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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 cooperation 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, Fascicule 2, 1931-34; XII, Fascicule 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 fre-

quency 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 ($^{\circ}\text{C}$)
 T = temperature, absolute ($^{\circ}\text{K}$)
 $a = -d\epsilon/dt$
 $\alpha = -d\log_{10} \epsilon/dt$
 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:

$$\epsilon_t' = \epsilon_t - a(t' - t) \quad (1)$$

$$\text{Log}_{10} \epsilon_t' = \text{Log}_{10} \epsilon_t - \alpha(t' - t) \quad (2)$$

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

		ϵ 20° C	ϵ 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_3O	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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
A	Argon.....	1.53 _g	-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 ₂ Cl ₂	Chromyl chloride.....	2.6 ^a	20	.....	.....	17
D ₂	Deuterium.....	1.277	20°K	0.4	18.8, 21.2°K	249
D ₂ O	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			
		8 ₄ .	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 ₂ O	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 ₂ O 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 pressure 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. $\pm 0.04\%$.

^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. $\pm 0.03\%$.

^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	$t^{\circ}\text{C}$	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 ₅	2.06°K	.....	.....	46,72,73 [290]
		1.055 ₉	2.30 ^r	.....	.....
		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.....	2.56 ^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.....	2.85	160	.....	.....	120 [108]
PH_3	Phosphine.....	2.56 ^b	-60	.....	.....	28
		2.71 ^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.^r 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.

B. INORGANIC LIQUIDS—Continued

Substance		ϵ	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
S	Sulfur.....	3.52	118	(ϵ)	.....	125 [95]
		3.48	231			
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	20	7.7	14, 140	5, 10, 15 [14]
		2.1 ₀	154 ^b			
SO ₃	Sulfur trioxide.....	3.11	18	.....	.....	197 [14]
S ₂ Cl ₂	Sulfur monochloride.....	4.79	15	0.146(α)	-41, 15	92 [14, 26]
SO ₂ Cl 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	-80	.....	.....	28
		2.5 ₈ ^b	-50			
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]
VC1 ₄	Vanadium tetrachloride.....	3.0 ₅ ^b	25	.....	.....	33
VOBr ₃	Vanadium oxybromide.....	4.4 ^b	-70	.....	.....	33
		3.6 ^b	25			
VOCl ₃	Vanadium oxychloride.....	3.4 ^b	25	.....	.....	33

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

C. ORGANIC LIQUIDS

Substance		ϵ	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
C_I						
CCl ₂ O	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 ₄ O 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	(¹) 0.63(α)	-13, 18 18, 26	255 [39, 76]
CH ₂ Br ₂	Dibromomethane.....	7.77 6.68	10 40	.....	.....	97
CH ₂ Cl ₂	Dichloromethane.....	9.08	20	(¹)	-80, 25	94, 285
CH ₂ I ₂	Diiodomethane.....	5.32	25	.....	.....	97 [12]
CH ₂ O ₂	Formic acid.....	58. ₅ ^a	16	.....	.....	7 [4, 27]
CH ₃ Br	Bromomethane.....	9.82	0	(^k)	-80, 0	94 [282]
CH ₃ Cl	Chloromethane.....	12.6	-20	(¹)	-70, -20	94, 123
CH ₃ I	Iodomethane.....	7.00	20	(^m)	-70, 40	94 [12, 41, 160]
CH ₃ NO	Formamide.....	109.	20	72.	18, 25	270, 280
CH ₃ NO ₂	Nitromethane.....	35.8 ₇	30	0.189(α)	12.92	78, 295 [41]
CH ₃ NO ₃	Methyl nitrate.....	23. ₅ ^b	18	.....	.....	14
CH ₄	Methane.....	1.70	-173	0.2	-181, -159	93
CH ₄ O	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 atmospheres.

¹ $\log_{10} \epsilon = 2.199 - 0.0079t + 0.00005t^2$

^j $\epsilon = (3320/T) - 2.24$

^k $\epsilon = (3320/T) - 2.34$

¹ $\epsilon = 12.6 - 0.061(t + 20) + 0.0005(t + 20)^2$

^m $\epsilon = (2160/T) - 0.39$

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
CH_5N	Methylamine.....	11.4 9.4	-10 25	0.26(α)	-30, -10	123 268
C_2						
$\text{C}_2\text{Cl}_2\text{O}_2$	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
$\text{C}_2\text{HBr}_3\text{O}$	Bromal.....	7.6 ⁿ	20	.....	.....	27
C_2HCl_3	Trichloroethylene.....	3.4 ₂	ca 16	.....	.....	45
$\text{C}_2\text{HCl}_3\text{O}$	Chloral.....	4.9 ₄ 7.6 4.2	20 -40 62	0.17(α)	15, 45	44 [4, 7]
$\text{C}_2\text{HCl}_3\text{O}_2$	Trichloroacetic acid.....	4.6	60	.....	.....	26
C_2HCl_5	Pentachloroethane.....	3.73	20	.....	.....	45, 57, 156
$\text{C}_2\text{HF}_3\text{O}_2$	Trifluoroacetic acid.....	39.5 26.2	20 -11	-50.	0, 28	297
$\text{C}_2\text{H}_2\text{BrCl}$	<i>cis</i> -1-Bromo-2-chloroethylene...	7.3 ₁	17	.....	.....	49
	<i>trans</i> -1-Bromo-2-chloroethylene	2.5 ₀	17	.....	.....	49
$\text{C}_2\text{H}_2\text{Br}_2$	<i>cis</i> -1,2-Dibromoethylene.....	7.7 ₂ 7.0 ₈	0 25	.....	.....	148 [49]
	<i>trans</i> -1,2-Dibromoethylene.....	2.9 ₇ 2.8 ₈	0 25	.....	.....	148 [49]
$\text{C}_2\text{H}_2\text{Br}_2\text{O}$	Bromoacetyl bromide.....	12.4 ^a	20	.....	.....	17
$\text{C}_2\text{H}_2\text{Br}_4$	1,1,2,2-Tetrabromoethane.....	8.6 7.0	3 22	.....	.....	26
$\text{C}_2\text{H}_2\text{Cl}_2$	1,1-Dichloroethylene.....	4.6 ₇	16	.....	.....	49
	<i>cis</i> -1,2-Dichloroethylene.....	9.20	25	.....	.....	227 [45, 48, 49, 148]
	<i>trans</i> -1,2-Dichloroethylene...	2.14	25	.....	.....	196, 227 [45, 48, 49, 148]
$\text{C}_2\text{H}_2\text{Cl}_2\text{O}_2$	Dichloroacetic acid.....	8.2 7.8	22 61	.....	.....	26 [27]
$\text{C}_2\text{H}_2\text{Cl}_4$	1,1,2,2-Tetrachloroethane....	8.2 ₀	20	.....	.....	53 [45, 57]
$\text{C}_2\text{H}_2\text{I}_2$	<i>cis</i> -1,2-Diiodoethylene.....	4.4 ₆	83	.....	.....	48
	<i>trans</i> -1,2-Diiodoethylene.....	3.1 ₉	83	.....	.....	48
$\text{C}_2\text{H}_3\text{BrO}$	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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_2\text{H}_3\text{ClO}$	Acetyl chloride.....	16. ₉	2	.....	.....	26 [7,17]
		15. ₈	22	.....	.....
$\text{C}_2\text{H}_3\text{ClO}_2$	Chloroacetic acid.....	12.3	60	2.	60, 80	123 [181]
$\text{C}_2\text{H}_3\text{Cl}_3$	1,1,1-Trichloroethane.....	7.1 ₀	0	3.6	-33, 2	234
		7.5 ₂	20	.....	.....	156
$\text{C}_2\text{H}_3\text{N}$	Acetonitrile.....	37.5	20	16.	15, 25	13, 26, 41, 123
		26. ₆	82	.....	.....
$\text{C}_2\text{H}_3\text{NO}$	Glycolonitrile.....	68. ^a	20	.....	.....	17
$\text{C}_2\text{H}_3\text{NS}$	Methyl thiocyanate.....	35. ^a	16	.....	.....	17, 18, 22
	Methyl isothiocyanate.....	19. ₃ ^a	38	.....	.....	17, 18, 22
$\text{C}_2\text{H}_4\text{BrCl}$	1-Bromo-2-chloroethane.....	7.1 ₄	20	0.140(α)	10, 90	110
		7.98	-10	.....	.....
$\text{C}_2\text{H}_4\text{Br}_2$	1,2-Dibromoethane.....	4.78	25	0.60	10, 55	12, 144, 156, 199, 272 41
		4.09	131	.....	.....
$\text{C}_2\text{H}_4\text{Cl}_2$	1,1-Dichloroethane.....	10. ₀	18	.....	.....	1, 27
		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	.....	.....
$\text{C}_2\text{H}_4\text{N}_2\text{O}_6$	Ethylene nitrate.....	28. ₃	20	.....	.....	244
$\text{C}_2\text{H}_4\text{O}$	Ethylene oxide.....	13. ₉	-1	.....	.....	26
		21. ₈ ^a	10	.....	.....	7 [4]
		21.1 ^a	21	.....	.....
$\text{C}_2\text{H}_4\text{OS}$	Ethanethiolic acid..... (Thioacetic acid)	13. ^a	20	.....	.....	17 [18]
$\text{C}_2\text{H}_4\text{O}_2$	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
$\text{C}_2\text{H}_5\text{Br}$	Bromoethane.....	9.39	20	0.196(α)	-30, 30	34, 70, 94 127, 272 [207, 228]
		16.1	-90	.....	.....
		13.6	-60	.....	.....
$\text{C}_2\text{H}_5\text{Cl}$	Chloroethane.....	6.2 ₉	170	.....	.....	15
		6.0 ₆	179	.....	.....
		5.1 ₃	183	.....	.....
		4.6 ₃	185.5 ^h	.....	.....
$\text{C}_2\text{H}_5\text{ClO}$	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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_2\text{H}_5\text{I}$ Iodoethane.....	7.82 12.3 10.2	20 -90 -50	0.150(α)	-20, 70	81, 207 [7, 12, 160]
$\text{C}_2\text{H}_5\text{NO}$ Acetamide.....	59. ^a	83	.....	.....	17
Acetaldehyde oxime.....	3.0	23	.....	.....	26 [17, 27]
$\text{C}_2\text{H}_5\text{NO}_2$ Nitroethane.....	28.0 ₆	30	11.4	30, 35	295 [14]
$\text{C}_2\text{H}_5\text{NO}_3$ Ethyl nitrate.....	19. ₄	20	9.	0, 50	7, 17, 26 [4, 14]
$\text{C}_2\text{H}_6\text{N}_2\text{O}$ <i>N</i> -Nitrosodimethylamine.....	53. ^a	20	.....	.....	17
$\text{C}_2\text{H}_6\text{O}$ Ethanol.....	24.30 24.3 ^x 41.0 ^x	25 25 -60	..... 0.270(α) 0.297(α)	..... -5, 70 -110, -20	111, 174 111, 112, 207 81 [9]
Methyl ether.....	5.02 2.97 2.64 2.37 2.26 1.90	25 110 120 125 126.1 127.6 ^p	2.38	25, 100	161
$(\text{C}_2\text{H}_6\text{OSi})_n$					
$n = 4$ Octamethylcyclotetrasiloxane..	2.39	20	.....	.....	266
$n = 5$ Decamethylcyclopentasiloxane	2.50	20	.....	.....	266
$n = 6$ Dodecamethylcyclohexasiloxane	2.59	20	.....	.....	266
$n = 7$ Tetradecamethylcycloheptasiloxane	2.68	20	.....	.....	266
$n = 8$ Hexadecamethylcyclooctasiloxane	2.74	20	.....	.....	266
$\text{C}_2\text{H}_6\text{O}_2$ Glycol.....	37. ₇	25	0.224(α)	20, 100	112 [26, 131, 142, 236]
$\text{C}_2\text{H}_6\text{O}_4\text{S}$ Methyl sulfate.....	60. ₂ 48. ₃ 42. ₆	-30 0 20	.....	.....	122 [17, 26, 43]
$\text{C}_2\text{H}_6\text{S}$ Ethanethiol.....	6.9 ₁	15	.....	.....	236
Methyl sulfide.....	6.2 ^a	20	.....	.....	17
$\text{C}_2\text{H}_7\text{N}$ Ethylamine.....	6.94	10	($^{\circ}$)	-20, 10	123 [14]
Dimethylamine.....	6.32 5.26	0 25	.....	.....	268
$\text{C}_2\text{H}_8\text{N}_2$ 1,2-Ethanediamine.....	14.2	20	10.	10, 27	199

