

5. Tabulated Data on Density - Carboxylic Acids

5.1 Saturated Carboxylic Acids

5.1.1 Saturated Carboxylic Acids, C₁ - C₆

Methanoic acid

[64-18-6]

CH₂O₂

MW = 46.03

347

Table 1. Coefficients of the polynomial expansion equation. Standard deviations (see introduction): $\sigma_{c,w} = 5.7160 \cdot 10^{-1}$ (combined temperature ranges, weighted), $\sigma_{c,uw} = 1.2932 \cdot 10^{-1}$ (combined temperature ranges, unweighted).

Coefficient	T = 273.15 to 372.95 K $\rho = A + BT + CT^2 + DT^3 + \dots$
A	$1.55579 \cdot 10^3$
B	-1.03627
C	$-3.74609 \cdot 10^{-4}$

Table 2. Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
<i>crystal</i>				372.95	1117.00 ± 1.00	-0.21	1917-jae-1(X)
90.15	1566.0 ± 3.0		1930-bil/fis-1	284.15	1231.07 ± 1.00	-0.02	1918-her-2(X)
194.15	1519.0 ± 3.0		1930-bil/fis-1	288.15	1226.23 ± 1.00	0.14	1922-tro(X)
<i>liquid</i>				298.15	1213.78 ± 1.00	0.25	1922-tro ¹⁾
288.15	1227.34 ± 1.00	1.25	1884-per(X)	273.15	1245.60 ± 1.00	0.81	1928-coo(X)
298.15	1217.41 ± 1.00	3.88	1884-per ¹⁾	293.15	1220.60 ± 1.00	0.78	1928-coo ¹⁾
283.15	1230.80 ± 1.00	-1.54	1890-gar(X)	298.15	1213.70 ± 0.50	0.17	1930-bil/fis-1(X)
293.15	1218.70 ± 1.00	-1.12	1890-gar ¹⁾	288.15	1226.47 ± 1.00	0.38	1930-tim/hen(X)
298.15	1212.60 ± 1.00	-0.93	1890-gar ¹⁾	298.15	1214.05 ± 1.00	0.52	1930-tim/hen ¹⁾
303.15	1206.50 ± 1.00	-0.72	1890-gar ¹⁾	303.15	1207.75 ± 1.00	0.53	1930-tim/hen ¹⁾
313.15	1194.10 ± 1.00	-0.45	1890-gar(X)	313.15	1195.38 ± 1.00	0.83	1930-tim/hen(X)
323.15	1182.00 ± 1.00	0.19	1890-gar(X)	293.15	1219.59 ± 0.40	-0.23	1949-dre/mar(◆)
282.35	1233.00 ± 1.00	-0.34	1917-jae-1(X)	298.15	1213.26 ± 0.40	-0.27	1949-dre/mar(◆)
294.35	1218.00 ± 1.00	-0.31	1917-jae-1 ¹⁾	273.15	1241.30 ± 1.00	-3.49	1953-nau ¹⁾
308.45	1200.00 ± 1.00	-0.52	1917-jae-1(X)	293.15	1218.00 ± 1.00	-1.82	1953-nau ¹⁾
323.55	1181.00 ± 1.00	-0.29	1917-jae-1(X)	303.15	1204.80 ± 1.00	-2.42	1953-nau ¹⁾
337.95	1162.00 ± 1.00	-0.80	1917-jae-1(X)	313.15	1193.50 ± 1.00	-1.05	1953-nau(X)
348.45	1149.00 ± 1.00	-0.22	1917-jae-1(X)	333.15	1170.90 ± 1.00	1.92	1953-nau(X)
363.15	1130.00 ± 1.00	-0.07	1917-jae-1(X)	298.15	1213.85 ± 0.50	0.32	1956-fai/win(X)

¹⁾ Not included in Fig. 1.

cont.

Methanoic acid (cont.)**Table 2.** (cont.)

