A RELATION BETWEEN ORTHOBARIC DENSITIES.
PART II.

By Jurô HORIUCHI.

The writer has derived in his foregoing paper[1] the following relation between orthobaric densities,

$$\varphi = RT \ln\, V_g/V_l = A(1/(V_l - E) - 1/(V_g - E)) \cdots\cdots\cdots\cdots\cdots(1)$$

where φ denotes the internal heat of vaporization of hypothetical infinitesimal molecules, while A and E denote characteristic constants for individual substance, and V_l and V_g the molecular volume of liquid and vapour respectively. There have been given 21 cases of actual calculations to prove validity of equation (1). In the present work 22 more substances have been taken. Some of them which are provided with full data of orthobaric densities have been treated just in the same manner as before. For the others, of which only vapour tension and liquid density are given, the vapour density was calculated from vapour tension applying gas law below boiling point, and for those substances whose vapour densities only are given in a certain range of temperature, liquid densities were estimated by Cailletet-Mathias' rule from the vapour densities and a few known data of liquid densities. The calculations have been done with following 22 substance; carbon dioxide,[2] nitrous oxide, ammonia, sulphur dioxide, phosgene, n-pentane, n-hexane, di-isopropyl, n-heptane, di-isobutyl, fluorobenzene, bromobenzene, iodobenzene, chloroform, carbon disulphide, methyl formate, methyl propionate, methyl isobutylate, ethyl acetate, ethyl propionate, propyl acetate, and acetone. In this paper, however, abridged data[3] are shown to save the space.

In the following tables Q_M, Q_z, D_l and D_g denote $RT\,\ln\dfrac{V_g}{V_l}$, $A\left(\dfrac{1}{V_l - E} - \dfrac{1}{V_g - E}\right)$, and densities of liquid and vapour respectively.

(1) *J. Chem. Soc. Japan*, 47 (1926), 587; this journal, 1 (1926), 189.
(2) By Cailletet-Mathias' data, while in the previous paper by those of Amagat.
(3) Full data will be published in the *Journal of the Chemical Society of Japan* in Japanese.

TABLE 1.   Carbon dioxide.

$t°C$	D_l	D_g	Q_M	Q_z
-23.0	0.998	(0.0475)	1514	1495
$- 2.2$	(0.898)	0.1040	1179	1179
15.9	0.796	(0.1726)	878	881
25.0	(0.685)	0.2543	587	585
28.9	(0.608)	0.3118	400	407

Critical temperature=31.0°C,[1] A=35270, E=21.1.

(Cailletet and Mathias, *J. Phys.*, (2) **5** (1886), 549).

Parenthesis in the table show numbers computed by empirical equations given by the observers.

TABLE 2.   Nitrous oxide.

$t°C$	D_l	D_g	Q_M	Q_z
-23.5	(1.017)	0.0413	1590	1597
-12.2	(0.964)	0.0566	1471	1470
$- 1.5$	(0.907)	0.0785	1321	1330
9.2	(0.838)	0.1066	1157	1159
19.8	0.758	(0.1476)	953	949
25.4	(0.690)	0.1782	803	795

Crit. temp.=36.5°C,[2] A= 56770, E=8.89.

(Cailletet and Mathias, ibid.)

Parenthesis in the table show numbers computed by empirical equations given by the observers.

TABLE 3.   Ammonia.

$t°C$	D_l	D_g	Q_M	Q_z
-50	*1.4241	*2550	3322	3316
-20	*1.5033	* 612	3026	3026
$+10$	*1.6006	* 205.0	2731	2727
40	*1.7251	* 82.8	2409	2407
78.7	0.5120	0.0322	1935	1943
121.3	0.3831	0.1024	1035	1071

Crit. temp.=132.9°C,[3] A=47490. E=9.98.

Numbers with asteriscs express the specific volume given by Osborne and Van Dusen[4]; while the others are the densities obtained by Berthoud.[5]

(1)   Cardoso and Bell. *J. chim. phys.*, **10** (1912), 497; Landolt, "Tabellen," 5 ed., p. 258.

(2)   Cardoso and Arni, *J. chim. phys.*, **10** (1912), 504; Landolt, "Tabellen," 5 ed., p. 262.

(3)   Cardoso and Giltay, *J. chim. phys.*, **10** (1912), 514; Landolt, "Tabellen," 5 ed. p. 255.

(4)   *Bur. Stannds Bull.*, **14** (1917), 414; "Tables Annuales," **5** (1925), 20.