^a $f = 4 \times 10^8$ cycles/sec.^o $\epsilon = 6.94 - 0.036(t - 10) + 0.0004(t - 10)^2$ ^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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
C₃						
C ₃ H ₂ N ₂	Malononitrile.....	46. ^b	36	.....	.....	18
C ₃ H ₄ Cl ₂ O	1,1-Dichloro-2-propanone.....	14. ₆ ⁿ	20	.....	.....	27
C ₃ H ₅ Br	3-Bromo-1-propene.....	7.4	1	.....	.....	26
		7.0	19	.....	.....
C ₃ H ₅ BrO ₂	α -Bromopropionic acid.....	11. ₀ ⁿ	21	.....	.....	27
C ₃ H ₅ Br ₃	1,2,3-Tribromopropane.....	6.45	20	.....	.....	244
C ₃ H ₅ Cl	3-Chloro-1-propene.....	8.7	1	.....	.....	26 [27]
		8.2	20	.....	.....
C ₃ H ₅ ClN ₂ O ₆	3-Chloro-1,2-propanediol dinitrate	17. ₅	20	.....	.....	244
C ₃ H ₅ ClO	1-Chloro-2-propanone.....	30. ⁿ	19	.....	.....	27
	3-Chloro-1,2-epoxypropane.... (Epichlorohydrin)	25. ₆	1	.....	.....	26 [27]
		22. ₆	22	.....	.....
C ₃ H ₅ ClO ₂	Ethyl chloroformate.....	11. ₀ ^a	20	.....	.....	17 [27]
	Methyl chloroacetate.....	12. ₉ ⁿ	21	.....	.....	27
C ₃ H ₅ Cl ₂ NO ₃	1,3-Dichloro-2-propanol nitrate	13. ₃	20	.....	.....	244
C ₃ H ₅ Cl ₃	1,2,3-Trichloropropane.....	7.5 ⁿ	20	.....	.....	27
C ₃ H ₅ I	3-Iodo-1-propene.....	6.1 ⁿ	19	.....	.....	27
C ₃ H ₅ N	Propionitrile.....	31. ₀	0	.....	.....	13, 17, 26
		27. ₂	20	.....	.....
		24. ₃	50	.....	.....
C ₃ H ₅ NO	Lactonitrile.....	38. ^a	20	.....	.....	17
C ₃ H ₅ NS	Ethyl thiocyanate.....	34. ₅	3	.....	.....	26 [17, 18, 22]
		29. ₃	21	.....	.....
	Ethyl isothiocyanate.....	23. ₄	2	.....	.....	26 [17, 18, 22]
		19. ₅	21	.....	.....
C ₃ H ₅ N ₃ O ₉	1,2,3-Propanetriol trinitrate (Nitroglycerin)	19. ₃	20	.....	.....	244
C ₃ H ₆	Propene.....	1.87 ₅	20	.....	.....	161
		1.79 ₅	45	.....	.....
		1.69 ₀	65	.....	.....
		1.53 ₀	85	.....	.....
		1.44 ₁	90	.....	.....
		1.33 ₁	91.9 ^h	.....	.....
C ₃ H ₆ Br 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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_3\text{H}_5\text{Cl}_2$	1,2-Dichloropropane.....	8.93	26	.....	.....	107
	2,2-Dichloropropane.....	10.1 ₉	20	0.247(α)	-33, 20	234
$\text{C}_3\text{H}_5\text{N}_2\text{O}_6$	1,2-Propanediol dinitrate....	26.8	20	.....	.....	244
	1,3-Propanediol dinitrate....	19.0	20	.....	.....	244
$\text{C}_3\text{H}_8\text{O}$	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]
$\text{C}_3\text{H}_6\text{O}_2$	Propionic acid.....	3.30	10	.....	.....	149 [1, 7, 27]
		3.44	40			
	Ethyl formate.....	7.1 ₆	25	.....	.....	160 [1, 7]
	Methyl acetate.....	6.68	25	2.2	25, 40	63, 260
$\text{C}_3\text{H}_6\text{O}_3$	<i>dl</i> -Lactic acid.....	22.	17	.....	.....	4, 8 [7]
$\text{C}_3\text{H}_7\text{Br}$	1-Bromopropane.....	8.09	25	3.35	1, 55	272
	2-Bromopropane.....	9.46	25	4.40	1, 55	272
		16.1	-85	.....	.....	211
$\text{C}_3\text{H}_7\text{Cl}$	1-Chloropropane.....	7.7 ⁿ	20	.....	.....	27
$\text{C}_3\text{H}_7\text{ClO}_2$	3-Chloro-1,2-propanediol....	37.	3	.....	.....	26
		31.	19			
$\text{C}_3\text{H}_7\text{I}$	1-Iodopropane.....	7.00	20	.....	.....	242
	2-Iodopropane.....	8.19	20	.....	.....	242
$\text{C}_3\text{H}_7\text{NO}_2$	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
$\text{C}_3\text{H}_7\text{NO}_3$	Propyl nitrate.....	13.9 ^b	18	.....	.....	14
C_3H_8	Propane.....	1.61	0	0.20	-90, 15	172
$\text{C}_3\text{H}_8\text{O}$	1-Propanol.....	20.1	25	0.293(α)	20, 90	112, 222, 279 [41, 51, 157, 177]
		38.	-80	.....	.....	9
		29.	-34			
	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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_3\text{H}_8\text{O}_2$	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).. $\text{C}_3\text{H}_8\text{O}_3$	2.7 ^a	20	.....	.....	17
	Glycerol.....	42.5	25	0.203(α)	0, 100	40, 112, 185 [38, 103, 142, 177]
$\text{C}_3\text{H}_9\text{BO}_3$	Trimethylborate.....	8.0 ^a	20	.....	.....	17
$\text{C}_3\text{H}_9\text{N}$	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
$\text{C}_4\text{H}_2\text{O}_3$	Maleic anhydride.....	50. ^a	60	.....	.....	17
$\text{C}_4\text{H}_4\text{N}_2$	Succinonitrile.....	56.5	57.4	.....	.....	199 [14, 17]
		53.6	67.7			
		52.3	78.2			
	Pyrazine.....	2.80	50	.....	.....	153
$\text{C}_4\text{H}_4\text{O}$	Furan.....	2.95	25	.....	.....	121
$\text{C}_4\text{H}_4\text{S}$	Thiophene.....	2.76	16	.....	.....	12, 283 [18]
$\text{C}_4\text{H}_5\text{Cl}_3\text{O}$	α, α, α -Trichlorobutyraldehyde (Butyl chloral)	10.0 ⁿ	18	.....	.....	27
$\text{C}_4\text{H}_5\text{Cl}_3\text{O}_2$	Ethyl trichloroacetate.....	7.8	20	2.8	2, 60	26
$\text{C}_4\text{H}_5\text{N}$	Crotononitrile ^a (bp 108°C)...	36.1	ca 20	.....	.....	48
	Crotononitrile ^a (bp 122°C)...	28.1	ca 20	.....	.....	48
	Pyrrole.....	7.48	18	.....	.....	171
$\text{C}_4\text{H}_5\text{NO}_2$	Methyl cyanoacetate.....	28.8 ^a	20	.....	.....	17
$\text{C}_4\text{H}_5\text{NS}$	Allyl isothiocyanate.....	17.2 ^b	18	.....	.....	18, 22
$\text{C}_4\text{H}_6\text{Cl}_2\text{O}_2$	Ethyl dichloroacetate.....	11.6	2	.....	.....	26
		10.3	22			
$\text{C}_4\text{H}_6\text{O}$	Vinyl ether.....	3.94	20	.....	.....	121
	Ethoxyacetylene.....	8.05	25	.....	.....	257
$\text{C}_4\text{H}_6\text{O}_3$	Acetic anhydride.....	22.4	1	.....	.....	26 [17, 27, 166]
		20.7	19			

^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.^a *cis-trans* isomers.

