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Table of Dielectric Constants of Pure Liquids

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Arthur A. Maryott and Edgar R. Smith

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Table of Dielectric Constants of Pure Liquids

Arthur A. Maryott and Edgar R. Smith

The "static" dielectric constants of more than 800 substances in the liquid state were critically examined and tabulated in concise form. The table consists of three sections: A, Standard Liquids; B, Inorganic Liquids; and C, Organic Liquids. An indication of the probable accuracy of the data is given. Wherever feasible, a simple analytical function is employed to express the variation of dielectric constant with temperature.

1. Introduction

This tabulation of the dielectric constants of pure liquids is part of a program for a critical examination of the data of physics and chemistry, sponsored by the National Bureau of Standards in coöperation with the Committee on Tables of Constants and Numerical Data of the National Research Council and the Commission on Tables of Constants of the International Union of Chemistry. The preparation of additional tables of the dielectric constants of gases, solids, aqueous and nonaqueous solutions and mixtures, and of dipole moments is in progress.

The assemblage and evaluation of the data have been made entirely at the National Bureau of Standards with the assistance of M. Eden during the preliminary stages. However, helpful suggestions from M. E. Hobbs of Duke University, C. P. Smyth of Princeton University, and the Committees of the National Research Council and International Union of Chemistry are gratefully acknowledged. The compilations of P. Debye and H. Sack (Tables de Constantes et Données Numériques XI, Fasicule 2, 1931–34; XII, Fasicule 32, 1935–36 and earlier volumes of Tables Annuelles), International Critical Tables, and Landolt-Börnstein Tabellen have been useful in checking the tables for accuracy and completeness. In several instances data have been obtained from the Tables of Dielectric Materials, volume III, prepared by the Laboratory of Insulation Research, Massachusetts Institute of Technology, Cambridge, Mass., 1948.

2. Description of the Table

The table consists of three sections: A, Standard Liquids, B, Inorganic Liquids, C, Organic Liquids. The dielectric constants are intended to be the limiting values at low frequencies, the so-called "static" values. Data obtained at such high frequencies that anomalous dispersion was evident are not included. In questionable cases the frequency is given in a footnote. Temperature is the only variable considered explicitly. Usually the pressure is atmospheric or insignificantly different with respect to its effect on dielectric constant. However, where data are listed at temperatures above the normal boiling point, the pressure corresponds to the vapor pressure of the liquid unless indicated otherwise in a footnote.

2.1. List of Symbols

ϵ = dielectric constant ($\epsilon_{\text{vacuum}} = 1$)
t = temperature, Celsius (°C)
T = temperature, absolute (°K)
$a = -d\epsilon/dt$
$\alpha = -d\text{Log}_{10}\,\epsilon/dt$
f = frequency of alternating current in cycles per second
t_1, t_2 = the limits of temperature between which a or α is considered applicable
mp = melting point
bp = boiling point

2.2. Standard Liquids

Section A contains values of the dielectric constant at selected temperatures for 10 substances that are recommended as reference liquids because of their chemical stability, availability, and the reliability of the data. The probable accuracy is estimated to be about 0.2 percent for methanol and nitrobenzene and about 0.1 percent in the remaining cases. Values of a or α are included for interpolating or for extrapolating over a limited range of temperature without materially altering the accuracy. Additional data for these substances are contained in sections B or C.

2.3. Chemical Formulas and the Order of Listing Substances

Formulas for the inorganic substances are written in the usual manner. The order of listing compounds in section B is alphabetical according to the symbols for the elements in these formulas with consideration also given to the number of atoms of each kind.

Formulas for the organic compounds are written with carbon first and hydrogen, if present, second. Symbols for all remaining elements then follow in alphabetical sequence The arrangement of these compounds in section C is determined first by the number of carbon atoms, secondly by the number of hydrogen atoms, and finally by the symbols for the remaining elements in alphabetical order.[1]

2.4. Estimated Accuracy of the Values of Dielectric Constant

Values of dielectric constant recorded in sections B and C have an estimated accuracy indicated by the number of figures retained.

(a) Values listed to four figures are considered probably accurate to 0.5 percent or better.

(b) Values listed to three figures are considered probably accurate to 2 percent or better.

(c) Values listed to two figures are considered probably less accurate than 2 percent.

However, where lack of detailed information makes any assignment of accuracy difficult or where excessive rounding off is undesirable, an additional figure is often retained which is not to be counted in determining the probable range of accuracy. Such figures are printed in smaller type as subscripts. They are also retained when significant with respect to variations of dielectric constant with temperature or to differences between isomeric or other closely related compounds in a series of measurements.

These estimates of accuracy were assigned arbitrarily after considerations of the investigators' apparatus and methods, precision, probable purity of materials, and comparisons, where possible, with the results of others.

[1] Exception is made for certain series of polymers (e. g., polysiloxanes) which may be represented by the general formula $(X)_n$ or $A(X)_nB$, where $n=1, 2, 3$, etc. The location of all compounds of such a series is determined by the formula corresponding to $n=1$.

2.5. Variation of Dielectric Constant With Temperature

Where feasible, the variation of dielectric constant with temperature is represented by one of the following equations:

$$\epsilon_{t'}=\epsilon_t-a(t'-t) \tag{1}$$

$$\mathrm{Log}_{10}\ \epsilon_{t'}=\mathrm{Log}_{10}\ \epsilon_t-\alpha(t'-t) \tag{2}$$

where ϵ_t, t, and a (or α if the value is followed immediately by α in parentheses) are specified in the table. Occasionally other equations are indicated in footnotes.

The range of temperature over which the equation is considered satisfactory appears under the heading t_1, t_2. This range was chosen such that the deviations between the calculated and reported values of ϵ are not greater than one-fourth of the accuracy assigned to ϵ. Thus if ϵ is listed to four figures (discounting figures in smaller type), the equation fits the reported data to 0.13 percent or better over the specified range of temperature; and, if ϵ is listed to three figures (discounting figures in smaller type), the equation fits the data to 0.5 percent or better. Values of ϵ falling outside of this range of temperature are listed at selected temperatures.

2.6. Literature Reference in Table

All tabulated data are based on the references indicated by numbers not enclosed in brackets. The numbers refer to the bibliography following the table. Some additional references not employed for one reason or another are enclosed in brackets. These latter references are not intended to be complete with regard to data published for each substance but have been selected on the basis that they probably merit consideration in any revision of the tabulated data.

Table of Dielectric Constants of Pure Liquids

A. STANDARD LIQUIDS

		$\epsilon_{20°\,C}$	$\epsilon_{25°\,C}$	a (or α)*
C_6H_{12}	Cyclohexane	2.023	2.015	0.0016
CCl_4	Carbon tetrachloride	2.238	2.228	.0020
C_6H_6	Benzene	2.284	2.274	.0020
C_6H_5Cl	Chlorobenzene	5.708	5.621	.00133 (α)
$C_2H_4Cl_2$	1,2-Dichloroethane	10.65	10.36	.00240 (α)
CH_4O	Methanol	33.62	32.63	.00260 (α)
$C_6H_5NO_2$	Nitrobenzene	35.74	34.82	.00225 (α)
H_2O	Water	80.37	78.54	.00200 (α)
H_2	Hydrogen	1.228 at 20.4°K		.0034
O_2	Oxygen	1.507 at 80.0°K		.0024

*The values of a or α given in this table are derived from data in the vicinity of room temperature and are not necessarily identical with the values listed in Parts B and C. They may be used to calculate values of dielectric constant between 15° and 30° C without introducing significant error.

B. INORGANIC LIQUIDS

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
A	Argon	1.53_8	−191	0.34	−191,−184	93
$AlBr_3$	Aluminum bromide	3.38	100	0.33	100,240	226
$AsBr_3$	Arsenic tribromide	9.0[a]	35	.....	.....	17,20
$AsCl_3$	Arsenic trichloride	12.6[a]	20	.....	.....	14,17,20
AsH_3	Arsine	2.50	−100	0.43	−116,−72	183 [30]
AsI_3	Arsenic triiodide	7.0[b]	150	.....	.....	20
BBr_3	Boron bromide	2.58	0	0.28	−70,80	265
Br_2	Bromine	3.09	20	0.7	0,50	64,87,226
CO_2	Carbon dioxide	1.60[c]	20	.....	.....	139 [10,31]
Cl_2	Chlorine	2.10_1	−50	0.31	−65,−33	193
		1.91	14	0.32	−22,14	5,10,19
		1.7_3	77			
		1.5_4	142			
CrO_2Cl_2	Chromyl chloride	2.6[a]	20	.....	.....	17
D_2	Deuterium	1.277	20°K	0.4	18.8,21.2°K	249
D_2O	Deuterium oxide	78.25	25	([d])	0.4,98	210 [135]
F_2	Fluorine	1.54	−202	0.19	−216,−190	193
$GeCl_4$	Germanium tetrachloride	2.43_0	25	0.240	0,55	147
HBr	Hydrogen bromide	7.00	−85	0.26(α)	−85,−70	137 [296]
		3.8[b]	25	.....	.....	25
HCl	Hydrogen chloride	6.35	−15	0.288(α)	−85,−15	173
		12.	−113	.....	.....	101,137,193
		4.6	28	.....	.....	25
HF	Hydrogen fluoride	17_5.	−73	.....	.....	75
		13_4.	−42			
		11_1.	−27			
		84.	0			
HI	Hydrogen iodide	3.39	−50	0.8	−51,−37	137
		2.9[b]	22	.....	.....	25
H_2	Hydrogen	1.228	20.4°K	0.34	14,21°K	47,58,220,229,249
H_2O	Water	78.54	25	([e])	0,100	89,99,210,218 [50a, 105,112,118,264]
		34.5_9	200	([y])	100,370	284
H_2O_2	Hydrogen peroxide	84.2	0	([z])	−30,20	291 [119]

[a] $f = 4 \times 10^8$ cycles/sec.
[b] $f = 3.6 \times 10^8$ cycles/sec.
[c] At presure of 50 atmospheres.
[d] $\epsilon = 78.25\,[1 - 4.617(10^{-3})(t-25) + 1.22(10^{-5})(t-25)^2 - 2.7(10^{-8})(t-25)^3]$; av. dev. ±0.04%.
[e] $\epsilon = 78.54\,[1 - 4.579(10^{-3})(t-25) + 1.19(10^{-5})(t-25)^2 - 2.8(10^{-8})(t-25)^3]$; av. dev. ±0.03%.
[y] $\epsilon = 5321/T + 233.76 - 0.9297T + 0.001417T^2 - 0.0000008292T^3$.
[z] $\epsilon = 84.2 - 0.62t + 0.0032t^2$.

B. INORGANIC LIQUIDS—Continued

Substance		ϵ	t°C	a (or α) $\times 10^2$	Range t_1, t_2	References
H_2S	Hydrogen sulfide.....	9.26	−85.5	.....	.....	152
		9.05	−78.5	.....	.....	165
He	Helium.....	1.055_6	2.06°K	.....	.....	46,72,73 [290]
		1.055_9	2.30[f]			
		1.055_3	2.63			
		1.053_9	3.09			
		1.051_8	3.58			
		1.048	4.19			
I_2	Iodine.....	$11._1$	118	.....	.....	117
		$11._7$	140			
		$13._0$	168			
NH_3	Ammonia.....	25.	−77.7	.....	.....	152
		22.4	−33.4	.....	.....	144
		18.9	5	.....	.....	175
		17.8	15			
		16.9	25			
		16.3	35			
NOBr	Nitrosyl bromide.....	$13._4$	15	.....	.....	252
NOCl	Nitrosyl chloride.....	$18._2$	12	.....	.....	252
N_2	Nitrogen.....	1.454	−203	0.29	−210,−195	54,205,229 [93]
N_2H_4	Hydrazine.....	$52._9$	20	0.21(α)	0,25	123
N_2O	Dinitrogen oxide.....	1.97	−90	.....	.....	11,93
		1.61	0	0.6	−6,14	5
N_2O_4	Dinitrogen tetroxide.....	2.5_6[b]	15	.....	.....	20
O_2	Oxygen.....	1.507	−193	0.24	−218,−183	59,193,224
P	Phosphorus.....	4.10	34	.....	.....	126 [20]
		4.06	46			
		3.86	85			
PBr_3	Phosphorus tribromide.....	3.9[b]	20	.....	.....	20
PCl_3	Phosphorus trichloride.....	3.43	25	0.84	17,60	120 [14,20,26]
PCl_5	Phosphorus pentachloride.....	2.8_5	160	.....	.....	120 [108]
PH_3	Phosphine.....	2.5_5[b]	−60	.....	.....	28
		2.7_1[b]	−25			
PI_3	Phosphorus triiodide.....	4.1[b]	65	.....	.....	20
$POCl_3$	Phosphoryl chloride.....	$13._3$	22	.....	.....	14,26
$PSCl_3$	Thiophosphoryl chloride.....	5.8	22	.....	.....	26
$PbCl_4$	Lead tetrachloride.....	2.78	20	.....	.....	65

[b] $f = 3.6 \times 10^8$ cycles/sec.