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
298.15	1213.36 \pm 0.40	-0.17	1963-ito/yos(∇)	298.15	1213.90 \pm 0.40	0.37	1981-cas/wil(\times)
298.15	1213.60 \pm 0.30	0.07	1971-kor(Δ)	293.15	1219.59 \pm 0.30	-0.23	1981-koh/atr(\square)
298.15	1213.60 \pm 0.30	0.07	1977-wis/tam(\circ)	313.15	1194.46 \pm 0.30	-0.09	1981-koh/atr(\square)

Further references: [1848-kop, 1854-kop, 1862-lan, 1881-pet-1, 1884-zan, 1886-sch, 1886-tra, 1896-zan, 1897-ric/all, 1898-kah, 1905-hom, 1908-tsa, 1908-tsa-1, 1908-wal-2, 1914-ewi, 1914-kre/mei, 1914-low, 1914-mer/tur, 1914-sch/mar, 1914-tur/pol, 1916-sch/col, 1918-cre/way, 1922-gor/rei, 1933-koz/koz, 1936-ang/eus, 1936-ray, 1940-lan, 1944-sch, 1946-ave/tar, 1947-udo/air-1, 1949-tsv/mar, 1966-sun-1, 1967-mat/san-1].

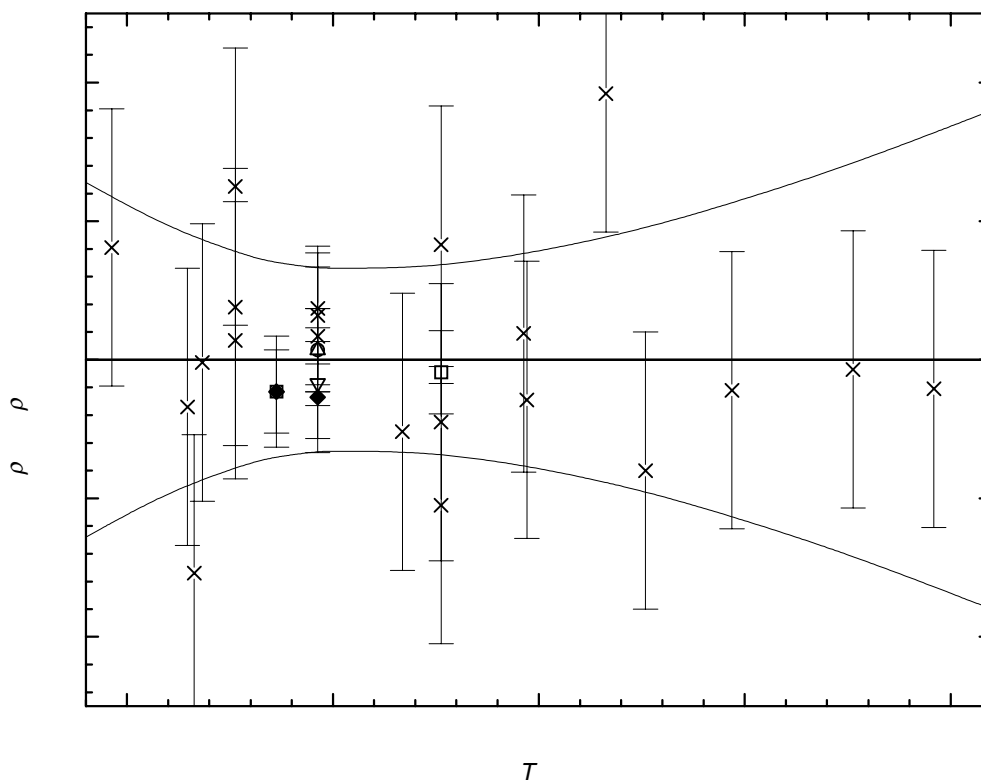


Fig. 1. The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the symbols are omitted for clarity of the figure.)

cont.

$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
270.00	1248.69 ± 1.28	300.00	1211.20 ± 0.66	350.00	1147.21 ± 1.16
280.00	1236.27 ± 0.95	310.00	1198.55 ± 0.66	360.00	1134.19 ± 1.35
290.00	1223.77 ± 0.74	320.00	1185.83 ± 0.73	370.00	1121.09 ± 1.57
293.15	1219.82 ± 0.70	330.00	1173.03 ± 0.84	380.00	1107.92 ± 1.80
298.15	1213.53 ± 0.66	340.00	1160.16 ± 0.98		