C. ORGANIC LIQUIDS—Continued

Substance	ϵ	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_4\text{H}_7\text{Br}$ 1-Bromo-1-butene ^a (bp 95°C)..	5.8 ₉	ca 20	.....	.....	48
1-Bromo-1-butene ^a (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
$\text{C}_4\text{H}_7\text{BrO}_2$ α -Bromobutyric acid.....	7.2 ⁿ	20	.....	.....	27
$\text{C}_4\text{H}_7\text{ClO}_2$ Propyl chloroformate.....	11.2 ⁿ	20	.....	.....	27
Ethyl chloroacetate.....	11.4 ⁿ	21	.....	.....	27
$\text{C}_4\text{H}_7\text{N}$ Butyronitrile.....	20.3 ^b	21	.....	.....	13
Isobutyronitrile.....	20.4 ^b	24	.....	.....	13
$\text{C}_4\text{H}_8\text{Br}_2$ <i>meso</i> -2,3-Dibromobutane.....	6.24 ₅	25	.....	.....	238 [184]
<i>dl</i> -2,3-Dibromobutane.....	5.75 ₈	25	.....	.....	238 [184]
1,2-Dibromo-2-methylpropane..	4.1 ⁿ	20	.....	.....	27
$\text{C}_4\text{H}_8\text{Cl}_2$ 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
$\text{C}_4\text{H}_8\text{Cl}_2\text{O}$ β, β' -Dichlorodiethyl ether...	21.2	20	.....	.....	156
$\text{C}_4\text{H}_8\text{N}_2\text{O}_6$ 1,3-Butanediol dinitrate.....	18.9	20	.....	.....	244
2,3-Butanediol dinitrate.....	28.8	20	.....	.....	244
$\text{C}_4\text{H}_8\text{O}$ 2-Butanone.....	18.5 ₁	20	0.207(α)	-60, 60	240 [41, 84, 123]
Butyraldehyde.....	13.4 10.8	26 77	.....	.....	41
$\text{C}_4\text{H}_8\text{O}_2$ 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
$\text{C}_4\text{H}_8\text{O}_3$ 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.^a *cis-trans* isomers.^r Br and CH_3 *trans*.^s Br and CH_3 *cis*.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_4\text{H}_9\text{Br}$	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
$\text{C}_4\text{H}_9\text{Cl}$	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
	1-Chlorobutane.....	7.39	20	0.173(α)	-10, 70	97, 242
		12.2	-90			
		9.94	-50			
$\text{C}_4\text{H}_9\text{I}$		9.07	-30			
	1-Chloro-2-methylpropane.....	12.2	-120	.....	.....	247
		10.1	-89			
		7.87	-38			
		6.49	14			
$\text{C}_4\text{H}_9\text{I}$	2-Chloro-2-methylpropane.....	10.9 ₅	0	0.225(α)	-23, 30	109, 213
	1-Iodobutane.....	6.22	20	0.135(α)	0, 80	41, 97, 242
		8.89	-80			
		7.53	-40			
		4.52	130			
$\text{C}_4\text{H}_9\text{NO}$	1-Iodo-2-methylpropane.....	6.47	20	.....	.....	242
	2-Iodopropane.....	7.87	20	.....	.....	242
	2-Iodo-2-methylpropane.....	8.42	20	.....	.....	242
		10.5	-33	.....	.....	213
	2-Butanone oxime.....	3.4 ^a	20	.....	.....	27
$\text{C}_4\text{H}_9\text{NO}_3$	Morpholine.....	7.33	25	.....	.....	225
	Butyl nitrate.....	13.1	20	.....	.....	244
	Isobutyl nitrate.....	11.7 ^b	19	.....	.....	14
$\text{C}_4\text{H}_{10}\text{Hg}$	Diethyl mercury.....	2.3	23	.....	.....	17, 22
$\text{C}_4\text{H}_{10}\text{O}$	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
$\text{C}_4\text{H}_{10}\text{O}$		26.	-34			
	2-Butanol.....	15.8	25	.....	.....	222

