

## PRESSURE AND TEMPERATURE DEPENDENCE OF LIQUID DENSITY

This table gives data on the variation of the density of some common liquids with pressure and temperature. The pressure dependence is described to first order by the isothermal compressibility coefficient  $\kappa$  defined as

$$\kappa = -(1/V) (\partial V/\partial P)_T$$

where  $V$  is the volume, and the temperature dependence by the cubic expansion coefficient  $\alpha$ ,

$$\alpha = (1/V) (\partial V/\partial T)_P$$

Substances are listed by molecular formula in the Hill order. More precise data on the variation of density with temperature over a wide temperature range can be found in Reference 1.

### REFERENCES

1. Lide, D. R., and Kehiaian, H. V., *CRC Handbook of Thermophysical and Thermochemical Data*, CRC Press, Boca Raton, FL, 1994.
2. Le Neindre, B., *Effets des Hautes et Très Hautes Pressions*, in *Techniques de l'Ingénieur*, Paris, 1991.
3. *Landolt-Börnstein, Numerical Data and Functional Relationships in Science and Technology, New Series, IV/4, High-pressure Properties of Matter*, Springer-Verlag, Heidelberg, 1980.
4. Riddick, J.A., Bunger, W.B., and Sakano, T.K., *Organic Solvents, Fourth Edition*, John Wiley & Sons, New York, 1986.
5. Isaacs, N. S., *Liquid Phase High Pressure Chemistry*, John Wiley, New York, 1981.

Molecular formula	Name	Isothermal Compressibility		Cubic Thermal Expansion	
		$t/^\circ\text{C}$	$\kappa \times 10^4/\text{MPa}^{-1}$	$t/^\circ\text{C}$	$\alpha \times 10^3/^\circ\text{C}^{-1}$
Cl <sub>3</sub> P	Phosphorus trichloride	20	9.45	20	1.9
H <sub>2</sub> O	Water	20	4.591	20	0.206
		25	4.524	25	0.256
		30	4.475	30	0.302
Hg	Mercury	20	0.401	20	1.811
CCl <sub>4</sub>	Tetrachloromethane	20	10.50	20	1.14
		40	12.20	40	1.21
		70	15.6	70	1.33
CHBr <sub>3</sub>	Tribromomethane	50	8.76	25	0.91
CHCl <sub>3</sub>	Trichloromethane	20	9.96	20	1.21
		50	12.9	50	1.33
CH <sub>2</sub> Br <sub>2</sub>	Dibromomethane	27	6.85		
CH <sub>2</sub> Cl <sub>2</sub>	Dichloromethane	25	10.3	25	1.39
CH <sub>3</sub> I	Iodomethane	27	10.3	25	1.26
CH <sub>4</sub> O	Methanol	20	12.14	20	1.49
		40	13.83	40	1.59
CS <sub>2</sub>	Carbon disulfide	20	9.38	20	1.12
		40	10.6	35	1.16
C <sub>2</sub> Cl <sub>4</sub>	Tetrachloroethylene	25	7.56	25	1.02
C <sub>2</sub> HCl <sub>3</sub>	Trichloroethylene	25	8.57	25	1.17
C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub>	trans-1,2-Dichloroethylene	25	11.2	25	1.36
C <sub>2</sub> H <sub>4</sub> Cl <sub>2</sub>	1,1-Dichloroethane	20	7.97	25	0.93
C <sub>2</sub> H <sub>4</sub> Cl <sub>2</sub>	1,2-Dichloroethane	30	8.46	20	1.14
C <sub>2</sub> H <sub>4</sub> O <sub>2</sub>	Acetic acid	20	9.08	20	1.08
		80	13.7	80	1.38
C <sub>2</sub> H <sub>5</sub> Br	Bromoethane	20	11.53	20	1.31
C <sub>2</sub> H <sub>5</sub> I	Iodoethane	20	9.82	25	1.17
C <sub>2</sub> H <sub>6</sub> O	Ethanol	20	11.19	20	1.40
		70	15.93	70	1.67
C <sub>2</sub> H <sub>6</sub> O <sub>2</sub>	Ethylene glycol	20	3.64	20	0.626
C <sub>3</sub> H <sub>6</sub> O	Acetone	20	12.62	20	1.46
		40	15.6	40	1.57
C <sub>3</sub> H <sub>7</sub> Br	1-Bromopropane	0	10.22	25	1.2
C <sub>3</sub> H <sub>7</sub> Cl	1-Chloropropane	0	12.09	20	1.4
C <sub>3</sub> H <sub>7</sub> I	1-Iodopropane	0	10.22	25	1.09
C <sub>3</sub> H <sub>8</sub> O	1-Propanol	0	8.43	0	1.22
C <sub>3</sub> H <sub>8</sub> O	2-Propanol	40	13.32	40	1.55
C <sub>3</sub> H <sub>8</sub> O <sub>2</sub>	1,2-Propanediol	0	4.45	20	0.695

