did *not* cause the direction of the intermolecular forces to deviate from the direction required by NEWTON: an angle, namely, deviating from the joining line, of the value $\frac{1}{10^{26}}$ can be excluded; a deviation between the direction indicated in the law of NEWTON, namely the joining line, and the direction of attraction through the relative ether motion of 2×30 km. per sec. remains *below* this amount of $\frac{1}{10^{26}}$; the deviation, provided there be one, amounts to less than 1 micron at a distance of 100 light-centuries.

Chemistry. — *"Investigations on the Temperature-Coefficients of the Free Molecular Surface-Energy of Liquids from —80° to 1650° C."* **XIII.** *The Surface-Energy of position-isomeric Benzene-Derivatives.* By Prof. Dr. F. M. JAEGER and Dr. JUL. KAHN.

(Communicated in the meeting of September 25, 1915)

§ **1.** For the purpose of investigating the influence of the chemical constitution of the liquids on the magnitude and on the temperature-coefficients of the free surface-energy, we also made a series of measurements with a number of benzene-derivatives, which are to each other in relation of position-isomerides. The problem considered seemed to us of yet greater importance, because i. a. in the already previously mentioned paper of FEUSTEL[1]), some position isomerides were studied with this same purpose, and this author as a result of his experiments concluded, that the surface-tensions of such isomeric substances did not differ from each other in any appreciable degree. His conclusion, founded only on a relatively small number of data, seemed to us not too probable, judging from some experience already gathered by us in the course of these investigations: for the μ-t-curves, determined by the first of us in the cases of *dimethyl-resorcinol* and *dimethyl-hydroquinone*[2]), and also of *mesitylene* and *pseudocumene*[3]), appeared to be clearly different for the two pairs of isomerides.

Therefore it seemed of importance to extend such a comparison of the magnitude of the surface-tension to a greater number of such position-isomeric derivatives.

[1]) FEUSTEL, Drude's Annalen **16**, 61. (1905).
[2]) F. M JAEGER, these Proceedings, **23**, 357, (1914).
[3]) F. M. JAEGER, these Proceedings, **23**, 408, 409. (1914).

In the following paper we therefore publish the measurements made with 36 position-isomeric substances: *ortho-*, *meta-*, and *para-Dinitrobenzene*; *meta-*, and *para-Fluoronitrobenzene*; *ortho-*, *meta-*, and *para-Chloronitrobenzene; meta-*[1]), and *para-Dichlorobenzene*; 1-2-4, 1-3-4- and 1-4 2-*Dichloronitrobenzenes*, *ortho-*, *meta-*, and *para-Bromonitrobenzene; ortho-*, and *meta-Jodonitrobenzene; ortho-*[2]), and *para-Nitrotoluene*; *ortho-*, *meta-*, and *para-Nitrophenol*; *ortho-*[3]), and *para-Nitroanisol*; *ortho-*, and *para-Cresol; ortho-*, and *para-Chloroaniline*; *meta-*, and *para-Nitroaniline*; 3-*Nitro-*, and 5-*Nitro-ortho-Toluidine*, and 3-*Nitro-para-Toluidine;* and finally the cyclic derivatives: *sylvestrene* and *terebene*.

The purification of these compounds, as well as the determination of the density, occurred in the same way as formerly described. In the case of some compounds evaporating rapidly already at the meltingpoint, these determinations could not be made with satisfactory exactitude.

§ 2.

I.

ortho-Dinitrobenzene: 1-2-$C_6H_4(NO_2)_2$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg. pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
126°	1.279	1705.0	38.4	1.305	979.2
140	1.230	1639.8	36.9	1.291	947.8
155	1.183	1580.0	35.6	1.276	923.4
176	1.125	1499.8	33.6	1.259	877.6
194.4	1.082	1442.5	32.3	1.245	849.9
209.1	1.034	1378.4	30.9	1.235	817.5

Molecular weight: **168.05.** Radius of the Capillary tube: 0.04595 cm. Depth: 0.1 mm.

Under a pressure of 30 mm. the substance boils at 194° C.; the meltingpoint was 117° C.

At 120° C. the density was: 1.3119; at 140° C.: 1.2915; at 160° C.: 1,2737. At t° C. in general: $d_{4°} = 1.3349 - 0.001215\,(t-100°) + 0.00000325\,(t-100°)^2$.

The temperature-coefficient of μ oscillates somewhat round a mean value of: **1.95** Erg pro degree.

[1]) F. M. JAEGER, these Proceedings, **23**, 411, (1914).

[2]) F. M. JAEGER and M. J. SMIT, these Proceedings, **23**, 387, (1914)

[3]) F. M. JAEGER and JUL. KAHN, ibidem, **23**. 400, (1914).

II.

meta-Dinitrobenzene: $_{(1,3)}C_6H_4(NO_2)_2$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm.	Specific gravity d_{4°	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
94.8°	1.410	1880.3	42.3	1.361	1048.9
114.9	1.342	1788.9	40.2	1.340	1007.2
136	1.264	1688.5	38.1	1.316	966.1
155	1.209	1611.7	36.1	1.295	925.3
175.5	1.149	1532.1	34.3	1.271	890 3
191.2	1.103	1471.2	32.9	1.248	864.5
204.5	1.069	1425.0	31.8	1.235	841.4

Molecular weight: 168 05. Radius of the Capillary tube: 0.04595 cm. Depth: 0.1 mm.

The substance boils at 291° C. under a pressure of 756 mm.; it melts at 91° C. At 120° C. the density was: 1.3349; at 140° C. 1.3149; at 160° C.: 1.2957. At t° C.: $d_{4^\circ} = 1.3557 - 0.00106\,(t-100^\circ) - 0.000001\,(t-100^\circ)^2$.

The [illegible] of μ is originally: **2.05** Erg; afterwards it decreas[illegible] **1 71** Erg pro degree.

III.

para-Dinitrobenzene: 1-4 $C_6H_4(NO_2)_2$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg. pro cm².
	in mm. mercury of 0° C.	in Dynes	
176.2°	1.139	1518.5	34.4
196.5	1.080	1439.8	32.6
210	1.043	1391.0	31.5
226	1.007	1342.5	30.4

Molecular weight: **168.05.** Radius of the Capillary tube: 0.04529 cm. Depth: 0.1 mm.

The compound melts at 172° C.; it is very volatile and sublimes readily.

IV.

meta-Fluoronitrobenzene: $C_6H_4(NO_2)_{(1)}F_{(3)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity d_{4°	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
*0°	1.274	1698.7	40.1	1.348	890.4
29.9	1.193	1590.9	37.1	1.314	837.9
47.8	1.137	1515.6	35.3	1.293	805.9
64.5	1.083	1444.4	33.6	1.274	774.7
80.8	1.031	1374.5	32.1	1.256	747.2
104.5	0.961	1281.1	29.7	1.232	700.3
122	0.914	1218.3	28.2	1.215	671.1
151.5	0.822	1095.9	25.4	1.187	613.9
178	0.741	988 0	22.8	1.160	559.6
196	0.697	929.4	21.4	1.145	529.8

Molecular weight: **141.04.** Radius of the Capillary tube: 0.04777 cm.; with the measurements indicated by *, it was: 0.04839 cm.
Depth: 0.1 mm.