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

C. ORGANIC LIQUIDS—Continued

Substance	ϵ	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_4\text{H}_{10}\text{O}$ —Con.					
2-Methyl-2-propanol.....	10.9 8.49 6.89	30 50 70	.....	.....	109 [43, 112, 142, 157, 261]
Ethyl ether.....	4.335 4.34 ^x 10.4 3.97 2.1 ₂ 1.8 ₉ 1.5 ₃	20 20 -116 40 180 190 193.3 ^h	2.0 0.217(α) 0.170(α)	at 20 -40, 30 40, 140	12, 35, 62, 96, 251 207 [36, 80, 143, 187] 180 16 [15, 19, 79]
$\text{C}_4\text{H}_{10}\text{O}_2$ 1,4-Butanediol.....	32.9 30.2	15 30	.....	.....	236
$\text{C}_4\text{H}_{10}\text{O}_2$ 1,1-Dimethoxyethane.....	3.49	20	.....	.....	298
$\text{C}_4\text{H}_{10}\text{O}_3\text{S}$ Ethyl sulfite.....	17.5 15.9 13.7	1 20 50	.....	.....	26
$\text{C}_4\text{H}_{10}\text{O}_4$ Erythritol (1,2,3,4- Butanetetrol)	28.2	120	.....	.....	131, 142
$\text{C}_4\text{H}_{10}\text{O}_4\text{S}$ Ethyl sulfate.....	29.2	20	0.24(α)	-25, 20	122
$\text{C}_4\text{H}_{10}\text{S}$ 1-Butanethiol.....	4.95 4.59	25 50	.....	.....	140
Ethyl sulfide.....	5.72 5.24	25 50	.....	.....	140
$\text{C}_4\text{H}_{10}\text{Zn}$ Diethyl zinc.....	2.5 ₅	20	.....	.....	132
$\text{C}_4\text{H}_{11}\text{N}$ Butylamine.....	5.3 ^b	21	.....	.....	14
Isobutylamine.....	4.4 ^b	21	.....	.....	14
Diethylamine.....	3.6 ^b	22	.....	.....	14, 22
$\text{C}_4\text{H}_{12}\text{O}_4\text{Si}$ Tetramethyl silicate.....	6.0 ^b	ca 20	.....	.....	22
C₅					
C_5FeO_5 Iron pentacarbonyl.....	2.60	20	.....	.....	114
$\text{C}_5\text{H}_4\text{O}_2$ Furfural.....	46.9 41.9 34.9	1 20 50	.....	.....	26 [7]
$\text{C}_5\text{H}_5\text{N}$ Pyridine.....	12.3 9.4	25 116	.....	.....	51, 53, 159 [166] 41
$\text{C}_5\text{H}_7\text{NO}_2$ 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	$t^{\circ}\text{C}$	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
$\text{C}_5\text{H}_8\text{O}$ Cyclopentanone.....	16.3	-51	.....	.....	237
$\text{C}_5\text{H}_8\text{O}_2$ 2,4-Pentanedione..... (Acetylacetone)	25.7 ^a	20	.....	.....	7, 17, 18
$\text{C}_5\text{H}_8\text{O}_4$ Dimethyl malonate.....	10.3 ^a	20	.....	.....	17 [27]
$\text{C}_5\text{H}_9\text{BrO}_2$ α -Bromoisovaleric acid.....	6.5 ⁿ	20	.....	.....	27
Ethyl α -bromopropionate.....	10.0 9.3	2 22	.....	.....	26 [27]
$\text{C}_5\text{H}_9\text{ClO}_2$ Isobutyl chloroformate.....	9.1 ⁿ	20	.....	.....	27
Ethyl α -chloropropionate....	10.1 ⁿ	20	.....	.....	27
$\text{C}_5\text{H}_9\text{IO}_2$ Ethyl β -iodopropionate.....	8.6 ⁿ	20	.....	.....	27
$\text{C}_5\text{H}_9\text{N}$ 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
$\text{C}_5\text{H}_{10}\text{Br}_2$ 1,2-Dibromopentane.....	4.39	25	.....	.....	150
<i>dl</i> -erythro-2,3-..... Dibromopentane	5.43 ₀	25	.....	.....	238 [150]
<i>dl</i> -threo-2,3-..... Dibromopentane	6.50 ₇	25	.....	.....	238
$\text{C}_5\text{H}_{10}\text{O}$ Cyclopentanol.....	18.0 25.5	20 -20	0.38(α)	at 20	232 237
2-Pentanone.....	15.4 ₅ 22.0	20 -60	0.195(α)	-40, 80	240 [7, 84]
3-Pentanone.....	17.0 ₀ 19.4 19.8	20 -20 -40	0.225(α)	0, 80	240 [7, 84]
Valeraldehyde.....	10.1 ^a	17	.....	.....	7 [4]
$\text{C}_5\text{H}_{10}\text{O}_2$ 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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_5\text{H}_{10}\text{O}_2$ —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
$\text{C}_5\text{H}_{10}\text{O}_3$ Diethyl carbonate.....	2.82	20	.....	.....	298 [7,22]
$\text{C}_5\text{H}_{11}\text{Br}$ 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
$\text{C}_5\text{H}_{11}\text{Cl}$ 1-Chloropentane.....	6.6	11	.....	.....	2
1-Chloro-3-methylbutane.....	6.05 10.0 8.53	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]
$\text{C}_5\text{H}_{11}\text{F}$ 1-Fluoropentane.....	4.24	20	.....	.....	243
2-Fluoro-2-methylbutane.....	5.89	20	.....	.....	243
$\text{C}_5\text{H}_{11}\text{I}$ 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
$\text{C}_5\text{H}_{11}\text{N}$ Piperidine.....	5.8 ^b	22	.....	.....	14
$\text{C}_5\text{H}_{11}\text{NO}$ 2-Pentanone oxime.....	3.3 ⁿ	20	.....	.....	27
$\text{C}_5\text{H}_{11}\text{NO}_3$ Amyl nitrate..... (bp 140-145°C)	9.0 ⁿ	18	.....	.....	22
C_5H_{12} <i>n</i> -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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_5\text{H}_{12}\text{O}$	1-Pentanol.....	13.9	25	0.23(α)	15,35	142,177,222 [9]
	3-Methyl-1-butanol.....	14.7 5.8 ₂	25 132	.....	.....	41,51,63,276
	2-Methyl-2-butanol.....	5.82	25	.....	.....	51,85,276 [261]
$\text{C}_5\text{H}_{12}\text{O}_5$	Xylitol.....	40.	20	.....	.....	131,142
$\text{C}_5\text{H}_{12}\text{S}$	1-Pentanethiol.....	4.55	25	.....	.....	140 [14,18]
		4.23	50	.....	.....
$\text{C}_5\text{H}_{12}\text{S}_4$	Tetramethylthiomethane..... [C(SCH ₃) ₄]	2.82	70	.....	.....	250
$\text{C}_5\text{H}_{13}\text{N}$	Amlyamine (bp 95°C).....	4.5 ^b	22	.....	.....	14
C₆						
$\text{C}_6\text{H}_4\text{BrCl}$	1-Bromo-2-chlorobenzene.....	6.8 ₀	20	.....	.....	83
	1-Bromo-3-chlorobenzene.....	4.5 ₈	20	.....	.....	83
$\text{C}_6\text{H}_4\text{Br}_2$	<i>o</i> -Dibromobenzene.....	7.35	20	.....	.....	55,83
	<i>m</i> -Dibromobenzene.....	4.80	20	.....	.....	55,83
	<i>p</i> -Dibromobenzene.....	2.5 ₇	95	.....	.....	55
$\text{C}_6\text{H}_4\text{ClNO}_2$	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]
$\text{C}_6\text{H}_4\text{Cl}_2$	<i>o</i> -Dichlorobenzene.....	9.93	25	0.194(α)	0,50	69 [53,55,61,179]
	<i>m</i> -Dichlorobenzene.....	5.04	25	0.120(α)	0,50	69 [55,61]
	<i>p</i> -Dichlorobenzene.....	2.41	50	0.18	50,80	55,94 [61]
$\text{C}_6\text{H}_4\text{I}_2$	<i>o</i> -Diiodobenzene.....	5.7	20	.....	.....	55
	<i>m</i> -Diiodobenzene.....	4.2 ₅	25	.....	.....	55
	<i>p</i> -Diiodobenzene.....	2.8 ₈	120	.....	.....	55
$\text{C}_6\text{H}_5\text{Br}$	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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_6\text{H}_5\text{Cl}$	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			
$\text{C}_6\text{H}_5\text{ClO}$	<i>o</i> -Chlorophenol.....	6.31	25	2.7	25, 58	57, 61, 261
	<i>p</i> -Chlorophenol.....	9.47	55	3.7	55, 65	61, 261
$\text{C}_6\text{H}_5\text{F}$	Fluorobenzene.....	5.42	25	.....	.....	153, 255a 83
		4.76	60			
$\text{C}_6\text{H}_5\text{I}$	Iodobenzene.....	4.63	20	.....	.....	243, 83
$\text{C}_6\text{H}_5\text{NO}_2$	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			
$\text{C}_6\text{H}_5\text{NO}_3$	<i>o</i> -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			
$\text{C}_6\text{H}_6\text{BrN}$	<i>m</i> -Bromoaniline.....	13.0 ⁿ	19	.....	.....	27
$\text{C}_6\text{H}_6\text{ClN}$	<i>m</i> -Chloroaniline.....	13.4 ⁿ	19	.....	.....	27
$\text{C}_6\text{H}_6\text{Cl}_6$	α -Hexachlorocyclohexane..... (mp 156°C)	4.77	156	.....	.....	237
$\text{C}_6\text{H}_6\text{N}_2\text{O}_2$	<i>o</i> -Nitroaniline.....	34.6	90	3.	90, 110	260
	<i>p</i> -Nitroaniline.....	56.3	160	6.	160, 180	260
$\text{C}_6\text{H}_6\text{O}$	Phenol.....	9.78	60	0.32(α)	40, 70	61, 123, 145, 194
$\text{C}_6\text{H}_7\text{N}$	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]
		9.8 ^b	20	.....	.....	14
C_6H_8	1,3-Cyclohexadiene.....	2.66	-89	.....	.....	237

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

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_6\text{H}_8\text{N}_2$	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
$\text{C}_6\text{H}_8\text{O}_2$	1,4-Cyclohexadione.....	4.4 ₀	78	.....	.....	237
$\text{C}_6\text{H}_9\text{Cl}_2\text{O}$	<i>cis</i> -Ethyl β -chlorocrotonate..	7.6 ₇	18	.....	.....	49
	<i>trans</i> -Ethyl β -chlorocrotonate	4.7 ₀	18	.....	.....	49
C_6H_{10}	Cyclohexene.....	2.220	25	.....	.....	271
		2.6 ₀	-105	.....	.....	237
	2,4-Hexadiene ^c	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	-75	.....	.....	129,130
		2.84	-25			
		2.60	25			
		2.49	50			
	2,3-Dimethyl-1,3-butadiene...	2.10	25	0.17	-50,50	129,130
$\text{C}_6\text{H}_{10}\text{O}$	Cyclohexanone.....	18.3	20	.....	.....	35,98
		19. ₉	-40	.....	.....	237
	4-Methyl-3-penten-2-one.....	15. ₆	0	.....	.....	232
	(Mesityl oxide)					
		15. ₁ ^a	20	.....	.....	17
	Butoxyacetylene.....	6.62	25	.....	.....	257
$\text{C}_6\text{H}_{10}\text{O}_2$	Ethyl crotonate.....	5.4 ⁿ	20	.....	.....	27
$\text{C}_6\text{H}_{10}\text{O}_3$	Propionic anhydride.....	18. ₃ ⁿ	16	.....	.....	27
	Ethyl acetoacetate.....	15. ₇ ^a	22	.....	.....	7
$\text{C}_6\text{H}_{10}\text{O}_4$	Diethyl oxalate.....	8.1 ^a	21	.....	.....	7
	Dimethyl succinate.....	5.1	20	.....	.....	32
$\text{C}_6\text{H}_{11}\text{Br}$	Bromocyclohexane.....	7.92	25	0.140(α)	1,55	272 [98]
		11. ₀	-65	.....	.....	237
$\text{C}_6\text{H}_{11}\text{BrO}_2$	<i>dl</i> -threo-2-Acetoxy-3-.....	7.41 ₄	25	.....	.....	238
	bromobutane					
	<i>dl</i> -erythro-2-Acetoxy-.....	7.26 ₈	25	.....	.....	238
	3-bromobutane					

^a $f = 4 \times 10^8$ cycles/sec.ⁿ $f = 5 \times 10^8$ cycles/sec.^tMixture of *cis-trans* isomers.^uSome polymerization at the higher temperatures.

C. ORGANIC LIQUIDS—Continued

Substance	ϵ	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_6\text{H}_{11}\text{BrO}_2$ —Con.					
Ethyl α -bromobutyrate.....	8.0 ⁿ	20	.....	.....	27
Ethyl α -bromoisobutyrate.....	7.9 ⁿ	20	.....	.....	27
$\text{C}_6\text{H}_{11}\text{Cl}$ Chlorocyclohexane.....	7.6	25	.....	.....	98
	10. ₉	-47	.....	.....	237
$\text{C}_6\text{H}_{11}\text{ClO}_2$ Isoamyl chloroformate.....	7.8 ⁿ	20	.....	.....	27
$\text{C}_6\text{H}_{11}\text{N}$ Isocapronitrile.....	15. ₅ ^b	22	.....	.....	13
$\text{C}_6\text{H}_{11}\text{NO}$ Cyclohexanone oxime.....	3.0 ₄	89	.....	.....	237
$\text{C}_6\text{H}_{11}\text{NS}$ 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
<i>cis</i> -3-Hexene.....	2.062	25	.....	.....	239
<i>trans</i> -3-Hexene.....	2.000	25	.....	.....	239
$\text{C}_6\text{H}_{12}\text{Br}_2$ <i>dl</i> -3,4-Dibromohexane.....	6.73 ₂	25	.....	.....	238
<i>meso</i> -3,4-Dibromohexane.....	4.67 ^v	25	.....	.....	238
$\text{C}_6\text{H}_{12}\text{O}$ 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]
$\text{C}_6\text{H}_{12}\text{O}_2$ 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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_6\text{H}_{12}\text{O}_2$ —Con.					
Methyl valerate.....	4.3 ⁿ	19	.....	.....	27
4-Hydroxy-4-methyl-2-..... pentanone (Diacetone alcohol)	18. ₂	25	.....	.....	115
$\text{C}_6\text{H}_{12}\text{O}_3$ β -Ethoxyethyl acetate..... ("Cellosolve" acetate)	7.57	30	3.1	30,50	260
Paraldehyde.....	13.9 6.29	25 128	.....	.....	41 [17,26]
$\text{C}_6\text{H}_{13}\text{Br}$ 1-Bromohexane.....	5.82 6.30	25 1	1.73	25,55	272
$\text{C}_6\text{H}_{13}\text{I}$ 1-Iodohexane.....	5.37	20	.....	.....	242
$\text{C}_6\text{H}_{13}\text{N}$ Cyclohexylamine.....	5.3 ₇	-21	.....	.....	237
C_6H_{14} <i>n</i> -Hexane.....	1.890 2.044 1.990	20 -90 -50	0.155	-10,50	88 [35,116,207]
$\text{C}_6\text{H}_{14}\text{O}$ 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]
$\text{C}_6\text{H}_{14}\text{O}_2$ 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]
$\text{C}_6\text{H}_{14}\text{O}_6$ Sorbitol.....	33. ₅	80	.....	.....	131,142
Mannitol.....	24. ₆	170	.....	.....	131,142
$\text{C}_6\text{H}_{15}\text{Al}$ Triethyl aluminum.....	2.9	20	.....	.....	91
$\text{C}_6\text{H}_{15}\text{N}$ Dipropylamine.....	2.9 ^b	21	.....	.....	14,22
Triethylamine.....	2.42	25	.....	.....	206 [26]
$\text{C}_6\text{H}_{18}\text{OSi}_2$ $(\text{CH}_3)_3\text{Si} [\text{OSi}(\text{CH}_3)_2]_n\text{CH}_3$					
$n=1$ 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
$n=66^w$	2.72	20	.....	.....	266

