19.3	24.5		38.5		57	8
9	chloride	KCl		27.6	31.0	34.0	37.0	40.0	42.6	45.5	48.3	51.1	54.0	56.7	9
10	chromate	K_2CrO_4		58.2	60.0	61.7	63.4	65.2	66.8	68.6	70.4	72.1	73.9	75.6	10
11	dichromate	$K_2Cr_2O_7$		5	7	12	20	26	34	43	52	61	70	80	11
12	ferricyanide	$K_3Fe(CN)_6$		31	36	43	50	60		66				82.6^{104}	12
13	hydroxide	KOH	$2H_2O$	97	103	112	126								13
14	hydroxide	KOH	$1H_2O$						140					178	14
15	nitrate	KNO_3		13.3	20.9	31.6	45.8	63.9	85.5	110.0	138	169	202	246	15
16	nitrite	KNO_2		278.8		298.4		334.9						412.8	16
17	perchlorate	$KClO_4$		0.75	1.05	1.80	2.6	4.4	6.5	9	11.8	14.8	18	21.8	17
18	permanganate	$KMnO_4$		2.83	4.4	6.4	9.0	12.56	16.89	22.2					18
19	persulfate†	$K_2S_2O_8$†	†	1.62	2.60	4.49	7.19	9.89							19
20	sulfate	K_2SO_4		7.35	9.22	11.11	12.97	14.76	16.50	18.17	19.75	21.4	22.8	24.1	20
21	thiocyanate	KCNS		177.0		217.5									21
22	Silver cyanide	AgCN				2.2×10^{-5}									22
23	nitrate	$AgNO_3$		122	170	222	300	376	455	525		669		952	23
24	sulfate	Ag_2SO_4		0.573	0.695	0.796	0.888	0.979	1.08	1.15	1.22	1.30	1.36	1.41	24
25	Sodium acetate	$NaC_2H_3O_2$	$3H_2O$	36.3	40.8	46.5	54.5	65.5	83	139					25
26	acetate	$NaC_2H_3O_2$		119	121	123.5	126	129.5	134	139.5	146	153	161	170	26
27	bicarbonate	$NaHCO_3$		6.9	8.15	9.6	11.1	12.7	14.45	16.4					27
28	carbonate	Na_2CO_3	$10H_2O$	7	12.5	21.5	38.8								28
29	carbonate	Na_2CO_3	$1H_2O$				50.5	48.5		46.4		45.8		45.5	29
30	chlorate	$NaClO_3$		79	89	101	113	126	140	155	172	189		230	30
31	chloride	NaCl		35.7	35.8	36.0	36.3	36.6	37.0	37.3	37.8	38.4	39.0	39.8	31
32	chromate	Na_2CrO_4	$10H_2O$	31.70	50.17	88.7									32
33	chromate	Na_2CrO_4	$4H_2O$				88.7	95.96	104	114.6					33
34	chromate	Na_2CrO_4									123.0	124.8		125.9	34
35	dichromate	$Na_2Cr_2O_7$	$2H_2O$	163.0		177.8			244.8		316.7	376.2			35
36	dichromate	$Na_2Cr_2O_7$												426.3	36
37	dihydrogen phosphate	NaH_2PO_4	$2H_2O$	57.9	69.9	85.2	106.5	138.2							37
38	dihydrogen phosphate	NaH_2PO_4	$1H_2O$						158.6						38
39	dihydrogen phosphate	NaH_2PO_4								179.3	190.3	207.3	225.3	246.6	39
40	hydrogen arsenate	Na_2HAsO_4	$12H_2O$	7.3	15.5	26.5	37	47		65		85			40
41	hydrogen phosphate	Na_2HPO_4	$12H_2O$	1.67	3.6	7.7	20.8								41
42	hydrogen phosphate	Na_2HPO_4	$7H_2O$					51.8							42
43	hydrogen phosphate	Na_2HPO_4	$2H_2O$						80.2	82.9	88.1	92.4	102.9		43
44	hydrogen phosphate	Na_2HPO_4												102.2	44
45	hydroxide	NaOH	$4H_2O$	42											45
46	hydroxide	NaOH	$3½H_2O$		51.5										46
47	hydroxide	NaOH	$1H_2O$			109	119	129	145	174					47
48	hydroxide	NaOH											313	347	48
49	nitrate	$NaNO_3$		73	80	88	96	104	114	124		148		180	49