$$\rho_c = 351.00 \text{ kg}\cdot\text{m}^{-3} \text{ [1995-van/tej-1]}$$

Coefficient	$T = 273.15 \text{ to } 480.00 \text{ K}$ $\rho = A + BT + CT^2 + DT^3 + \dots$	$T = 480.00 \text{ to } 592.70 \text{ K}$ $\rho = [1 + 1.75(1 - T/T_c)^{1/3} + 0.75(1 - T/T_c)]$ $[\rho_c + A(T_c - T) + B(T_c - T)^2 + C(T_c - T)^3 + D(T_c - T)^4]$
<i>A</i>	$1.27334 \cdot 10^3$	1.78457
<i>B</i>	$-4.77633 \cdot 10^{-1}$	$-4.37921 \cdot 10^{-2}$
<i>C</i>	$-9.81320 \cdot 10^{-4}$	$4.45618 \cdot 10^{-4}$
<i>D</i>		$-1.56911 \cdot 10^{-6}$

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{ca}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
		<i>crystal</i>		353.15	983.50 ± 0.60	1.22	1886-ram/you-5 ¹⁾
90.15	1326.0 ± 3.0		1930-bil/fis-1	363.15	971.80 ± 0.60	1.33	1886-ram/you-5 ¹⁾
194.15	1288.0 ± 3.0		1930-bil/fis-1	373.15	959.90 ± 0.60	1.43	1886-ram/you-5(×)
		<i>liquid</i>		383.15	948.30 ± 0.60	2.03	1886-ram/you-5(×)
273.15	1069.70 ± 0.40	0.04	1886-ram/you-5(×)	393.15	936.20 ± 0.60	2.32	1886-ram/you-5 ¹⁾
283.15	1059.30 ± 0.40	-0.12	1886-ram/you-5 ¹⁾	403.15	923.50 ± 0.60	2.21	1886-ram/you-5(×)
291.10	1051.30 ± 0.40	0.16	1886-ram/you-5 ¹⁾	413.15	910.80 ± 0.60	2.30	1886-ram/you-5(×)
293.15	1049.10 ± 0.40	0.11	1886-ram/you-5 ¹⁾	423.15	897.80 ± 0.60	2.28	1886-ram/you-5(×)
298.15	1043.27 ± 0.60	-0.43	1886-ram/you-5 ¹⁾	433.15	884.90 ± 0.60	2.56	1886-ram/you-5(×)
303.15	1039.20 ± 0.60	0.84	1886-ram/you-5 ¹⁾	443.15	871.00 ± 0.60	2.04	1886-ram/you-5(×)
313.15	1028.40 ± 0.60	0.86	1886-ram/you-5 ¹⁾	453.15	856.30 ± 0.60	0.91	1886-ram/you-5(×)
323.15	1017.50 ± 0.60	0.98	1886-ram/you-5 ¹⁾	463.15	841.20 ± 0.80	-0.42	1886-ram/you-5 ¹⁾
333.15	1006.00 ± 0.60	0.70	1886-ram/you-5 ¹⁾	473.15	825.30 ± 0.80	-2.36	1886-ram/you-5 ¹⁾
343.15	994.80 ± 0.60	0.91	1886-ram/you-5 ¹⁾	483.15	809.10 ± 0.80	-4.12	1886-ram/you-5(×)

cont.

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Table 2. (cont.)

