

CRITICAL CONSTANTS

ADDITIONAL REFERENCES

Other data and estimation techniques for the elements are contained in Gates and Thodos, *Am. Inst. Chem. Eng. J.*, **6** (1960):50–54; and Ohse and von Tippelskirch, *High Temperatures—High Pressures*, **9**

(1977):367–385. For inorganic substances see Mathews, *Chem. Rev.*, **72** (1972):71–100; for organics see Kudchaker, Alani, and Zwolinski, *Chem. Rev.*, **68** (1968):659–735; and for fluorocarbons see *Advances in Fluorine Chemistry*, App. B, Butterworth. Washington, 1963, pp. 173–175.

TABLE 2-164    Critical Constants and Acentric Factors of Inorganic and Organic Compounds

Cmpd. no.	Name	Formula	CAS no.	Mol. wt.	<i>T</i> <sub>c</sub> , K	<i>P</i> <sub>c</sub> × 1E-06 Pa	<i>V</i> <sub>c</sub> , m <sup>3</sup> /Kmol	<i>Z</i> <sub>c</sub>	Acentric factor
1	Methane	CH <sub>4</sub>	74828	16.043	190.564	4.59	0.099	0.286	0.011
2	Ethane	C <sub>2</sub> H <sub>6</sub>	74840	30.070	305.32	4.85	0.146	0.279	0.098
3	Propane	C <sub>3</sub> H <sub>8</sub>	74986	44.097	369.83	4.21	0.200	0.273	0.149
4	<i>n</i> -Butane	C <sub>4</sub> H <sub>10</sub>	106978	58.123	425.12	3.77	0.255	0.272	0.197
5	<i>n</i> -Pentane	C <sub>5</sub> H <sub>12</sub>	109660	72.150	469.7	3.36	0.315	0.271	0.251
6	<i>n</i> -Hexane	C <sub>6</sub> H <sub>14</sub>	110543	86.177	507.6	3.04	0.373	0.269	0.304
7	<i>n</i> -Heptane	C <sub>7</sub> H <sub>16</sub>	142825	100.204	540.2	2.72	0.428	0.259	0.346
8	<i>n</i> -Octane	C <sub>8</sub> H <sub>18</sub>	111659	114.231	568.7	2.47	0.486	0.254	0.396
9	<i>n</i> -Nonane	C <sub>9</sub> H <sub>20</sub>	111842	128.258	594.6	2.31	0.540	0.252	0.446
10	<i>n</i> -Decane	C <sub>10</sub> H <sub>22</sub>	124185	142.285	617.7	2.09	0.601	0.245	0.488
11	<i>n</i> -Undecane	C <sub>11</sub> H <sub>24</sub>	1120214	156.312	639	1.95	0.658	0.242	0.530
12	<i>n</i> -Dodecane	C <sub>12</sub> H <sub>26</sub>	112403	170.338	658	1.82	0.718	0.239	0.577
13	<i>n</i> -Tridecane	C <sub>13</sub> H <sub>28</sub>	629505	184.365	675	1.68	0.779	0.233	0.617
14	<i>n</i> -Tetradecane	C <sub>14</sub> H <sub>30</sub>	629594	198.392	693	1.57	0.830	0.226	0.643
15	<i>n</i> -Pentadecane	C <sub>15</sub> H <sub>32</sub>	629629	212.419	708	1.47	0.888	0.222	0.685
16	<i>n</i> -Hexadecane	C <sub>16</sub> H <sub>34</sub>	544763	226.446	723	1.41	0.943	0.221	0.721
17	<i>n</i> -Heptadecane	C <sub>17</sub> H <sub>36</sub>	629787	240.473	736	1.34	0.998	0.219	0.771
18	<i>n</i> -Octadecane	C <sub>18</sub> H <sub>38</sub>	593453	254.500	747	1.26	1.059	0.214	0.806
19	<i>n</i> -Nonadecane	C <sub>19</sub> H <sub>40</sub>	629925	268.527	758	1.21	1.119	0.215	0.851
20	<i>n</i> -Eicosane	C <sub>20</sub> H <sub>42</sub>	112958	282.553	768	1.17	1.169	0.215	0.912
21	2-Methylpropane	C <sub>4</sub> H <sub>10</sub>	75285	58.123	408.14	3.62	0.261	0.278	0.177
22	2-Methylbutane	C <sub>5</sub> H <sub>12</sub>	78784	72.150	460.43	3.37	0.304	0.268	0.226
23	2,3-Dimethylbutane	C <sub>6</sub> H <sub>14</sub>	79298	86.177	499.98	3.13	0.358	0.269	0.246