(5)   *J. chim. phys.*, **16** (1918), 429.

TABLE 4. Sulphur dioxide.

$t°C$	D_l	D_g	Q_M	Q_z
7.3	(1.4162)	0.00624	3024	3018
21.7	1.3757	(0.0105)	2857	2864
37.5	(1.3306)	0.0169	2696	2697
58.2	(1.2653)	0.0310	2443	2463
82.4	1.1845	(0.0525)	2202	2186
120.45	1.0166	(0.1268)	1628	1629
140.8	0.8690	(0.2250)	1131	1142
154.9	0.6483	0.4017	407	425

Crit. temp.=157.15°C,[1] $A=77740$, $E=19.54$.
(Cailletet and Mathias, *Compt. rend.*, 102 (1887), 1563; Landolt, "Tabellen," 5 ed., p. 281.)
Parenthesis denote the numbers obtained by interpolation.

TABLE 5. Phosgene.

$t°C$	D_l	D_g	Q_M	Q_z
60.3	1.2780	0.0193	2779	2777
100.1	1.1655	0.0493	2347	2347
130.0	1.0637	0.0905	1975	1973
170.6	0.8219	0.2424	1077	1081
181.6	0.7089	0.3276	697	715

Crit. temp.=187°C,[2] $A=116200$, $E=28.09$.
(Patterno and Mazzuccuelli, *Gazz. Chim.*, 50 (1920), 38; "Tables Annuales," 5 (1925), 20.

TABLE 6. n-Pentane.

$t°C$	D_l	D_g	Q_M	Q_z
0	0.64539	(0.0007844)	3645	3642
40	0.6 62	0.003361	3234	3239
80	0.5624	0.01012	2821	2817
120	0.5107	0.0250	2358	2355
160	0.4394	0.0591	1727	1745
197.1	0.2560	0.2090	190	203

Crit. temp.=197.2°C, $A=21690$, $E=53.62$.
(Young, *Sci. Proc. Roy. Dublin Soc.*, 12 (1910), 374).
Parenthesis denote the data calculated from vapour pressure.

(1) Cardoso and Bell, loc. cit.; Landolt, "Tabellen," 5 ed., p. 261.
(2) Critical temperature mentioned here as well as those hereafter, if not otherwise described, are the data given by the observer of the densities.

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TABLE 7. n-Hexane.

$t°C$	D_l	D_g	Q_M	Q_z
0	0.6769	(0.0002319)	4332	4324
30	0.6505	(0.0008523)	3999	3999
60	0.6221	0.002488	3656	3668
90	0.5918	0.00585	3325	3337
120	0.5588	0.01202	3000	2998
150	0.5207	0.02299	2627	2627
180	0.4751	0.04228	2179	2194
210	0.4124	0.07899	1584	1624

Crit. temp. = 234.8°C, $A = 276000$, $E = 64.48$.
(Young, ibid.)
Parenthesis denote the numbers calculated from vapour pressure.

TABLE 8. Di-isopropyl.

$t°C$	D_l	D_g	Q_M	Q_z
0	0.67948	(0.0003876)	4055	4040
30	0.6525	(0.001311)	3742	3741
60	0.6243	0.003479	3437	3439
90	0.5931	0.007782	3129	3125
120	0.5589	0.01555	2799	2798
150	0.5197	0.02825	2450	2439
180	0.4705	0.05216	1981	2000
226.5	0.2967	0.1848	470	499

Crit. temp. = 227.35°C, $A = 264400$, $E = 62.58$.
(Young, ibid.)
Parenthesis denote the numbers calculated from vapour pressure.

TABLE 9. n-Heptane.

$t°C$	D_l	D_g	Q_M	Q_z
30	0.6951	(0.0003115)	4628	4620
60	0.6491	(0.001015)	4279	4273
90	0.6218	0.002703	3926	3931
120	0.5926	0.006075	3580	3585
150	0.5598	0.01222	3217	3226
180	0.5232	0.02242	2838	2834
210	0.4793	0.04005	2384	2414
240	0.4177	0.07446	1759	1789

Crit. temp. = 266.85°C, $A = 340500$, $E = 75.90$.
(Young, ibid.)
Parenthesis denote the numbers calculated from vapour pressure.

TABLE 10. Di-isobutyl.