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{ca}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
493.15	791.60 ± 0.80	-3.57	1886-ram/you-5(X)	299.36	1042.00 ± 0.50	-0.41	1945-rit/sim ¹⁾
503.15	773.20 ± 0.80	-1.45	1886-ram/you-5(X)	307.25	1032.40 ± 0.50	-1.55	1945-rit/sim ¹⁾
513.15	753.60 ± 0.80	0.20	1886-ram/you-5(X)	315.61	1024.60 ± 0.50	-0.24	1945-rit/sim ¹⁾
523.15	733.10 ± 1.00	0.92	1886-ram/you-5(X)	324.83	1013.40 ± 0.50	-1.25	1945-rit/sim ¹⁾
533.15	711.20 ± 1.00	0.31	1886-ram/you-5(X)	336.71	1000.70 ± 0.50	-0.56	1945-rit/sim ¹⁾
543.15	686.80 ± 1.00	-1.70	1886-ram/you-5(X)	348.07	987.50 ± 0.50	-0.70	1945-rit/sim ¹⁾
553.05	659.10 ± 1.00	-4.31	1886-ram/you-5(X)	358.24	976.10 ± 0.60	-0.19	1945-rit/sim ¹⁾
273.15	1070.00 ± 0.60	0.34	1910-you-1 ¹⁾	359.46	974.40 ± 0.60	-0.45	1945-rit/sim ¹⁾
283.15	1059.00 ± 0.60	-0.42	1910-you-1 ¹⁾	370.57	961.10 ± 0.60	-0.49	1945-rit/sim(X)
293.15	1049.00 ± 0.60	0.01	1910-you-1 ¹⁾	379.85	950.60 ± 0.60	0.28	1945-rit/sim ¹⁾
303.15	1039.00 ± 0.60	0.64	1910-you-1 ¹⁾	390.67	939.10 ± 0.60	2.13	1945-rit/sim ¹⁾
313.15	1028.00 ± 0.60	0.46	1910-you-1 ¹⁾	403.01	923.50 ± 0.60	2.03	1945-rit/sim(X)
323.15	1018.00 ± 0.60	1.48	1910-you-1 ¹⁾	412.67	911.90 ± 1.00	2.78	1945-rit/sim ¹⁾
333.15	1006.00 ± 1.00	0.70	1910-you-1 ¹⁾	418.75	903.00 ± 1.00	1.75	1945-rit/sim ¹⁾
343.15	994.83 ± 1.00	0.94	1910-you-1 ¹⁾	429.55	888.90 ± 1.00	1.79	1945-rit/sim ¹⁾
353.15	983.48 ± 1.00	1.20	1910-you-1 ¹⁾	273.15	1069.70 ± 0.40	0.04	1958-cos/bow-1(X)
363.15	971.82 ± 1.00	1.35	1910-you-1 ¹⁾	293.15	1049.10 ± 0.40	0.11	1958-cos/bow-1 ¹⁾
373.15	959.88 ± 1.00	1.41	1910-you-1 ¹⁾	313.15	1028.40 ± 0.50	0.86	1958-cos/bow-1 ¹⁾
383.15	948.32 ± 1.00	2.05	1910-you-1 ¹⁾	333.15	1006.00 ± 0.50	0.70	1958-cos/bow-1 ¹⁾
393.15	936.15 ± 1.00	2.27	1910-you-1 ¹⁾	353.15	983.50 ± 0.50	1.22	1958-cos/bow-1 ¹⁾
403.15	923.53 ± 1.50	2.24	1910-you-1 ¹⁾	373.15	959.90 ± 0.50	1.43	1958-cos/bow-1(X)
413.15	909.09 ± 1.50	0.59	1910-you-1 ¹⁾	393.15	932.90 ± 0.50	-0.98	1958-cos/bow-1(X)
423.15	896.22 ± 1.50	0.70	1910-you-1 ¹⁾	413.15	909.10 ± 0.60	0.60	1958-cos/bow-1(X)
433.15	882.92 ± 1.50	0.58	1910-you-1 ¹⁾	433.15	882.90 ± 0.60	0.56	1958-cos/bow-1(X)
443.15	869.41 ± 1.50	0.45	1910-you-1 ¹⁾	453.15	855.50 ± 0.60	0.11	1958-cos/bow-1(X)
453.15	855.51 ± 1.50	0.12	1910-you-1 ¹⁾	473.15	826.50 ± 0.60	-1.16	1958-cos/bow-1(X)
463.15	841.33 ± 1.50	-0.29	1910-you-1 ¹⁾	493.15	794.10 ± 0.60	-1.07	1958-cos/bow-1(X)
473.15	826.45 ± 1.50	-1.21	1910-you-1 ¹⁾	513.15	757.10 ± 0.60	3.70	1958-cos/bow-1(X)
483.15	810.90 ± 2.00	-2.32	1910-you-1(X)	533.15	713.60 ± 0.60	2.71	1958-cos/bow-1(X)
493.15	794.09 ± 2.00	-1.08	1910-you-1 ¹⁾	553.15	662.90 ± 0.60	-0.23	1958-cos/bow-1(X)
503.15	775.80 ± 2.00	1.15	1910-you-1(X)	293.15	1049.28 ± 0.20	0.29	1958-how/ham ¹⁾
513.15	757.17 ± 2.00	3.77	1910-you-1(X)	298.15	1043.78 ± 0.20	0.08	1958-how/ham ¹⁾
523.15	735.84 ± 2.00	3.66	1910-you-1(X)	310.95	1029.34 ± 0.40	-0.60	1958-how/ham ¹⁾
533.15	713.57 ± 3.00	2.68	1910-you-1 ¹⁾	323.20	1015.48 ± 0.40	-0.98	1958-how/ham ¹⁾
543.15	690.04 ± 3.00	1.54	1910-you-1(X)	333.26	1004.00 ± 0.40	-1.18	1958-how/ham(X)
553.15	662.91 ± 3.50	-0.22	1910-you-1 ¹⁾	343.35	992.42 ± 0.40	-1.24	1958-how/ham ¹⁾
563.15	633.43 ± 3.50	1.54	1910-you-1(X)	353.50	980.81 ± 0.40	-1.06	1958-how/ham(X)
573.15	595.03 ± 5.00	4.65	1910-you-1 ¹⁾	363.69	968.33 ± 0.40	-1.50	1958-how/ham(X)
583.15	542.30 ± 5.00	12.40	1910-you-1 ¹⁾	391.65	935.30 ± 0.40	-0.45	1958-how/ham(X)
593.15	461.50 ± 5.00	111.51	1910-you-1 ¹⁾	293.15	1049.28 ± 0.20	0.29	1959-how/pik ¹⁾
594.75	350.60 ± 5.00	4.35	1910-you-1 ¹⁾	298.15	1043.78 ± 0.20	0.08	1959-how/pik ¹⁾