24	2-Methylpentane	C <sub>6</sub> H <sub>14</sub>	107835	86.177	497.5	3.02	0.366	0.267	0.279
25	2,3-Dimethylpentane	C <sub>7</sub> H <sub>16</sub>	565593	100.204	537.35	2.88	0.396	0.255	0.292
26	2,3,3-Trimethylpentane	C <sub>8</sub> H <sub>18</sub>	560214	114.231	573.5	2.81	0.455	0.268	0.289
27	2,2,4-Trimethylpentane	C <sub>8</sub> H <sub>18</sub>	540841	114.231	543.96	2.56	0.465	0.264	0.301
28	Ethylene	C <sub>2</sub> H <sub>4</sub>	74851	28.054	282.34	5.03	0.132	0.283	0.086
29	Propylene	C <sub>3</sub> H <sub>6</sub>	115071	42.081	365.57	4.63	0.188	0.286	0.137
30	1-Butene	C <sub>4</sub> H <sub>8</sub>	106989	56.108	419.95	4.04	0.241	0.279	0.190
31	cis-2-Butene	C <sub>4</sub> H <sub>8</sub>	590181	56.108	435.58	4.24	0.233	0.273	0.204
32	trans-2-Butene	C <sub>4</sub> H <sub>8</sub>	624646	56.108	428.63	4.08	0.237	0.272	0.216
33	1-Pentene	C <sub>5</sub> H <sub>10</sub>	109671	70.134	464.78	3.56	0.295	0.271	0.236
34	1-Hexene	C <sub>6</sub> H <sub>12</sub>	592416	84.161	504.03	3.14	0.354	0.265	0.280
35	1-Heptene	C <sub>7</sub> H <sub>14</sub>	592767	98.188	537.29	2.82	0.413	0.261	0.330
36	1-Octene	C <sub>8</sub> H <sub>16</sub>	111660	112.215	566.65	2.57	0.460	0.251	0.377
37	1-Nonene	C <sub>9</sub> H <sub>18</sub>	124118	126.242	593.25	2.33	0.528	0.249	0.417
38	1-Decene	C <sub>10</sub> H <sub>20</sub>	872059	140.269	616.4	2.21	0.584	0.252	0.478
39	2-Methylpropene	C <sub>4</sub> H <sub>8</sub>	115117	56.108	417.9	3.98	0.238	0.272	0.192
40	2-Methyl-1-butene	C <sub>5</sub> H <sub>10</sub>	563462	70.134	465	3.45	0.292	0.261	0.237
41	2-Methyl-2-butene	C <sub>5</sub> H <sub>10</sub>	513359	70.134	471	3.38	0.292	0.252	0.272
42	1,2-Butadiene	C <sub>4</sub> H <sub>6</sub>	590192	54.092	452	4.36	0.220	0.255	0.166
43	1,3-Butadiene	C <sub>4</sub> H <sub>6</sub>	106990	54.092	425.17	4.30	0.220	0.268	0.192
44	2-Methyl-1,3-butadiene	C <sub>5</sub> H <sub>8</sub>	78795	68.119	484	3.85	0.277	0.265	0.158
45	Acetylene	C <sub>2</sub> H <sub>2</sub>	74862	26.038	308.32	6.15	0.113	0.271	0.188
46	Methylacetylene	C <sub>3</sub> H <sub>4</sub>	74997	40.065	402.39	5.62	0.164	0.276	0.216
47	Dimethylacetylene	C <sub>4</sub> H <sub>6</sub>	503173	54.092	473.2	4.87	0.221	0.274	0.239
48	3-Methyl-1-butyne	C <sub>5</sub> H <sub>8</sub>	598232	68.119	463.2	4.20	0.275	0.300	0.308
49	1-Pentyne	C <sub>5</sub> H <sub>8</sub>	627190	68.119	481.2	4.17	0.277	0.289	0.290
50	2-Pentyne	C <sub>5</sub> H <sub>8</sub>	627214	68.119	519	4.02	0.276	0.257	0.174
51	1-Hexyne	C <sub>6</sub> H <sub>10</sub>	693027	82.145	516.2	3.64	0.322	0.273	0.335
52	2-Hexyne	C <sub>6</sub> H <sub>10</sub>	764352	82.145	549	3.53	0.331	0.256	0.221
53	3-Hexyne	C <sub>6</sub> H <sub>10</sub>	928494	82.145	544	3.54	0.334	0.261	0.219
54	1-Heptyne	C <sub>7</sub> H <sub>12</sub>	628717	96.172	559	3.13	0.386	0.260	0.272
55	1-Octyne	C <sub>8</sub> H <sub>14</sub>	629050	110.199	585	2.82	0.441	0.256	0.323
56	Vinylacetylene	C <sub>4</sub> H <sub>4</sub>	689974	52.076	454	4.89	0.205	0.265	0.109