50	nitrite	$NaNO_2$		72.1	78.0	84.5	91.6	98.4	104.1			132.6		163.2	50
51	oxalate	$Na_2C_2O_4$				3.7								6.33	51
52	phosphate, tri-	Na_3PO_4	$12H_2O$	1.5	4.1	11	20	31	43	55		81		108	52
53	pyrophosphate	$Na_4P_2O_7$	$10H_2O$	3.16	3.95	6.23	9.95	13.50	17.45	21.83		30.04		40.26	53
54	sulfate	Na_2SO_4	$10H_2O$	5.0	9.0	19.4	40.8								54
55	sulfate	Na_2SO_4	$7H_2O$	19.5	30	44									55
56	sulfate	Na_2SO_4						48.8	46.7	45.3		43.7		42.5	56
57	sulfide	Na_2S	$9H_2O$		15.42	18.8	22.5	28.5							57
58	sulfide	Na_2S	$5½H_2O$						39.82	42.69	45.73	51.40	59.23		58
59	sulfide	Na_2S	$6H_2O$						36.4	39.1	43.31	49.14	57.28		59
60	sulfite	Na_2SO_3	$7H_2O$	13.9	20	26.9	36								60
61	sulfite	Na_2SO_3						28	28.2	28.8		28.3			61
62	tetraborate	$Na_2B_4O_7$	$10H_2O$	1.3	1.6	2.7	3.9		10.5	20.3					62
63	tetraborate	$Na_2B_4O_7$	$5H_2O$								24.4	31.5	41	52.5	63
64	vanadate (meta)	$NaVO_8$	$2H_2O$			$15.3^{25°}$		30.2		68.4					64

TABLE 2-120 Solubilities of Inorganic Compounds in Water at Various Temperatures (*Concluded*)

	Substance	Formula	Solid phase	0°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C	80°C	90°C	100°C	
1	Sodium vanadate (meta)	$NaVO_3$				$21.10^{25°}$		26.23		32.97	36.9	$38.8^{75°}$			1
2	Stannous chloride	$SnCl_2$		83.9		$269.8^{15°}$									2
3	sulfate	$SnSO_4$				19								18	3
4	Strontium acetate	$Sr(C_2H_3O_2)_2$	$4H_2O$	36.9	43.61										4
5	acetate	$Sr(C_2H_3O_2)_2$	$½H_2O$		42.95	41.6	39.5		37.35		36.24	36.10		36.4	5
6	chloride	$SrCl_2$	$6H_2O$	43.5	47.7	52.9	58.7	65.3	72.4	81.8					6
7	chloride	$SrCl_2$	$2H_2O$								85.9	90.5		100.8	7
8	nitrate	$Sr(NO_3)_2$	$1H_2O$	52.7		64.0			83.8	97.2			130.4	139	8
9	nitrate	$Sr(NO_3)_2$	$4H_2O$	40.1		70.5									9
10	nitrate	$Sr(NO_3)_2$					88.6	90.1		93.8	96	98	100		10
11	sulfate	$SrSO_4$		0.0113		0.0114	0.0114								11
12	Sulfur dioxide, 760 mm †	SO_2		22.83	16.21	11.29	7.81	5.41	4.5						12
13	Thallium sulfate	Tl_2SO_4		2.70	3.70	4.87	6.16		9.21	10.92	12.74	14.61	16.53	18.45	13
14	Thorium sulfate	$Th(SO_4)_2$	$9H_2O$	0.74	0.98	1.38	1.995	2.998	5.22						14
15	sulfate	$Th(SO_4)_2$	$8H_2O$	1.0	1.25	1.62									15
16	sulfate	$Th(SO_4)_2$	$6H_2O$	1.50		1.90	2.45			6.64					16
17	sulfate	$Th(SO_4)_2$	$4H_2O$					4.04	2.54	1.63	1.09				17
18	Zinc chlorate	$ZnClO_3$	$6H_2O$	145.0	152.5										18
19	chlorate	$ZnClO_3$	$4H_2O$			200.3	209.2	223.2	273.1						19
20	nitrate	$Zn(NO_3)_2$	$6H_2O$	94.78		118.3									20
21	nitrate	$Zn(NO_3)_2$	$3H_2O$					206.9							21
22	sulfate	$ZnSO_4$	$7H_2O$	41.9	47	54.4									22
23	sulfate	$ZnSO_4$	$6H_2O$					70.1	76.8						23
24	sulfate	$ZnSO_4$	$1H_2O$									86.6	83.7	80.8	24