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

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
C₇						
C ₇ H ₅ ClO	Benzoyl chloride.....	29.	0	.....	.....	43 [22]
		23.	20	.....	.....
C ₇ H ₅ Cl ₃	α, α, α -Trichlorotoluene.....	6.9 ⁿ	21	.....	.....	22, 27
C ₇ H ₅ F ₃	α, α, α -Trifluorotoluene.....	9.18	30	.....	.....	255a
		8.09	60	.....	.....
C ₇ H ₅ N	Benzonitrile.....	25.20	25	0.157(α)	0, 25	85, 138 [194]
		24.02	40			
		22.10	70			
C ₇ H ₅ NO	Phenyl isocyanate.....	8.8 ^b	20	.....	.....	22 [18]
C ₇ H ₅ NS	Phenyl isothiocyanate.....	10.4 ^a	20	.....	.....	17, 22 [18]
C ₇ H ₆ Cl ₂	α, α -Dichlorotoluene.....	6.9 ⁿ	20	.....	.....	27
C ₇ H ₆ O	Benzaldehyde.....	19.7	0	.....	.....	26, 56 [4, 7, 22]
		17.8	20	.....	.....
C ₇ H ₆ O ₂	Salicylaldehyde.....	17.1	30	7.	30, 40	261 [4, 7, 17]
C ₇ H ₇ Br	<i>o</i> -Bromotoluene.....	4.28	58	.....	.....	61 [27]
	<i>m</i> -Bromotoluene.....	5.36	58	.....	.....	61 [27]
	<i>p</i> -Bromotoluene.....	5.49	58	.....	.....	61 [27, 32]
C ₇ H ₇ BrO	<i>p</i> -Bromoanisole.....	7.06	30	1.6	30, 40	260
C ₇ H ₇ Cl	<i>o</i> -Chlorotoluene.....	4.45	20	.....	.....	83 [27]
		4.16	58	.....	.....	61
	<i>m</i> -Chlorotoluene.....	5.55	20	.....	.....	83 [27]
		5.04	58	.....	.....	61
	<i>p</i> -Chlorotoluene.....	6.08	20	.....	.....	83 [27, 32]
		5.55	58	.....	.....	61
C ₇ H ₇ F	<i>o</i> -Fluorotoluene.....	7.0	13	.....	.....	2 [27]
		4.22	30	.....	.....	255a
		3.88	60	.....	.....
	<i>m</i> -Fluorotoluene.....	5.42	30	.....	.....	255a
		4.90	60	.....	.....
	<i>p</i> -Fluorotoluene.....	5.86	30	.....	.....	255a
		5.34	60	.....	.....
C ₇ H ₇ I	<i>p</i> -Iodotoluene.....	4.4	35	.....	.....	32
C ₇ H ₇ NO	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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_7\text{H}_7\text{NO}_2$	<i>o</i> -Nitrotoluene.....	27.4	20	15.	at 20	12, 85 [50]
		21.6	58	.....	.....	61
		11.8	222	.....	.....	41
	<i>m</i> -Nitrotoluene.....	23.8	20	.....	.....	53 [27]
		21.9	58	.....	.....	61
	<i>p</i> -Nitrotoluene.....	22.2	58	.....	.....	61 [32]
$\text{C}_7\text{H}_7\text{NO}_3$	<i>m</i> -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			
$\text{C}_7\text{H}_8\text{O}$	Benzyl alcohol.....	13.1	20	.....	.....	26, 56 [8, 256]
		9.47	70	.....	.....	194
		6.6	132	.....	.....	117
	<i>o</i> -Cresol.....	11.5	25	11.	25, 30	261 [61]
	<i>m</i> -Cresol.....	11.8	25	0.41(α)	15, 50	56, 145, 261 [43, 61]
	<i>p</i> -Cresol.....	9.9 ₁	58	.....	.....	61
	Methoxybenzene..... (Anisole)	4.33	25	1.1	20, 40	66, 144, 260, 277
		3.89	70	.....	.....	194
	<i>o</i> -Methoxyphenol (Guaiacol)..	11.7 ⁿ	28	.....	.....	27
	<i>N</i> -Methylaniline.....	5.5	1	.....	.....	26 [27]
		4.6	21			
		4.3	50			
$\text{C}_7\text{H}_9\text{N}$	<i>o</i> -Toluidine.....	6.34	18	.....	.....	171 [14, 27, 117]
		5.71	58	.....	.....	61
		4.00	200	.....	.....	41
	<i>m</i> -Toluidine.....	5.95	18	.....	.....	171 [14, 27]
		5.45	58	.....	.....	61
	<i>p</i> -Toluidine.....	4.98	54	.....	.....	61, 145 32
	<i>N</i> -Methylaniline.....	5.97	22	.....	.....	159, 171 14, 26
	<i>N</i> -Methyl- <i>N</i> -phenylhydrazine...	7.3 ⁿ	19	.....	.....	27

ⁿ $f = 5 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance	ϵ	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_7\text{H}_{11}\text{F}_3$ Cyclohexyltrifluoromethane...	11.9	-85	.....	.....	237
$\text{C}_7\text{H}_{12}\text{O}$ 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
$\text{C}_7\text{H}_{12}\text{O}_2$ Cyclohexanecarboxylic acid...	2.67	31	.....	.....	237
$\text{C}_7\text{H}_{12}\text{O}_3$ Ethyl levulinate.....	11.9 ^a	21	.....	.....	7
$\text{C}_7\text{H}_{12}\text{O}_4$ Diethyl malonate.....	8.03	25	3.	25,30	260,276 [7,27]
$\text{C}_7\text{H}_{13}\text{ClO}_2$ 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
$\text{C}_7\text{H}_{14}\text{Br}_2$ 1,2-Dibromoheptane.....	3.77	25	.....	.....	150
2,3-Dibromoheptane.....	5.08	25	.....	.....	150
3,4-Dibromoheptane.....	4.70	25	.....	.....	150
$\text{C}_7\text{H}_{14}\text{O}$ Cyclohexanemethanol.....	9.7 ₀	60	.....	.....	256
	8.0 ₅	80	.....	.....
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	20	0.200(α)	0,100	240 [90]
	14.3	-20			
	7.10	140			
3-Heptanone.....	12.9	22	.....	.....	90
4-Heptanone.....	12.5 ₈	20	0.205(α)	0,100	90,240 [7,84]
	15.1	-20			
	8.00	120			