The liquid boils constantly at 197.°5 C. and a pressure of 760 mm. It solidifies on cooling very soon, and melts then at −1° C. At the boilingpoint χ is about: **21.2** Erg pro cm². The specific weight at 25° C. was: 1.3189; at 50° C.: 1.2905; at 75° C.: 1.2632; at t°: $d_{4^\circ} = 1.3484 \quad 0.001202\,t + 0.00000088\,t^2$.

The temperature-coefficient of μ oscillates round a mean value of **1 82** Erg pro degree.

V.

para-Fluoronitrobenzene: $C_6H_4(NO_2)_{(1)}F_{(4)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity d_{4°	Molecular Surface-energy μ in Erg pro cm².
	in mm mercury of 0° C.	in Dynes			
24.5°	1.284	1711.7	38.4	1.325	862.5
31	1.269	1689.0	37.6	1.319	847.1
46.8	1.201	1601.1	35.9	1.301	816.2
60.4	1.149	1531.8	34.3	1.288	785.1
74.2	1.096	1461.2	32.8	1.270	757.8
89.3	1.050	1399.8	31.3	1.254	729.3
110	0.968	1292.8	29.0	1.229	684.4
124	0.931	1240.5	27.7	1.213	659.9
140.3	0.868	1157.8	25.9	1.193	623.9
156	0.805	1076.0	24.3	1.172	592.3
174.5	0.747	996.6	22.3	1.152	549.8
194.1	0.688	913.4	20.3	1.125	508.5

Molecular weight: **141.04.** Radius of the Capillary tube: 0.04595 cm.
Depth: 0.1 mm.

The substance boils at 203.°5 C. under a pressure of 755 mm.; its meltingpoint is 26°.5 C. The specific gravity at 30° C. was: 1.3204; at 50° C.: 1.2986; at 75° C.: 1.2691. At t° in general: $d_{4^\circ} = 1.3509 - 0.0010275\,t - 0.00000078\,t^2$.

At the boilingpoint χ has the value: 19.3 Erg. The temperature-coefficient of μ is about **2.09** Erg pro degree, as a mean value.

VI.

ortho-Chloronitrobenzene: $C_6H_4(NO_2)_{(1)}Cl_{(2)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity d_{4°	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
31°.2	1.387	1849.8	41.6	1.355	990.8
46	1.330	1777.5	39.9	1.340	957.4
61.2	1.279	1706.2	38.3	1.323	926.9
73.5	1.227	1638.7	36.9	1.304	901.6
89	1.176	1567.8	35.1	1.285	866.1
110	1.102	1470.2	32.9	1.270	818.2
124	1.056	1408.4	31 5	1.256	789.2
140	0.999	1330.9	29.6	1.237	749.1
155.5	0.960	1277.5	28 3	1.222	722.1
175	0.877	1171.0	26.1	1.199	674.5
194.5	0.824	1098.5	24.3	1.177	635.7
209.1	0.797	1062.0	23.5	1.159	621.2

Molecular weight: **157.50.** Radius of the Capillary tube: 0.04595 cm. Depth: 0.1 mm.

Under a pressure of 755 *mm.* the substance boils at 241°; it melts at 33° C. The density at 75° C. was: 1.3083; at 100° C.: 1.2812; at 125° C.: 1.2536. At t° C. in general: $d_{4^\circ} = 1.3866 - 0.001014\,t - 0\,0000004\,t^2$.

The temperature-coefficient of μ is up to 195° C. fairly constant and equal to **2.16** Erg pro degree as a mean value.

VII.

meta-Chloronitrobenzene: $C_6H_4(NO_2)_{(1)}Cl_{(3)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg. pro cm².	Specific gravity d_{4°	Molecular Surface-energy μ in Erg. pro cm².
	in mm. mercury of 0° C.	in Dynes			
46°.3	1.312	1749.7	39.3	1.339	943.4
60.5	1.258	1675.9	37.6	1.327	908.1
74.8	1.206	1608.4	36.1	1.308	880.3
90.3	1.148	1535.2	34.4	1.291	846.2
110	1.082	1442.4	32.2	1.272	799.9
124	1.037	1382.5	30.8	1.256	771.6
140.3	0.979	1304.4	29.2	1.237	739.0
155.2	0.928	1240.8	27.7	1.219	708.0
175.2	0.858	1147.0	25.7	1.194	666.0
194.2	0.806	1075.0	23.8	1.172	624.4
209.2	0.770	1026.6	22.7	1.154	601.7

Molecular weight: **157.50.** Radius of the Capillary tube: 0.04595 cm. Depth: 0.1 mm.

The compound boils at 236° C. under a pressure of 756 mm. It melts at 44°.5 C. The density at 75° C. was: 1.3082; at 100° C.: 1.2816; at 125° C.: 1.2536; at t° C.: $d_{4^\circ} = 1\,3788 - 0.00086\,t - 0.00000112\,t^2$.

The temperature-coefficient of μ between 46° and 194° C. is fairly constant; its mean value is: **2.19** Erg pro degree.

VIII.

para-Chloronitrobenzene: $C_6H_4(NO_2)_{(1)}Cl_{(4)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg. pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg. pro cm².
	in mm. mercury of 0° C.	in Dynes			
90°	1.147	1529.1	34.3	1.293	842.8
110	1.080	1439.8	32.3	1.272	802.4
125	1 029	1374.0	30.9	1.256	774.1
139.9	0.992	1322.0	29.6	1.242	747.2
155	0.937	1252.6	28.2	1.225	718.3
175.2	0.882	1177.6	26.4	1.204	680.3
194.4	0.835	1113.2	24.8	1.184	646.2
209.2	0 795	1059.9	23.5	1.169	617.6

Molecular weight: **157.50.** Radius of the Capillary tube: 0 04595 cm. Depth: 0.1 mm.

Under a pressure of 756 mm. the substance boils at 234° C.; it melts at 83° 5 C. The density at 85° C. was: 1.2998; at 110° C. 1 2722; at 135° C.: 1.2457. In general at t C.: $d_{4°} = 1.3285 - 0.00117\,(t - 60) + 0.00000088\,(t - 60°)^2$.

The temperature-coefficient of μ is fairly constant; its mean value is **1 88** Erg pro degree Celsius.

IX.

para-Dichlorobenzene: 1-4-$C_6H_4Cl_2$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular-Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
60° 3	0.972	1294.7	29.4	1.242	708 6
82.6	0.903	1204.4	27.4	1.218	669.0
95.1	0.872	1161.3	26.3	1.205	646.8
114	0.816	1087.9	24.6	1.185	611.7
130.4	0.768	1024.0	23.1	1.168	580.0
144.5	0.727	970.0	21.9	1.153	554.6
166.5	0.671	894.6	20.1	1.130	515.9

Molecular weight: **146.95.** Radius of the Capillary tube 0.04660 cm. Depth: 0.1 mm.

The para-Dichlorobenzene boils under a pressure of 755 mm. at 173.°5 C.; it melts at 52° C.