**PRESSURE AND TEMPERATURE DEPENDENCE OF LIQUID DENSITY (continued)**

Molecular formula	Name	Isothermal Compressibility		Cubic Thermal Expansion	
		$t/^\circ\text{C}$	$\kappa \times 10^4/\text{MPa}^{-1}$	$t/^\circ\text{C}$	$\alpha \times 10^3/^\circ\text{C}^{-1}$
C <sub>3</sub> H <sub>8</sub> O <sub>2</sub>	1,3-Propanediol	0	4.09	20	0.61
C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>	Glycerol	0	2.54	20	0.520
C <sub>4</sub> H <sub>8</sub> O <sub>2</sub>	Ethyl acetate	20	11.32	20	1.35
		60	16.2	60	1.54
C <sub>4</sub> H <sub>9</sub> Br	1-Bromobutane	25	10.26	20	1.13
C <sub>4</sub> H <sub>9</sub> I	1-Iodobutane	0	7.73	25	1.02
C <sub>4</sub> H <sub>10</sub> O	1-Butanol	0	8.10	0	1.12
C <sub>4</sub> H <sub>10</sub> O	Diethyl ether	20	18.65	20	1.65
		30	20.85	30	1.72
C <sub>4</sub> H <sub>10</sub> O <sub>3</sub>	Diethylene glycol	0	3.34	20	0.635
C <sub>5</sub> H <sub>10</sub>	Cyclopentane	20	13.31	20	1.35
C <sub>5</sub> H <sub>11</sub> Br	1-Bromopentane	0	8.42	25	1.04
C <sub>5</sub> H <sub>11</sub> I	1-Iodopentane	0	7.56		
C <sub>5</sub> H <sub>12</sub>	Pentane	25	21.80	25	1.64
C <sub>5</sub> H <sub>12</sub> O	1-Pentanol	0	7.71	0	1.02
C <sub>6</sub> H <sub>5</sub> Br	Bromobenzene	20	6.46	20	0.86
C <sub>6</sub> H <sub>5</sub> Cl	Chlorobenzene	20	7.45	20	0.94
C <sub>6</sub> H <sub>5</sub> NO <sub>2</sub>	Nitrobenzene	20	4.93	25	0.833
C <sub>6</sub> H <sub>6</sub>	Benzene	25	9.66	25	1.14
		45	11.28	45	1.21
C <sub>6</sub> H <sub>6</sub> O	Phenol	60	6.05	60	0.82
C <sub>6</sub> H <sub>7</sub> N	Aniline	20	4.53	20	0.81
		80	6.32	80	0.91
C <sub>6</sub> H <sub>12</sub>	Cyclohexane	20	11.30	20	1.15
		60	15.2	60	1.29
C <sub>6</sub> H <sub>14</sub>	Hexane	25	16.69	25	1.41
		45	20.27	45	1.52
C <sub>6</sub> H <sub>14</sub>	2-Methylpentane	0	13.97	25	1.43
		0	14.57	25	1.40
C <sub>6</sub> H <sub>14</sub>	2,3-Dimethylbutane	20	17.97	25	1.39
C <sub>6</sub> H <sub>14</sub> O	1-Hexanol	25	8.24	25	1.03
C <sub>6</sub> H <sub>15</sub> NO <sub>3</sub>	Triethanolamine	0	3.61	55	0.53
C <sub>7</sub> H <sub>8</sub>	Toluene	20	8.96	20	1.05
		50	11.0	50	1.13
C <sub>7</sub> H <sub>8</sub> O	Anisole	20	6.60	20	0.951
C <sub>7</sub> H <sub>14</sub>	Cycloheptane	20	9.22		
C <sub>7</sub> H <sub>16</sub>	Heptane	25	14.38	25	1.26
C <sub>8</sub> H <sub>10</sub>	<i>o</i> -Xylene	25	8.10	25	0.96
C <sub>8</sub> H <sub>10</sub>	<i>m</i> -Xylene	20	8.46	20	0.99
C <sub>8</sub> H <sub>10</sub>	<i>p</i> -Xylene	25	8.59	25	1.00
C <sub>8</sub> H <sub>16</sub>	Cyclooctane	20	8.03		
C <sub>8</sub> H <sub>18</sub>	Octane	25	12.82	25	1.16
		45	15.06	45	1.23
C <sub>8</sub> H <sub>18</sub> O	1-Octanol	25	7.64	25	0.827
C <sub>9</sub> H <sub>12</sub>	Mesitylene	25	8.14	25	0.94
C <sub>9</sub> H <sub>14</sub> O <sub>6</sub>	Triacetin	0	4.49	25	0.94
C <sub>9</sub> H <sub>20</sub>	Nonane	25	11.75	25	1.08
C <sub>10</sub> H <sub>22</sub>	Decane	25	10.94	25	1.02
C <sub>11</sub> H <sub>24</sub>	Undecane	25	10.31	25	0.97
C <sub>12</sub> H <sub>26</sub>	Dodecane	25	9.88	25	0.93
C <sub>13</sub> H <sub>28</sub>	Tridecane	25	9.48	25	0.90
C <sub>14</sub> H <sub>30</sub>	Tetradecane	25	9.10	25	0.87
C <sub>15</sub> H <sub>32</sub>	Pentadecane	25	8.82		
C <sub>16</sub> H <sub>22</sub> O <sub>4</sub>	Butyl phthalate	0	5.0	25	0.86
C <sub>16</sub> H <sub>34</sub>	Hexadecane	25	8.57		
		45	9.78		
C <sub>19</sub> H <sub>36</sub> O <sub>2</sub>	Methyl oleate	0	6.18	60	0.85