¹⁾ Not included in Fig. 1.

cont.

Table 2. (cont.)

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{ca}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
310.95	1029.34 ± 0.20	-0.60	1959-how/pik(×)	298.15	1043.92 ± 0.20	0.22	1983-hal/gun ¹⁾
323.20	1015.48 ± 0.20	-0.98	1959-how/pik(×)	303.15	1038.25 ± 0.20	-0.11	1983-hal/gun ¹⁾
333.26	1004.00 ± 0.25	-1.18	1959-how/pik(×)	320.00	1019.19 ± 0.20	-0.82	1983-hal/gun(◆)
343.35	992.42 ± 0.25	-1.24	1959-how/pik(×)	340.00	996.46 ± 0.20	-1.04	1983-hal/gun(◆)
353.50	980.81 ± 0.30	-1.06	1959-how/pik(×)	360.00	973.42 ± 0.20	-0.79	1983-hal/gun(◆)
363.69	968.33 ± 0.30	-1.50	1959-how/pik(×)	380.00	949.90 ± 0.20	-0.24	1983-hal/gun(◆)
391.65	935.30 ± 0.50	-0.45	1959-how/pik(×)	400.00	925.60 ± 0.20	0.32	1983-hal/gun(◆)
298.15	1043.40 ± 0.40	-0.30	1971-kor ¹⁾	420.00	900.27 ± 0.20	0.64	1983-hal/gun(◆)
313.15	1026.50 ± 0.40	-1.04	1971-kor ¹⁾	440.00	873.56 ± 0.20	0.36	1983-hal/gun(◆)
328.15	1009.50 ± 0.40	-1.43	1971-kor(×)	460.00	845.04 ± 0.20	-0.94	1983-hal/gun(◆)
293.15	1049.30 ± 0.20	0.31	1976-haf/har ¹⁾	470.00	829.88 ± 0.20	-2.20	1983-hal/gun(◆)
298.15	1043.60 ± 0.20	-0.10	1976-haf/har ¹⁾	480.00	814.07 ± 0.20	-3.91	1983-hal/gun ¹⁾
308.15	1032.50 ± 0.20	-0.47	1976-haf/har(×)	490.00	797.44 ± 0.20	-3.79	1983-hal/gun(◆)
318.15	1021.30 ± 0.20	-0.75	1976-haf/har(×)	293.15	1049.16 ± 0.10	0.17	1986-dal/las(○)
293.15	1049.20 ± 0.10	0.21	1982-mik/sol(∇)	293.15	1049.20 ± 0.10	0.21	1986-mal/sys(Δ)
293.15	1049.55 ± 0.20	0.56	1983-hal/gun ¹⁾	298.15	1043.70 ± 0.10	-0.00	1994-hui/shu(□)

