Physical constants of liquids

~~~ means *same decade for the whole column*

	Density kg/dm³ (or rel. to water)	Volume Coefficient of Expansion	Sp. heat (20°C–100°C) j/g °C	Sp. heat (20°C–100°C) cal/g°C = Btu/lb°F	Thermal Conductivity w/m°C	Thermal Conductivity cal/cm sec°C	Melting point °C
Acetone	0.791	1.43×10^{-3}	2.17	0.52	0.180	4.31×10^{-4}	− 96
Aniline	1.030	0.85	2.05	0.49	0.17	4.1	− 6
Benzene, Benzol	0.881	1.15	1.71	0.41	0.139	3.33	+ 5.5
Bromine	3.14	1.12	0.46	0.11	—	—	− 7
Chloroform	1.498	1.27	0.96	0.23	0.121	2.89	− 64
Carbon disulfide	1.261	1.22	1.00	0.24	0.143	3.42	−112
Carbon tetrachloride	1.596	1.22	0.84	0.20	0.10	2.5	− 23
Ethyl acetate	0.900	1.35	2.01	0.48	0.15	3.6	− 84
Ethyl alcohol	0.791	1.10	2.43	0.58	0.181	4.33	−115
Ethyl ether	0.716	1.62	2.30	0.55	0.138	3.30	−116
Glycerol	1.270	0.505	2.43	0.58	0.285	6.81	+ 18
Glycol	1.116	—	2.43	0.58	—	—	− 17
Mercury	13.55	0.181	0.147	0.035	10.5	250	− 39
Methyl alcohol	0.793	1.20	2.48	0.58	0.21	5.0	− 98
Nitrobenzene	1.210	0.83	1.47	0.35	0.163	3.90	+ 5.7
Olive oil	0.915	0.72	1.67	0.40	0.167	4.0	—
Ricinus oil	0.961	0.69	1.80	0.43	0.184	4.4	—
Sulfuric acid	1.85	0.56	1.38	0.33	—	—	—
Terpentine	0.85	1.0	1.76	0.42	0.15	3.6	− 10
Toluene	0.890	1.09	1.72	0.41	0.15	3.6	− 95
Trichloroethylene	1.480	1.19	0.96	0.23	—	—	− 86
Water	0.999	0.18	4.18	0.999	0.560	13.4	0
Xylol (meta-)	0.870	0.99	1.67	0.40	—	—	− 54

General comments on the tables pp. 48–53

After the decision of 1960 mentioned on p. 1A, the SI units are likely to be used by all physicists after some transition time. This has already happened in many texts from the US, Europe, and the Soviet Union (officially since 1963). In some of the countries, they have been recommended officially.

However, in tables like these it is also necessary to use two other representations. One is the cgs system of units, the other those used by mechanical technologists. As stated on p. 46 and elsewhere, reductions between SI and cgs units are simple, e.g. 1 w/m°C = 1×10^7 erg/10^2 cm°C = 10^5 erg/cm°C. The cal units which belong neither to the SI nor the cgs system have been retained here and given in parallel columns.

For mechanical technologists, the force and pressure units are particularly useful, and it is doubtful whether the SI units will replace the pound and inch systems in practice. In any case, these units will inevitably be used together for a long time. We have taken this into account by giving both sorts of units, or all sorts of units when the conversion factors at the bottom of the pages are taken into account. For those quantities which are closest to mechanical practice, such as tensile strength, the units are mainly given in the pound force system. Further, the thermal unit Btu and related quantities have been used when appropriate.

A few compound units are worth special attention:

Thermal conductivity

The SI unit is w/m°C. It is transformed into other units by the relations 1 w/m°C = 10^{-3} kw hr/m hr °C = 860×10^{-3} kcal/m hr °C = 0.860 kcal/m hr °C. Further 1 w/m°C = 6.939 British termal unit per square foot per hour for a temperature gradient of 1°F per inch, or expressed dimensionally, = 6.939 Btu in/ft² hr °F.