[f] Liquid transition and discontinuity in variation of dielectric constant with temperature at 2.295°K. Values reported in reference 290 agree closely with those listed.

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B. INORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
S	Sulfur.....	3.52 3.48	118 231	([g])	.....	125 [95]
$SOBr_2$	Thionyl bromide.....	9.06	20	3.0	at 20	203
$SOCl_2$	Thionyl chloride.....	9.25	20	3.9	at 20	203 [14]
SO_2	Sulfur dioxide.....	17.6	−20	0.287(α)	−65,−15	299
		15.0_8	0	.....	.....	294
		$14._1$ 2.1_0	20 154[h]	7.7	14,140	5,10,15 [14]
SO_3	Sulfur trioxide.....	3.11	18	.....	.....	197 [14]
S_2Cl_2	Sulfur monochloride.....	4.79	15	0.146(α)	−41,15	92 [14,26]
SO_2Cl_2	Sulfuryl chloride.....	$10._0$	22	.....	.....	26 [14,17]
$SbBr_3$	Antimony tribromide.....	$20._9$[b]	100	.....	.....	20
$SbCl_3$	Antimony trichloride.....	33.[b]	75	.....	.....	14
$SbCl_5$	Antimony pentachloride.....	3.22	20	0.46	2,47	108 [14]
SbH_3	Stibine.....	2.9_3[b] 2.5_8[b]	−80 −50	.....	.....	28
SbI_3	Antimony triiodide.....	$13._9$[b]	175	.....	.....	20
Se	Selenium.....	5.40	250	0.25	237,301	209
$SiCl_4$	Silicon tetrachloride.....	2.4_0	16	.....	.....	20
$SnCl_4$	Tin tetrachloride.....	2.87	20	0.30	−30,20	65,124 [14,22,26]
$TiCl_4$	Titanium tetrachloride.....	2.80	20	0.20	−20,20	65,124 [22]
VCl_4	Vanadium tetrachloride.....	3.0_5[b]	25	.....	.....	33
$VOBr_3$	Vanadium oxybromide.....	4.4[b] 3.6[b]	−70 25	.....	.....	33
$VOCl_3$	Vanadium oxychloride.....	3.4[b]	25	.....	.....	33

[b] $f = 3.6 \times 10^8$ cycles/sec.
[g] Graphical data in the range 118°–350°C show a minimum near 160° and a broad maximum near 200°.
[h] Critical temperature.

C. ORGANIC LIQUIDS

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
	C_1					
CCl_2O	Phosgene.....	4.7_2[b] 4.3_4[b]	0 22	.....	.....	52
CCl_4	Carbon tetrachloride.....	2.238	20	0.200	−10,60	146,169,233,240a, 245,292
CN_4O_8	Tetranitromethane.....	2.52_1	25	.....	.....	225 [26]
CO_2	Carbon dioxide.....	1.60_4[c]	0	.....	.....	139 [10,31]
CS_2	Carbon disulfide.....	2.641 3.001 2.19	20 −110 180	0.268	−90,130	16,146,188,196,204, 240a,292 [80,200,207]
$CHBr_3$	Bromoform.....	4.39	20	0.105(α)	10,70	97,156,160
$CHCl_3$	Chloroform.....	4.806	20	0.160(α)	0,50	85,146,169
		6.76 6.12 5.61	−60 −40 −20	.....	.....	70,94,187 [36,80]
		3.7_1 3.3_3 2.9_3	100 140 180	.....	.....	16
CHN	Hydrocyanic acid.....	$158._1$ $114._9$	0 20	(i) 0.63(α)	−13,18 18,26	255 [39,76]
CH_2Br_2	Dibromomethane.....	7.77 6.68	10 40	.....	.....	97
CH_2Cl_2	Dichloromethane.....	9.08	20	(j)	−80,25	94,285
CH_2I_2	Diiodomethane.....	5.32	25	.....	.....	97 [12]
CH_2O_2	Formic acid.....	$58._5$[a]	16	.....	.....	7 [4,27]
CH_3Br	Bromomethane.....	9.82	0	(k)	−80,0	94 [282]
CH_3Cl	Chloromethane.....	12.6	−20	(l)	−70,−20	94,123
CH_3I	Iodomethane.....	7.00	20	(m)	−70,40	94 [12,41,160]
CH_3NO	Formamide.....	109.	20	72.	18,25	270,280
CH_3NO_2	Nitromethane.....	35.8_7	30	0.189(α)	12,92	78,295 [41]
CH_3NO_3	Methyl nitrate.....	$23._5$[b]	18	.....	.....	14
CH_4	Methane.....	1.70	−173	0.2	−181,−159	93
CH_4O	Methanol.....	32.63	25	0.264(α)	5,55	218,264 [78,112,207]
		64. 54. 40.	−113 −80 −20	.....	.....	9

[a] $f = 4 \times 10^8$ cycles/sec.
[b] $f = 3.6 \times 10^8$ cycles/sec.
[c] At pressure of 50 atomspheres.
[i] $\text{Log}_{10}\ \epsilon = 2.199 - 0.0079t + 0.00005t^2$
[j] $\epsilon = (3320/T) - 2.24$
[k] $\epsilon = (3320/T) - 2.34$
[l] $\epsilon = 12.6 - 0.061\ (t + 20) + 0.0005\ (t + 20)^2$
[m] $\epsilon = (2160/T) - 0.39$

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
CH_5N	Methylamine	11.4	−10	0.26(α)	−30, −10	123
		9.4	25	.....	.....	268
	C_2					
$C_2Cl_2O_2$	Oxalyl chloride	3.47	21	.....	.....	107
C_2Cl_4	Tetrachloroethylene	2.30	25	0.20	25,90	100,196,279 [74]
C_2N_2	Cyanogen	2.5_2	23	.....	.....	14
C_2HBr_3O	Bromal	7.6[n]	20	.....	.....	27
C_2HCl_3	Trichloroethylene	3.4_2	ca 16	.....	.....	45
C_2HCl_3O	Chloral	4.9_4	20	0.17(α)	15,45	44 [4,7]
		7.6	−40			
		4.2	62			
$C_2HCl_3O_2$	Trichloroacetic acid	4.6	60	.....	.....	26
C_2HCl_5	Pentachloroethane	3.73	20	.....	.....	45,57,156
$C_2HF_3O_2$	Trifluoroacetic acid	$39._5$	20	−50.	0,28	297
		$26._2$	−11			
C_2H_2BrCl	*cis*-1-Bromo-2-chloroethylene	7.3_1	17	.....	.....	49
	trans-1-Bromo-2-chloroethylene	2.5_0	17	.....	.....	49
$C_2H_2Br_2$	*cis*-1,2-Dibromoethylene	7.7_2	0	.....	.....	148 [49]
		7.0_8	25			
	trans-1,2-Dibromoethylene	2.9_7	0	.....	.....	148 [49]
		2.8_8	25			
$C_2H_2Br_2O$	Bromoacetyl bromide	12.4[a]	20	.....	.....	17
$C_2H_2Br_4$	1,1,2,2-Tetrabromoethane	8.6	3	.....	.....	26
		7.0	22			
$C_2H_2Cl_2$	1,1-Dichloroethylene	4.6_7	16	.....	.....	49
	cis-1,2-Dichloroethylene	9.20	25	.....	.....	227 [45,48,49,148]
	trans-1,2-Dichloroethylene	2.14	25	.....	.....	196,227 [45,48,49,148]
$C_2H_2Cl_2O_2$	Dichloroacetic acid	8.2	22	.....	.....	26 [27]
		7.8	61			
$C_2H_2Cl_4$	1,1,2,2-Tetrachloroethane	8.2_0	20	.....	.....	53 [45,57]
$C_2H_2I_2$	*cis*-1,2-Diiodoethylene	4.4_6	83	.....	.....	48
	trans-1,2-Diiodoethylene	3.1_9	83	.....	.....	48
C_2H_3BrO	Acetyl bromide	$16._2$[a]	20	.....	.....	17

[a] $f = 4 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
C_2H_3ClO	Acetyl chloride.....	$16._9$	2	.....	.....	26 [7,17]
		$15._8$	22			
$C_2H_3ClO_2$	Chloroacetic acid.....	12.3	60	2.	60,80	123 [181]
$C_2H_3Cl_3$	1,1,1-Trichloroethane.....	7.1_0	0	3.6	−33,2	234
		7.5_2	20	.....	.....	156
C_2H_3N	Acetonitrile.....	37.5	20	16.	15,25	13,26,41,123
		$26._8$	82			
C_2H_3NO	Glycolonitrile.....	68.[a]	20	.....	.....	17
C_2H_3NS	Methyl thiocyanate.....	35.[a]	16	.....	.....	17,18,22
	Methyl isothiocyanate.....	$19._3$[a]	38	.....	.....	17,18,22
C_2H_4BrCl	1-Bromo-2-chloroethane.....	7.14	20	0.140(α)	10,90	110
		7.98	−10			
$C_2H_4Br_2$	1,2-Dibromoethane.....	4.78	25	0.60	10,55	12,144,156,199,272
		4.09	131	.....	.....	41
$C_2H_4Cl_2$	1,1-Dichloroethane.....	$10._0$	18	.....	.....	1,27
	1,2-Dichloroethane.....	10.65	20	.....	.....	138,170,263
		10.36	25			
		10.3_6[x]	25	0.235(α)	10,55	123,133,254,272
		12.7	−10			
$C_2H_4N_2O_6$	Ethylene nitrate.....	$28._3$	20	.....	.....	244
C_2H_4O	Ethylene oxide.....	$13._9$	−1	.....	.....	26
	Acetaldehyde.....	$21._8$[a]	10	.....	.....	7 [4]
		21.1[a]	21			
C_2H_4OS	Ethanethiolic acid..... (Thioacetic acid)	13.[a]	20	.....	.....	17 [18]
$C_2H_4O_2$	Acetic acid.....	6.15	20	.....	.....	96,207 [7,181]
		6.29	40			
		6.62	70			
	Methyl formate.....	8.5	20	5.	0,20	7,26
C_2H_5Br	Bromoethane.....	9.39	20	0.196(α)	−30,30	34,70,94 127,272 [207,228]
		16.1	−90			
		13.6	−60			
C_2H_5Cl	Chloroethane.....	6.2_9	170	.....	.....	15
		6.0_6	179			
		5.1_3	183			
		4.6_8	185.5[h]			
C_2H_5ClO	2-Chloroethanol..... (Ethylene chlorohydrin)	$25._8$	25	.....	.....	41
		$13._2$	132			

[a] $f = 4 \times 10^8$ cycles/sec.
[h] Critical temperature.
[x] Value chosen to conform with the remainder of the tabulated data for this substance.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
C_2H_5I	Iodoethane.....	7.82	20	0.150(α)	−20,70	81,207 [7,12,160]
		12.3	−90			
		10.2	−50			
C_2H_5NO	Acetamide.....	59.[a]	83	.....	.....	17
	Acetaldehyde oxime.....	3.0	23	.....	.....	26 [17,27]
$C_2H_5NO_2$	Nitroethane.....	28.0_6	30	11.4	30,35	295 [14]
$C_2H_5NO_3$	Ethyl nitrate.....	$19._4$	20	9.	0,50	7,17,26 [4,14]
$C_2H_6N_2O$	*N*-Nitrosodimethylamine.....	53.[a]	20	.....	.....	17
C_2H_6O	Ethanol.....	24.30	25	.....	.....	111,174
		24.3[x]	25	0.270(α)	−5,70	111,112,207
		41.0[x]	−60	0.297(α)	−110,−20	81 [9]
	Methyl ether.....	5.02	25	2.38	25,100	161
		2.97	110			
		2.64	120			
		2.37	125			
		2.26	126.1			
		1.90	127.6[p]			
$(C_2H_6OSi)_n$						
$n = 4$	Octamethylcyclotetrasiloxane..	2.39	20	.....	.....	266
$n = 5$	Decamethylcyclopentasiloxane	2.50	20	.....	.....	266
$n = 6$	Dodecamethylcyclohexasiloxane	2.59	20	.....	.....	266
$n = 7$	Tetradecamethylcyclo-heptasiloxane	2.68	20	.....	.....	266
$n = 8$	Hexadecamethylcyclo-octasiloxane	2.74	20	.....	.....	266
$C_2H_6O_2$	Glycol.....	$37._7$	25	0.224(α)	20,100	112 [26,131,142,236]
$C_2H_6O_4S$	Methyl sulfate.....	$60._2$	−30	.....	.....	122 [17,26,43]
		$48._3$	0			
		$42._6$	20			
C_2H_6S	Ethanethiol.....	6.9_1	15	.....	.....	236
	Methyl sulfide.....	6.2[a]	20	.....	.....	17
C_2H_7N	Ethylamine.....	6.94	10	(°)	−20,10	123 [14]
	Dimethylamine.....	6.32	0	.....	.....	268
		5.26	25			
$C_2H_8N_2$	1,2-Ethanediamine.....	14.2	20	10.	10,27	199