Further references: [1848-kop, 1854-kop, 1862-lan, 1863-gla/dal, 1871-lin, 1881-pet-1, 1884-per, 1884-zan, 1890-gar, 1893-dev, 1893-ram/shi-3, 1894-abe, 1894-jah/mol, 1896-per, 1898-kah, 1901-nef, 1907-che-1, 1908-tsa-1, 1909-gru, 1910-eis, 1910-hub, 1910-pol, 1911-bou/low, 1912-fau, 1912-mal, 1912-sch, 1912-sch-3, 1913-muc, 1913-tho/mus, 1914-kre/mei, 1914-low, 1914-mer/tur, 1914-tur/pol, 1914-tyr, 1914-wor-1, 1917-jae-1, 1918-her-2, 1919-wae/pes, 1921-ken/bra, 1922-gor/rei, 1922-tro, 1924-mar-1, 1924-mil, 1924-pou/rus, 1925-rak, 1926-sch, 1927-del, 1927-pou, 1927-woo, 1928-han/dur, 1929-ham/and, 1930-bil/fis-1, 1930-smy/rog, 1930-tim/hen, 1934-kol/wil, 1934-pes/hoe, 1935-swe/ros, 1936-ang/eus, 1937-dol/bri, 1946-ber/bon, 1947-fre, 1947-udo/air-1, 1947-usa/kal, 1948-bha/sub, 1948-jon/bow, 1948-lev/erm, 1949-bab, 1949-dre/mar, 1950-sac/sau, 1951-sum/glu, 1952-gin/kaz, 1952-gro/feu, 1952-iof, 1952-soh/war, 1954-ano-2, 1954-gar/ell, 1954-pur/bow, 1955-dru, 1955-usa/bil, 1956-sum/vol, 1957-mur/las, 1957-pri/hun, 1957-ven/sur, 1958-ano-5, 1958-ano-3, 1960-fro/shr, 1963-yar/kog, 1965-for/moo, 1965-mye, 1967-mat/san-1, 1968-ano, 1968-bar/sat, 1969-mik/rat, 1969-sun, 1970-bag/raj, 1971-bar/hsu, 1971-shl-1, 1972-abr/mir, 1972-had/edm, 1972-koh/lie, 1973-dut/pan, 1973-laz/mar, 1973-vit/zag, 1975-rad/kac, 1975-vir/paj, 1975-wis/tam, 1976-bul/pro, 1977-wis/tam, 1981-cas/wil, 1985-jan/pan-1, 1985-ven/ram, 1988-kat-1, 1989-bec/ric, 1989-bha/nai, 1989-com/fra, 1990-ber/esq, 1990-lu/ish, 1991-dra/cib, 1991-say/tat, 1997-ste/chi-3].

Table 3. Recommended values (fit to the reliable experimental values according to the equations

$$\rho = A + BT + CT^2 + DT^3 + \dots \text{ or } \rho = [1 + 1.75(1 - T/T_c)^{1/3} + 0.75(1 - T/T_c)][\rho_c + A(T_c - T) + B(T_c - T)^2 + C(T_c - T)^3 + D(T_c - T)^4]$$

$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
270.00	1072.84 ± 0.36	298.15	1043.70 ± 0.33	330.00	1008.85 ± 0.35
280.00	1062.67 ± 0.34	300.00	1041.73 ± 0.33	340.00	997.50 ± 0.35
290.00	1052.30 ± 0.33	310.00	1030.97 ± 0.34	350.00	985.96 ± 0.36
293.15	1048.99 ± 0.33	320.00	1020.01 ± 0.34	360.00	974.21 ± 0.37

cont.

Ethanoic acid (cont.)**Table 3.** (cont.)