$t°C$	D_l	D_g	Q_M	Q_z
90	0.6328	0.002239	4074	4072
120	0.6046	0.005219	3714	3725
150	0.5732	0.01070	3348	3361
180	0.5383	0.01959	2984	2979
210	0.4970	0.03484	2552	2551
240	0.4434	0.06223	2003	2017
270	0.3482	0.1387	1047	1092

Crit. temp. = 276.8°C, $A = 381000$, $E = 86.98$.
(Young, ibid.)

TABLE 11. Fluorobenzene.

$t°C$	D_l	D_g	Q_M	Q_z
0	1.04653	(0.0001180)	4935	4935
30	1.0104	(0.0004908)	4598	4598
60	0.9744	(0.001503)	4288	4284
90	0.9366	0.003846	3967	3971
120	0.8955	0.008347	3654	3650
150	0.8519	0.01629	3329	3326
180	0.8037	0.02911	2989	2983
210	0.7480	0.04968	2605	2601
240	0.6789	0.08403	2131	2140
270	0.5739	0.1535	1424	1456

Crit. temp. = 286.55°C, $A = 221600$, $E = 46.87$.
(Young, ibid.)
Parenthesis denote the numbers calculated from vapour pressure.

TABLE 12. Bromobenzene.

$t°C$	D_l	D_g	Q_M	Q_z
50	1.4546	(0.0001321)	5979	5979
80	1.4142	(0.0004722)	5620	5643
110	1.3729	(0.001307)	5299	5320
140	1.3293	(0.003021)	4999	4999
170	1.2847	0.006562	4649	4681
200	1.2385	0.01209	4354	4371
230	1.1876	0.02079	4046	4040
260	1.1310	0.03427	3706	3687

Crit. temp. = 397°C, $A = 312100$. $E = 55.73$.
(Young ibid.)
Parenthesis denote the numbers calculated from vapour pressure.

TABLE 13. Iodobenzene.

$t°C$	D_l	D_g	Q_M	Q_z
80	1.7391	(0.0002018)	6357	6357
110	1.6932	(0.0006307)	6014	6024
140	1.6453	(0.001622)	5684	5697
170	1.5972	(0.003542)	5384	5384
200	1.5470	0.007278	5040	5063
230	1.4941	0.01295	4749	4745
260	1.4384	0.02200	4430	4423

Crit. temp.$=448°C$, $A=367100$, $E=5957$.

(Young, ibid.)

Parenthesis denote the numbers calculated from vapour pressure.

TABLE 14. Chloroform.

$t°C$	D_l	D_g	Q_M	Q_z
-53.6	1.62580 (T)	0.00001340 (D)	5120	5115
-51.0	1.62075 (I)	0.00001639 (D)	5079	5079
-45.0	1.60988 (T)	0.00002593 (D)	5005	5002
-37.2	1.59511 (T)	0.00004563 (D)	4907	4903
-17.5	1.5559 (I)	0.0001667 (D)	4645	4645
$- 6.2$	1.53811 (T)	0.0003095 (D)	4517	4535
5.0	1.51700 (I)	0.0005281 (R)	4403	4406
12.87	1.50175 (Ty)	0.0007596 (R)	4315	4316
15.00	1.49739 (T.H.)	0.0008174 (R)	4290	4291

Crit. temp.$=260.0°C$,[1] $A=167800$, $E=40.60$.

(D) :   From vapour pressures given by Drucker and Kangro, *Z. physik. Chem.*, **90** (1915), 513.

(R) :   From vapour pressures given by Rex, *Z. physik. Chem.*, **55** (1906), 358.

(T) :   Timmermanns, *Sci. Proc. Roy. Dublin Soc.*, **13**, 326; "Tables Annuales," **3** (1914), 10.

(Ty):   Tyrer, *J. Chem. Soc.*, **99** (1911), 871.

(H):   Herz and Rathmann, *Chem. Zt.*, **146**, 1417; "Tables Annuales," **3** (1914), 10.

(T.H.):   Mean of the densities given by (T) and (H).

(I):   Interpolated from the data given in the above papers as well as the followings. Isnardi, *Z. Physik*, **9** (1922), 158; Faust, *Z. physik. Chem.*, **79** (1912), 97; Dolezalek and Schulze, *Z. physik. Chem.*, **83** (1913), 67; Flecker and Tyrer, *J. Chem. Soc.*, **103** (1913), 52; Tyrer, *J. Chem. Soc.*, **104** (1914), 2534.

(1)   Sajetschewsky, *Kiewer. Univers. Unters.*, 1878, No. 4 & No. 8; Landolt, "Tabellen" 5 ed., p. 257.