[a] $f = 4 \times 10^8$ cycles/sec.
° $\epsilon = 6.94 - 0.036(t - 10) + 0.0004(t - 10)^2$
[p] Critical temperature = 126.9 °C.
[x] Value chosen to conform with the remainder of the tabulated data for this substance.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
	C_3					
$C_3H_2N_2$	Malononitrile.....	46.[b]	36	.....	.....	18
$C_3H_4Cl_2O$	1,1-Dichloro-2-propanone.....	$14._6$[n]	20	.....	.....	27
C_3H_5Br	3-Bromo-1-propene.....	7.4 7.0	1 19	.....	.....	26
$C_3H_5BrO_2$	α-Bromopropionic acid.....	$11._0$[n]	21	.....	.....	27
$C_3H_5Br_3$	1,2,3-Tribromopropane.....	6.45	20	.....	.....	244
C_3H_5Cl	3-Chloro-1-propene.....	8.7 8.2	1 20	.....	.....	26 [27]
$C_3H_5ClN_2O_6$	3-Chloro-1,2-propanediol dinitrate	$17._5$	20	.....	.....	244
C_3H_5ClO	1-Chloro-2-propanone.....	30.[n]	19	.....	.....	27
	3-Chloro-1,2-epoxypropane.... (Epichlorohydrin)	$25._6$ $22._6$	1 22	.....	.....	26 [27]
$C_3H_5ClO_2$	Ethyl chloroformate.....	$11._0$[a]	20	.....	.....	17 [27]
	Methyl chloroacetate.....	$12._9$[n]	21	.....	.....	27
$C_3H_5Cl_2NO_3$	1,3-Dichloro-2-propanol nitrate	$13._3$	20	.....	.....	244
$C_3H_5Cl_3$	1,2,3-Trichloropropane.....	7.5[n]	20	.....	.....	27
C_3H_5I	3-Iodo-1-propene.....	6.1[n]	19	.....	.....	27
C_3H_5N	Propionitrile.....	$31._0$ $27._2$ $24._3$	0 20 50	.....	.....	13,17,26
C_3H_5NO	Lactonitrile.....	38.[a]	20	.....	.....	17
C_3H_5NS	Ethyl thiocyanate.....	$34._5$ $29._3$	3 21	.....	.....	26 [17,18,22]
	Ethyl isothiocyanate.....	$23._4$ $19._5$	2 21	.....	.....	26 [17,18,22]
$C_3H_5N_3O_9$	1,2,3-Propanetriol trinitrate (Nitroglycerin)	$19._3$	20	.....	.....	244
C_3H_6	Propene.....	1.87_5 1.79_5 1.69_0 1.53_0 1.44_1 1.33_1	20 45 65 85 90 91.9[h]	.....	.....	161
$C_3H_6Br_2$	1,2-Dibromopropane.....	4.3[n]	20	.....	.....	27

[a] $f = 4 \times 10^8$ cycles/sec.
[b] $f = 3.6 \times 10^8$ cycles/sec.
[h] Critical temperature.
[n] $f = 5 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_3H_6Cl_2$	1,2-Dichloropropane.....	8.93	26	.....	.....	107
	2,2-Dichloropropane.....	10.1_9	20	0.247(α)	−33,20	234
$C_3H_6N_2O_6$	1,2-Propanediol dinitrate....	$26._8$	20	.....	.....	244
	1,3-Propanediol dinitrate....	$19._0$	20	.....	.....	244
C_3H_6O	2-Propen-1-ol (Allyl alcohol)	$21._6$	15	.....	.....	4 [7,27]
	Acetone.....	20.7_0	25	0.205(α)	−60,40	156,185,240,274 [112,207]
		17.7	56	.....	.....	41
	Propionaldehyde.....	$18._5$ [a]	17	.....	.....	7 [4]
$C_3H_6O_2$	Propionic acid.....	3.30 3.44	10 40	.....	.....	149 [1,7,27]
	Ethyl formate.....	7.1_6	25	.....	.....	160 [1,7]
	Methyl acetate.....	6.68	25	2.2	25,40	63,260
$C_3H_6O_3$	*dl*-Lactic acid.....	22.	17	.....	.....	4,8 [7]
C_3H_7Br	1-Bromopropane.....	8.09	25	3.35	1,55	272
	2-Bromopropane.....	9.46 16.1	25 −85	4.40	1,55	272 211
C_3H_7Cl	1-Chloropropane.....	7.7 [n]	20	.....	.....	27
$C_3H_7ClO_2$	3-Chloro-1,2-propanediol.....	37. 31.	3 19	.....	.....	26
C_3H_7I	1-Iodopropane.....	7.00	20	.....	.....	242
	2-Iodopropane.....	8.19	20	.....	.....	242
$C_3H_7NO_2$	1-Nitropropane.....	23.2_4	30	10.1	30,35	295
	2-Nitropropane.....	25.5_2	30	10.9	30,35	295
	Ethyl carbamate (Urethan)....	14.2	50	5.2	50,70	123 [14]
	Isopropyl nitrite.....	12. [b]	19	.....	.....	14
$C_3H_7NO_3$	Propyl nitrate.....	$13._9$ [b]	18	.....	.....	14
C_3H_8	Propane.....	1.61	0	0.20	−90,15	172
C_3H_8O	1-Propanol.....	20.1	25	0.293(α)	20,90	112,222,279 [41,51,157,177]
		38. 29.	−80 −34	.....	.....	9
	2-Propanol.....	18.3	25	0.310(α)	20,70	112,222 [157]

[a] $f = 4 \times 10^8$ cycles/sec.
[b] $f = 3.6 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t°C	a (or α) $\times 10^2$	Range t_1-t_2	References
$C_3H_8O_2$	1,2-Propanediol	$32._0$	20	0.27(α)	at 20	232 [142]
	1,3-Propanediol	$35._0$	20	0.23(α)	at 20	232
	2-Methoxyethanol	$16._0$	30	.....	.....	261 [115]
	Dimethoxymethane (Methylal)	2.7[a]	20	.....	.....	17
$C_3H_8O_3$	Glycerol	42.5	25	0.208(α)	0,100	40,112,185 [38,103,142,177]
$C_3H_9BO_3$	Trimethylborate	8.0[a]	20	.....	.....	17
C_3H_9N	Isopropylamine	5.5[b]	20	.....	.....	14
	Trimethylamine	2.44	25	0.52	0,25	268 [14]
	C_4					
C_4Cl_6	Hexachloro-1,3-butadiene	2.55	25	.....	.....	279
$C_4H_2O_3$	Maleic anhydride	50.[a]	60	.....	.....	17
$C_4H_4N_2$	Succinonitrile	56.5 53.6 52.3	57.4 67.7 78.2	.....	.....	199 [14,17]
	Pyrazine	2.80	50	.....	.....	153
C_4H_4O	Furan	2.95	25	.....	.....	121
C_4H_4S	Thiophene	2.76	16	.....	.....	12,283 [18]
$C_4H_5Cl_3O$	α,α,α-Trichlorobutyraldehyde (Butyl chloral)	$10._0$[n]	18	.....	.....	27
$C_4H_5Cl_3O_2$	Ethyl trichloroacetate	7.8	20	2.8	2,60	26
C_4H_5N	Crotononitrile[q] (bp 108°C)	$36._1$	ca 20	.....	.....	48
	Crotononitrile[q] (bp 122°C)	$28._1$	ca 20	.....	.....	48
	Pyrrole	7.48	18	.....	.....	171
$C_4H_5NO_2$	Methyl cyanoacetate	$28._8$[a]	20	.....	.....	17
C_4H_5NS	Allyl isothiocyanate	$17._2$[b]	18	.....	.....	18,22
$C_4H_6Cl_2O_2$	Ethyl dichloroacetate	$11._6$ $10._3$	2 22	.....	.....	26
C_4H_6O	Vinyl ether	3.94	20	.....	.....	121
	Ethoxyacetylene	8.05	25	.....	.....	257
$C_4H_6O_3$	Acetic anhydride	$22._4$ $20._7$	1 19	.....	.....	26 [17,27,166]

[a] $f = 4 \times 10^8$ cycles/sec.
[b] $f = 3.6 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.
[q] *cis-trans* isomers.

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C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
C_4H_7Br	1-Bromo-1-butene[q] (bp 95°C)..	5.8_9	ca 20	.....	.....	48
	1-Bromo-1-butene[q] (bp 86°C)..	5.0_5	ca 20	.....	.....	48
	2-Bromo-2-butene[r].....	6.7_6	ca 20	.....	.....	48
	2-Bromo-2-butene[s].....	5.3_8	ca 20	.....	.....	48
$C_4H_7BrO_2$	α-Bromobutyric acid.....	7.2^n	20	.....	.....	27
$C_4H_7ClO_2$	Propyl chloroformate.....	$11._2^n$	20	.....	.....	27
	Ethyl chloroacetate.....	$11._4^n$	21	.....	.....	27
C_4H_7N	Butyronitrile.....	$20._3^b$	21	.....	.....	13
	Isobutyronitrile.....	$20._4^b$	24	.....	.....	13
$C_4H_8Br_2$	*meso*-2,3-Dibromobutane.....	6.24_5	25	.....	.....	238 [184]
	dl-2,3-Dibromobutane.....	5.75_8	25	.....	.....	238 [184]
	1,2-Dibromo-2-methylpropane..	4.1^n	20	.....	.....	27
$C_4H_8Cl_2$	1,4-Dichlorobutane.....	8.90	25	3.07	1,55	272
	1,2-Dichloro-2-methylpropane	14.0 10.8 8.71 7.22	−100 −60 −20 20	.....	.....	247
$C_4H_8Cl_2O$	β,β′-Dichlorodiethylether...	21.2	20	.....	.....	156
$C_4H_8N_2O_6$	1,3-Butanediol dinitrate.....	$18._9$	20	.....	.....	244
	2,3-Butanediol dinitrate.....	$28._8$	20	.....	.....	244
C_4H_8O	2-Butanone.....	18.5_1	20	0.207(α)	−60,60	240 [41,84,123]
	Butyraldehyde.....	13.4 10.8	26 77	.....	.....	41
$C_4H_8O_2$	Butyric acid.....	2.97	20	−0.23	10,70	96,149 [2,7]
	Isobutyric acid.....	2.71 2.73	10 40	.....	.....	149 [2,7]
	Propyl formate.....	7.7_2^a	19	.....	.....	7 [1]
	Ethyl acetate.....	6.02 5.3_0	25 77	1.5	at 25	8,63,276 41
	Methyl propionate.....	5.5^n	19	.....	.....	27
	1,4-Dioxane.....	2.209	25	0.170	20,50	144,156,196,230,231, 240a,258,271,276
$C_4H_8O_3$	β-Hydroxyethyl acetate (Glycol monoacetate)	$13._0$	30	.....	.....	261

[a] $f = 4 \times 10^8$ cycles/sec.
[b] $f = 3.6 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.