$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
370.00	962.27 \pm 0.38	450.00	859.69 \pm 0.52	530.00	717.65 \pm 1.11
380.00	950.14 \pm 0.40	460.00	845.98 \pm 0.54	540.00	695.76 \pm 1.23
390.00	937.80 \pm 0.42	470.00	832.08 \pm 0.57	550.00	671.59 \pm 1.40
400.00	925.28 \pm 0.43	480.00	817.98 \pm 0.59	560.00	642.59 \pm 1.65
410.00	912.55 \pm 0.45	490.00	801.23 \pm 0.85	570.00	604.94 \pm 2.04
420.00	899.63 \pm 0.47	500.00	781.26 \pm 0.90	580.00	551.99 \pm 2.74
430.00	886.51 \pm 0.49	510.00	760.11 \pm 0.95	590.00	459.86 \pm 4.27
440.00	873.20 \pm 0.51	520.00	738.85 \pm 1.02		

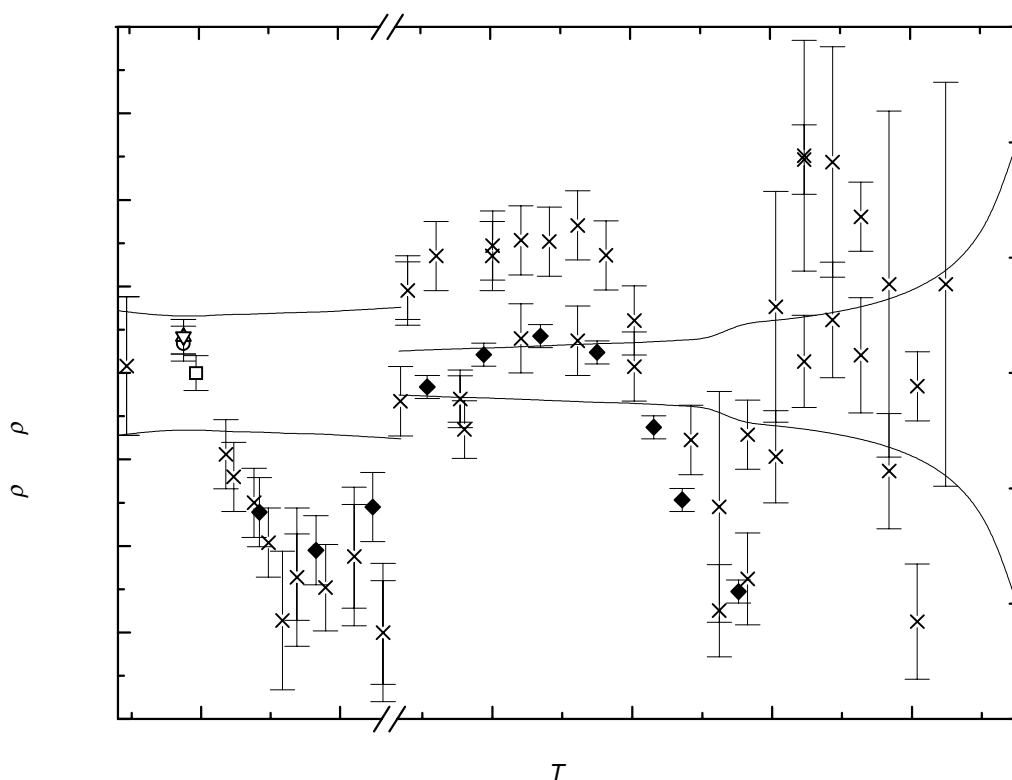


Fig. 1. The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the symbols are omitted for clarity of the figure.)

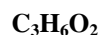
Propanoic acid**[79-09-4]****MW = 74.08****349**

Table 1. Coefficients of the polynomial expansion equation. Standard deviations (see introduction): $\sigma_{c,w} = 8.4502 \cdot 10^{-1}$ (combined temperature ranges, weighted), $\sigma_{c,uw} = 2.3949 \cdot 10^{-1}$ (combined temperature ranges, unweighted).

Coefficient	T = 288.15 to 490.00 K $\rho = A + BT + CT^2 + DT^3 + \dots$
A	$1.19861 \cdot 10^3$
B	$-4.14449 \cdot 10^{-1}$
C	$-9.77881 \cdot 10^{-4}$