TABLE 2-164 Critical Constants and Acentric Factors of Inorganic and Organic Compounds (Continued)

Cmpd. no.	Name	Formula	CAS no.	Mol. wt.	$T_c$ , K	$P_c \times 1E-06$ Pa	$V_c$ m <sup>3</sup> /Kmol	$Z_c$	Acentric factor
57	Cyclopentane	C <sub>5</sub> H <sub>10</sub>	287923	70.134	511.76	4.50	0.257	0.272	0.196
58	Methylcyclopentane	C <sub>6</sub> H <sub>12</sub>	96377	84.161	532.79	3.78	0.319	0.272	0.230
59	Ethylcyclopentane	C <sub>7</sub> H <sub>14</sub>	1640897	98.188	569.52	3.40	0.374	0.269	0.271
60	Cyclohexane	C <sub>6</sub> H <sub>12</sub>	110827	84.161	553.58	4.10	0.308	0.274	0.212
61	Methylcyclohexane	C <sub>7</sub> H <sub>14</sub>	108872	98.188	572.19	3.48	0.368	0.269	0.236
62	1,1-Dimethylcyclohexane	C <sub>8</sub> H <sub>16</sub>	590669	112.215	591.15	2.94	0.450	0.269	0.233
63	Ethylcyclohexane	C <sub>8</sub> H <sub>16</sub>	1678917	112.215	609.15	3.04	0.430	0.258	0.246
64	Cyclopentene	C <sub>5</sub> H <sub>8</sub>	142290	68.119	507	4.81	0.245	0.279	0.196
65	1-Methylcyclopentene	C <sub>6</sub> H <sub>10</sub>	693890	82.145	542	4.13	0.303	0.278	0.232
66	Cyclohexene	C <sub>6</sub> H <sub>10</sub>	110838	82.145	560.4	4.39	0.291	0.274	0.216
67	Benzene	C <sub>6</sub> H <sub>6</sub>	71432	78.114	562.16	4.88	0.261	0.273	0.209
68	Toluene	C <sub>7</sub> H <sub>8</sub>	108883	92.141	591.8	4.10	0.314	0.262	0.262
69	<i>o</i> -Xylene	C <sub>8</sub> H <sub>10</sub>	95476	106.167	630.33	3.74	0.374	0.267	0.311
70	<i>m</i> -Xylene	C <sub>8</sub> H <sub>10</sub>	108383	106.167	617.05	3.53	0.377	0.259	0.325
71	<i>p</i> -Xylene	C <sub>8</sub> H <sub>10</sub>	106423	106.167	616.23	3.50	0.381	0.260	0.320
72	Ethylbenzene	C <sub>8</sub> H <sub>10</sub>	100414	106.167	617.2	3.60	0.375	0.263	0.301
73	Propylbenzene	C <sub>9</sub> H <sub>12</sub>	103651	120.194	638.32	3.20	0.440	0.265	0.344
74	1,2,4-Trimethylbenzene	C <sub>9</sub> H <sub>12</sub>	95636	120.194	649.13	3.25	0.430	0.259	0.380
75	Isopropylbenzene	C <sub>9</sub> H <sub>12</sub>	98828	120.194	631.1	3.18	0.429	0.260	0.322
76	1,3,5-Trimethylbenzene	C <sub>9</sub> H <sub>12</sub>	108678	120.194	637.36	3.11	0.433	0.254	0.397
77	<i>p</i> -Isopropyltoluene	C <sub>10</sub> H <sub>14</sub>	99876	134.221	653.15	2.80	0.497	0.256	0.366
78	Naphthalene	C <sub>10</sub> H <sub>8</sub>	91203	128.174	748.35	3.99	0.413	0.265	0.296
79	Biphenyl	C <sub>12</sub> H <sub>10</sub>	92524	154.211	789.26	3.86	0.502	0.295	0.367
80	Styrene	C <sub>8</sub> H <sub>8</sub>	100425	104.152	636	3.82	0.352	0.254	0.295
81	<i>m</i> -Terphenyl	C <sub>18</sub> H <sub>14</sub>	92068	230.309	924.85	3.53	0.768	0.352	0.561
82	Methanol	CH <sub>3</sub> O	67561	32.042	512.64	8.14	0.117	0.224	0.566
83	Ethanol	C <sub>2</sub> H <sub>6</sub> O	64175	46.069	513.92	6.12	0.168	0.240	0.643
84	1-Propanol	C <sub>3</sub> H <sub>8</sub> O	71238	60.096	536.78	5.12	0.220	0.252	0.617
85	1-Butanol	C <sub>4</sub> H <sub>10</sub> O	71363	74.123	563.05	4.34	0.276	0.256	0.585
86	2-Butanol	C <sub>4</sub> H <sub>10</sub> O	78922	74.123	536.05	4.20	0.270	0.254	0.574
87	2-Propanol	C <sub>3</sub> H <sub>8</sub> O	67630	60.096	508.3	4.79	0.221	0.250	0.670
88	2-Methyl-2-propanol	C <sub>4</sub> H <sub>10</sub> O	75650	74.123	506.21	3.99	0.276	0.262	0.613