[q] *cis-trans* isomers.
[r] Br and CH_3 *trans*.
[s] Br and CH_3 *cis*.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
C_4H_9Br	1-Bromobutane.....	7.07	20	0.150(α)	10,90	97,243,272
		11.1	−90			
		9.26	−50			
		7.88	−10			
	1-Bromo-2-methylpropane.....	7.18	25	2.8	1,55	272
	2-Bromobutane.....	8.64	25	3.30	1,55	272
	2-Bromo-2-methylpropane.....	10.1_5	25	5.20	−15,55	213,243,272
C_4H_9Cl	1-Chlorobutane.....	7.39	20	0.173(α)	−10,70	97,242
		12.2	−90			
		9.94	−50			
		9.07	−30			
	1-Chloro-2-methylpropane.....	12.2	−120	.....	.....	247
		10.1	−89			
		7.87	−38			
		6.49	14			
	2-Chloro-2-methylpropane.....	10.9_5	0	0.255(α)	−23,30	109,213
C_4H_9I	1-Iodobutane.....	6.22	20	0.135(α)	0,80	41,97,242
		8.89	−80			
		7.53	−40			
		4.52	130			
	1-Iodo-2-methylpropane.....	6.47	20	.....	.....	242
	2-Iodobutane.....	7.87	20	.....	.....	242
	2-Iodo-2-methylpropane.....	8.42	20	.....	.....	242
		10.5	−33	.....	.....	213
C_4H_9NO	2-Butanone oxime.....	3.4[n]	20	.....	.....	27
	Morpholine.....	7.33	25	.....	.....	225
$C_4H_9NO_3$	Butyl nitrate.....	$13._1$	20	.....	.....	244
	Isobutyl nitrate.....	$11._7$[b]	19	.....	.....	14
$C_4H_{10}Hg$	Diethyl mercury.....	2.3	23	.....	.....	17,22
$C_4H_{10}O$	1-Butanol.....	17.8	20	0.300(α)	−40,20	81,222,278
		17.1	25	0.335(α)	25,70	279
		8.2	118	.....	.....	41
	2-Methyl-1-propanol.....	17.7	25	0.377(α)	20,90	12,85,103,112,222
		34.	−80	.....	.....	9
		26.	−34			
	2-Butanol.....	15.8	25	.....	.....	222

[b] $f = 3.6 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^6$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_4H_{10}O$—Con.						
	2-Methyl-2-propanol.....	10.9	30	.....	.....	109 [43,112,142, 157,261]
		8.49	50			
		6.89	70			
	Ethyl ether.....	4.335	20	2.0	at 20	12,35,62,96,251
		4.34[x]	20	0.217(α)	−40,30	207 [36,80,143,187]
		10.4	−116	.....	.....	180
		3.97	40	0.170(α)	40,140	16 [15,19,79]
		2.1_2	180			
		1.8_9	190			
		1.5_3	193.3[h]			
$C_4H_{10}O_2$	1,4-Butanediol.....	$32._9$	15	.....	.....	236
		$30._2$	30			
$C_4H_{10}O_2$	1,1-Dimethoxyethane.....	3.49	20	.....	.....	298
$C_4H_{10}O_3S$	Ethyl sulfite.....	$17._5$	1	.....	.....	26
		$15._9$	20			
		$13._7$	50			
$C_4H_{10}O_4$	Erythritol (1,2,3,4-Butanetetrol)	$28._2$	120	.....	.....	131,142
$C_4H_{10}O_4S$	Ethyl sulfate.....	$29._2$	20	0.24(α)	−25,20	122
$C_4H_{10}S$	1-Butanethiol.....	4.95	25	.....	.....	140
		4.59	50			
	Ethyl sulfide.....	5.72	25	.....	.....	140
		5.24	50			
$C_4H_{10}Zn$	Diethyl zinc.....	2.5_5	20	.....	.....	132
$C_4H_{11}N$	Butylamine.....	5.3[b]	21	.....	.....	14
	Isobutylamine.....	4.4[b]	21	.....	.....	14
	Diethylamine.....	3.6[b]	22	.....	.....	14,22
$C_4H_{12}O_4Si$	Tetramethyl silicate.....	6.0[b]	ca 20	.....	.....	22
	C_5					
C_5FeO_5	Iron pentacarbonyl.....	2.60	20	.....	.....	114
$C_5H_4O_2$	Furfural.....	$46._9$	1	.....	.....	26 [7]
		$41._9$	20			
		$34._9$	50			
C_5H_5N	Pyridine.....	12.3	25	.....	.....	51,53,159 [166]
		9.4	116	.....	.....	41
$C_5H_7NO_2$	Ethyl cyanoacetate.....	$26._9$	20	.....	.....	7,17,26
	α-Cyanoethyl acetate.....	$18._9$[a]	20	.....	.....	17

[a] $f = 4 \times 10^8$ cycles/sec.
[b] $f = 3.6 \times 10^8$ cycles/sec.
[h] Critical temperature.
[x] Value chosen to conform with the remainder of the tabulated data for this substance.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
C_5H_8	1,3-Pentadiene[t]	2.32	25	.....	.....	104,130
	2-Methyl-1,3-butadiene (Isoprene)	2.10	25	0.24	−75,25	129
C_5H_8O	Cyclopentanone	$16._3$	−51	.....	.....	237
$C_5H_8O_2$	2,4-Pentanedione (Acetylacetone)	$25._7$[a]	20	.....	.....	7,17,18
$C_5H_8O_4$	Dimethyl malonate	$10._3$[a]	20	.....	.....	17 [27]
$C_5H_9BrO_2$	α-Bromoisovaleric acid	6.5[n]	20	.....	.....	27
	Ethyl α-bromopropionate	$10._0$	2	.....	.....	26 [27]
		$9._3$	22			
$C_5H_9ClO_2$	Isobutyl chloroformate	9.1[n]	20	.....	.....	27
	Ethyl α-chloropropionate	$10._1$[n]	20	.....	.....	27
$C_5H_9IO_2$	Ethyl β-iodopropionate	8.6[n]	20	.....	.....	27
C_5H_9N	Valeronitrile	$17._4$[b]	21	.....	.....	13
	Isovaleronitrile	$18._0$[b]	22	.....	.....	13
C_5H_{10}	1-Pentene	2.100	20	.....	.....	248 [151]
	2-Methyl-1-butene	2.197	20	.....	.....	248
	Cyclopentane	1.965	20	.....	.....	248
	Ethylcyclopropane	1.933	20	.....	.....	248
$C_5H_{10}Br_2$	1,2-Dibromopentane	4.39	25	.....	.....	150
	dl-erythro-2,3-Dibromopentane	5.43_0	25	.....	.....	238 [150]
	dl-threo-2,3-Dibromopentane	6.50_7	25	.....	.....	238
$C_5H_{10}O$	Cyclopentanol	$18._0$	20	0.38(α)	at 20	232
		$25._5$	−20	.....	.....	237
	2-Pentanone	15.4_5	20	0.195(α)	−40,80	240 [7,84]
		22.0	−60			
	3-Pentanone	17.0_0	20	0.225(α)	0,80	240 [7,84]
		19.4	−20			
		19.8	−40			
	Valeraldehyde	$10._1$[a]	17	.....	.....	7 [4]
$C_5H_{10}O_2$	Valeric acid	2.6_6	20	.....	.....	2,7,27
	Isovaleric acid	2.6_4	20	.....	.....	7

[a] $f = 4 \times 10^8$ cycles/sec.
[b] $f = 3.6 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.
[t] Mixture of *cis-trans* isomers.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t°C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_5H_{10}O_2$—Con.						
	Isobutyl formate.....	6.4_1[a]	19	.....	.....	7 [1]
	Propyl acetate.....	5.69	19	0.8	at 19	7,8 [27]
	Ethyl propionate.....	5.65	19	1.8	at 19	7,8
	Methyl butyrate.....	5.6[n]	20	.....	.....	27
$C_5H_{10}O_3$	Diethyl carbonate.....	2.82	20	.....	.....	298 [7,22]
$C_5H_{11}Br$	1-Bromopentane.....	6.32 9.90	25 −90	0.152(α)	−45,55	211,272
	1-Bromo-3-methylbutane.....	6.05 10.2 8.04	20 −107 −56	2.3	−18,23	212
		4.70	120.6	.....	.....	41
	2-Bromo-2-methylbutane.....	9.1[n]	19	.....	.....	27
$C_5H_{11}Cl$	1-Chloropentane.....	6.6	11	.....	.....	2
	1-Chloro-3-methylbutane.....	6.05 10.0 8.63	20 −100 −70	0.160(α)	−40,23	247
	2-Chloro-2-methylbutane.....	12.3	−50	0.32(α)	−77, −50	247
		9.3	16	.....	.....	2 [27]
$C_5H_{11}F$	1-Fluoropentane.....	4.24	20	.....	.....	243
	2-Fluoro-2-methylbutane.....	5.89	20	.....	.....	243
$C_5H_{11}I$	1-Iodopentane.....	5.81	20	.....	.....	242
	1-Iodo-3-methylbutane.....	5.6[n]	19	.....	.....	27
	3-Iodopentane.....	7.43	20	.....	.....	242
	2-Iodo-2-methylbutane.....	8.19	20	.....	.....	242
$C_5H_{11}N$	Piperidine.....	5.8[b]	22	.....	.....	14
$C_5H_{11}NO$	2-Pentanone oxime.....	3.3[n]	20	.....	.....	27
$C_5H_{11}NO_3$	Amyl nitrate..... (bp 140-145°C)	9.0[n]	18	.....	.....	22
C_5H_{12}	n-Pentane.....	1.844 2.011 1.984	20 −90 −70	0.160	−50,30	88
	2-Methylbutane.....	1.843	20	.....	.....	196

[a] $f = 4 \times 10^8$ cycles/sec.
[b] $f = 3.6 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t°C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_5H_{12}O$	1-Pentanol.....	13.9	25	0.23(α)	15,35	142,177,222 [9]
	3-Methyl-1-butanol.....	14.7	25	.....	.....	41,51,63,276
		5.8_2	132			
	2-Methyl-2-butanol.....	5.82	25	.....	.....	51,85,276 [261]
$C_5H_{12}O_5$	Xylitol.....	40.	20	.....	.....	131,142
$C_5H_{12}S$	1-Pentanethiol.....	4.55	25	.....	.....	140 [14,18]
		4.23	50			
$C_5H_{12}S_4$	Tetramethylthiomethane..... [$C(SCH_3)_4$]	2.82	70	.....	.....	250
$C_5H_{13}N$	Amylamine (bp 95°C).....	4.5[b]	22	.....	.....	14
	C_6					
C_6H_4BrCl	1-Bromo-2-chlorobenzene.....	6.8_0	20	.....	.....	83
	1-Bromo-3-chlorobenzene.....	4.5_8	20	.....	.....	83
$C_6H_4Br_2$	*o*-Dibromobenzene.....	7.35	20	.....	.....	55,83
	m-Dibromobenzene.....	4.80	20	.....	.....	55,83
	p-Dibromobenzene.....	2.5_7	95	.....	.....	55
$C_6H_4ClNO_2$	1-Chloro-2-nitrobenzene.....	$37._7$	50	.....	.....	176 [32]
		$31._8$	80			
		$27._3$	110			
		$23._7$	140			
		$21._6$	163			
	1-Chloro-3-nitrobenzene.....	$20._9$	50	.....	.....	176 [260]
		$18._1$	80			
		$15._9$	110			
		$14._1$	140			
		$13._0$	160			
	1-Chloro-4-nitrobenzene.....	8.0_9	120	0.16(α)	85,160	176 [32]
$C_6H_4Cl_2$	*o*-Dichlorobenzene.....	9.93	25	0.194(α)	0,50	69 [53,55,61,179]
	m-Dichlorobenzene.....	5.04	25	0.120(α)	0,50	69 [55,61]
	p-Dichlorobenzene.....	2.41	50	0.18	50,80	55,94 [61]
$C_6H_4I_2$	*o*-Diiodobenzene.....	5.7	20	.....	.....	55
	m-Diiodobenzene.....	4.2_5	25	.....	.....	55
	p-Diiodobenzene.....	2.8_8	120	.....	.....	55
C_6H_5Br	Bromobenzene.....	5.40	25	0.115(α)	0,70	60,61,86,194,272

[b] $f = 3.6 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
C_6H_5Cl	Chlorobenzene.....	5.708	20	.....	.....	60,138,170,251
		5.621	25			
		5.71	20	0.130(α)	0,80	41,69,70,86,123,133
		7.28	−50			187,194,207
		6.30	−20			
		4.21	130			
C_6H_5ClO	*o*-Chlorophenol.....	6.31	25	2.7	25,58	57,61,261
	p-Chlorophenol.....	9.47	55	3.7	55,65	61,261
C_6H_5F	Fluorobenzene.....	5.42	25	.....	.....	153,255a 83
		4.76	60			
C_6H_5I	Iodobenzene.....	4.63	20	.....	.....	243,83
$C_6H_5NO_2$	Nitrobenzene.....	34.82	25	0.225(α)	10,80	85,138 [12,38,41, 78,141,194,251]
		20.8	130	0.164(α)	130,211	207
		24.9	90			
		22.7	110			
$C_6H_5NO_3$	*o*-Nitrophenol.....	$17._3$	50	6.4	50,60	261
C_6H_6	Benzene.....	2.284	20	0.200	10,60	12,77,138,190,250a, 263,273,283a,292
		2.073	129	.....	.....	16
		1.966	182			
C_6H_6BrN	*m*-Bromoaniline.....	$13._0$[n]	19	.....	.....	27
C_6H_6ClN	*m*-Chloroaniline.....	$13._4$[n]	19	.....	.....	27
$C_6H_6Cl_6$	α-Hexachlorocyclohexane..... (mp 156°C)	4.7_7	156	.....	.....	237
$C_6H_6N_2O_2$	*o*-Nitroaniline.....	$34._5$	90	3.	90,110	260
	p-Nitroaniline.....	$56._3$	160	6.	160,180	260
C_6H_6O	Phenol.....	9.78	60	0.32(α)	40,70	61,123,145, 194
C_6H_7N	Aniline.....	6.89	20	0.148(α)	0,50	6,66,122,159,171,251
		5.93	70	.....	.....	194
		4.54	184.6	.....	.....	41 [38]
	2-Methylpyridine (α-Picoline)	9.8[b]	20	.....	.....	14
C_6H_8	1,3-Cyclohexadiene.....	2.6_6	−89	.....	.....	237

[b] $f = 3.6 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.