At 75° C. the specific gravity was 1.2261; at 100° C.: 1.1983; at 125° C.: 1.1697. At t° C: $d_{4°} = 1.2531 - 0.001064\,(t - 50°) - 0.00000064\,(t - 50°)^2$.

The temperature-coefficient of μ is constant: **1.83** Erg.

X.

1-2-Dichloro-4-Nitrobenzene: $C_6H_3Cl_{2(1,2)}(NO_2)_{(4)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
46°	1.340	1787.5	40.2	1.490	1025.4
61	1.294	1724.4	38.7	1.471	995.6
76.7	1.246	1660.5	37.2	1.454	964.5
95	1 217	1622.5	35 6	1.430	933.3
113.5	1.150	1533.2	34.0	1.407	901.1
136	1 074	1431.8	32.0	1.379	859.4
155.1	1.016	1355.0	30.3	1.356	823.0
177	0.948	1263.9	28.1	1.329	773.5
190.5	0.917	1217.9	26.8	1.313	743.7
204	0.867	1155.9	25.6	1.295	717.0

Molecular weight: **191.95.** Radius of the Capillary tube 0.04595 cm. Depth: 0.1 mm.

The meltingpoint of the compound is 43° C. The specific gravity at 75° C. was: 1.4558; at 100° C.: 1.4266; at 125° C. 1.3979. At t° C.: $d_{4°} = 1.5464 - 0.001238\,t + 0.0000004\,t^2$.

The temperature-coefficient of μ is rather constant; its mean value is: **1.96** Erg pro degree.

XI.

1-3-Dichloro-4-Nitrobenzene: $C_6H_3Cl_{2(1,3)}(NO_2)_{(4)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
35°	1.375	1833.1	41.3	1.487	1054.9
46.3	1.342	1787.4	40.1	1.475	1029.8
60.5	1.294	1724.4	38.8	1.460	1003 2
76.5	1.249	1665.7	37 3	1.443	972.0
95	1.176	1567 7	35.2	1.421	926 7
114.9	1.104	1475.1	33.3	1.399	885.8
136	1.042	1390.5	31.2	1.373	840.4
155.1	0.982	1308.6	29.2	1.350	795.4
176	0.929	1246.0	27.2	1.325	750 3
191	0.870	1158.7	25.7	1.305	716.2
204	0.823	1096 8	24.4	1.289	685.5

Molecular weight: **191.95.** Radius of the Capillary tube: 0.04595 cm. Depth: 0.1 mm.

Under a pressure of 15 mm. the boilingpoint is 154° C. The meltingpoint 34° C. The specific gravity was hydrostatically determined: at 75° C. it was: 1.4434; at 100° C.: 1.4149; at 125° C.. 1.3856. At t C. it was in general; $d_{4°} = 1.5241 - 0.001028\,t - 0.00000064\,t^2$.

The temperature-coefficient of μ has a mean value of **2.16** Erg pro degree.

XII.

1-4-Dichloro-2-Nitrobenzene: $C_6H_3Cl_{2(1,4)}(NO_2)_{(2)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg. pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg. pro cm².
	in mm. mercury of 0° C.	in Dynes			
60.5°	1.281	1705.6	38.3	1.455	992.6
76	1.234	1645.2	37.1	1.438	969.0
95	1.172	1564.1	35.3	1.416	931.5
115	1.118	1491.1	33.6	1.393	896.4
136	1.053	1403.8	31.5	1.368	850.6
155	0.986	1314.4	29.5	1.344	806.0
177.5	0.938	1247.0	27.5	1.315	762.4
190.2	0.886	1181.2	26.4	1.298	738.3
204	0.840	1119.3	25.0	1.281	705.3

Molecular weight: **191.95.** Radius of the Capillary tube: 0.04595 cm
Depth: 0.1 mm.

The compound boils at 267° C., and melts at 55° C. The specific weight at 75° C. was 1.4390; at 100° C.: 1.4102; at 125° C.: 1.3804. In general at t°C.: $d_{4°} = 1.5194 - 0.001012\ t - 0.0000008\ t^2$.

The temperature-coefficient of μ is fairly constant; its mean value is **2.01** Erg pro degree.

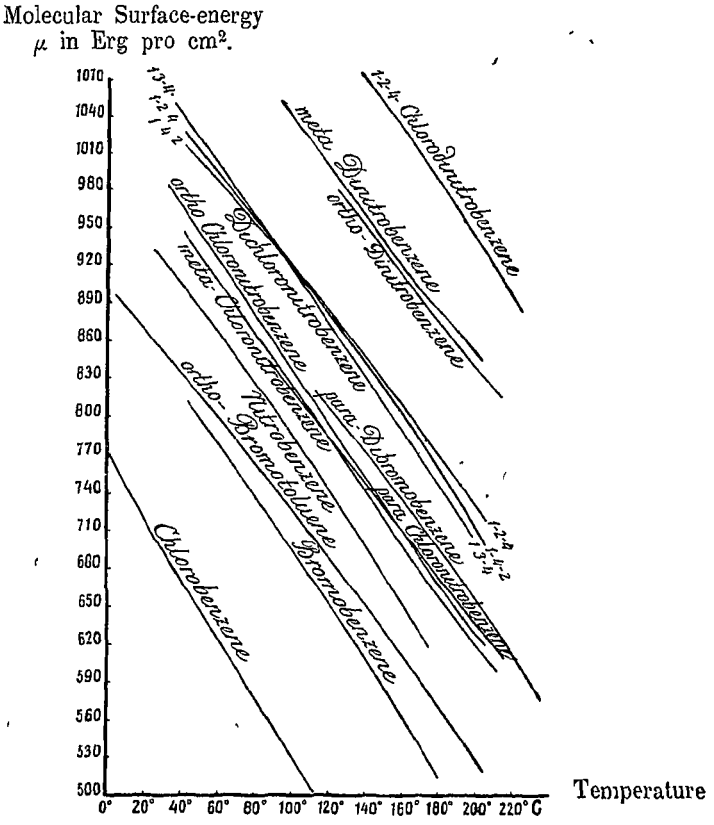

Fig. 1.

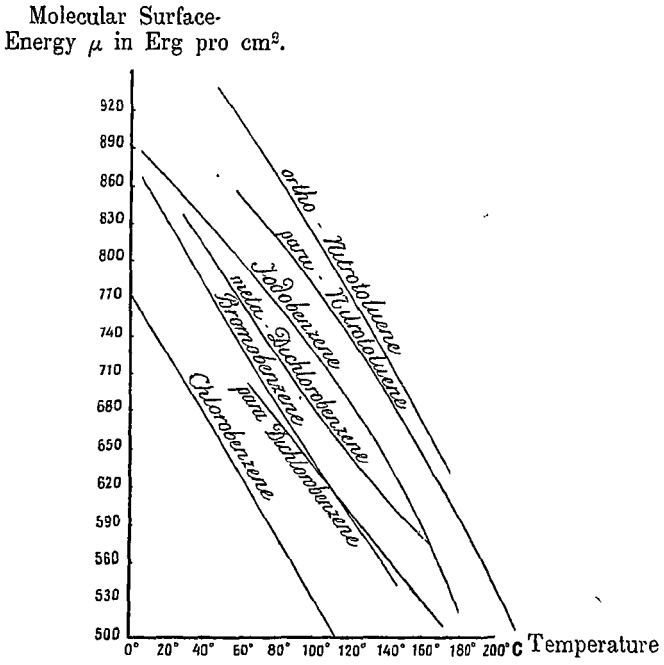

Fig. 2.