TABLE 15.   Carbon disulphide.

$t°C$	D_l	D_g	Q_M	Q
−14.1	1.31324	0.00030170	4301	4306
− 3.06	1.29680	0.00051030	4209	4209
+ 8.26	1.28004	0.00079920	4121	4128
16.37	1.26807	0.0010964	4058	4059
22.44	1.25909	0.0013642	4011	4011
57.08	1.20484	0.0040642	3732	3736
78.82	1.17021	0.0072888	3558	3554
99.24	1.13583	0.011671	3389	3389
130.48	1.07964	0.021660	3117	3137

Crit. temp. = 273.05°C,[1] $A = 149500$, $E = 23.22$

Densities of vapour were given by Battelli[2] for the whole range of temperature. Densities of liquid have been estimated by Cailletet-Mathias' rule. Densities of liquid from 0° to 35° have been found from the following papers: Bugarsky, *Z. physik. Chem.*, **71** (1910), 705; Dawson, *J. Chem. Soc.*, **97** (1910), 1041; Tyrer, *J. Chem. Soc.*, **97** (1910), 2620; De Leeuw, Dissert. Amsterdam, **1910**, 22; "Tables Annuales," **1** (1912), 11.

TABLE 16.   Methyl formate.

$t°C$	D_l	D_g	Q_M	Q_z
0	1.00319	(0.000687)	3956	3956
30	0.9598	0.002291	3638	3636
60	0.9133	0.006039	3324	3323
90	0.8634	0.01350	3002	3001
120	0.8070	0.02688	2659	2654
150	0.7403	0.05063	2256	2259
180	0.6521	0.09434	1762	1754
210	0.4857	0.2188	765	803

Crit. temp. = 214.0°C, $A = 125200$, $E = 28.21$.

(Young, ibid.)

Parenthesis denote the numbers calculated from vapour pressure.

(1) Battelli, *Mem. Torino*, (2) **42** (1891), 1; ibid., **41** (1890), 1; Landolt, "Tabellen," 5 ed., p. 281.
(2) Ibid.

TABLE 17.   Methyl propionate.

$t°C$	D_l	D_g	Q_M	Q_z
70	0.8537	0.002331	4026	4026
100	0.8137	0.005741	3678	3678
130	0.7705	0.01214	3326	3324
160	0.7221	0.02356	2936	2945
190	0.6657	0.04320	2518	2532
220	0.5938	0.07812	1988	2011
250	0.4655	0.1675	1063	1110

Crit. temp.$=257.4°C$, $A=222400$, $E=47.99$.
(Young, ibid.)

TABLE 18.   Methyl i-butylate.

$t°C$	D_l	D_g	Q_M	Q_z
90	0.8069	0.003361	3957	3957
120	0.7680	0.007628	3604	3606
150	0.7248	0.01533	3244	3237
180	0.6767	0.02869	2847	2847
210	0.6200	0.05141	2392	2403
250	0.5021	0.1218	1473	1519

Crit. temp.$=267.55°C$, $A=270600$, $E=58.29$.
(Young, ibid.)

TABLE 19.   Ethyl acetate.

$t°C$	D_l	D_M	Q_M	Q_z
10	0.9127	(0.000213)	4707	4700
40	0.8762	(0.000840)	4327	4328
70	0.8376	0.002561	3950	3964
100	0.7972	0.006158	3608	3609
130	0.7533	0.01314	3245	3246
160	0.7033	0.02577	2847	2853
190	0.6441	0.04751	2398	2415
210	0.5944	0.07128	2037	2029
249	0.3839	0.2288	537	570

Crit. temp.$=250.1°C$, $A=221300$, $E=49.40$.
(Young, ibid.)
Parentesis denote the numbers calculated from vapour pressure.

TABLE 20. Ethyl propionate.

$t°C$	D_l	D_g	Q_M	Q_z
90	0.8077	0.002674	4122	4127
120	0.7692	0.00620	3767	3766
150	0.7267	0.01292	3390	3391
180	0.6795	0.02469	2986	2986
210	0.6243	0.04464	2534	2550
240	0.5501	0.08230	1938	1974
270	0.4018	0.1957	777	831

Crit. temp. $=272.9°C$, $A=281600$, $E=58.29$.

TABLE 21. Propyl acetate.