89	1-Pentanol	C <sub>5</sub> H <sub>12</sub> O	71410	88.150	586.15	3.87	0.327	0.260	0.592
90	2-Methyl-1-butanol	C <sub>5</sub> H <sub>12</sub> O	137326	88.150	565	3.87	0.327	0.270	0.678
91	3-Methyl-1-butanol	C <sub>5</sub> H <sub>12</sub> O	123513	88.150	577.2	3.90	0.327	0.266	0.586
92	1-Hexanol	C <sub>6</sub> H <sub>14</sub> O	111273	102.177	611.35	3.46	0.381	0.259	0.572
93	1-Heptanol	C <sub>7</sub> H <sub>16</sub> O	111706	116.203	631.9	3.18	0.435	0.263	0.592
94	Cyclohexanol	C <sub>6</sub> H <sub>12</sub> O	108930	100.161	650	4.25	0.322	0.253	0.371
95	Ethylene glycol	C <sub>2</sub> H <sub>6</sub> O <sub>2</sub>	107211	62.068	719.7	7.71	0.191	0.246	0.487
96	1,2-Propylene glycol	C <sub>3</sub> H <sub>8</sub> O <sub>2</sub>	57556	76.095	626	6.04	0.239	0.277	1.102
97	Phenol	C <sub>6</sub> H <sub>6</sub> O	108952	94.113	694.25	6.06	0.229	0.240	0.438
98	<i>o</i> -Cresol	C <sub>7</sub> H <sub>8</sub> O	95487	108.140	697.55	5.06	0.282	0.246	0.438
99	<i>m</i> -Cresol	C <sub>7</sub> H <sub>8</sub> O	108394	108.140	705.85	4.52	0.312	0.240	0.444
100	<i>p</i> -Cresol	C <sub>7</sub> H <sub>8</sub> O	106445	108.140	704.65	5.15	0.277	0.244	0.507
101	Dimethyl ether	C <sub>2</sub> H <sub>6</sub> O	115106	46.069	400.1	5.27	0.171	0.271	0.192
102	Methyl ethyl ether	C <sub>3</sub> H <sub>8</sub> O	540670	60.096	437.8	4.47	0.221	0.271	0.229
103	Methyl <i>n</i> -propyl ether	C <sub>4</sub> H <sub>10</sub> O	557175	74.123	476.3	3.77	0.276	0.263	0.264
104	Methyl isopropyl ether	C <sub>4</sub> H <sub>10</sub> O	598538	74.123	464.5	3.89	0.276	0.278	0.280
105	Methyl <i>n</i> -butyl ether	C <sub>5</sub> H <sub>12</sub> O	628284	88.150	510	3.31	0.329	0.257	0.335
106	Methyl isobutyl ether	C <sub>5</sub> H <sub>12</sub> O	625445	88.150	497	3.41	0.331	0.273	0.310
107	Methyl <i>tert</i> -butyl ether	C <sub>5</sub> H <sub>12</sub> O	1634044	88.150	497.1	3.41	0.329	0.272	0.264
108	Diethyl ether	C <sub>4</sub> H <sub>10</sub> O	60297	74.123	466.7	3.64	0.281	0.264	0.281
109	Ethyl propyl ether	C <sub>5</sub> H <sub>12</sub> O	628320	88.150	500.23	3.37	0.336	0.273	0.347
110	Ethyl isopropyl ether	C <sub>5</sub> H <sub>12</sub> O	625547	88.150	489	3.41	0.329	0.276	0.306
111	Methyl phenyl ether	C <sub>7</sub> H <sub>8</sub> O	100663	108.140	645.6	4.27	0.337	0.268	0.353
112	Diphenyl ether	C <sub>12</sub> H <sub>10</sub> O	101848	170.211	766.8	3.10	0.503	0.244	0.441
113	Formaldehyde	CH <sub>2</sub> O	50000	30.026	408	6.59	0.115	0.223	0.282
114	Acetaldehyde	C <sub>2</sub> H <sub>4</sub> O	75070	44.053	466	5.57	0.154	0.221	0.292
115	1-Propanal	C <sub>3</sub> H <sub>6</sub> O	123386	58.080	504.4	4.92	0.204	0.239	0.256
116	1-Butanal	C <sub>4</sub> H <sub>8</sub> O	123728	72.107	537.2	4.32	0.258	0.250	0.278
117	1-Pentanal	C <sub>5</sub> H <sub>10</sub> O	110623	86.134	566.1	3.97	0.313	0.264	0.347
118	1-Hexanal	C <sub>6</sub> H <sub>12</sub> O	66251	100.161	591	3.46	0.369	0.260	0.387
119	1-Heptanal	C <sub>7</sub> H <sub>14</sub> O	111717	114.188	617	3.18	0.421	0.261	0.427
120	1-Octanal	C <sub>8</sub> H <sub>16</sub> O	124130	128.214	638.1	2.97	0.474	0.265	0.474
121	1-Nonanal	C <sub>9</sub> H <sub>18</sub> O	124196	142.241	658	2.74	0.527	0.264	0.514
122	1-Decanal	C <sub>10</sub> H <sub>20</sub> O	112312	156.268	674.2	2.60	0.580	0.269	0.582

