Dr. H. KAMERLINGH ONNES. *On the coëfficient of viscosity of liquids in corresponding states according to calculations by* Dr. M. DE HAAS.

Continuing the investigation, the results of which were communicated in the session of 27 January 1894, Dr. M. DE HAAS has calculated the coëfficient of viscosity for a number of substances at the corresponding temperatures 0.58 T_k (T_k denoting the critical temperature) and besides the quantities $C = \mu \frac{\sqrt[6]{p^4_k}}{M^3\, T_k}$ (in which μ denotes the coëfficient of viscosity, p_k the critical pressure, M the molecular weight of the substance) and $C' = \mu \frac{\sqrt[3]{m^2_k}}{\sqrt{M T_k}}$ (in which m_k represents the critical molecular volume) which according to the thesis: that corresponding states are mechanically equivalent for all substances, should have the same value in corresponding states. The result of the calculations is laid down in the following table:

Hydrocarbons.		$0.58 T_k - 273$	p_k	m	μ	C	C′
Benzene	$C_6 H_6$	52.7	47.9	92.2	23.6	0.58	2.3
Toluene	$C_7 H_8$	71.4	40.1	114.5	18.8	0.48	1.9
Metaxylene	$C_8 H_{10}$	85.3 (H)	38.0	134.5	18.5	0.48	1.8

Halogen Compounds.		$0,58 T_k - 273$	p_k	m	μ	C	C′
Methyl chloride	CH_3Cl	—31.7	65.0	50.1	16.2	0.38	1.5
Methyl iodide	CH_3J	33.2 (H)		67.4	26.0		1.6
Ethyl bromide	$C_2 H_5 Br$	22.2		76.7	21.3		1.6
Propyl chloride	$C_3 H_7 Cl$	13.5	49.0	89.6	20.9	0.50	2.1
Propyl iodide	$C_2 H_7 J$	65.3 (H)	44.8	103.0	23.4	0.44	1.6
Butyl iodide	$C_4 H_9 J$	85.0 (H)	39.8	125.0	27.3	0.50	2.0
Benzene chloride	C_6H_5Cl	94.5 (H)	44.7	109.4	21.5	0.47	1.9
Benzene bromide	C_6H_5Br	117.1 (H)		114.7	25.4		1.9
Allyl chloride	C_3H_5Cl	24.9		82.3	19.0		1.8
Ethylene chloride	$C_2 H_4 Cl_2$	52.6	53.0	82.3	30.7	0.62	2.4
Ethylidene chloride	$C_2 H_4 Cl_2$	30.3	50.0	86.0	25.9	0.54	2.2
Chloroform	$CH\ Cl_3$	38.5	54.9	82.1	26.5	0.48	1.9
Tetra-chlormethane	$C\ Cl_4$	49.5	45.0	99.8	37.2	0.68	2.7
Ether	$C_4H_{10}O$	— 2.2	35.6	102.1	16.1	0.48	1.8
Ethyl sulphide	$C_4 H_{10} S$	37.3 (H)		113.2	20.5		2.2