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C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t°C	a (or α) x10^2	Range t_1, t_2	References
$C_6H_8N_2$	Phenylhydrazine.....	7.2	23	.....	.....	12 [22,27]
	2,5-Dimethylpyrazine.....	2.43_6	20	0.13	20,50	153
	2,6-Dimethylpyrazine.....	2.65_3	35	0.30	35,65	153
$C_6H_8O_2$	1,4-Cyclohexadione.....	4.4_0	78	.....	.....	237
$C_6H_9Cl_2O$	*cis*-Ethyl β-chlorocrotonate..	7.6_7	18	.....	.....	49
	trans-Ethyl β-chlorocrotonate	4.7_0	18	.....	.....	49
C_6H_{10}	Cyclohexene.....	2.220	25	.....	.....	271
		2.6_0	−105	.....	.....	237
	2,4-Hexadiene[t].....	2.22	25	.....	.....	130
	2-Methyl-1,3-pentadiene[t].....	2.42	25	.....	.....	104,130
	3-Methyl-1,3-pentadiene[t].....	2.43	25	.....	.....	104,130
	4-Methyl-1,3-pentadiene[u].....	3.16 2.84 2.60 2.49	−75 −25 25 50	.....	.....	129,130
	2,3-Dimethyl-1,3-butadiene...	2.10	25	0.17	−50,50	129,130
$C_6H_{10}O$	Cyclohexanone.....	18.3 $19._9$	20 −40	....	....	35,98 237
	4-Methyl-3-penten-2-one..... (Mesityl oxide)	$15._6$	0	.....	.....	232
		$15._1$[a]	20	.....	.....	17
	Butoxyacetylene.....	6.62	25	.....	.....	257
$C_6H_{10}O_2$	Ethyl crotonate.....	5.4[n]	20	.....	.....	27
$C_6H_{10}O_3$	Propionic anhydride.....	$18._3$[n]	16	.....	.....	27
	Ethyl acetoacetate.....	$15._7$[a]	22	.....	.....	7
$C_6H_{10}O_4$	Diethyl oxalate.....	8.1[a]	21	.....	.....	7
	Dimethyl succinate.....	5.1	20	.....	.....	32
$C_6H_{11}Br$	Bromocyclohexane.....	7.92	25	0.140(α)	1,55	272 [98]
		$11._0$	−65	.....	.....	237
$C_6H_{11}BrO_2$	*dl*-threo-2-Acetoxy-3-..... bromobutane	7.41_4	25	.....	.....	238
	dl-erythro-2-Acetoxy-..... 3-bromobutane	7.26_8	25	.....	.....	238

[a] $f = 4 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.
[t] Mixture of *cis-trans* isomers.
[u] Some polymerization at the higher temperatures.

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C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t°C	a (or α) x10^2	Range t_1, t_2	References
$C_6H_{11}BrO_2$—Con.						
	Ethyl α-bromobutyrate.....	8.0^n	20	.....	.....	27
	Ethyl α-bromoisobutyrate.....	7.9^n	20	.....	.....	27
$C_6H_{11}Cl$	Chlorocyclohexane.....	7.6	25	.....	.....	98
		$10._9$	−47	.....	.....	237
$C_6H_{11}ClO_2$	Isoamyl chloroformate.....	7.8^n	20	.....	.....	27
$C_6H_{11}N$	Isocapronitrile.....	$15._5{}^b$	22	.....	.....	13
$C_6H_{11}NO$	Cyclohexanone oxime.....	3.0_4	89	.....	.....	237
$C_6H_{11}NS$	Amyl thiocyanate..... (bp 195°C)	$17._1{}^b$	19.5	.....	.....	18
C_6H_{12}	Cyclohexane.....	2.023	20	0.160	10,60	81,146,188,190,196, 259,292
	Methylcyclopentane.....	1.985	20	.....	.....	248
	Ethylcyclobutane.....	1.965	20	.....	.....	248
	cis-3-Hexene.....	2.062	25	.....	.....	239
	trans-3-Hexene.....	2.000	25	.....	.....	239
$C_6H_{12}Br_2$	*dl*-3,4-Dibromohexane.....	6.73_2	25	.....	.....	238
	meso-3,4-Dibromohexane.....	4.67^v	25	.....	.....	238
$C_6H_{12}O$	Cyclohexanol.....	15.0 7.2_4 4.8_8	25 100 150	0.437(α)	20,66	35,98,207 [84,261]
	1-Methyl-1-cyclopentanol.....	6.9_7	34.6	.....	.....	237
	2-Hexanone.....	14.6	14.5	.....	.....	84
	4-Methyl-2-pentanone.....	13.1_1 18.8	20 −60	0.210(α)	−20,100	240
	3,3-Dimethyl-2-butanone..... (Pinacolin)	13.1	14.5	.....	.....	84 [7,18]
$C_6H_{12}O_2$	Caproic acid.....	2.63	71	.....	.....	192 [27]
	Amyl formate.....	6.4_9	25	.....	.....	160 [7]
	Butyl acetate.....	5.01 6.8_5	20 −73	1.4	20,40	7,8,10,37,260
	Isobutyl acetate.....	5.29	20	1.6	at 20	7,8,10,57
	Propyl propionate.....	4.7^n	20	.....	.....	27
	Ethyl butyrate.....	5.10	18	1.0	at 20	7,8

[b] $f = 3.6 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.
[v] Extrapolated from mixtures containing both isomers.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t°C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_6H_{12}O_2$—Con.						
	Methyl valerate.....	4.3^n	19	.....	.....	27
	4-Hydroxy-4-methyl-2-..... pentanone (Diacetone alcohol)	$18._2$	25	.....	.....	115
$C_6H_{12}O_3$	β-Ethoxyethyl acetate..... ("Cellosolve" acetate)	7.57	30	3.1	30,50	260
	Paraldehyde.....	13.9 6.29	25 128	.....	.....	41 [17,26]
$C_6H_{13}Br$	1-Bromohexane.....	5.82 6.30	25 1	1.73	25,55	272
$C_6H_{13}I$	1-Iodohexane.....	5.37	20	.....	.....	242
$C_6H_{13}N$	Cyclohexylamine.....	5.3_7	−21	.....	.....	237
C_6H_{14}	n-Hexane.....	1.890 2.044 1.990	20 −90 −50	0.155	−10,50	88 [35,116,207]
$C_6H_{14}O$	1-Hexanol.....	13.3 8.5_5	25 75	0.35(α)	15,35	103,177
	Propyl ether.....	3.3_9	26	.....	.....	107
	Isopropyl ether.....	3.88	25	1.8	0,25	156,206 [107,198]
$C_6H_{14}O_2$	2-Methyl-2,4-pentanediol.....	24.4	30	14.5	30,35	295 [232]
	1,1-Diethoxyethane.....	3.80	25	.....	.....	85,102 [7,26,298]
$C_6H_{14}O_6$	Sorbitol.....	$33._5$	80	.....	.....	131,142
	Mannitol.....	$24._6$	170	.....	.....	131,142
$C_6H_{15}Al$	Triethyl aluminum.....	2.9	20	.....	.....	91
$C_6H_{15}N$	Dipropylamine.....	2.9^b	21	.....	.....	14,22
	Triethylamine.....	2.42	25	.....	.....	206 [26]
$C_6H_{18}OSi_2$	$(CH_3)_3Si\,[OSi(CH_3)_2]_nCH_3$					
$n = 1$	Hexamethyldisiloxane.....	2.17	20	.....	.....	266
$n = 2$	Octamethyltrisiloxane.....	2.30	20	.....	.....	266
$n = 3$	Decamethyltetrasiloxane.....	2.39	20	.....	.....	266
$n = 4$	Dodecamethylpentasiloxane....	2.46	20	.....	.....	266
$n = 5$	Tetradecamethylhexasiloxane..	2.50	20	.....	.....	266
$n = 66^*$		2.72	20	.....	.....	266

[b] $f = 3.6 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.
* Silicone oil of average molecular weight corresponding to this formula.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
	C_7					
C_7H_5ClO	Benzoyl chloride.....	29. 23.	0 20	.....	.....	43 [22]
$C_7H_5Cl_3$	α,α,α-Trichlorotoluene.....	6.9[n]	21	.....	.....	22,27
$C_7H_5F_3$	α,α,α-Trifluorotoluene.....	9.18 8.09	30 60	.....	.....	255a
C_7H_5N	Benzonitrile.....	25.20 24.02 22.10	25 40 70	0.157(α)	0,25	85,138 [194]
C_7H_5NO	Phenyl isocyanate.....	8.8[b]	20	.....	.....	22 [18]
C_7H_5NS	Phenyl isothiocyanate.....	$10._4$[a]	20	.....	.....	17,22 [18]
$C_7H_6Cl_2$	α,α-Dichlorotoluene.....	6.9[n]	20	.....	.....	27
C_7H_6O	Benzaldehyde.....	$19._7$ $17._8$	0 20	.....	.....	26,56 [4,7,22]
$C_7H_6O_2$	Salicylaldehyde.....	$17._1$	30	7.	30,40	261 [4,7,17]
C_7H_7Br	*o*-Bromotoluene.....	4.28	58	.....	.....	61 [27]
	m-Bromotoluene.....	5.36	58	.....	.....	61 [27]
	p- Bromotoluene.....	5.49	58	.....	.....	61 [27,32]
C_7H_7BrO	*p* - Bromoanisole.....	7.06	30	1.6	30,40	260
C_7H_7Cl	*o* - Chlorotoluene.....	4.45 4.16	20 58	....	....	83 [27] 61
	m - Chlorotoluene.....	5.55 5.04	20 58	....	....	83 [27] 61
	p - Chlorotoluene.....	6.08 5.55	20 58	....	....	83 [27,32] 61
	α - Chlorotoluene.....	7.0	13	.....	.....	2 [27]
C_7H_7F	*o* - Fluorotoluene.....	4.22 3.88	30 60	.....	.....	255a
	m - Fluorotoluene.....	5.42 4.90	30 60	.....	.....	255a
	p - Fluorotoluene.....	5.86 5.34	30 60	.....	.....	255a
C_7H_7I	*p* - Iodotoluene.....	4.4	35	.....	.....	32
C_7H_7NO	Benzaldehyde oxime (trans)...	3.8	20	.....	.....	8 [7,27]

[a] $f = 4 \times 10^8$ cycles/sec.
[b] $f = 3.6 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_7H_7NO_2$	*o*-Nitrotoluene.....	27.4	20	15.	at 20	12,85 [50]
		$21._6$	58	.....	.....	61
		11.8	222	.....	.....	41
	m-Nitrotoluene.....	$23._8$	20	.....	.....	53 [27]
		$21._9$	58	.....	.....	61
	p-Nitrotoluene.....	$22._2$	58	.....	.....	61 [32]
$C_7H_7NO_3$	*m*-Nitrobenzyl alcohol.....	$22.^n$	20	.....	.....	27
C_7H_8	Toluene.....	2.438	0	0.0455(α)	-90,0	16,60,188,196,223,
		2.379	25	0.243	0,90	229 [36,80,207]
		2.15_7	127			
		2.04_2	181			
C_7H_8O	Benzyl alcohol.....	13.1	20	.....	.....	26,56 [8,256]
		9.47	70	.....	.....	194
		6.6	132	.....	.....	117
	o-Cresol.....	11.5	25	11.	25,30	261 [61]
	m-Cresol.....	11.8	25	0.41(α)	15,50	56,145,261 [43,61]
	p-Cresol.....	9.9_1	58	.....	.....	61
	Methoxybenzene..... (Anisole)	4.33	25	1.1	20,40	66,144,260,277
		3.89	70	.....	.....	194
$C_7H_8O_2$	*o*-Methoxyphenol (Guaiacol)..	$11._7{}^n$	28	.....	.....	27
C_7H_9N	Benzylamine.....	5.5	1	.....	.....	26 [27]
		4.6	21			
		4.3	50			
	o-Toluidine.....	6.34	18	.....	.....	171 [14,27,117]
		5.71	58	.....	.....	61
		4.00	200	.....	.....	41
	m-Toluidine.....	5.95	18	.....	.....	171 [14,27]
		5.45	58	.....	.....	61
	p-Toluidine.....	4.98	54	.....	.....	61,145 32
	N-Methylaniline.....	5.97	22	.....	.....	159,171 14,26
$C_7H_{10}N_2$	1-Methyl-1-phenylhydrazine...	7.3^n	19	.....	.....	27