TABLE 2-164    Critical Constants and Acentric Factors of Inorganic and Organic Compounds (Continued)

Cmpd. no.	Name	Formula	CAS no.	Mol. wt.	<i>T</i> <sub>c</sub> , K	<i>P</i> <sub>c</sub> × 1E-06 Pa	<i>V</i> <sub>c</sub> , m <sup>3</sup> /Kmol	<i>Z</i> <sub>c</sub>	Acentric factor
123	Acetone	C <sub>3</sub> H <sub>6</sub> O	67641	58.080	508.2	4.71	0.210	0.234	0.307
124	Methyl ethyl ketone	C <sub>4</sub> H <sub>8</sub> O	78933	72.107	535.5	4.12	0.267	0.247	0.320
125	2-Pentanone	C <sub>5</sub> H <sub>10</sub> O	107879	86.134	561.08	3.71	0.301	0.239	0.345
126	Methyl isopropyl ketone	C <sub>5</sub> H <sub>10</sub> O	563804	86.134	553	3.84	0.313	0.261	0.349
127	2-Hexanone	C <sub>6</sub> H <sub>12</sub> O	591786	100.161	587.05	3.31	0.369	0.250	0.395
128	Methyl isobutyl ketone	C <sub>6</sub> H <sub>12</sub> O	108101	100.161	571.4	3.27	0.369	0.254	0.389
129	3-Methyl-2-pentanone	C <sub>6</sub> H <sub>12</sub> O	565617	100.161	573	3.32	0.371	0.259	0.386
130	3-Pentanone	C <sub>5</sub> H <sub>10</sub> O	96220	86.134	560.95	3.70	0.336	0.267	0.340
131	Ethyl isopropyl ketone	C <sub>6</sub> H <sub>12</sub> O	565695	100.161	567	3.34	0.369	0.262	0.394
132	Diisopropyl ketone	C <sub>7</sub> H <sub>14</sub> O	565800	114.188	576	3.06	0.416	0.266	0.411
133	Cyclohexanone	C <sub>6</sub> H <sub>10</sub> O	108941	98.145	653	4.01	0.311	0.230	0.308
134	Methyl phenyl ketone	C <sub>8</sub> H <sub>8</sub> O	98862	120.151	709.5	3.85	0.386	0.252	0.365
135	Formic acid	CH <sub>2</sub> O <sub>2</sub>	64186	46.026	588	5.81	0.125	0.148	0.317
136	Acetic acid	C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>	64197	60.053	591.95	5.74	0.179	0.208	0.463
137	Propionic acid	C <sub>3</sub> H <sub>6</sub> O <sub>2</sub>	79094	74.079	600.81	4.61	0.232	0.214	0.574
138	<i>n</i> -Butyric acid	C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	107926	88.106	615.7	4.07	0.291	0.231	0.682
139	Isobutyric acid	C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	79312	88.106	605	3.68	0.291	0.213	0.612
140	Benzoic acid	C <sub>7</sub> H <sub>6</sub> O <sub>2</sub>	65850	122.123	751	4.47	0.347	0.248	0.603
141	Acetic anhydride	C <sub>4</sub> H <sub>6</sub> O <sub>3</sub>	108247	102.090	606	3.97	0.290	0.229	0.450
142	Methyl formate	C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>	107313	60.053	487.2	5.98	0.173	0.255	0.254
143	Methyl acetate	C <sub>3</sub> H <sub>6</sub> O <sub>2</sub>	79209	74.079	506.55	4.69	0.229	0.256	0.326
144	Methyl propionate	C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	554121	88.106	530.6	4.03	0.284	0.259	0.349
145	Methyl <i>n</i> -butyrate	C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	623427	102.133	554.5	3.48	0.340	0.257	0.378
146	Ethyl formate	C <sub>3</sub> H <sub>6</sub> O <sub>2</sub>	109944	74.079	508.4	4.71	0.231	0.257	0.282
147	Ethyl acetate	C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	141786	88.106	523.3	3.85	0.287	0.254	0.363
148	Ethyl propionate	C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	105373	102.133	546	3.34	0.345	0.254	0.391
149	Ethyl <i>n</i> -butyrate	C <sub>6</sub> H <sub>12</sub> O <sub>2</sub>	105544	116.160	571	2.94	0.403	0.249	0.399
150	<i>n</i> -Propyl formate	C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	110747	88.106	538	4.03	0.286	0.257	0.310
151	<i>n</i> -Propyl acetate	C <sub>5</sub> H <sub>10</sub> O <sub>2</sub>	109604	102.133	549.73	3.37	0.349	0.257	0.390
152	<i>n</i> -Butyl acetate	C <sub>6</sub> H <sub>12</sub> O <sub>2</sub>	123864	116.160	579.15	3.11	0.389	0.251	0.410