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

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_7\text{H}_{14}\text{O}_2$	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]
$\text{C}_7\text{H}_{15}\text{Br}$	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
$\text{C}_7\text{H}_{15}\text{BrO}$	1-Bromo-2-ethoxypentane.....	6.45	25	.....	.....	150
	2-Bromo-3-ethoxypentane.....	6.40	25	.....	.....	150
	3-Bromo-2-ethoxypentane.....	8.24	25	.....	.....	150
$\text{C}_7\text{H}_{15}\text{Cl}$	1-Chloroheptane.....	5.48	22	.....	.....	90
	2-Chloroheptane.....	6.52	22	.....	.....	90
	3-Chloroheptane.....	6.70	22	.....	.....	90
	4-Chloroheptane.....	6.54	22	.....	.....	90
$\text{C}_7\text{H}_{15}\text{I}$	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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_7\text{H}_{16}\text{O}$	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
$\text{C}_7\text{H}_{16}\text{O}_7$	Glucoseptitol.....	27.4	120	.....	.....	131, 142
C_8						
$\text{C}_8\text{H}_2\text{Cl}_2\text{F}_6$	4,5-Dichloro-1,3-bis-..... (trifluoromethyl)-benzene	3.1 ₂	30	.....	.....	255a
		2.9 ₄	60	.....	.....
$\text{C}_8\text{H}_3\text{ClF}_6$	2-Chloro-1,3-bis-..... (trifluoromethyl)-benzene	3.2 ₀	30	.....	.....	255a
		3.0 ₀	60	.....	.....
$\text{C}_8\text{H}_4\text{F}_6$	1,3-bis-..... (trifluoromethyl)-benzene	5.44	30	.....	.....	255a
		4.96	60	.....	.....
$\text{C}_8\text{H}_4\text{F}_6$	1,3-bis-..... (trifluoromethyl)-benzene	5.98	30	.....	.....	255a
		5.37	60	.....	.....
C_8H_6	Ethynylbenzene..... (Phenylacetylene)	2.98	25	.....	.....	257
$\text{C}_8\text{H}_6\text{Cl}_2$	2,5-Dichlorostyrene.....	2.58	25	.....	.....	279
$\text{C}_8\text{H}_6\text{O}$	Phenoxyacetylene.....	4.76	25	.....	.....	257
$\text{C}_8\text{H}_6\text{O}_2$	Phthalide.....	36. ^a	75	.....	.....	7
$\text{C}_8\text{H}_7\text{Cl}_3$	β -Chloroethyl-2,5-di-..... chlorobenzene	5.2 ₀	24	.....	.....	279
$\text{C}_8\text{H}_7\text{N}$	<i>o</i> -Tolunitrile.....	18.5 ^b	23	.....	.....	13
	Phenylacetoneitrile.....	18.7	27	.....	.....	41 [7, 13, 17, 26]
		8.5	234	.....	.....
$\text{C}_8\text{H}_7\text{NO}$	Mandelonitrile.....	17.8 ^b	23	.....	.....	14 [39]
$\text{C}_8\text{H}_7\text{NO}_4$	Methyl <i>o</i> -nitrobenzoate.....	27.8	27	.....	.....	107
C_8H_8	Styrene..... (Phenylethylene)	2.43	25	.....	.....	162, 196, 279
		2.32	75	.....	.....
$\text{C}_8\text{H}_8\text{O}$	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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_8\text{H}_8\text{O}_2$	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
	<i>p</i> -Methoxybenzaldehyde..... (Anisaldehyde)	22.3 10.4	22 248	.....	.....	41 [17]
$\text{C}_8\text{H}_8\text{O}_3$	Methyl salicylate.....	9.41	30	3.1	30,40	261,276
C_8H_{10}	Ethylbenzene.....	2.412	20	.....	.....	3,248 [35]
	<i>o</i> -Xylene.....	2.568	20	0.266	-20,130	3,107,116,196
	<i>m</i> -Xylene.....	2.374	20	0.195	-40,180	3,12,16,35,107,116, 207,229
	<i>p</i> -Xylene.....	2.270	20	0.160	20,130	62,107,116,128,196, 248,271
$\text{C}_8\text{H}_{10}\text{O}$	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]
	<i>o</i> -Methoxytoluene.....	3.5 ₇	20	.....	.....	23 [22,27]
	<i>m</i> -Methoxytoluene.....	4.0 ₈	20	.....	.....	23 [27]
	<i>p</i> -Methoxytoluene.....	4.0 ₃	20	.....	.....	23 [27]
	3,4-Dimethyl-1-hydroxy- benzene	4.8 ⁿ	17	.....	.....	27
	2-Methoxy-4-methylphenol (Creosol)	11.	16	.....	.....	4,8
$\text{C}_8\text{H}_{10}\text{O}_2$	<i>o</i> -Dimethoxybenzene (Veratrole)	4.5	23	.....	.....	32
	Methylbenzylamine.....	4.4 ⁿ	19	.....	.....	27
$\text{C}_8\text{H}_{11}\text{N}$	<i>N</i> -Ethylaniline.....	5.76	20	2.	0,20	26,53 [27]
	<i>N,N</i> -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
	Ethyl fumarate.....	6.5 ₆	23	.....	.....	186 [167]
$\text{C}_8\text{H}_{12}\text{O}_4$	Ethyl maleate.....	8.5 ₈	23	.....	.....	186 [167]

ⁿ $f = 5 \times 10^8$ cycles/sec.

C. ORGANIC LIQUIDS—Continued

Substance		ϵ	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_8\text{H}_{14}\text{O}_3$	Butyric anhydride.....	12.9 ⁿ	20	.....	.....	27
	Isobutyric anhydride.....	13.6 ^a	20	.....	.....	17 [27]
$\text{C}_8\text{H}_{14}\text{O}_4$	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
$\text{C}_8\text{H}_{16}\text{O}$	2-Octanone.....	10.3 ₉	20	0.215(α)	0,60	240 [7,84]
		12.5	-20			
		7.42	100			
		6.10	160			
$\text{C}_8\text{H}_{16}\text{O}_2$	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
$\text{C}_8\text{H}_{17}\text{Br}$	1-Bromooctane.....	6.35	-50	1.9	-55, -39	286
		5.00	25	1.33	1,55	272
$\text{C}_8\text{H}_{17}\text{Cl}$	1-Chlorooctane.....	5.05	25	1.70	1,55	272
$\text{C}_8\text{H}_{17}\text{I}$	1-Iodoctane.....	4.62	25	1.17	1,55	242,272
	2-Iodoctane.....	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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_8\text{H}_{18}\text{O}$	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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_8\text{H}_{18}\text{O}$ —Con.					
3-Methyl-2-heptanol.....	7.33 10.8 9.13 6.22	20 -44 -20 55	0.23(α)	-8,30	82
4-Methyl-2-heptanol.....	4.6 3.90 3.63 3.52 3.36	-18 0 20 40 60	.....	.....	82
5-Methyl-2-heptanol.....	8.6 7.5	-18 5	.....	.....	82
6-Methyl-2-heptanol.....	10.3 6.20 5.17 4.70	-20 20 40 55	.....	.....	82
2-Methyl-3-heptanol.....	3.37 2.71 2.88 3.60 3.75	20 -40 -20 40 60	-1.30	-12,35	82
3-Methyl-3-heptanol.....	3.58 3.57 3.63 3.74 3.84 3.89	-30 -20 0 20 40 60	.....	.....	82
4-Methyl-3-heptanol.....	5.25 7.11 6.59 4.62	20 -52.5 -30 55	0.178(α)	-8,42	82
5-Methyl-3-heptanol.....	6.13 8.60 7.48 7.08	20 -43 -20 0	0.185(α)	18,57	82
6-Methyl-3-heptanol.....	5.50 8.70 7.16 6.22	20 -42 -20 0	0.202(α)	17,55	82
2-Methyl-4-heptanol.....	3.30 2.93 3.65	20 -20 60	-1.05	0,36	82
3-Methyl-4-heptanol.....	9.09 7.36	-20 20	0.248(α) 0.204(α)	-43,0 5,55	82