[n] $f = 5 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_7H_{11}F_3$	Cyclohexyltrifluoromethane...	$11._9$	−85	.....	.....	237
$C_7H_{12}O$	2-Methylcyclohexanone.....	$16._4$	−15	.....	.....	237
		$14._0$	20	.....	.....	232
	3-Methylcyclohexanone.....	$18._2$	−89	.....	.....	237
		$12._4$	20	.....	.....	232
	4-Methylcyclohexanone.....	$15._7$	−41	.....	.....	237
		$12._4$	20	.....	.....	232
$C_7H_{12}O_2$	Cyclohexanecarboxylic acid...	2.6_7	31	.....	.....	237
$C_7H_{12}O_3$	Ethyl levulinate.....	$11._9$[a]	21	.....	.....	7
$C_7H_{12}O_4$	Diethyl malonate.....	8.03	25	3.	25,30	260,276 [7,27]
$C_7H_{13}ClO_2$	Isoamyl chloroacetate.....	7.8[n]	20	.....	.....	27
C_7H_{14}	Methylcyclohexane.....	2.020	20	.....	.....	196 [107]
		2.26	−129	.....	.....	237
	1-Heptene.....	2.05	20	.....	.....	151
	2-Methyl-2-hexene.....	2.9_6	20	.....	.....	283
$C_7H_{14}Br_2$	1,2-Dibromoheptane.....	3.77	25	.....	.....	150
	2,3-Dibromoheptane.....	5.08	25	.....	.....	150
	3,4-Dibromoheptane.....	4.70	25	.....	.....	150
$C_7H_{14}O$	Cyclohexanemethanol.....	9.7_0 8.0_5	60 80	.....	.....	256
	2-Methylcyclohexanol.....	$13._3$	20	0.56(α)	at 20	232 [261]
	3-Methylcyclohexanol.....	$12._3$	20	0.43(α)	at 20	232 [261]
	4-Methylcyclohexanol.....	$13._3$	20	0.41(α)	at 20	232 [261]
	Heptaldehyde.....	9.07	22	.....	.....	90
	2-Heptanone.....	11.9_5 14.3 7.10	20 −20 140	0.200(α)	0,100	240 [90]
	3-Heptanone.....	12.9	22	.....	.....	90
	4-Heptanone.....	12.5_8 15.1 8.00	20 −20 120	0.205(α)	0,100	90,240 [7,84]

[a] $f = 4 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_7H_{14}O_2$	Heptanoic acid.....	2.59	71	.....	.....	192
	Amyl acetate.....	4.75	20	1.2	at 20	7,8,10,57, 160
	Isoamyl acetate.....	4.63	30	1.3	30,40	260,276
	Propyl butyrate.....	4.3[n]	20	.....	.....	27
	Ethyl valerate.....	4.71	18	0.9	at 18	7,8 [27]
$C_7H_{15}Br$	1-Bromoheptane.....	5.33 4.48	25 90	1.40	25,70	90,97,272
		5.96 5.58	−10 10	0.155(α)	−70,−10	97,286
	2-Bromoheptane.....	6.46	22	.....	.....	90
	3-Bromoheptane.....	6.93	22	.....	.....	90
	4-Bromoheptane.....	6.81	22	.....	.....	90
$C_7H_{15}BrO$	1-Bromo-2-ethoxypentane.....	6.45	25	.....	.....	150
	2-Bromo-3-ethoxypentane.....	6.40	25	.....	.....	150
	3-Bromo-2-ethoxypentane.....	8.24	25	.....	.....	150
$C_7H_{15}Cl$	1-Chloroheptane.....	5.48	22	.....	.....	90
	2-Chloroheptane.....	6.52	22	.....	.....	90
	3-Chloroheptane.....	6.70	22	.....	.....	90
	4-Chloroheptane.....	6.54	22	.....	.....	90
$C_7H_{15}I$	1-Iodoheptane.....	4.92	22	.....	.....	90,242
	3-Iodoheptane.....	6.39	22	.....	.....	90
C_7H_{16}	Heptane.....	1.924 2.074 1.850	20 −90 70	0.140	−50,50	71,88,292
	2-Methylhexane.....	1.919	20	0.14	at 20	71
	3-Methylhexane.....	1.927	20	0.14	at 20	71
	3-Ethylpentane.....	1.939	20	0.146	−120,80	71
	2,2-Dimethylpentane.....	1.912	20	0.146	−120,80	71
	2,3-Dimethylpentane.....	1.939	20	0.15	at 20	71
	2,4-Dimethylpentane.....	1.914	20	0.15	at 20	71
	3,3-Dimethylpentane.....	1.937	20	0.15	at 20	71
	2,2,3-Trimethylbutane.....	1.927	20	0.13	at 20	71

[n] $f = 5 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_7H_{16}O$	1-Heptanol	12.1_0	22	.....	.....	90
	2-Heptanol	9.21	22	.....	.....	90
	3-Heptanol	6.86	22	.....	.....	90
	4-Heptanol	6.17	22	.....	.....	90
	Ethoxypentane	3.6	23	.....	.....	29 [27]
	1-Ethoxy-3-methylbutane	3.96	20	1.3	20,50	66
$C_7H_{16}O_7$	Glucoheptitol	$27._4$	120	.....	.....	131,142
	C_8					
$C_8H_2Cl_2F_6$	4,5-Dichloro-1,3-bis-(trifluoromethyl)-benzene	3.1_2 2.9_4	30 60	.....	.....	255a
$C_8H_3ClF_6$	2-Chloro-1,3-bis-(trifluoromethyl)-benzene	3.2_0 3.0_0	30 60	.....	.....	255a
	4-Chloro-1,3-bis-(trifluoromethyl)-benzene	5.44 4.96	30 60	.....	.....	255a
$C_8H_4F_6$	1,3-bis-(trifluoromethyl)-benzene	5.98 5.37	30 60	.....	.....	255a
C_8H_6	Ethynylbenzene (Phenylacetylene)	2.98	25	.....	.....	257
$C_8H_6Cl_2$	2,5-Dichlorostyrene	2.58	25	.....	.....	279
C_8H_6O	Phenoxyacetylene	4.76	25	.....	.....	257
$C_8H_6O_2$	Phthalide	36.[a]	75	.....	.....	7
$C_8H_7Cl_3$	β-Chloroethyl-2,5-di-chlorobenzene	5.2_0	24	.....	.....	279
C_8H_7N	o-Tolunitrile	$18._5$[b]	23	.....	.....	13
	Phenylacetonitrile	$18._7$ 8.5	27 234	.....	.....	41 [7,13,17,26]
C_8H_7NO	Mandelonitrile	$17._8$[b]	23	.....	.....	14 [39]
$C_8H_7NO_4$	Methyl o-nitrobenzoate	$27._8$	27	.....	.....	107
C_8H_8	Styrene (Phenylethylene)	2.43 2.32	25 75	.....	.....	162,196,279
C_8H_8O	Phenylacetaldehyde	4.8[a]	20	.....	.....	7
	Acetophenone	17.39	25	4.	at 25	138,260 [12,26,117]
		8.64	202	.....	.....	41

[a] $f = 4 \times 10^8$ cycles/sec.
[b] $f = 3.6 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_8H_8O_2$	Phenyl acetate.....	5.23	20	0.7	at 20	7,8,10,57
	Methyl benzoate.....	6.59	20	0.14(α)	20,50	7,8,56,66,260
	p-Methoxybenzaldehyde..... (Anisaldehyde)	$22._3$ 10.4	22 248	.....	.....	41 [17]
$C_8H_8O_3$	Methyl salicylate.....	9.41	30	3.1	30,40	261,276
C_8H_{10}	Ethylbenzene.....	2.412	20	.....	.....	3,248 [35]
	o-Xylene.....	2.568	20	0.266	−20,130	3,107,116,196
	m-Xylene.....	2.374	20	0.195	−40,180	3,12,16,35,107,116, 207,229
	p-Xylene.....	2.270	20	0.160	20,130	62,107,116,128,196, 248,271
$C_8H_{10}O$	1-Phenylethanol.....	8.9_0	20	0.22(α)	20,90	256
	2-Phenylethanol.....	$13._0$ 9.0_4 7.6_3	20 60 90	.....	.....	256
	Ethoxybenzene (Phenetole)	4.22	20	0.90	20,50	66,260 [56]
	o-Methoxytoluene.....	3.5_7	20	.....	.....	23 [22,27]
	m-Methoxytoluene.....	4.0_8	20	.....	.....	23 [27]
	p-Methoxytoluene.....	4.0_3	20	.....	.....	23 [27]
	3,4-Dimethyl-1-hydroxy-benzene	4.8^n	17	.....	.....	27
$C_8H_{10}O_2$	2-Methoxy-4-methylphenol (Creosol)	11.	16	.....	.....	4,8
	o-Dimethoxybenzene (Veratrole)	4.5	23	.....	.....	32
$C_8H_{11}N$	Methylbenzylamine.....	4.4^n	19	.....	.....	27
	N-Ethylaniline.....	5.76	20	2.	0,20	26,53 [27]
	N,N-Dimethylaniline.....	4.91 4.42	20 70	2.	at 20	26,56,159,171,178, 194
	2,4-Dimethylaniline.....	4.9^n	20	.....	.....	14,22,27
$C_8H_{12}O_4$	Ethyl fumarate.....	6.5_6	23	.....	.....	186 [167]
	Ethyl maleate.....	8.5_8	23	.....	.....	186 [167]

[n] $f = 5 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_8H_{14}O_3$	Butyric anhydride.....	$12._9{}^n$	20	.....	.....	27
	Isobutyric anhydride.....	$13._6{}^a$	20	.....	.....	17 [27]
$C_8H_{14}O_4$	Diethyl succinate.....	6.64	30	1.0	30,40	260
	meso-2,3-Diacetoxybutane.....	6.64_4	25	.....	.....	238
	dl-2,3-Diacetoxybutane.....	5.10^v	25	.....	.....	238
C_8H_{16}	*cis*-3-Octene.....	2.062	25	.....	.....	239
	trans-3-Octene.....	2.002	25	.....	.....	239
	cis-4-Octene.....	2.053	25	.....	.....	239
	trans-4-Octene.....	2.004	25	.....	.....	239
	3-Methyl-2-heptene.....	$2.4_4{}^t$	20	.....	.....	283
	2,5-Dimethyl-2-hexene.....	2.4_3	20	.....	.....	283
	3,5-Dimethyl-2-hexene.....	$2.6_5{}^t$	20	.....	.....	283
$C_8H_{16}O$	2-Octanone.....	10.3_9	20	0.215(α)	0,60	240 [7,84]
		12.5	−20			
		7.42	100			
		6.10	160			
$C_8H_{16}O_2$	Caprylic acid.....	2.4_5	20	.....	.....	181
		2.54	71	.....	.....	192
	Isoamyl propionate.....	4.2^n	20	.....	.....	27
	Isobutyl butyrate.....	4.1^n	20	.....	.....	27
	Propyl valerate.....	4.0^n	19	.....	.....	27
$C_8H_{17}Br$	1-Bromooctane.....	6.35	−50	1.9	−55, −39	286
		5.00	25	1.33	1,55	272
$C_8H_{17}Cl$	1-Chlorooctane.....	5.05	25	1.70	1,55	272
$C_8H_{17}I$	1-Iodooctane.....	4.62	25	1.17	1.55	242,272
	2-Iodooctane.....	5.77	20	.....	.....	242
C_8H_{18}	*n*-Octane.....	1.948	20	0.130	−50,50	88 [35]
		1.879	70			
		1.817	110			
	2,2,3-Trimethylpentane.....	1.96	20	.....	.....	35
	2,2,4-Trimethylpentane.....	1.940	20	0.142	−100,100	71