153	Methyl benzoate	C <sub>8</sub> H <sub>8</sub> O <sub>2</sub>	93583	136.150	693	3.59	0.436	0.272	0.421
154	Ethyl benzoate	C <sub>9</sub> H <sub>10</sub> O <sub>2</sub>	93890	150.177	698	3.22	0.489	0.271	0.477
155	Vinyl acetate	C <sub>4</sub> H <sub>6</sub> O <sub>2</sub>	108054	86.090	519.13	3.93	0.270	0.246	0.348
156	Methylamine	CH <sub>5</sub> N	74895	31.057	430.05	7.41	0.154	0.319	0.279
157	Dimethylamine	C <sub>2</sub> H <sub>7</sub> N	124403	45.084	437.2	5.26	0.180	0.260	0.293
158	Trimethylamine	C <sub>3</sub> H <sub>9</sub> N	75503	59.111	433.25	4.10	0.254	0.289	0.210
159	Ethylamine	C <sub>2</sub> H <sub>7</sub> N	75047	45.084	456.15	5.59	0.202	0.298	0.283
160	Diethylamine	C <sub>4</sub> H <sub>11</sub> N	109897	73.138	496.6	3.67	0.301	0.268	0.300
161	Triethylamine	C <sub>6</sub> H <sub>15</sub> N	121448	101.192	535.15	3.04	0.389	0.266	0.316
162	<i>n</i> -Propylamine	C <sub>3</sub> H <sub>9</sub> N	107108	59.111	496.95	4.74	0.260	0.298	0.280
163	di- <i>n</i> -Propylamine	C <sub>6</sub> H <sub>15</sub> N	142847	101.192	550	3.11	0.401	0.273	0.446
164	Isopropylamine	C <sub>3</sub> H <sub>9</sub> N	75310	59.111	471.85	4.54	0.221	0.256	0.276
165	Diisopropylamine	C <sub>6</sub> H <sub>15</sub> N	108189	101.192	523.1	3.20	0.417	0.307	0.388
166	Aniline	C <sub>6</sub> H <sub>7</sub> N	62533	93.128	699	5.35	0.270	0.248	0.381
167	<i>N</i> -Methylaniline	C <sub>7</sub> H <sub>9</sub> N	100618	107.155	701.55	5.19	0.373	0.332	0.480
168	<i>N,N</i> -Dimethylaniline	C <sub>8</sub> H <sub>11</sub> N	121697	121.182	687.15	3.63	0.465	0.295	0.403
169	Ethylene oxide	C <sub>2</sub> H <sub>4</sub> O	75218	44.053	469.15	7.26	0.142	0.264	0.201
170	Furan	C <sub>4</sub> H <sub>4</sub> O	110009	68.075	490.15	5.55	0.218	0.297	0.205
171	Thiophene	C <sub>4</sub> H <sub>4</sub> S	110021	84.142	579.35	5.71	0.219	0.260	0.195
172	Pyridine	C <sub>5</sub> H <sub>5</sub> N	110861	79.101	619.95	5.64	0.254	0.278	0.239
173	Formamide	CH <sub>3</sub> NO	75127	45.041	771	7.75	0.163	0.197	0.410
174	<i>N,N</i> -Dimethylformamide	C <sub>3</sub> H <sub>7</sub> NO	68122	73.095	649.6	4.37	0.262	0.212	0.312
175	Acetamide	C <sub>2</sub> H <sub>5</sub> NO	60355	59.068	761	6.57	0.215	0.223	0.419
176	<i>N</i> -Methylacetamide	C <sub>3</sub> H <sub>7</sub> NO	79163	73.095	718	5.00	0.267	0.224	0.437
177	Acetonitrile	C <sub>2</sub> H <sub>3</sub> N	75058	41.053	545.5	4.85	0.173	0.185	0.340
178	Propionitrile	C <sub>3</sub> H <sub>5</sub> N	107120	55.079	564.4	4.19	0.229	0.205	0.325
179	<i>n</i> -Butyronitrile	C <sub>4</sub> H <sub>7</sub> N	109740	69.106	582.25	3.79	0.278	0.217	0.371
180	Benzonitrile	C <sub>7</sub> H <sub>5</sub> N	100470	103.123	699.35	4.21	0.339	0.245	0.352
181	Methyl mercaptan	CH <sub>4</sub> S	74931	48.109	469.95	7.23	0.145	0.268	0.158
182	Ethyl mercaptan	C <sub>2</sub> H <sub>6</sub> S	75081	62.136	499.15	5.49	0.206	0.273	0.188
183	<i>n</i> -Propyl mercaptan	C <sub>3</sub> H <sub>8</sub> S	107039	76.163	536.6	4.63	0.254	0.263	0.232
184	<i>n</i> -Butyl mercaptan	C <sub>4</sub> H <sub>10</sub> S	109795	90.189	570.1	3.97	0.307	0.257	0.272
185	Isobutyl mercaptan	C <sub>4</sub> H <sub>10</sub> S	513440	90.189	559	4.06	0.307	0.268	0.253
186	sec-Butyl mercaptan	C <sub>4</sub> H <sub>10</sub> S	513531	90.189	554	4.06	0.307	0.271	0.251
187	Dimethyl sulfide	C <sub>2</sub> H <sub>6</sub> S	75183	62.136	503.04	5.53	0.200	0.264	0.194
188	Methyl ethyl sulfide	C <sub>3</sub> H <sub>8</sub> S	624895	76.163	533	4.26	0.254	0.244	0.209
189	Diethyl sulfide	C <sub>4</sub> H <sub>10</sub> S	352932	90.189	557.15	3.96	0.320	0.273	0.294