XIII.

ortho-Bromonitrobenzene: $C_6H_4Br_{(1)}(NO_2)_{(2)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity d_{4°	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
46°.3	1.405	1876.2	42.0	1.669	1027.5
61	1.353	1802.7	40.1	1.651	988.1
76.5	1.303	1734.3	38.4	1.632	953.6
95.2	1.220	1627.3	36.3	1.608	910.4
116	1.156	1540.8	34.2	1.582	867.1
136.2	1.076	1437.3	32.0	1.556	820.3
155.2	1.018	1358.0	30.1	1.532	779.7
176.3	0.950	1266.6	28.1	1.505	736.6
191	0.908	1210.0	26.9	1.484	711.7
204.5	0.867	1155.9	25.6	1.468	682.2

Molecular weight: **201.96.** Radius of the Capillary tube: 0.04595 cm. Depth: 0.1 mm.

The substance boils at 258°.5 C. under a pressure of 756 mm. it melts at 43° C.

The specific gravity at 75° C. was: 1.6333; at 100 C.: 1.6020; at 125° C.: 1.5703. In general at $t°$ C.: $d_{4^\circ} = 1.6642 - 0.001228\,(t - 50°) - 0.00000032\,(t - 50°)^2$.

The temperature-coefficient of μ is fairly constant; its mean value is 2.19 Erg pro degree.

XIV.

meta-Bromonitrobenzene: $C_6H_4Br_{(1)}(NO_2)_{(3)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy ν in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
61°.5	1.347	1798.8	39.9	1.650	983.6
74	1.296	1730.0	38.6	1.634	957.8
89	1.256	1672.9	37.1	1.616	927.4
110	1.164	1556.4	34.9	1.590	881.9
124	1.137	1512.8	33.4	1.572	850.4
139.8	1.085	1445.6	32.0	1.553	821.4
156	1.032	1376.4	30.6	1.532	792.6
175	0.961	1303.0	28.8	1.506	754.5
194.4	0.910	1212.6	26.9	1.480	713.0
209	0.888	1179.3	25.9	1.459	693.0

Moleculair weight: **201.96** Radius of the Capillary tube: 0.04595 cm. Depth: 0.1 mm.

Under a pressure of 755 mm. the substance boils at 251° C.; it melts at 56°.5 C. At 75° C. the density is: 1.6329; at 100° C.: 1.6024; at 125° C.: 1.5710. In general at $t°$ C.: $d_{4°} = 1.6625 - 0.001166\,(t-50°) - 0.00000072\,(t-50°)^2$.

Up to 195° C. the temperature-coefficient of ν is fairly constant; its mean value is: **2.04** Erg pro degree.

XV.

para-Bromonitrobenzene: $C_6H_4Br_{(1)}(NO_2)_{(4)}$.

Temperature in ° C.	Maximum Pressure H		Molecular Surface-energy χ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes	
127°	1.116	1488.6	34.2
140.3	1 085	1445.9	33.1
155	1.025	1367.3	31.5
178	0.956	1274.5	29.3
194.5	0.908	1211.3	27.8
209.3	0.870	1159.9	26.6

Moleculair weight: **201.96.** Radius of the Capillary tube: 0.04595 cm. Depth: 0.1 mm.

Under a pressure of 758 mm. the compound boils at 254° C.; it melts at 127° C. At 140° already it sublimes rather rapidly against the colder parts of the capillar tube.

XVI.

ortho-Iodonitrobenzene: $C_6H_4J_{(1)}(NO_2)_{(2)}$.

Temperature in ° C.	Maximum Pressure H in mm. mercury of 0° C.	Maximum Pressure H in Dynes	Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy ν in Erg pro cm².
61°	1.448	1930.5	43.1	1.938	1097.1
76.5	1.400	1866.5	41.7	1.916	1069.6
95.2	1.339	1784.5	39.8	1.890	1030.2
114.1	1.280	1706.2	38.0	1.863	993.1
136	1.209	1611.7	35.8	1.832	946.1
155.5	1.150	1533.1	34.0	1.805	907.5
176	1.085	1445.4	31.9	1.775	861.0
191	1.037	1382.5	30.6	1 754	832.5
205	1.004	1338.5	29.5	1.734	808.7

Molecular weight: **248.90.** Radius of the Capillary tube: 0.04595 cm. Depth: 0.1 mm.

The substance boils at 162°.5 C. under a pressure of 18 mm. it melts at 50° C. The specific gravity at 75° C. is: 1.9186; at 100° C.: 1.8831; at 125° C.: 1.8475. At $t°$ C.: $d_{4°} = 1.9541 - 0.001422\,(t - 50°)$.

The temperature-coefficient of ν has a mean value of **1.98** Erg per degree.

XVII.

meta-Iodonitrobenzene: $C_6H_4J_{(1)}NO_{2(3)}$.

Temperature in ° C.	Maximum Pressure H in mm. mercury of 0° C.	Maximum Pressure H in Dynes	Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy ν in Erg pro cm².
*25.7°	1.564	2086.2	47.3	1.981	1186.8
*41.1	1.509	2010.7	45.4	1.960	1147.2
*59.8	1.449	1929.4	43.4	1.935	1106.1
*83	1.362	1815.4	41.0	1.902	1056.9
95	1.324	1765.7	39.8	1.885	1032.2
110	1.273	1696.8	38 2	1.864	998.1
124.5	1.224	1632.2	36.8	1.842	969.2
140.2	1.181	1572.8	35.3	1 821	936.8
156.1	1.124	1498.7	33.7	1.797	902.3
170	1.084	1444.0	32.4	1.775	874.7
185.5	1.038	1381.6	30.9	1.752	841.5
198	0.999	1330.8	29.8	1.732	817.7
215	0.957	1276.3	28.6	1.688	798.4

Molecular weight: **248 96.** Radius of the Capillary tube: 0.04644 cm.; with the observations indicated by *, it was 0.04660 cm. Depth: 0.1 mm.

Under a pressure of 14 mm. the boilingpoint was 153° C.; the substance melts at 36° C. It can remain in an undercooled state during a very long time, and crystallises extremely slowly.

At 50 C. the density was: 1.9477; at 75° C.: 1.9131; at 100° C.: 1.8778. In general at $t°$ C.: $d_{4°} = 1.9816 - 0.001342\,(t - 25°) - 0.00000056\,(t - 25°)^2$.

Up to 198° C. the temperature-coefficient of ν is fairly constant and has a mean value of: **2.16** Erg pro degree.