C. ORGANIC LIQUIDS—Continued

Substance	ϵ	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_8\text{H}_{18}\text{O}$ —Con.					
4-Methyl-4-heptanol.....	2.87 2.53 2.59 2.70 3.27	20 -44 -20 0 60	-1.04	10,55	82
Butyl ether.....	3.06	25	.....	.....	144,198
$\text{C}_8\text{H}_{18}\text{N}$ Diisobutylamine.....	2.7 ^b	22	.....	.....	14
$\text{C}_8\text{H}_{20}\text{O}_4\text{Si}$ Tetraethyl silicate.....	4.1 ^b	ca 20	.....	.....	22
C_9					
$\text{C}_9\text{H}_7\text{N}$ Quinoline.....	9.00 5.05	25 238	.....	.....	41,156,159
Isoquinoline.....	10.7	25	.....	.....	159
$\text{C}_9\text{H}_8\text{O}$ 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
$\text{C}_9\text{H}_{10}\text{O}$ α -Indanol (mp 55°C).....	7.8 ₃ 7.1 ₀ 6.7 ₄	60 80 90	.....	.....	256
α -Indanol (mp 40°C).....	7.7 ₃ 7.1 ₁ 6.4 ₂	40 60 90	.....	.....	256
β -Indanol (mp 70°C).....	7.2 ₃	80	.....	.....	256
1-Phenyl-1-propanone..... (Propiophenone)	15.5 ^a	17	.....	.....	7
$\text{C}_9\text{H}_{10}\text{O}_2$ Benzyl acetate.....	5.1 ⁿ	21	.....	.....	27
Ethyl benzoate.....	6.02	20	2.1	20,40	7,8,56,178,189,260, 276
Methyl <i>p</i> -methylbenzoate.....	4.3	33	.....	.....	32
$\text{C}_9\text{H}_{10}\text{O}_3$ Methyl <i>o</i> -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]
<i>p</i> -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	$t^{\circ}\text{C}$	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]
$\text{C}_9\text{H}_{12}\text{O}$ α -Ethoxytoluene (Benzyl ethyl ether)	3.9 ⁿ	20	.....	.....	27
$\text{C}_9\text{H}_{13}\text{N}$ Benzylethylamine.....	4.3 ⁿ	20	.....	.....	27
<i>N,N</i> -Dimethyl- <i>o</i> -toluidine.....	3.4 ⁿ	20	.....	.....	27
<i>N,N</i> -Dimethyl- <i>p</i> -toluidine.....	3.9 ⁿ	20	.....	.....	27
$\text{C}_9\text{H}_{14}\text{O}_6$ Glyceryl triacetate (Triacetin)	7.1 ₉	20	.....	.....	244 [27,232]
$\text{C}_9\text{H}_{16}\text{O}_4$ Diethyl glutarate.....	6.66	30	2.7	30,40	260
<i>dl</i> -erythro-2,3-Diacetoxypentane	6.73 ₄	25	.....	.....	238
<i>dl</i> -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
$\text{C}_9\text{H}_{18}\text{O}$ 2,2,4,4-Tetramethyl-3-pentanone (Hexamethyl acetone)	10.0	14.5	.....	.....	84
$\text{C}_9\text{H}_{18}\text{O}_2$ Isoamyl butyrate.....	4.0 ⁿ	20	.....	.....	27
Isobutyl valerate.....	3.8 ⁿ	19	.....	.....	27
$\text{C}_9\text{H}_{19}\text{Br}$ 1-Bromononane.....	5.42 4.74	-20 25	1.3 1.13	-35,16 1,55	286 272
$\text{C}_9\text{H}_{19}\text{BrO}$ 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} <i>n</i> -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	$t^{\circ}\text{C}$	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}					
$\text{C}_{10}\text{H}_7\text{Br}$ 1-Bromonaphthalene.....	4.83	25	0.87	25,55	272 [7,12]
$\text{C}_{10}\text{H}_7\text{Cl}$ 1-Chloronaphthalene.....	5.04	25	1.07	1,55	272
C_{10}H_8 Naphthalene.....	2.54	85	.....	.....	196,246
$\text{C}_{10}\text{H}_{10}\text{N}_2$ 2,3-Dimethylquinoxaline.....	2.28	25	.....	.....	153
$\text{C}_{10}\text{H}_{10}\text{O}_2$ 1-Allyl-3,4-methylenedioxy- benzene (Safrole)	3.1 ^a	21	.....	.....	7 [22]
1-Propenyl-3,4-methylene- dioxybenzene (Isosafrole)	3.3 ^a	21	.....	.....	7 [22]
$\text{C}_{10}\text{H}_{10}\text{O}_4$ Dimethyl phthalate.....	8.5	24	.....	.....	232
$\text{C}_{10}\text{H}_{12}$ Dicyclopentadiene.....	2.43	40	0.20	40,100	241
1,2,3,4-Tetrahydro- naphthalene (Tetralin)	2.757	20	0.29	10,40	163,196
$\text{C}_{10}\text{H}_{12}\text{O}$ Cumaldehyde (<i>p</i> -Isopropylbenzaldehyde)	11.	15	.....	.....	4
Tetrahydro- β -naphthol.....	11.7 8.1 ₇ 6.7 ₅	20 60 90	.....	.....	256
$\text{C}_{10}\text{H}_{12}\text{O}_2$ Ethyl phenylacetate.....	5.2 ₉ ^a	21	.....	.....	7
4-Allyl-1-hydroxy-2- methoxybenzene (Eugenol)	10.5	0	.....	.....	103 [22]
$\text{C}_{10}\text{H}_{14}$ Isobutylbenzene.....	2.35	17	.....	.....	1,3
<i>t</i> -Butylbenzene.....	2.38	20	.....	.....	35
1-Methyl-4-isopropylbenzene (<i>p</i> -Cymene)	2.24 ₃	20	0.16	4,60	3,100,158 [41,196]
$\text{C}_{10}\text{H}_{14}\text{O}$ Carvone.....	11. ^b	22	.....	.....	22
$\text{C}_{10}\text{H}_{14}\text{O}_2$ <i>d</i> l-2,3-Camphanedione.....	16. ₃	203	.....	.....	237
$\text{C}_{10}\text{H}_{15}\text{N}$ <i>N,N</i> -Diethylaniline.....	5.5 ⁿ	19	.....	.....	27
$\text{C}_{10}\text{H}_{15}\text{NO}_2$ 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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_{10}\text{H}_{16}$	<i>d</i> -Camphene.....	2.33	ca 40	.....	.....	237 [24]
	<i>d</i> -Pinene.....	2.64	25	.....	.....	164 [24]
	<i>l</i> -Pinene.....	2.76	20	.....	.....	196 [24]
	Terpinene.....	2.7 ^b	21	.....	.....	22
	<i>d</i> -Limonene.....	2.3 ₆	20	.....	.....	24
	<i>dl</i> -Limonene (Dipentene).....	2.3 ₀	20	.....	.....	24
$\text{C}_{10}\text{H}_{16}\text{O}$	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
$\text{C}_{10}\text{H}_{17}\text{Cl}$	<i>dl</i> -Bornyl chloride.....	5.21	95	.....	.....	237
$\text{C}_{10}\text{H}_{18}$	5-Decyne (Dibutylacetylene)..<	2.173	25	0.148	25, 125	154
	<i>cis</i> -Decahydronaphthalene....	2.19 ₇	20	0.11	20, 100	128, 275
	<i>trans</i> -Decahydronaphthalene...	2.17 ₂	20	0.11	20, 100	128, 275
$\text{C}_{10}\text{H}_{18}\text{O}$	Menthone.....	8.8 ^b	18	.....	.....	22 [27]
		11. ₈	-35	.....	.....	232
$\text{C}_{10}\text{H}_{20}$	<i>cis</i> -5-Decene.....	2.071	25	.....	.....	239
	<i>trans</i> -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
$\text{C}_{10}\text{H}_{20}\text{O}$	<i>l</i> - α -Menthol.....	3.95	42	.....	.....	237 [289]
$\text{C}_{10}\text{H}_{20}\text{O}_2$	Isoamyl valerate.....	3.6 ⁿ	19	.....	.....	27
$\text{C}_{10}\text{H}_{21}\text{Br}$	1-Bromodecane.....	4.44	25	1.07	25, 55	272
		4.75	1			
$\text{C}_{10}\text{H}_{22}$	<i>n</i> -Decane.....	1.991	20	0.130	10, 110	88
		2.050	-30			
		1.844	130			
		1.783	170			
	2,7-Dimethyloctane.....	1.983	20	0.137	20, 120	141 [35]
$\text{C}_{10}\text{H}_{22}\text{O}$	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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_{10}\text{H}_{22}\text{S}$	Amyl sulfide.....	3.83	25	.....	.....	140
		3.59	50	.....	.....
$\text{C}_{10}\text{H}_{23}\text{N}$	Diisoamylamine.....	2.5 ^b	18	.....	.....	22
C₁₁						
$\text{C}_{11}\text{H}_7\text{N}$	1-Naphthonitrile.....	16. ₀ ^b	70	0.16(α)	22,70	14
	2-Naphthonitrile.....	16. ₉ ^b	70	.....	.....	14
$\text{C}_{11}\text{H}_{10}$	1-Methylnaphthalene.....	2.71	20	.....	.....	113,202
$\text{C}_{11}\text{H}_{12}\text{O}_2$	Ethyl cinnamate.....	6.1	18	.....	.....	8,56 [7,216,260]
$\text{C}_{11}\text{H}_{12}\text{O}_3$	Ethyl benzoylacetate.....	12. ₄	20	.....	.....	8 [7,17]
$\text{C}_{11}\text{H}_{14}\text{O}_2$	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
$\text{C}_{11}\text{H}_{14}\text{O}_3$	Ethyl o-ethoxybenzoate.....	7.0 ^a	21	.....	.....	7
$\text{C}_{11}\text{H}_{16}$	1-Methyl-4-tert-butylbenzene...	2.33	20	0.20	0,60	158
$\text{C}_{11}\text{H}_{20}\text{O}_4$	<i>dl</i> -erythro-3,4-Di- acetoxyheptane	6.68 ₄	25	.....	.....	238
	<i>dl</i> -threo-3,4 -Di- acetoxyheptane	5.02 ₉	25	.....	.....	238
$\text{C}_{11}\text{H}_{22}\text{O}$	2-Undecanone.....	8.4	14.5	.....	.....	84
$\text{C}_{11}\text{H}_{23}\text{Br}$	1-Bromoundecane.....	4.73	-9	.....	.....	286
$\text{C}_{11}\text{H}_{24}$	<i>n</i> -Undecane.....	2.005	20	0.125	10,130	88
		2.039	-10	.....	.....
		1.838	150	.....	.....
		1.781	190	.....	.....
C₁₂						
$\text{C}_{12}\text{H}_8\text{O}$	Dibenzofuran.....	3.0 ₀	100	.....	.....	232
	(Diphenylene oxide)					
$\text{C}_{12}\text{H}_{10}$	Diphenyl.....	2.53	75	0.18	75,155	67
$\text{C}_{12}\text{H}_{10}\text{O}$	Azoxybenzene.....	5.1	40	.....	.....	289
$\text{C}_{12}\text{H}_{10}\text{O}$	Phenyl ether.....	3.65	30	0.7	30,50	66,260 [289]
$\text{C}_{12}\text{H}_{11}\text{N}$	Diphenylamine.....	3.3	52	.....	.....	32
$\text{C}_{12}\text{H}_{12}\text{O}$	1-Ethoxynaphthalene.....	3.3 ⁿ	19	.....	.....	27
$\text{C}_{12}\text{H}_{16}\text{O}$	<i>o</i> -Cyclohexylphenol.....	3.97	55	.....	.....	237
	<i>p</i> -Cyclohexylphenol.....	4.42	131	.....	.....	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	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
$\text{C}_{12}\text{H}_{16}\text{O}_2$	Amyl benzoate.....	5.00	20	0.7	at 20	7,8,10 [27]
$\text{C}_{12}\text{H}_{16}\text{O}_3$	Isoamyl salicylate.....	5.4 ⁿ	20	.....	.....	27
$\text{C}_{12}\text{H}_{20}\text{O}_2$	Bornyl acetate.....	4.6	21	.....	.....	232
$\text{C}_{12}\text{H}_{22}$	6-Dodecyne (Diamylacetylene)	2.171	25	0.148	25,125	154
$\text{C}_{12}\text{H}_{22}\text{O}_6$	Dibutyl tartrate.....	9.4	41	.....	.....	232
$\text{C}_{12}\text{H}_{25}\text{Br}$	1-Bromododecane.....	4.07	25	0.9	1,55	272
$\text{C}_{12}\text{H}_{25}\text{Cl}$	1-Chlorododecane.....	4.17	25	1.2	1,40	272
		3.85	55			
$\text{C}_{12}\text{H}_{25}\text{I}$	1-Iodododecane.....	3.93	20	.....	.....	242
$\text{C}_{12}\text{H}_{26}$	<i>n</i> -Dodecane.....	2.014	20	0.120	10,150	88
		2.047	-10			
		1.776	210			
$\text{C}_{12}\text{H}_{26}\text{O}$	1-Dodecanol.....	6.5	25	.....	.....	281 [142]
$\text{C}_{12}\text{H}_{27}\text{O}_4\text{P}$	Tributylphosphate.....	7.95 ₉	30	2.74	30,35	295
C₁₃						
$\text{C}_{13}\text{H}_{10}\text{O}$	Benzophenone.....	11.4	50	.....	.....	180 [26,260]
$\text{C}_{13}\text{H}_{10}\text{O}_3$	Phenylsalicylate.....	6.3	50	.....	.....	289
$\text{C}_{13}\text{H}_{12}$	Diphenylmethane.....	2.57	25	0.14	20,50	66,269
$\text{C}_{13}\text{H}_{14}\text{O}_4$	Ethyl α -benzoyl-acetoacetate	12.	21	.....	.....	8 [7]
$\text{C}_{13}\text{H}_{20}\text{O}$	α -Ionone.....	10.8	19	.....	.....	253
	β -Ionone.....	11.7	25	.....	.....	253
$\text{C}_{13}\text{H}_{24}\text{O}_4$	Diethyl azelate.....	5.13	30	1.6	30,40	260
$\text{C}_{13}\text{H}_{26}\text{O}_2$	Ethyl undecanoate.....	3.55	20	0.83	-22,28	201
$\text{C}_{13}\text{H}_{27}\text{Br}$	1-Bromotridecane.....	4.20	10	.....	.....	286
C₁₄						
$\text{C}_{14}\text{H}_{10}$	Phenanthrene.....	2.72	110	.....	.....	246
$\text{C}_{14}\text{H}_{10}\text{O}_2$	Benzil.....	13.0	95	.....	.....	68 [32]
		12.1	120			
$\text{C}_{14}\text{H}_{12}\text{O}_2$	Benzyl benzoate.....	4.9 ⁿ	20	.....	.....	27
$\text{C}_{14}\text{H}_{12}\text{O}_3$	Benzyl salicylate.....	4.1 ⁿ	20	.....	.....	27
$\text{C}_{14}\text{H}_{14}$	1,2-Diphenylethane.....	2.38	110	0.17	57,178	67
$\text{C}_{14}\text{H}_{15}\text{N}$	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	$t^{\circ}\text{C}$	a (or a) $\times 10^2$	Range t_1, t_2	References
$\text{C}_{14}\text{H}_{16}\text{O}_4$ Diethyl benzalmalonate.....	8.0 7.6 5.9	0 20 70	.....	.....	8
$\text{C}_{14}\text{H}_{26}\text{O}_4$ Diethyl sebacate.....	5.00	30	1.2	30, 40	260
$\text{C}_{14}\text{H}_{28}\text{O}_2$ Ethyl dodecanoate (Ethyl laurate)	3.44 2.73	20 143	0.65	20, 100	67
$\text{C}_{14}\text{H}_{29}\text{Br}$ 1-Bromotetradecane.....	3.84	25	0.80	1, 55	272
$\text{C}_{14}\text{H}_{30}\text{O}$ 1-Tetradecanol.....	4.72 4.40	38 48	.....	.....	281
C₁₅					
$\text{C}_{15}\text{H}_{24}$ Cedrene.....	3.27	25	.....	.....	221
$\text{C}_{15}\text{H}_{31}\text{Br}$ 1-Bromopentadecane.....	3.89	20	.....	.....	286
C₁₆					
$\text{C}_{16}\text{H}_{22}\text{O}_4$ Dibutyl phthalate.....	6.43 ₆	30	1.98	30, 35	295 [267]
$\text{C}_{16}\text{H}_{32}\text{O}_2$ Palmitic acid.....	2.30	71	.....	.....	181, 192
$\text{C}_{16}\text{H}_{33}\text{Br}$ 1-Bromohexadecane.....	3.71	25	0.7	25, 55	272, 293
$\text{C}_{16}\text{H}_{33}\text{I}$ 1-Iodohexadecane.....	3.50	20	.....	.....	242 [27]
$\text{C}_{16}\text{H}_{34}\text{O}$ 1-Hexadecanol.....	3.82	50	1.7	48, 67	191, 201
C₁₇					
$\text{C}_{17}\text{H}_{34}\text{O}$ 9-Heptadecanone.....	5.3	60	.....	.....	195
$\text{C}_{17}\text{H}_{34}\text{O}_4$ Monomyristin.....	6.1	70	.....	.....	214
C₁₈					
$\text{C}_{18}\text{H}_{30}\text{O}_4$ Dicyclohexyl adipate.....	4.84	35	.....	.....	237
$\text{C}_{18}\text{H}_{32}\text{O}_2$ Linoleic acid.....	2.61 2.71 2.70 2.60	0 20 70 120	.....	.....	208, 235, 262
$\text{C}_{18}\text{H}_{33}\text{NaO}_2$ Sodium oleate.....	2.8 ^a	mp	.....	.....	21
$\text{C}_{18}\text{H}_{34}\text{O}_2$ Oleic acid.....	2.46 2.45 2.41	20 60 100	.....	.....	136, 181, 208, 235, 262
$\text{C}_{18}\text{H}_{34}\text{O}_4$ Dibutyl sebacate.....	4.54 ₀	30	1.07	30, 35	295 [267, 279]