[a] $f = 4 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.
[t] Mixture of *cis-trans* isomers.
[v] Extrapolated from mixtures containing both isomers.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_8H_{18}O$	1-Octanol.....	10.3_4	20	0.410(α)	20,60	81,82
		13.3	−10			
		11.3	10			
	2-Octanol.....	12.0	−10	.....	.....	82,217
		8.20	20			
		6.52	40			
		5.61	56			
	3-Octanol.....	9.88	−20	.....	.....	82
		8.18	0			
		7.03	20			
		6.16	40			
		5.68	54			
	4-Octanol.....	8.97	−31	.....	.....	82
		7.76	−20			
		5.97	0			
		5.12	20			
		4.70	40			
		4.51	55			
	2-Methyl-1-heptanol.....	8.23	−20	.....	.....	82
		6.28	0			
		5.15	20			
		4.48	40			
		4.15	55			
	3-Methyl-1-heptanol.....	3.24	−32	.....	.....	82
		3.12	−20			
		2.98	0			
		2.87	20			
		2.79	40			
		2.75	55			
	4-Methyl-1-heptanol.....	6.40	−20	.....	.....	82
		5.30	0			
		4.53	20			
		4.02	40			
		3.73	59			
	5-Methyl-1-heptanol.....	7.47	20	0.430(α)	−20,43	82
		5.37	55			
	6-Methyl-1-heptanol.....	10.2_7	20	0.404(α)	17,55	82
		14.3	−20			
		12.2	0			
	2-Methyl-2-heptanol.....	3.46	25	−0.30	5,50	82
		3.49	−33			
		3.38	−13			
		3.38	−7			

C. ORGANIC LIQUIDS—Continued

Substance	ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_8H_{18}O$—Con.					
3-Methyl-1-heptanol.....	7.33	20	0.23(α)	−8,30	82
	10.8	−44			
	9.13	−20			
	6.22	55			
4-Methyl-2-heptanol.....	4.6	−18	.....	.....	82
	3.90	0			
	3.63	20			
	3.52	40			
	3.36	60			
5-Methyl-2-heptanol.....	8.6	−18	.....	.....	82
	7.5	5			
6-Methyl-2-heptanol.....	10.3	−20	.....	.....	82
	6.20	20			
	5.17	40			
	4.70	55			
2-Methyl-3-heptanol.....	3.37	20	−1.30	−12,35	82
	2.71	−40			
	2.88	−20			
	3.60	40			
	3.75	60			
3-Methyl-3-heptanol.....	3.58	−30	.....	.....	82
	3.57	−20			
	3.63	0			
	3.74	20			
	3.84	40			
	3.89	60			
4-Methyl-3-heptanol.....	5.25	20	0.178(α)	−8,42	82
	7.11	−52.5			
	6.59	−30			
	4.62	55			
5-Methyl-3-heptanol.....	6.13	20	0.185(α)	18,57	82
	8.60	−43			
	7.48	−20			
	7.08	0			
6-Methyl-3-heptanol.....	5.50	20	0.202(α)	17,55	82
	8.70	−42			
	7.16	−20			
	6.22	0			
2-Methyl-4-heptanol.....	3.30	20	−1.05	0,36	82
	2.93	−20			
	3.65	60			
3-Methyl-4-heptanol.....	9.09	−20	0.248(α)	−43,0	82
	7.36	20	0.204(α)	5,55	

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t°C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_8H_{18}O$—Con.						
	4-Methyl-4-heptanol.....	2.87	20	−1.04	10,55	82
		2.53	−44			
		2.59	−20			
		2.70	0			
		3.27	60			
	Butyl ether.....	3.06	25	.....	.....	144,198
$C_8H_{19}N$	Diisobutylamine.....	2.7[b]	22	.....	.....	14
$C_8H_{20}O_4Si$	Tetraethyl silicate.....	4.1[b]	ca 20	.....	.....	22
	C_9					
C_9H_7N	Quinoline.....	9.00	25	.....	.....	41,156,159
		5.05	238			
	Isoquinoline.....	10.7	25	.....	.....	159
C_9H_8O	Cinnamaldehyde.....	16.9	24	.....	.....	107
C_9H_{10}	1-Phenyl-1-propene.....	2.7_3	20	.....	.....	215
	2-Phenyl-1-propene.....	2.2_8	20	.....	.....	215
	3-Phenyl-1-propene.....	2.6_3	20	.....	.....	215
$C_9H_{10}O$	α-Indanol (mp 55°C).....	7.8_3	60	.....	.....	256
		7.1_0	80			
		6.7_4	90			
	α-Indanol (mp 40°C).....	7.7_3	40	.....	.....	256
		7.1_1	60			
		6.4_2	90			
	β-Indanol (mp 70°C).....	7.2_3	80	.....	.....	256
	1-Phenyl-1-propanone..... (Propiophenone)	$15._5$[a]	17	.....	.....	7
$C_9H_{10}O_2$	Benzyl acetate.....	5.1[n]	21	.....	.....	27
	Ethyl benzoate.....	6.02	20	2.1	20,40	7,8,56,178,189,260, 276
	Methyl *p*-methylbenzoate.....	4.3	33	.....	.....	32
$C_9H_{10}O_3$	Methyl *o*-methoxybenzoate.....	7.7[a]	21	.....	.....	7
	Ethyl salicylate.....	7.99	30	2.	30,40	261 [7,8,27]
C_9H_{12}	Propylbenzene.....	2.36_9	20	.....	.....	3,35 [1]
	Isopropylbenzene..... (Cumene)	2.38_0	20	.....	.....	3,35 [1,7]
	p-Ethyltoluene.....	2.24_0	25	0.19	25,45	158

[a] $f = 4 \times 10^8$ cycles/sec.
[b] $f = 3.6 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
C_9H_{12}—Con.						
	1,2,4-Trimethylbenzene (Pseudocumene)	2.42	17	.....	.....	1,3
	1,3,5-Trimethylbenzene (Mesitylene)	2.27_9	20	.....	.....	196 [1,35]
$C_9H_{12}O$	α-Ethoxytoluene (Benzyl ethyl ether)	3.9[n]	20	.....	.....	27
$C_9H_{13}N$	Benzylethylamine.....	4.3[n]	20	.....	.....	27
	N,N-Dimethyl-o-toluidine.....	3.4[n]	20	.....	.....	27
	N,N-Dimethyl-p-toluidine.....	3.9[n]	20	.....	.....	27
$C_9H_{14}O_6$	Glyceryl triacetate (Triacetin)	7.1_9	20	.....	.....	244 [27,232]
$C_9H_{16}O_4$	Diethyl glutarate.....	6.66	30	2.7	30,40	260
	dl-erythro-2,3-Diacetoxy-pentane	6.73_4	25	.....	.....	238
	dl-threo-2,3-Diacetoxypentane..	5.22_8	25	.....	.....	238
C_9H_{18}	4-Ethyl-3-heptene[t].....	2.4_8	20	.....	.....	283
	2,6-Dimethyl-2-heptene.....	2.6_1	20	.....	.....	283
	3,6-Dimethyl-3-heptene[t].....	2.6_5	20	.....	.....	283
$C_9H_{18}O$	2,2,4,4-Tetramethyl-3-pentanone (Hexamethyl acetone)	10.0	14.5	.....	.....	84
$C_9H_{18}O_2$	Isoamyl butyrate.....	4.0[n]	20	.....	.....	27
	Isobutyl valerate.....	3.8[n]	19	.....	.....	27
$C_9H_{19}Br$	1-Bromononane.....	5.42 4.74	-20 25	1.3 1.13	-35,16 1,55	286 272
$C_9H_{19}BrO$	1-Bromo-2-ethoxyheptane.....	5.48	20	.....	.....	150
	2-Bromo-3-ethoxyheptane.....	5.22	25	.....	.....	150
	3-Bromo-4-ethoxyheptane.....	6.24	25	.....	.....	150
C_9H_{20}	*n*-Nonane.....	1.972 2.059 1.847 1.787	20 -50 110 150	0.135	-10,90	88 [35]
	2-Methyloctane.....	1.97	20	.....	.....	35
	4-Methyloctane.....	1.97	20	.....	.....	35

[n] $f = 5 \times 10^8$ cycles/sec.
[t] Mixture of *cis-trans* isomers.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
C_9H_{20}—Con.						
	2,4-Dimethylheptane.....	1.8_9	20	.....	.....	35
	2,5-Dimethylheptane.....	1.8_9	20	.....	.....	35
	2,6-Dimethylheptane.....	1.99	20	.....	.....	35
	C_{10}					
$C_{10}H_7Br$	1-Bromonaphthalene.....	4.83	25	0.87	25,55	272 [7,12]
$C_{10}H_7Cl$	1-Chloronaphthalene.....	5.04	25	1.07	1,55	272
$C_{10}H_8$	Naphthalene.....	2.54	85	.....	.....	196,246
$C_{10}H_{10}N_2$	2,3-Dimethylquinoxaline.....	2.28	25	.....	.....	153
$C_{10}H_{10}O_2$	1-Allyl-3,4-methylenedioxybenzene (Safrole)	3.1[a]	21	.....	.....	7 [22]
	1-Propenyl-3,4-methylenedioxybenzene (Isosafrole)	3.3[a]	21	.....	.....	7 [22]
$C_{10}H_{10}O_4$	Dimethyl phthalate.....	8.5	24	.....	.....	232
$C_{10}H_{12}$	Dicyclopentadiene.....	2.43	40	0.20	40,100	241
	1,2,3,4-Tetrahydronaphthalene (Tetralin)	2.757	20	0.29	10,40	163,196
$C_{10}H_{12}O$	Cumaldehyde (p-isopropylbenzaldehyde)	11.	15	.....	.....	4
	Tetrahydro-β-naphthol.....	$11._7$ 8.1_7 6.7_5	20 60 90	.....	.....	256
$C_{10}H_{12}O_2$	Ethyl phenylacetate.....	5.2_9[a]	21	.....	.....	7
	4-Allyl-1-hydroxy-2-methoxybenzene (Eugenol)	10.5	0	.....	.....	103 [22]
$C_{10}H_{14}$	Isobutylbenzene.....	2.35	17	.....	.....	1,3
	t-Butylbenzene.....	2.38	20	.....	.....	35
	1-Methyl-4-isopropylbenzene (p-Cymene)	2.24_3	20	0.16	4,60	3,100,158 [41,196]
$C_{10}H_{14}O$	Carvone.....	11.[b]	22	.....	.....	22
$C_{10}H_{14}O_2$	dl-2,3-Camphanedione.....	$16._3$	203	.....	.....	237
$C_{10}H_{15}N$	N,N-Diethylaniline.....	5.5[n]	19	.....	.....	27
$C_{10}H_{15}NO_2$	Camphoric imide.....	5.5	249	.....	.....	237

[a] $f = 4 \times 10^8$ cycles/sec.
[b] $f = 3.6 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_{10}H_{16}$	*d*-Camphene	2.33	ca 40	.....	.....	237 [24]
	d-Pinene	2.64	25	.....	.....	164 [24]
	l-Pinene	2.76	20	.....	.....	196 [24]
	Terpinene	2.7^b	21	.....	.....	22
	d-Limonene	2.3_6	20	.....	.....	24
	dl-Limonene (Dipentene)	2.3_0	20	.....	.....	24
$C_{10}H_{16}O$	Dihydrocarvone	$8.5_3{}^a$	19	.....	.....	7
	Carvenone	19.	20	.....	.....	7,8
	Pulegone	9.5^a	20	.....	.....	7
	Fenchone	$12._8$	21	.....	.....	232
	Thujone	$10._8$	0	.....	.....	232
$C_{10}H_{17}Cl$	*dl*-Bornyl chloride	5.21	95	.....	.....	237
$C_{10}H_{18}$	5-Decyne (Dibutylacetylene)	2.173	25	0.148	25,125	154
	cis-Decahydronaphthalene	2.19_7	20	0.11	20,100	128,275
	trans-Decahydronaphthalene	2.17_2	20	0.11	20,100	128,275
$C_{10}H_{18}O$	Menthone	8.8^b	18	.....	.....	22 [27]
		$11._8$	−35	.....	.....	232
$C_{10}H_{20}$	*cis*-5-Decene	2.071	25	.....	.....	239
	trans-5-Decene	2.030	25	.....	.....	239
	5-Methyl-4-nonene[t]	2.1_8	20	.....	.....	283
	2,4,6-Trimethyl-3-heptene[t]	2.2_9	20	.....	.....	283
$C_{10}H_{20}O$	*l*-α-Menthol	3.95	42	.....	.....	237 [289]
$C_{10}H_{20}O_2$	Isoamyl valerate	3.6^n	19	.....	.....	27
$C_{10}H_{21}Br$	1-Bromodecane	4.44 4.75	25 1	1.07	25,55	272
$C_{10}H_{22}$	*n*-Decane	1.991 2.050 1.844 1.783	20 −30 130 170	0.130	10,110	88
	2,7-Dimethyloctane	1.983	20	0.137	20,120	141 [35]
$C_{10}H_{22}O$	1-Decanol	8.1	20	.....	.....	142
	Amyl ether	2.77	25	0.7	25,40	7,198,260
	Isoamyl ether	2.82	20	0.50	20,50	66