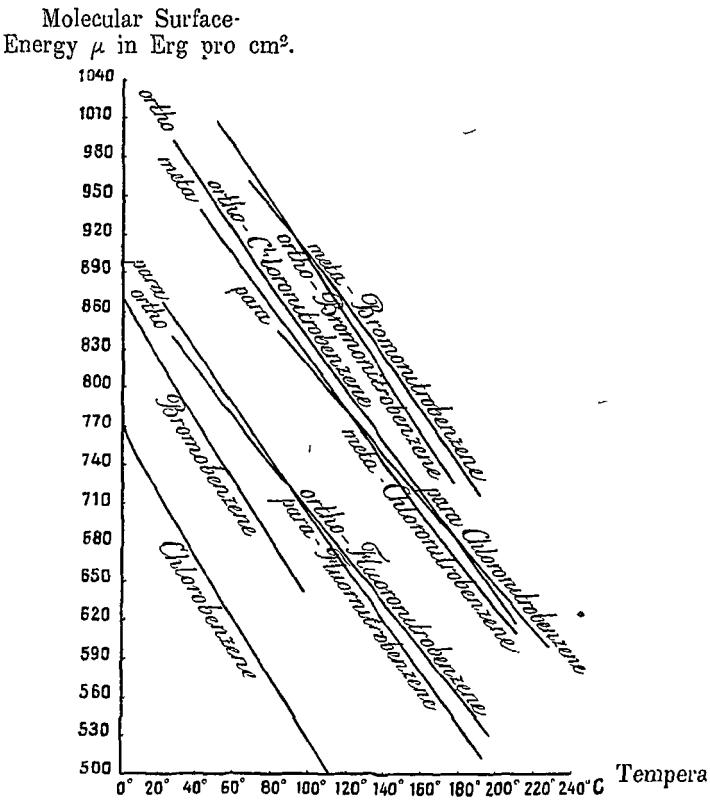

Fig. 3.

XVIII.

para-Nitrotoluene: $CH_3 \cdot {}_{(1)}C_6H_4 \cdot (NO_2)_{(4)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Mole Surf energy Erg pr
	in mm. mercury of 0° C.	in Dynes			
60°.2	1.166	1554.5	35.5	1.112	879
83.5	1.101	1467.8	33.5	1.098	836
95	1.069	1424.9	32.5	1.086	817
115	1.007	1343.3	30.6	1.066	779
130.1	0.956	1274.6	29.0	1.054	744
144.5	0.908	1210.3	27.5	1.040	712
166	0.827	1102.5	25.0	1.017	657
180.2	0.782	1042.9	23.6	0.995	629
194.5	0.738	982.8	22.1	0.973	598
214.6	0.659	876.9	19.9	0.954	546

Molecular weight: **137.1.** Radius of the Capillary tube: 0.0466(
Depth: 0.1 mm.

The compound boils at 236° C. under a pressure of 755 mm.; the mel point was 57°.5 C.

The density at 75° C was. 1.1038; at 100° C.: 1.0817; at 125° C.: 1.(At $t°$ C.: $d_{4°} = 1.1239 - 0.000764\,(t-50°) - 0.0000016\,(t-50°)^2$.

The temperature-coefficient of μ is originally (up to 95°) about **1.77** afterwards it becomes fairly constant and equal to **2.30** Erg pro degree.

XIX.

ortho-Nitrophenol: $C_6H_4(OH)_{(1)}(NO_2)_{(2)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
52°	1.289	1718.5	38.0	1.281	864.7
70	1.246	1660.0	36.6	1.264	840.3
90.2	1.185	1580.5	34.8	1.243	807.9
108	1.134	1512.4	33.1	1.224	776.4
124.3	1.029	1374.4	31.2	1.206	739.1
140.1	1.014	1352.3	29.5	1.195	703.1
156	0.955	1272.1	27.5	1.179	661.4
170	0.888	1184.4	25.6	1.153	624.9
185.7	0.805	1073.2	23.0	1.135	567.3
204	0.730	973.2	20.7	1.113	517.3

Molecular weight: **139.05.** Radius of the Capillary tube: 0.04644 cm. Depth: 0.1 mm.

The substance melts at 45° C. Under a pressure of 760 mm. it boils at 214°.5 C. Above 209° C. a brown colouring is produced by gradual decomposition.

The density at 75° C. was 1.2583; at 100° C.: 1.2323; at 125° C.: 1.2052. At $t°$ C.: $d_{4°} = 1.2832 - 0.000974\,(t-50°) - 0.00000088\,(t-50°)^2$.

The temperature-coefficient of μ increases evidently with rise of temperature: between 52° and 70° C. **1.35** Erg; between 70° and 90°: **1.60**; between 90° and 108° C: **1.77**; between 108° and 140° C.: **1.84**; between 140° and 170° C.: **2.61**; and between 170° and 204° C.: about **3.20** Erg pro degree. Probably a gradual decomposition of the substance occurs here, causing this increase of $\frac{\partial\mu}{\partial t}$ at higher temperatures.

XX.

meta-Nitrophenol: $C_6H_4(OH)_{(1)}(NO_2)_{(3)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
110°	1.354	1805.1	40.0	1.273	914.0
125	1.338	1783.8	39.5	1.259	909.2
140.1	1.316	1754.5	38.8	1.249	897.9
155.2	1.272	1701.5	37.9	1.237	882.8
170	1.247	1662.4	36.7	1.222	861.8
185.6	1.196	1594.4	35.1	1.207	831.0
201	1.146	1523.2	33.1	1.191	790.7
218	1.051	1401.2	30.6	1.174	738.0

Molecular weight: **139.05.** Radius of the Capillary tube: 0.04644 cm. Depth: 0.1 mm.

The carefully purified substance melts at 96° C.

The density at 100° C. was: 1.2797; at 125° C.: 1.2588; at 150° C.: 1.2359. At $t°$ C.: $d_{4°} = 1.2797 - 0.000716\,(t-100) - 0.0000016\,(t-100°)^2$.

The temperature-coefficient of μ increases rapidly with rise of temperature: between 110° and 140° C. it is: about **0.50** Erg; between 140° and 155° C.: **1.00**; between 155° and 170° C.: **1.41**; between 170° and 186° C.: **1.97**; between 186° and 201° C.: **2.61°**; and between 201° and 218° C.: **3.1** Erg pro degree. It is rather probable, that this fact is connected with a gradual decomposition of the substance.

XXI.

para-Nitrophenol: $C_6H_4(OH)_{(1)}(NO_2)_{(4)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
117°	1.497	1996.0	43.3	1.273	989.4
130.5	1.452	1936.9	42.0	1.262	965.3
145.5	1.408	1877.1	40.6	1.249	939.6
162	1.353	1815.3	39.1	1.234	912.2
176.5	1.311	1747.8	37.7	1.222	885.3
196.5	1.241	1654.4	35.6	1.205	843.8

Molecular weight: **139.05.** Radius of the Capillary tube: 0 04529 cm. Depth: 0.1 mm.

The compound melts at 113° C It sublimes rapidly and the measurements are thus made much more difficult by the gradual reduction of the cross-section of the capillary tube by the layers of crystals deposed there within.

The specific gravity at 120° C was: 1.2703; at 140° C.: 1.2532; at 160° C.: 1.2361. At t° C.: $d_{4°} = 1.2874 - 0.000855(t - 100°)$.