TABLE 2-164 Critical Constants and Acentric Factors of Inorganic and Organic Compounds (Concluded)

Cmpd. no.	Name	Formula	CAS no.	Mol. wt.	$T_c$ , K	$P_c \times 1E-06$ Pa	$V_c$ m <sup>3</sup> /Kmol	$Z_c$	Acentric factor
190	Fluoromethane	CH <sub>3</sub> F	593533	34.033	317.42	5.88	0.113	0.252	0.198
191	Chloromethane	CH <sub>3</sub> Cl	74873	50.488	416.25	6.69	0.142	0.275	0.154
192	Trichloromethane	CHCl <sub>3</sub>	67663	119.377	536.4	5.55	0.238	0.296	0.228
193	Tetrachloromethane	CCl <sub>4</sub>	56235	153.822	556.35	4.54	0.274	0.270	0.191
194	Bromomethane	CH <sub>3</sub> Br	74839	94.939	467	8.00	0.156	0.321	0.192
195	Fluoroethane	C <sub>2</sub> H <sub>5</sub> F	353366	48.060	375.31	5.01	0.164	0.263	0.218
196	Chloroethane	C <sub>2</sub> H <sub>5</sub> Cl	75003	64.514	460.35	5.46	0.155	0.221	0.206
197	Bromoethane	C <sub>2</sub> H <sub>5</sub> Br	74964	108.966	503.8	6.29	0.215	0.323	0.259
198	1-Chloropropane	C <sub>3</sub> H <sub>7</sub> Cl	540545	78.541	503.15	4.58	0.247	0.270	0.228
199	2-Chloropropane	C <sub>3</sub> H <sub>7</sub> Cl	75296	78.541	489	4.51	0.247	0.274	0.196
200	1,1-Dichloropropane	C <sub>3</sub> H <sub>6</sub> Cl <sub>2</sub>	78999	112.986	560	4.24	0.292	0.266	0.253
201	1,2-Dichloropropane	C <sub>3</sub> H <sub>6</sub> Cl <sub>2</sub>	78875	112.986	572	4.23	0.291	0.259	0.256
202	Vinyl chloride	C <sub>2</sub> H <sub>3</sub> Cl	75014	62.499	432	5.75	0.179	0.287	0.106
203	Fluorobenzene	C <sub>6</sub> H <sub>5</sub> F	462066	96.104	560.09	4.54	0.269	0.262	0.247
204	Chlorobenzene	C <sub>6</sub> H <sub>5</sub> Cl	108907	112.558	632.35	4.53	0.308	0.265	0.251
205	Bromobenzene	C <sub>6</sub> H <sub>5</sub> Br	108861	157.010	670.15	4.52	0.324	0.263	0.251
206	Air		132259100	28.951	132.45	3.79	0.092	0.318	0.000
207	Hydrogen	H <sub>2</sub>	1333740	2.016	33.19	1.32	0.064	0.307	-0.215
208	Helium-4	He	7440597	4.003	5.2	0.23	0.058	0.305	-0.388
209	Neon	Ne	7440019	20.180	44.4	2.67	0.042	0.300	-0.038
210	Argon	Ar	7440371	39.948	150.86	4.90	0.075	0.292	0.000
211	Fluorine	F <sub>2</sub>	7782414	37.997	144.12	5.17	0.067	0.287	0.053
212	Chlorine	Cl <sub>2</sub>	7782505	70.905	417.15	7.79	0.124	0.279	0.073
213	Bromine	Br <sub>2</sub>	7726956	159.808	584.15	10.28	0.135	0.286	0.128
214	Oxygen	O <sub>2</sub>	7782447	31.999	154.58	5.02	0.074	0.287	0.020
215	Nitrogen	N <sub>2</sub>	7727379	28.014	126.2	3.39	0.089	0.288	0.037
216	Ammonia	NH <sub>3</sub>	7664417	17.031	405.65	11.30	0.072	0.241	0.253
217	Hydrazine	N <sub>2</sub> H <sub>4</sub>	302012	32.045	653.15	14.73	0.158	0.429	0.315