[a] $f = 4 \times 10^8$ cycles/sec.
[b] $f = 3.6 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.
[t] Mixture of *cis-trans* isomers.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_{10}H_{22}S$	Amyl sulfide.....	3.83 3.59	25 50	.....	.....	140
$C_{10}H_{23}N$	Diisoamylamine.....	2.5^b	18	.....	.....	22
	C_{11}					
$C_{11}H_7N$	1-Naphthonitrile.....	$16._0{}^b$	70	0.16(α)	22,70	14
	2-Naphthonitrile.....	$16._9{}^b$	70	.....	.....	14
$C_{11}H_{10}$	1-Methylnaphthalene.....	2.71	20	.....	.....	113,202
$C_{11}H_{12}O_2$	Ethyl cinnamate.....	6.1	18	.....	.....	8,56 [7,216,260]
$C_{11}H_{12}O_3$	Ethyl benzoylacetate.....	$12._4$	20	.....	.....	8 [7,17]
$C_{11}H_{14}O_2$	Isobutyl benzoate.....	5.38	20	1.1	at 20	7,8,10 [27]
	4-Propenyl-1,2-dimethoxy-benzene (Methyl isoeugenol)	4.7	18	.....	.....	167
$C_{11}H_{14}O_3$	Ethyl *o*-ethoxybenzoate.....	7.0^a	21	.....	.....	7
$C_{11}H_{16}$	1-Methyl-4-tert-butylbenzene...	2.33	20	0.20	0,60	158
$C_{11}H_{20}O_4$	*dl*-erythro-3,4-Di-acetoxyheptane	6.68_4	25	.....	.....	238
	dl-threo-3,4-Di-acetoxyheptane	5.02_9	25	.....	.....	238
$C_{11}H_{22}O$	2-Undecanone.....	8.4	14.5	.....	.....	84
$C_{11}H_{23}Br$	1-Bromoundecane.....	4.73	−9	.....	.....	286
$C_{11}H_{24}$	*n*-Undecane.....	2.005 2.039 1.838 1.781	20 −10 150 190	0.125	10,130	88
	C_{12}					
$C_{12}H_8O$	Dibenzofuran..... (Diphenylene oxide)	3.0_0	100	.....	.....	232
$C_{12}H_{10}$	Diphenyl.....	2.53	75	0.18	75,155	67
$C_{12}H_{10}N_2O$	Azoxybenzene.....	5.1	40	.....	.....	289
$C_{12}H_{10}O$	Phenyl ether.....	3.65	30	0.7	30,50	66,260 [289]
$C_{12}H_{11}N$	Diphenylamine.....	3.3	52	.....	.....	32
$C_{12}H_{12}O$	1-Ethoxynaphthalene.....	3.3^n	19	.....	.....	27
$C_{12}H_{16}O$	*o*-Cyclohexylphenol.....	3.97	55	.....	.....	237
	p-Cyclohexylphenol.....	4.42	131	.....	.....	237

[a] $f = 4 \times 10^8$ cycles/sec.
[b] $f = 3.6 \times 10^9$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_{12}H_{16}O_2$	Amyl benzoate.....	5.00	20	0.7	at 20	7,8,10 [27]
$C_{12}H_{16}O_3$	Isoamyl salicylate.....	5.4^n	20	.....	.....	27
$C_{12}H_{20}O_2$	Bornyl acetate.....	4.6	21	.....	.....	232
$C_{12}H_{22}$	6-Dodecyne (Diamylacetylene)	2.171	25	0.148	25,125	154
$C_{12}H_{22}O_6$	Dibutyl tartrate.....	9.4	41	.....	.....	232
$C_{12}H_{25}Br$	1-Bromododecane.....	4.07	25	0.9	1,55	272
$C_{12}H_{25}Cl$	1-Chlorododecane.....	4.17 3.85	25 55	1.2	1,40	272
$C_{12}H_{25}I$	1-Iodododecane.....	3.93	20	.....	.....	242
$C_{12}H_{26}$	*n*-Dodecane.....	2.014 2.047 1.776	20 −10 210	0.120	10,150	88
$C_{12}H_{26}O$	1-Dodecanol.....	6.5	25	.....	.....	281 [142]
$C_{12}H_{27}O_4P$	Tributylphosphate.....	7.95_9	30	2.74	30,35	295
	C_{13}					
$C_{13}H_{10}O$	Benzophenone.....	11.4	50	.....	.....	180 [26,260]
$C_{13}H_{10}O_3$	Phenylsalicylate.....	6.3	50	.....	.....	289
$C_{13}H_{12}$	Diphenylmethane.....	2.57	25	0.14	20,50	66,269
$C_{13}H_{14}O_4$	Ethyl α-benzoyl-acetoacetate	12.	21	.....	.....	8 [7]
$C_{13}H_{20}O$	α-Ionone.....	$10._8$	19	.....	.....	253
	β-Ionone.....	$11._7$	25	.....	.....	253
$C_{13}H_{24}O_4$	Diethyl azelate.....	5.13	30	1.6	30,40	260
$C_{13}H_{26}O_2$	Ethyl undecanoate.....	3.55	20	0.83	−22,28	201
$C_{13}H_{27}Br$	1-Bromotridecane.....	4.20	10	.....	.....	286
	C_{14}					
$C_{14}H_{10}$	Phenanthrene.....	2.72	110	.....	.....	246
$C_{14}H_{10}O_2$	Benzil.....	13.0 12.1	95 120	.....	.....	68 [32]
$C_{14}H_{12}O_2$	Benzyl benzoate.....	4.9^n	20	.....	.....	27
$C_{14}H_{12}O_3$	Benzyl salicylate.....	4.1^n	20	.....	.....	27
$C_{14}H_{14}$	1,2-Diphenylethane.....	2.38	110	0.17	57,178	67
$C_{14}H_{15}N$	Dibenzylamine.....	3.6^b	20	.....	.....	14,22

[b] $f = 3.6 \times 10^8$ cycles/sec.
[n] $f = 5 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t°C	a (or α) x10^2	Range t_1, t_2	References
$C_{14}H_{16}O_4$	Diethyl benzalmalonate.....	8.0 7.6 5.9	0 20 70	.....	.....	8
$C_{14}H_{26}O_4$	Diethyl sebacate.....	5.00	30	1.2	30,40	260
$C_{14}H_{28}O_2$	Ethyl dodecanoate (Ethyl laurate)	3.44 2.73	20 143	0.65	20,100	67
$C_{14}H_{29}Br$	1-Bromotetradecane.....	3.84	25	0.80	1,55	272
$C_{14}H_{30}O$	1-Tetradecanol.....	4.72 4.40	38 48	.....	.....	281
	C_{15}					
$C_{15}H_{24}$	Cedrene.....	3.27	25	.....	.....	221
$C_{15}H_{31}Br$	1-Bromopentadecane.....	3.89	20	.....	.....	286
	C_{16}					
$C_{16}H_{22}O_4$	Dibutyl phthalate.....	6.43_6	30	1.98	30,35	295 [267]
$C_{16}H_{32}O_2$	Palmitic acid.....	2.30	71	.....	.....	181,192
$C_{16}H_{33}Br$	1-Bromohexadecane.....	3.71	25	0.7	25,55	272,293
$C_{16}H_{33}I$	1-Iodohexadecane.....	3.50	20	.....	.....	242 [27]
$C_{16}H_{34}O$	1-Hexadecanol.....	3.82	50	1.7	48,67	191,201
	C_{17}					
$C_{17}H_{34}O$	9-Heptadecanone.....	5.3	60	.....	.....	195
$C_{17}H_{34}O_4$	Monomyristin.....	6.1	70	.....	.....	214
	C_{18}					
$C_{18}H_{30}O_4$	Dicyclohexyl adipate.....	4.84	35	.....	.....	237
$C_{18}H_{32}O_2$	Linoleic acid.....	2.61 2.71 2.70 2.60	0 20 70 120	.....	.....	208,235,262
$C_{18}H_{33}NaO_2$	Sodium oleate.....	2.8*	mp	.....	.....	21
$C_{18}H_{34}O_2$	Oleic acid.....	2.46 2.45 2.41	20 60 100	.....	.....	136,181,208, 235,262
$C_{18}H_{34}O_4$	Dibutyl sebacate.....	4.54_0	30	1.07	30,35	295 [267,279]

* $f = 4 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
$C_{18}H_{36}O_2$	Stearic acid.....	2.29 2.26	70 100	....	....	67,181,192 262
	Ethyl palmitate.....	3.20	20	0.4	20,40	201
		2.71 2.46	104 182	.....	.....	67
$C_{18}H_{37}Br$	1-Bromooctadecane.....	3.53	30	0.5	27,58	293
$C_{18}H_{38}O$	1-Octadecanol.....	3.42 3.35	58 63	.....	.....	281
	C_{19}					
$C_{19}H_{16}$	Triphenylmethane.....	2.45	100	0.14	94,175	67
$C_{19}H_{38}O_4$	Monopalmitin.....	5.34 5.09	67 80	.....	.....	287
	C_{20}					
$C_{20}H_{38}O_2$	Ethyl oleate.....	3.17 2.63	28 150	0.48	28,122	67
$C_{20}H_{40}O_2$	Ethyl stearate.....	2.98 2.69 2.48	40 100 167	0.6	32,50	67,201,260
	C_{21}					
$C_{21}H_{21}O_4P$	Tricresyl phosphate.....	6.9	40	.....	.....	219
$C_{21}H_{42}O_3$	β-Methoxyethyl stearate.....	3.39	50	.....	.....	260
$C_{21}H_{42}O_4$	Monostearin.....	4.87 4.71	77 89	.....	.....	287 [214]
	C_{22}					
$C_{22}H_{42}O_2$	Butyl oleate.....	4.0	25	.....	.....	232
$C_{22}H_{42}O_3$	Isobutyl ricinoleate (Isobutyl 12-hydroxy-9-octadecenoate)	4.7	21	.....	.....	26
$C_{22}H_{44}O_2$	Butyl stearate.....	3.11_1	30	0.53	30,35	295
$C_{22}H_{45}Br$	1-Bromodocosane.....	3.12	55	0.5	43,60	293
$C_{22}H_{46}$	n-Docosane.....	2.00	50	.....	.....	195
$C_{22}H_{46}O$	1-Docosanol.....	2.96	70	.....	.....	281
	C_{23}					
$C_{23}H_{46}O$	12-Tricosanone.....	4.0_5	80	1.	72,90	195

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	t °C	a (or α) $\times 10^2$	Range t_1, t_2	References
	C_{24}					
$C_{24}H_{30}O_4$	Dibenzyl sebacate.....	4.6	25	.....	.....	267
$C_{24}H_{38}O_4$	Dioctyl phthalate.....	5.1	25	.....	.....	267
	C_{26}					
$C_{26}H_{50}O_4$	Dioctyl sebacate.....	4.01	26	.....	.....	279
	C_{34}					
$C_{34}H_{66}$	Tetratriacontadiene.....	2.82	25	.....	.....	155
	C_{35}					
$C_{35}H_{68}O_5$	1,3-Dipalmitin.....	3.52 3.49	72 76	.....	.....	288
	C_{36}					
$C_{36}H_{66}CuO_4$	Copper oleate.....	2.8_0[a]	mp	.....	.....	21
$C_{36}H_{66}O_4Pb$	Lead oleate.....	3.7_0[a]	mp	.....	.....	21
	C_{39}					
$C_{39}H_{76}O_5$	1,3-Distearin.....	3.32 3.29	78 82	.....	.....	288
	C_{51}					
$C_{51}H_{98}O_6$	Tripalmitin.....	2.92_7	60	0.32	60,70	288
	C_{57}					
$C_{57}H_{104}O_6$	Triolein.....	3.20	25	.....	.....	235 [208]
$C_{57}H_{110}O_6$	Tristearin.....	2.78_5	70	0.34	70,80	288 [262]

[a] $f = 4 \times 10^8$ cycles/sec.

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