Ethereal salts.							
Ethyl formate	$C_3 H_6 O_2$	20.5	48.7	80.1	22.5	0.55	2.2
Propyl formate	$C_4 H_8 O_2$	36.6	42.7	99.0	24.0	0.60	2.4
Isobutyl formate	$C_5 H_{10} O_2$	46.7 (H)	38.3	123.3	27.0	0.67	2.8
Methyl acetate	$C_3H_6O_2$	20.4	57.6	79.5	22.9	0.57	2.2
Ethyl acetate	$C_4H_8O_2$	29.5	41.1	98.7	22.4	0.57	2.2
Propyl acetate	$C_5 H_{10} O_2$	49.1	34.8	118.9	22.2	0.59	2.2
Normal butyl acetate	$C_6 H_{12} O_2$	62.7		139.0	24.7		2.5
Isobutyl acetate	$C_6 H_{12} O_2$	54.7	31.4	140.0	24.7	0.66	2.5
Methyl propionate	$C_4 H_8 O_2$	35.7	39.9	97.9	22.9	0.60	2.2
Ethyl propionate	$C_5 H_{10} O_2$	43.3	34.6	117.9	25.3	0.67	2.5
Norm. propyl prop.	$C_6 H_{12} O_2$	62.1		139 0	25.3		2.6
Isobutyl propionate	$C_7 H_{14} O_2$	70.2		124.4	25.2		2.3
Methyl butyrate	$C_5 H_{10} O_2$	46.6	36.0	117.1	22.9 (R)	0.59	2.3
Ethyl butyrate	$C_6 H_{12} O_2$	58.5	30.2	138.0	23.0	0.63	2.4
Norm.propyl butyrate	$C_7 H_{14} O_2$	74.7		147.0	24.7		2.5
Methyl isobutyrate	$C_5 H_{10} O_2$	44.0		118.1	24.2		2.1
Ethyl isobutyrate	$C_6 H_{12} O_2$	50.8	30.1	139.7	24.8	0.68	2.6
Norm. prop. isobutyr.	$C_7 H_{14} O_2$	68.6		160.0	25.5		2.7
Ethyl valerate	$C_7 H_{14} O_2$	55.7		156.6	26.7		2.8
Amyl valerate	$C_{10} H_{20} O_2$	71.6 (H)	21.3	214.7	36.4 (R)	1.04	4.1

		$0.58\,T_k - 273$	p_k	m	μ	C	C′
Acetic aldehyde	C_2H_4O	— 9.4 (H)		53.6	19.2		1.9
Acetone	C_4H_6O	24.2	52.2	74.3	21.2	0.56	2.1
Water	H_2O	99.9	195.5	18.7	16.0	0.33	1.0
Bisulphide of carbon.	CS_2	44.9	77.0	62.0	17.0(W)	0.31	1.3
Fatty acids.							
Formic acid	CH_2O_2	81.5	115.1	41.2	37.9 (R)	0.68	2.6
Acetic acid	$C_2H_4O_2$	71.8 (H)	76.4	59.1	35.3	0.73	2.8
Propionic acid	$C_3H_6O_2$	82.4	58.2	80.4	31.3	0.71	2.8
Butyric acid	$C_4H_8O_2$	81.5	48.0	99.0	38.3	0.91	3.5
Isobutyric acid	$C_4H_8O_2$	76.7	46.6	100.0	34.7	0.82	3.2
Valeric acid	$C_5H_{10}O_2$	80.4	40.1	117.0	47.2 (R)	1.2	4.0
Capronic acid	$C_6H_{12}O_2$	113.0	37.2	140.0	44.3 (R)	1.1	4.3
Alcohols.							
Methyl alcohol	CH_4O	24.5	73.7	40.5	33.7 (R)	0.96	3.1
Ethyl alcohol	C_2H_6O	26.6	64.5	58.5	61.9 (R)	1.61	6.0
Normal propyl alcohol	C_3H_8O	34.2	51.7	75.9	95.8	2.53	9.7
Isopropyl alcohol	C_3H_8O	21.4	53.0	77.0	130.3	3.37	13.5
Normal butyl alcohol	$C_4H_{10}O$	51.8		96.0	80.0		8.2
Isobutyl alcohol	$C_4H_{10}O$	39.0	48.3	96.0	129.0	3.2	13.5
Allyl alcohol	C_3H_6O	43.0		70.9	54.7		5.3

The critical temperature has been taken from the Annuaire du Bureau des Longitudes and from HEILBORN (H). Under μ are given the specific [1]) coëfficients of viscosity calculated from the results of PRIBRAM and HANDL, RELLSTAB (R) and WYKANDER (W) and from the formula of GRAETZ; under m the quotient of the molecular weight and the density in corresponding states, partially calculated with the aid of VAN DER WAALS's law.

Remarkable is the large deviation shown by the

[1]) Vide note on p. 11.

fatty acids and still more by the alcohols. In these anomalous series of bodies we also remark a tendency to reach higher values for C and C' with greater molecular weight and this the more as the class diverges more itself. With water and bisulphide of carbon however, we find a value which differs in a direction opposite to the fatty acids and alcohols.

The logarithmic gradients of the coëfficient of viscosity are dealt with in Dr. DE HAAS's dissertation. They show the desirableness of further determination of frictional coefficient above the boiling-point.