The temperature-coefficient of μ is somewhat oscillating round a mean value of **1.81** Erg pro degree.

XXII.

para-Nitroanisol: $CH_3O_{(1)} \cdot C_6H_4 \cdot (NO_2)_{(4)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg pro cm².
	in mm mercury of 0° C.	in Dynes			
60°.5	1.342	1789.2	40.9	1.216	1027.3
83	1.280	1706.2	39.1	1.194	994.1
95	1.243	1659.4	38.0	1.183	972.1
115.2	1.187	1582.5	36.1	1.165	932.9
130.6	1.148	1528.2	34.6	1.149	902.5
144.5	1.096	1459.5	33.1	1.137	869.4
167.2	1.014	1351.9	30.7	1.115	817.0
180.1	0.968	1291.8	29.3	1.101	786.3
194.5	0.909	1214.1	27.6	1.086	747.5
220	0.814	1085.9	24.5	1.059	674.7

Molecular weight: **153.06.** Radius of the Capillary tube: 0.04660 cm. Depth: 0.1 mm.

Under atmospheric pressure the boilingpoint is 259° C. The substance melts at 55° C.

The density was at 75° C.: 1.2012; at 100° C.: 1.1775; at 125° C.: 1.1535; at t° C.: $d_{4°} = 1.2246 - 0.00093(t - 50°) - 0.00000024(t - 05°)^2$.

The temperature-coefficient of μ increases gradually with rising temperature: it is between 60° and 83° **1.49** Erg; between 83° and 95° C.: **1.93**; between 95° C. and 131° C.: **1.97**; between 131° and 180° C.: **2.35**; between 180° and 195° C.: **2.69**; and between 195° and 220° C.: **2.80** Erg.

XXIII.

ortho-Cresol: $CH_{3(1)} \cdot C_6H_4(OH)_{(2)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
40°.3	1.142	1522.5	34.8	1.033	772.6
54.5	1.107	1475.8	33.7	1.019	755.0
75.6	1.047	1395.9	32.0	1.002	725.0
95	0.993	1323.3	30.3	0.987	693.5
116.2	0.918	1224.8	28.0	0.971	647.8
135	0.864	1152.0	26.3	0.956	614.8
151.5	0.814	1085.5	24.7	0.946	581.5
176	0.711	947.9	21.5	0.930	511.9

Molecular weight: **108.06.** Radius of the Capillary tube: 0.04670 cm. Depth: 0.1 mm.

Under a pressure of 755 mm. the ortho-cresol boils at 190°.2 C.; it melts at 30° C. The specific weight at 25° C. is: 1.0458; at 50° C.: 1.0236; at 75° C.: 1.0027. At $t°$ it is: $d_{4°} = 1.0693 - 0.000966\,t + 0.00000104\,t^2$.

XXIV.

para-Cresol: $CH_{3(1)} \cdot C_6H_4\,OH_{(4)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
25°.6	1.135	1514.9	34.5	1.030	767.4
41	1.100	1465.4	33.2	1.018	744.3
60.2	1.042	1389.2	31.6	1.004	715.0
83	0.981	1309.0	29.7	0.984	685.3
95	0.946	1261.8	28.7	0.975	658.2
114.3	0.898	1195.5	27.0	0.961	629.0
130.5	0.849	1132.4	25.7	0.950	603.3
144.5	0.809	1079.1	24.6	0.942	580.8
166	0.746	994.2	22.6	0.927	539.3
180.9	0.701	926.6	21.0	0.918	504.4
194.5	0.639	851.9	19.2	0.910	463.9

Molecular weight: **108.06.** Radius of the Capillary tube: 0.04660 cm. Depth: 0.1 mm.

The substance boils at 200° C. under a pressure of one atmosphere. It melts at 37° C. The specific weight at 25° C. was: 1.0309; at 50° C.: 1.0102; at 75° C.: 0.9905; at $t°$ C.: $d_{4°} = 1.0526 - 0.000888\,t + 0.0000008\,t^2$.

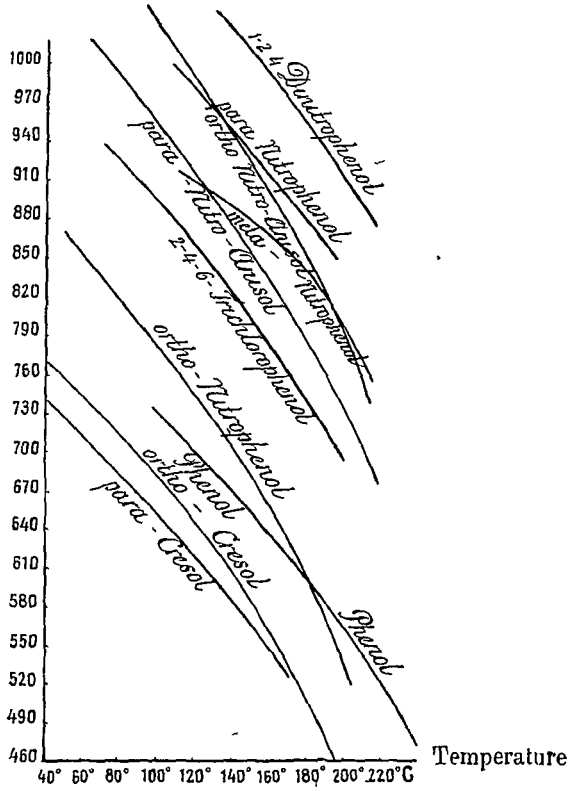

Fig. 4.

XXV.

ortho-Chloroaniline: $C_6H_4\,Cl_{(1)}\,(NH_2)_{(2)}$.

Temperature in ° C.	Maximum Pressure H in mm. mercury of 0° C.	Maximum Pressure H in Dynes	Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg pro cm².
*—19°	1.444	1926.0	45.7	1.259	993.0
* 0	1.379	1839.2	43.6	1.239	957.6
29.7	1.300	1733.3	40.5	1.208	904.6
47.8	1.240	1653.7	38.6	1.190	870.8
64.8	1.180	1574.2	36.7	1.174	835.5
80.9	1.130	1507.3	35.1	1.160	805.5
104.5	1.055	1406.8	32.7	1.140	759.1
125.1	0.977	1302.1	30.2	1.124	707.8
151.8	0.934	1245.2	28.8	1.103	683.5
177.5	0.883	1176.4	27.2	1.085	652.6
196.5	0.848	1130.4	26.1	1.073	630.9

Molecular weight: **127.52.** Radius of the Capillary tube: 0.04777 cm.; with the observations, *indicated by* *, *it was*: 0.04839 *cm.* Depth 0.1 mm.

The liquid boils under a pressure of 760 mm. at 210°.5 C. It can be strongly undercooled, but after solidification it melts again at 0° C. At the boiling-point χ has a value of: 25.3 Erg pro cm².

At 28°.5 C. the density is: 1.2178; at 50° C.: 1.1890; at 75° C.: 1.1660. At t° C.: $d_{4°} = 1.2388 - 0\,001047\,t + 0.000001\,t^2$.

The temperature-coefficient of μ is below 125° C. fairly constant and has a mean value of **1.97** Erg.: Afterwards it decreases to about **1.1** Erg pro degree.