218	Nitrous oxide	N <sub>2</sub> O	10024972	44.013	309.57	7.28	0.098	0.277	0.143
219	Nitric oxide	NO	10102439	30.006	180.15	6.52	0.058	0.252	0.585
220	Cyanogen	C <sub>2</sub> N <sub>2</sub>	460195	52.036	400.15	5.94	0.195	0.348	0.276
221	Carbon monoxide	CO	630080	28.010	132.92	3.49	0.095	0.300	0.048
222	Carbon dioxide	CO <sub>2</sub>	124389	44.010	304.21	7.39	0.095	0.277	0.224
223	Carbon disulfide	CS <sub>2</sub>	75150	76.143	552	8.04	0.160	0.280	0.118
224	Hydrogen fluoride	HF	7664393	20.006	461.15	6.49	0.069	0.117	0.383
225	Hydrogen chloride	HCl	7647010	36.461	324.65	8.36	0.082	0.253	0.134
226	Hydrogen bromide	HBr	10035106	80.912	363.15	8.46	0.100	0.280	0.069
227	Hydrogen cyanide	HCN	74908	27.026	456.65	5.35	0.139	0.195	0.407
228	Hydrogen sulfide	H <sub>2</sub> S	7783064	34.082	373.53	9.00	0.099	0.287	0.096
229	Sulfur dioxide	SO <sub>2</sub>	7446095	64.065	430.75	7.86	0.123	0.269	0.244
230	Sulfur trioxide	SO <sub>3</sub>	7446119	80.064	490.85	8.19	0.127	0.255	0.423
231	Water	H <sub>2</sub> O	7732185	18.015	647.13	21.94	0.056	0.228	0.343

All substances are listed in alphabetical order in Table 2-6a.

Compiled from Daubert, T. E., R. P. Danner, H. M. Sibul, and C. C. Stebbins, DIPPR Data Compilation of Pure Compound Properties, Project 801 Sponsor Release, July, 1993, Design Institute for Physical Property Data, AIChE, New York, NY; and from Ambrose, D. "Vapour-Liquid Critical Properties", Report Chem 107, National Physical Laboratory, Teddington, UK, October, 1979.

In order to ensure thermodynamic consistency, in almost all cases these properties are calculated from  $T_c$  and the vapor pressure and liquid density correlation coefficients listed in those tables. This means that there will be slight differences between the values listed here and those in the DIPPR tables. Most of the differences are less than 1%, and almost all the rest are less than the estimated accuracy of the quantity in question.

The atomic weights used, taken from *J. Phys. Chem. Ref. Data* **22**(6), 1993, are C = 12.011, H = 1.00794, O = 15.9994, N = 14.00674, S = 32.066, F = 18.9984, Cl = 35.4527, Br = 79.904, and I = 126.90447.

The value of the gas constant,  $R$ , used here is 8314.51 J/(kmol·K), as given by E. R. Cohen and B. N. Taylor in *J. Phys. Chem. Ref. Data* **17**, 1988. K - 273.15 = °C; 1.8 × K - 459.67 = °F; Pa × 9.869233E-06 = atm; Pa × 1.450377E-04 = psia; j; m<sup>3</sup>/kmol × (1E + 03/mol. wt.) = cm<sup>3</sup>/g; m<sup>3</sup>/kmol × (1.601846E + 01/mol wt) = ft<sup>3</sup>/lb.