Coefficients of heat radiation, or heat transfer at surfaces, are given most commonly

Heat of fusion j/g	Heat of fusion cal/g	Boiling point °C	Latent heat j/g	Latent heat cal/g	Viscosity centipoise	Surface tension dyne/cm	Dielectr. constant ε_r	Refr. index Na D	Formula
98	23.5	—	509	121.6	0.337	23.3	21.5	1.359	$(CH_3)_2 \cdot CO$
88	21	184	435	104	4.6	43	7.0	1.586	$C_6H_5 \cdot NH_2$
127	30.4	80	393	94	0.673	29	2.3	1.501	C_6H_6
68	16.2	59	180	43	1.02	44	3.2	1.661	Br_2
—	—	61	255	61	0.58	27	5.5	1.446	$CHCl_3$
—	—	46	351	84	0.38	32	—	1.628	CS_2
18	4.2	77	193	46	1.01	26	2.2	1.463	CCl_4
107	25.6	77	368	88	0.424	23	6.1	1.372	$CH_3 \cdot COO \cdot C_2H_5$
102	24.3	78	841	201	1.25	22	26	1.360	C_2H_5OH
113	27	35	377	90	0.238	17	4.3	1.353	$(C_2H_5)_2O$
176	42	290	—	—	1500	63	56	1.473	$C_3H_5(OH)_3$
201	48	197	800	191	—	48	41	1.427	$(CH_2OH)_2$
11.8	2.82	357	301	72	1.57	500	—	—	Hg
92	22	65	1109	265	0.60	23	32	1.331	CH_3OH
92	22	210	331	79	—	23	36	1.553	$C_6H_5NO_2$
—	—	—	—	—	90	—	3.1	—	Olive oil
—	—	—	—	—	> 5000	—	4.6	1.48	Ricinus oil
—	—	326	511	122	28	—	—	—	H_2SO_4
—	—	180	293	70	1.5	—	2.3	1.485	$C_{10}H_{14}$
71	17	111	356	85	0.6	29	2.4	1.496	$C_6H_5 \cdot CH_3$
—	—	87	239	57	1.2	32	—	1.481	C_2HCl_3
333	79.5	+100	2260	539	1.06	73	81	1.333	H_2O
109	26	139	339	81	0.69	29	2.4	1.500	$C_6H_4(CH_3)_2$

in the SI system by w/m²°C = 0.860 kcal/m² hr °C.

in the Btu-inch system, by Btu/ft² hr °F. Reduction, 1 Btu/ft² hr °F = 5.677 w/m² °C = 4.882 kcal/m² hr °C. Inversely, 1 w/m² °C = 0.1761 Btu/ft² hr °F.

Viscosity or Coefficient of Internal Friction, symbol η.

The most common unit, the centipoise, is used in the tables. It is related to the rarely used SI unit by: 10^3 centipoise = 1 newton sec/m².

Conversion factors: 1 centipoise = 10^{-2} poise (cgs units) = 10^{-2} dyne sec/cm².

1 centipoise = 1.020×10^{-4} kgf sec/m².

1 centipoise = 2.089×10^{-6} lbf sec/ft² = 1.450×10^{-7} lbf sec/in²

Viscosity units defined by special measurement methods, such as degree Engler (German), are to be avoided.

Kinematic Viscosity, symbol $\nu = \eta/\varrho$.

Being the ratio of viscosity to density, this unit is independent of the units of force and mass. It has the dimension length square over time.

The SI, and metric system, unit, is 1 m²/sec. (= 10^4 cm²/sec).

The cgs unit is called 1 stoke = 1 poise cm³/gram = 1 cm²/sec.

The inch unit is 1 in²/sec = 6.451 cm²/sec = 6.451 stoke.

Surface Tension

The cgs unit is most used, 1 dyne/cm, and is given in the table here.

The SI unit is 1 newton/m = 10^3 dyne/cm.

Other units, with their conversion factors, are

1 milligramf/mm; 1 dyne/cm = 0.1020 mgf/mm.

1 milligramf/inch; 1 dyne/cm = 2.5901 mgf/in.
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