XXVI.

para-Chloroaniline: $C_6H_4 . (NH_2)_{(1)} . Cl_{(4)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
74.6°	1.322	1762.5	37.8	1.166	864.5
90 6	1.262	1682.5	36.1	1.151	832.8
104.1	1.221	1627.9	34.9	1.139	810.7
121	1.166	1554.5	33 3	1.124	780.4
130.4	1.144	1525.2	32.6	1.116	767 7
151	1.073	1431.1	30.6	1.097	728 8
170	1.015	1353.2	28.9	1.080	695 6
185	0.981	1307.7	27.9	1 067	676.9

Molecular weight: **127.52.** Radius of the Capillary tube: 0.04374 cm. Depth: 0.1 mm.

The compound was often recrystallised from mixtures of chloroform and ether. The beautiful colourless crystals melt at 70° C.; the substance boils at 232° C. The specific gravity at 70° C. is 1.1704; at 100° C.: 1.1432. At 170° the liquid becomes coloured deeply violet; the measurements therefore were no longer continued. At the boilingpoint χ must have a value not very far deviating from 25,0 Erg. The density at $t°$ can be calculated from: $d_{4°} = 1.2337 - 0.000903\,t$.

The temperature-coefficient of μ decreases a little with increasing temperature: between 74° and 91° C. it is about **1.98** Erg; between 170° and 185° C.: **1.24** Erg, oscillating thus round a mean value of about: **1.64** Erg pro degree.

XXVII.

meta-Nitro-Aniline: $C_6H_4 (NH_2)_{(1)} NO_{2(3)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
124.2°	1.410	1879.8	42 7	1.206	1006.7
140.5	1.357	1809.7	41.2	1.192	979.0
157	1.266	1684.5	39.7	1.177	951.4
170	1.274	1698.4	38.5	1.166	928.4
186.2	1.221	1631.6	37.0	1.152	899.4
201.3	1.184	1577 4	35 6	1.139	872.0

Molecular weight: **138.07.** Radius of the Capillary tube: 0.04644 cm. Depth: 0.1 mm.

The beautifully yellow coloured and well crystallised substance melts at 112° C.; while the liquid is heated above 200° C, it is gradually tinged brownish by progressive decomposition, and therefore the measurements were no further continued. Under the pressure of one atmosphere, the liquid boils at 286° C. according to the data given in literature; however it must be decomposed partially already at that temperature.

At 120° C. the density was: 1.2095; at 140° C.: 1.1921; at 160° C.: 1.1747. At t C. in general: $d_{4°} = 1.2269 - 0.00087\,(t - 100°)$.

The temperature-coefficient of μ is fairly constant; its mean value is: **1.74** Erg pro degree.

XXVIII.

para-Nitroaniline: $C_6H_4(NH_2)_{(1)}(NO_2)_{(4)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes	
151°	1.601	2135.3	46.7
171.5	1.535	2048.4	44.8
184.5	1.496	1993.6	43.6

Molecular weight: **138.07.** Radius of the Capillary tube: 0.04374 cm. Depth: 0.1 m m.

The beautiful, orange-yellow crystals melt at 147° C. The substance is so volatile above 180°, that reliable measurements were no longer possible.

XXIX.

3-Nitro-ortho-Toluïdine: $CH_{3(1)} \cdot C_6H_3 \cdot (NH_2)_{(2)} \cdot (NO_2)_{(3)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity d_{4°	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
105°	1.370	1826.5	39.2	1.186	996.8
121.5	1.323	1764.9	37.9	1.171	972.0
130	1.295	1726.5	37.0	1.164	952.7
151	1.231	1641.5	35.2	1.144	916.8
170	1.166	1549 7	33.4	1.128	878.2
184.8	1.124	1499.7	32.1	1 115	850.6
201.2	1.077	1435.8	30.7	1.101	820.3

Molecular weight: **152.08.** Radius of the Capillary tube: 0.04374 cm. Depth: 0.1 mm.

The compound melts at 96° C. At 100° C. the density was: 1.1900; at 120° C.: 1.1722; 140° C.: 1.1546. At t° C.: $d_{4^\circ} = 1.1900 - 0\,0008815\,(t - 100^\circ)$.

Originally the temperature-coefficient of μ is somewhat increasing: from 1.27 Erg at 130° C. to 1.71 Erg at 151° C. Then it remains fairly constant, with a mean value of about: 1.9 Erg per degree.

XXX.

5-Nitro-ortho-Toluïdine: $CH_{3(1)} \cdot C_6H_3 (NH_2)_{(2)} \cdot (NO_2)_{(5)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
142°	1.477	1969.1	43.0	1.157	1115 1
151	1.444	1925.1	41.1	1.150	1070.2
170.5	1.333	1777.1	37.9	1.135	995.5
184.5	1.279	1705.5	36.3	1.122	960.9

Molecular weight: **152.08.** Radius of the Capillary tube: 0.04374 cm. Depth: 0.1 mm.

The beautiful yellow crystals melt at 128° C. Above 180° C. the volatility of the compound was too great, to make any reliable measurements possible.

XXXI.

3-Nitro-para-Toluïdine: $CH_{3(1)} \cdot C_6H_3 (NH_2)_{(4)} \cdot (NO_2)_{(3)}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
121°	1.274	1698.5	36.4	1.164	969.1
130.5	1.248	1664.2	35.7	1.156	943.1
151	1.134	1511.8	33.1	1.137	865.7
170.5	1.094	1458.6	31.2	1.120	807.0
185	1.045	1393.2	29.8	1.107	767.3

Molecular weight: **152.08.** Radius of the Capillary tube: 0.04374 cm. Depth: 0.1 mm.

The substance melts at 117° C. Above 180° C. the compound is so volatile, that reliable measurements were hardly any more possible. The specific gravity at 120° C. was: 1.1645; at 140° C.: 1.1468; at 160° C.: 1 1292. At t° C.: $d_{4°} = 1\ 1821 - 0\ 000882\,(t - 100)$.

The temperature-coefficient of μ is abnormally great; its mean value is about: **3.08** Erg per degree.

Molecular Surface-
Energy μ in Erg pro cm².

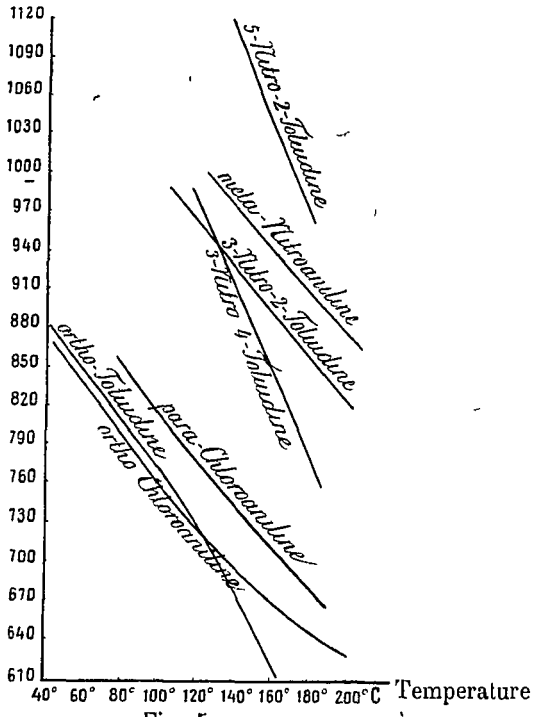

Fig 5

XXXII.