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

C. ORGANIC LIQUIDS—Continued

Substance	ϵ	$t^{\circ}\text{C}$	n (or n_D) $\times 10^2$	Range t_1, t_2	References
$\text{C}_{18}\text{H}_{36}\text{O}_2$ Stearic acid.....	2.29 2.26	70 100	..... .....	..... .....	67, 181, 192 262
Ethyl palmitate.....	3.20 2.71 2.46	20 104 182	0.4	20, 40	201 67
$\text{C}_{18}\text{H}_{37}\text{Br}$ 1-Bromooctadecane.....	3.53	30	0.5	27, 58	293
$\text{C}_{18}\text{H}_{36}\text{O}$ 1-Octadecanol.....	3.42 3.35	58 63	..... .....	..... .....	281
C₁₉					
$\text{C}_{19}\text{H}_{16}$ Triphenylmethane.....	2.45	100	0.14	94, 175	67
$\text{C}_{19}\text{H}_{38}\text{O}_4$ Monopalmitin.....	5.34 5.09	67 80	..... .....	..... .....	287
C₂₀					
$\text{C}_{20}\text{H}_{38}\text{O}_2$ Ethyl oleate.....	3.17 2.63	28 150	0.48	28, 122	67
$\text{C}_{20}\text{H}_{40}\text{O}_2$ Ethyl stearate.....	2.98 2.69 2.48	40 100 167	0.6	32, 50	67, 201, 260
C₂₁					
$\text{C}_{21}\text{H}_{21}\text{O}_4\text{P}$ Tricresyl phosphate.....	6.9	40	.....	.....	219
$\text{C}_{21}\text{H}_{42}\text{O}_3$ β -Methoxyethyl stearate.....	3.39	50	.....	.....	260
$\text{C}_{21}\text{H}_{42}\text{O}_4$ Monostearin.....	4.87 4.71	77 89	..... .....	..... .....	287 [214]
C₂₂					
$\text{C}_{22}\text{H}_{42}\text{O}_2$ Butyl oleate.....	4.0	25	.....	.....	232
$\text{C}_{22}\text{H}_{42}\text{O}_3$ Isobutyl ricinoleate (Isobutyl 12-hydroxy-9-octadecenoate)	4.7	21	.....	.....	26
$\text{C}_{22}\text{H}_{44}\text{O}_2$ Butyl stearate.....	3.11 ₁	30	0.53	30, 35	295
$\text{C}_{22}\text{H}_{45}\text{Br}$ 1-Bromodocosane.....	3.12	55	0.5	43, 60	293
$\text{C}_{22}\text{H}_{46}$ <i>n</i> -Docosane.....	2.00	50	.....	.....	195
$\text{C}_{22}\text{H}_{46}\text{O}$ 1-Docosanol.....	2.96	70	.....	.....	281
C₂₃					
$\text{C}_{23}\text{H}_{46}\text{O}$ 12-Tricosanone.....	4.0 ₅	80	1.	72, 90	195

C. ORGANIC LIQUIDS—Continued

Substance	ϵ	$t^{\circ}\text{C}$	a (or α) $\times 10^2$	Range t_1, t_2	References
C₂₄					
$\text{C}_{24}\text{H}_{30}\text{O}_4$ Dibenzyl sebacate.....	4.6	25	.....	.....	267
$\text{C}_{24}\text{H}_{38}\text{O}_4$ Dioctyl phthalate.....	5.1	25	.....	.....	267
C₂₆					
$\text{C}_{26}\text{H}_{50}\text{O}_4$ Dioctyl sebacate.....	4.01	26	.....	.....	279
C₃₄					
$\text{C}_{34}\text{H}_{66}$ Tetratriacontadiene.....	2.82	25	.....	.....	155
C₃₅					
$\text{C}_{35}\text{H}_{68}\text{O}_5$ 1,3-Dipalmitin.....	3.52 3.49	72 76	.....	.....	288
C₃₆					
$\text{C}_{36}\text{H}_{66}\text{CuO}_4$ Copper oleate.....	2.8_0^a	mp	.....	.....	21
$\text{C}_{36}\text{H}_{66}\text{O}_4\text{Pb}$ Lead oleate.....	3.7_0^a	mp	.....	.....	21
C₃₉					
$\text{C}_{39}\text{H}_{76}\text{O}_5$ 1,3-Distearin.....	3.32 3.29	78 82	.....	.....	288
C₅₁					
$\text{C}_{51}\text{H}_{98}\text{O}_6$ Tripalmitin.....	2.92_7	60	0.32	60,70	288
C₅₇					
$\text{C}_{57}\text{H}_{104}\text{O}_6$ Triolein.....	3.20	25	235 [208]
$\text{C}_{57}\text{H}_{110}\text{O}_6$ Tristearin.....	2.78_5	70	0.34	70,80	288 [262]

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

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