$t°C$	D_l	D_g	Q_M	Q_z
90	0.8079	0.002457	4184	4184
120	0.7702	0.005760	3826	3824
150	0.7297	0.01195	3459	3460
180	0.6835	0.02268	3068	3065
210	0.6301	0.04115	2623	2628
240	0.5586	0.07576	2038	2067
270	0.4333	0.1661	1031	1093

Crit. temp. $=276.2°C$, $A=283700$, $E=58.70$

TABLE 22. Acetone.

$t°C$	D_l	D_g	Q_M	Q_z
-83.4	0.90321 (T)	0.000000317	5605	5558
-78.0	0.900 (S)	0.000000608	5511	5511
-63.3	0.88150 (T)	0.00000287	5269	5254
-50.0	0.8670 (K)	0.00000967	5058	5058
-37.2	0.85337 (T)	0.00002490	4897	4891
-30.0	0.8463 (K)	0.00004056	4807	4799
-13.0	0.83105 (D)	0.0001185	4587	4620
-6.2	0.81943 (T)	0.0001768	4479	4486
5	0.8081 (B)	0.0002985	4365	4365
10	0.8038 (B)	0.0003793	4310	4301

Crit. temp. $=234.4°C$,[1] $A=152700$, $E=36.80$.

D_g was calculated from vapour tensions given by Drucker and Kangro, ibid.

(T): Timmermanns, ibid.
(K): Körber, *Ann. Phys.*, **37** (1912), 1014; "Tables Annuales," 3 (1914), 10.
(S): Stern, *Z. physik. Chem.*, **81** (1913), 441.
(D): Dutich, *Verh. K. Akad. Wet. Amsterdam*, **11**, 44; "Tables Annuales" 3 (1914), 10.
(B): Bramley, *J. Chem. Soc.*, **109** (1916), 434.

(1) Galizine, *Wied. Ann.*, **41** (1890), 620.

Table 1—22 show that the concordance of $RT \ln \dfrac{V_g}{V_i}$ with $A \left(\dfrac{1}{V_i - E} - \dfrac{1}{V_g - E} \right)$ is excellent except at temperatures immediately near the critical temperature. Moreover, as vapour densities are calculated from vapour tensions at low temperatures, it is evident that following equation (2), which was derived from equation (1) as a vapour tension formula in the previous work, agrees with experimental data.

TABLE 23. Summary of constant E.

Substance	$E_{calc.}$	$E_{add.}$	$V_{P=\infty}$	V_K	E/V_K
Hydrogen	4.20	—		70.3	0.060
~en	9.68	8.0		74.5	0.130
Ni.	12.8	—		90.1	0.142
Argc	10.3	—		75.2	0.137
Carbon dioxide	21.1	21.6		94.8	0.223
Nitrous oxide	8.87	—		107	0.083
Ammonia	9.98	—		72.0	0.139
Sulphur dioxide	19.54	—		125.0	0.156
Phosgene	28.09	28.9		192.7	0.146
n-Pentane	53.62	54.0		310	0.173
i-Pentane	53.8	54.0		308	0.175
n-Hexane	64.48	65.0		367	0.176
Di-isopropyl	62.58	65.0		357	0.175
Heptane	75.90	76.0		427	0.178
n-Octane	87.0	86.9		491	0.177
Di-isobutyl	86.98	86.9		482	0.180
Benzene	41.51	41.5		256	0.162
Hexamethylene	52.6	52.3		308	0.171
Fluorobenzene	46.87	46.7		271	0.173
Chlorobenzene	50.15	51.0		308	0.163
Bromobenzene	55.73	55.4		323	0.172
Iodobenzene	59.57	59.7		351	0.170
Chloroform	40.60	37.7		—	—
Carbon tetrachloride	44.32	46.9		276	0.161
Carbon disulphide	23.22	—		202	0.115
Stannic chloride	58.43	—		351	0.166
Methyl formate	28.21	25.9		172	0.164
Methyl acetate	37.8	37.0		228	0.166
Methyl propionate	47.99	48.0		282	0.169
Methyl butylate	59.2	59.0		340	0.174
Methyl i-butylate	58.29	59.0		339	0.169
Ethyl formate	37.8	37.0		229	0.165
Ethyl acetate	49.40	48.0		286	0.173
Ethyl propionate	58.29	59.0		344	0.168
Propyl formate	46.5	48.0		285	0.163
Propyl acetate	58.7	59.0		346	0.170
Ethyl ether	50.0	47.0	49.9 (Tas.)	286	0.174
Acetone	36.80	34.0	35.6 (Tas.)	—	—
Methyl alcohol	24.40	26.7	23.1 (Tam.)	118	0.207
Ethyl alcohol	37.8	37.7	33.6 (Tam.)	167	0.226
Propyl alcohol	48.6	48.7		220	0.221
Acetic acid	30.0	—		171	0.175

Additive constants.