Sylvestrene: $C_{10}H_{16}$.

Temperature in ° C.	Maximum Pressure H		Surface-tension χ in Erg pro cm².	Specific gravity $d_{4°}$	Molecular Surface-energy μ in Erg pro cm².
	in mm. mercury of 0° C.	in Dynes			
—70°	1.139	1518.5	35.7	0.923	979.2
—20	0.964	1285.5	30.1	0.891	860.2
0	0.908	1210.5	28.3	0.878	816.8
25.8	0.833	1110.2	25.9	0.859	758.5
41	0.792	1055.9	24.6	0.847	727.2
55.5	0.736	981.2	23.2	0.841	689.1
80.4	0.682	909.8	21.2	0.827	636.7
92	0.654	872.3	20.3	0.820	613.2
116.2	0.582	776.3	18.0	0.807	549.6
*136	0.546	728.1	16.4	0.797	504.8
*149.5	0.507	676.7	14.6	0.790	452.1

Molecular weight: **136.13.** Radius of the Capillary tube: 0.04792 cm.; with the observations indicated by *, the radius was: 0.04670 cm.
Depth: 0.1 mm.

Under a pressure of 21 mm. it boils at 63°.5 C.; under atmospheric pressure at 177° C. The specific gravity at 25° C. was: 0.8599; at 50° C.: 0.8409; at 75° C.: 0.8209; at $t°$ in general: $d_{4°} = 0.8779 - 0.0007\,t - 0.0000008\,t^2$.

The temperature-coefficient of μ is between —70° and 136° C. fairly constant; its mean value is: **2.28** Erg pro degree. Above 136° it increases rapidly and becomes **3.9** Erg.

XXXIII.

Terebene: $C_{10}H_{16}$.

Temperature in ° C.	Maximum Pressure H in mm. mercury of 0° C.	Maximum Pressure H in Dynes	Surface-tension χ in Erg pro cm².	Specific gravity d_{4°	Molecular Surface-energy μ in Erg pro cm².
—74°	1.131	1508.6	35.8	0.956	976.2
* —22	0 968	1290.4	30.7	0.912	863.9
* 0	0.906	1208.2	28.7	0.893	819.0
29.9	0.825	1099.3	25.9	0.868	753.2
46.8	0.775	1033.2	24.3	0 853	714.9
58.3	0.744	991.9	23.4	0.844	693.4
86.3	0.673	896.9	21.1	0.820	637.4
102.7	0.626	834.9	19.6	0.806	598.9
118	0.573	764.6	17.9	0.793	552.9
127.4	0.558	743.9	17.4	0.786	540.6
153	0.499	665.4	15.5	0.764	494.0
170	0.449	599.3	13.9	0.749	446.0

Molecular weight: **136.13.** Radius of the Capillary tube: 0.04839 cm.; in the measurements indicated by *, the radius was 0.04867 cm.; Depth: 0.1 mm

Under a pressure of 761 mm. the liquid boils at 170° C.; at the boilingpoint the value of χ is about 13.7 Erg pro cm². Even at —79° C. the compound is not crystallised, but the liquid is turbid then. Probably it is a mixture of isomerides.

The specific gravity at 25° C. is: 0.8721; at 50° C.: 0.8509; at 75° C.: 0.8298. At $t°$ in general: $d_{4^\circ} = 0.8932 - 0.000846\,t$. The temperaturecoefficient of μ is in mean: **2.16** Erg pro degree, and fairly constant.

§ **3.** If we now review the results here obtained, it will appear in first instance that such position-isomeric substances at the same temperatures do *not* possess the same surface-energy in general, as was formerly occasionally supposed. One cannot deny that the μ-t-curves, and especially those of the aromatic hydrocarbons, if substituted by halogen-atoms or nitro-groups, often closely approach each other: so e.g. with *o-* and *m-Dinitrobenzene*, with *o-*, *m-* and *p-Chloronitrobenzene*; with *o-* and *m-Bromonitrobenzene*; with *o-* and *p-Fluoronitrobenzene*; and with 1-2-4-, 1-4-2-, and 1-3-4-*Dichloronitrobenzenes*. In the case of the nitrated *phenols* these curves deviate much more; but we must conclude this to be caused by differences of the internal structure of the mentioned compounds, which are undoubtedly connected with the presence of the *H*-atom in the *OH*-group. For while the mutual differences are rather great in the case of the substituted phenols themselves, these differences will be strongly diminished, if e. g. in the derivatives of polyvalent phenols *one* of

the *OH*-groups is substituted by an oxalkyl-group, as e.g. with *monomethylresorcinol* and *guajacol*. These differences however are completely reduced to the size found in the case of the above mentioned substituted hydrocarbons, if *all H*-atoms of the *OH*-groups present are esterified: between *ortho-*, and *para-Nitroanisol* e.g. the deviation of the two curves is already much weaker, as in the case of *ortho-*, and *para-Nitrophenol* itself, while it is yet more considerably diminished in the case of *Veratrol*, *Dimethylhydroquinone*, where the μ-*t*-curves of the two last named substances even coincide almost over their full length. If we now observe so much stronger differences between e.g. *ortho-*, and *para-Nitrophenol*, than between their corresponding *anisols*, this could probably be considered as an indication, that the internal equilibrium in the liquid between the molecules with the constitution of the pseudo-acid, and between those with the true nitrophenol-formula, may be situated in the case of the *ortho*-compound in such a way, that it much more approaches to the side of the pseudo-acid, than in the case of the *para*-compound: a circumstance probably caused by the more immediate vicinity of *OH*-groups and NO_2-radical in the case of the *ortho-nitrophenol*. In the case of the corresponding *anisols*, they might then be supposed to possess a quite analogous structure, no freely movable *H*-atom being any more present.

Even in the cases, where the μ-*t*-curves of such isomerides, approach each other relatively closely, it can be often observed, that the values of the temperature-coefficient $\frac{\partial \mu}{\partial t}$ are evidently different, which thus determines the steeper or flatter shape of the curves.

Besides in the case of the *phenols*, also somewhat greater differences may be stated between isomeric *aromatic bases*, and between the *cresols*. The abnormal shape of the curves with some of the considered bases, undoubtedly must be partially explained by the alterations and decompositions, which seem more easily to occur in the case of these compounds at higher temperatures, than with other substances. Finally we can draw attention to the fact, that within the series of the *halogennitrobenzenes*, just as within that of the *halogenated benzenes* themselves, the values of μ at the same temperatures appear to be the greater, the higher the atomic weight of the halogen-atom is. This fact is of course just opposite to that observed in the case of the molten halogenides of the alcali-metals.

A general rule considering the relative magnitude of μ in the case of *ortho-*, *meta-*, and *para-*monosubstitutionproducts, could not be formulated.

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