(H) = −0.54	(F) = 4.35	Double bond = − 4.6
(C) = 12.1	(Cl) = 2 × (F) = 8.70	Hydroxyl group = 16.2
(O) = 4.0	(Br) = 3 × (F) = 13.05	Ring formation = −13.7
	(J) = 4 × (F) = 17.4	

$$\ln P = \ln \frac{RT}{V_l} - \frac{1}{RT}\frac{A}{V_l - E} \qquad (2)$$

Table 23 is the summary of the values of E hitherto obtained for 42 substances. In this work, besides that of carbon dioxdie shown in Table 1, the constants of carbon tetrachloride and benzene were recalculated by more careful computation, and are shown in the table.

E_{calc} in the second column is the values directly calculated. E_{add} in the third column which show pretty good agreement with E_{calc}, were calculated from additive constants shown at the bottom of the table. These constants consist of 6 fundamental numbers, and enable us to calculate constant E for 33 different substances. The values for C and H have been estimated from the data for normal hydrocarbons. The constant for a double bond was calculated assuming the benzene contains three of them. The group -CO-O- in esters was regarded to consist of two normal oxygen and a double bond. The constants for Cl are approximately the same for $COCl_2$, $CHCl_3$, CCl_4 etc.. It is interesting that the constants of halogenobenzenes are very accurately expressed by assuming to their constants 1, 2, 3, 4, times of that of fluorine respectively. $V_{p=\infty}$ in the fourth column denotes the volumes of liquids extrapolated to infinitely large pressure. The data adopted are of Tammann[1] and of Tashiro[2], the latter being very close to E_{calc} in the case of ethyl ether and acetone. In the fifth, there are shown critical volumes calculated from data given in Landolt-Börnstein's table. Values of E/V_k in the last column are almost universally constant for normal liquids, the mean value of which being 0.170.

In the previous work, it was derived a reduced equation from equation (1), taking into account that the ratio $\frac{T_k}{\sqrt{AP_k}}$ are universally constant as well as $\frac{E}{V_k}$. The total summary of values for the constant A and $\frac{T_k}{\sqrt{AP_k}}$ are given in Table 24. This table shows that the constancy of the value $\frac{T_k}{\sqrt{AP_k}}$ for normal liquids is satisfactory, the following value having been obtained for their mean through the total data:

$$\frac{T_k}{\sqrt{AP_k}} = 0.1765.$$

(1) *Ann. Phys.* **87** (1912), 975.
(2) *Bulletin of the Institute of Physical and Chemical Research* (in Japanese), **6** (1927), 105.

TEBLE 24.   Summary of constant A.

Substance	A	$\dfrac{T_k}{\sqrt{AP_k}}$
Hydrogen	3958	0.148
Oxygen	18160	0.162
Nitrogen	17520	0.164
Argon	17440	0.165
Carbon dioxide	35270	0.189
Nitrous oxide	56770	0.154
Ammonia	47490	0.176
Sulphur dioxide	77740	0.175
Phosgene	116200	—
n-Pentane	216900	0.176
i-Pentane	204300	0.174
Hexane	276000	0.177
Di-isopropyl	264400	0.176
Heptane	340500	0.178
Octane	355900	0.180
Di-isobutyl	381000	0.180
Benzene	218200	0.174
Hexamethylene	249700	0.175
Fluorobenzene	221600	0.178
Chlorobenzene	292700	0.175
Bromobenzene	312100	0.179
Iodobenzene	367100	0.178
Chloroform	167800	0.176
Carbon tetrachloride	232500	0.172
Carbon disulphide	149500	0.166
Stannic chloride	307600	0.176
Methyl formate	125200	0.179
Methyl acetate	173700	0.178
Methyl propionate	222400	0.179
Methyl butylate	276700	0.179
Methyl i-butylate	270600	0.179
Ethyl formate	174000	0.178
Ethyl acetate	221300	0.180
Ethyl propionate	281600	0.179
Propyl formate	232700	0.173
Propyl acetate	283700	0.179
Ethyl ether	185600	0.181
Acetone	152700	0.169
Methyl alcohol	78950	0.205
Ethyl alcohol	105900	0.200
Propyl alcohol	143500	0.197
Acetic acid	151100	0.202