Table 2. Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
		<i>crystal</i>		310.00	975.28 ± 0.15	-0.88	1983-hal/gun(□)
90.15	1566.0 ± 3.0		1930-bil/fis-1	320.00	964.49 ± 0.20	-1.36	1983-hal/gun(□)
194.15	1519.0 ± 3.0		1930-bil/fis-1	340.00	942.84 ± 0.20	-1.82	1983-hal/gun(□)
		<i>liquid</i>		360.00	921.07 ± 0.20	-1.61	1983-hal/gun(□)
288.00	998.80 ± 1.00	0.66	1895-eyk ¹⁾	380.00	898.98 ± 0.20	-0.94	1983-hal/gun(□)
348.75	933.40 ± 1.00	-1.74	1895-eyk(×)	400.00	876.26 ± 0.20	-0.11	1983-hal/gun(□)
288.95	998.50 ± 1.00	1.29	1943-fri/har ¹⁾	420.00	852.75 ± 0.20	0.71	1983-hal/gun(□)
352.05	930.10 ± 1.00	-1.41	1943-fri/har(×)	440.00	828.15 ± 0.20	1.21	1983-hal/gun(□)
369.05	912.60 ± 1.00	0.13	1943-fri/har(×)	460.00	802.01 ± 0.20	0.96	1983-hal/gun(□)
381.65	899.00 ± 1.00	1.00	1943-fri/har(×)	480.00	773.92 ± 0.20	-0.45	1983-hal/gun(□)
392.35	886.90 ± 1.00	1.43	1943-fri/har(×)	490.00	758.93 ± 0.20	-1.81	1983-hal/gun(□)
406.35	870.60 ± 1.00	1.87	1943-fri/har(×)	303.15	983.10 ± 0.25	-0.00	1985-ven/ram(○)
293.15	994.20 ± 1.00	1.12	1948-vog-2 ¹⁾	293.15	992.20 ± 0.30	-0.88	1990-ber/esq ¹⁾
298.15	989.10 ± 1.00	0.98	1948-vog-2 ¹⁾	298.15	987.20 ± 0.30	-0.92	1990-ber/esq ¹⁾
315.45	971.50 ± 1.00	0.93	1948-vog-2 ¹⁾	303.15	982.60 ± 0.30	-0.50	1990-ber/esq ¹⁾
335.25	951.00 ± 1.00	1.24	1948-vog-2(×)	308.15	977.80 ± 0.30	-0.24	1990-ber/esq ¹⁾
359.65	926.30 ± 1.00	3.23	1948-vog-2(×)	313.15	973.10 ± 0.30	0.17	1990-ber/esq(∇)
288.15	998.86 ± 0.15	0.87	1983-hal/gun(□)	318.15	968.10 ± 0.30	0.33	1990-ber/esq(∇)
293.15	993.49 ± 0.15	0.41	1983-hal/gun(□)	323.15	963.90 ± 0.30	1.33	1990-ber/esq(∇)
298.15	988.08 ± 0.15	-0.04	1983-hal/gun(□)	298.15	987.87 ± 0.30	-0.25	1996-com/fra ¹⁾
303.15	982.64 ± 0.15	-0.46	1983-hal/gun(□)	313.15	971.74 ± 0.30	-1.19	1996-com/fra(◆)

¹⁾ Not included in Fig. 1.

Further references: [1862-lan, 1871-lin, 1882-zan, 1884-per, 1884-zan, 1886-tra, 1890-gar, 1893-eyk, 1894-jah/mol, 1896-per, 1898-kah, 1902-guy/mal-1, 1908-tsa-1, 1910-eis, 1914-low, 1914-mer/tur, 1919-eyk, 1919-wae/pes, 1922-tro, 1929-hun/maa, 1930-bil/fis-1, 1930-tim/hen, 1935-sch-2, 1936-ang/eus, 1936-pri/col, 1937-col/pri, 1947-fre, 1948-den-1, 1949-dre/mar, 1949-tsv/mar, 1952-gin/kaz, 1954-pur/bow, 1956-sum/vol, 1957-ano, 1957-gol/ole, 1958-ano-5, 1958-ano-3, 1958-cos/bow-1, 1962-cha/rao, 1968-ano, 1971-bar/hsu, 1971-kor, 1975-rad/kac, 1976-pau, 1977-jai/bag, 1977-wis/tam, 1981-cas/wil, 1981-koh/atr, 1981-koh/atr, 1982-mik/sol, 1985-jan/pan-1, 1985-mal/vlc, 1986-mal/sys, 1988-sub/rao, 1988-sub/rao-1, 1989-bha/nai, 1991-dra/cib].

cont.

Propanoic acid (cont.)

Table 3. Recommended values (fit to the reliable experimental values according to the equations $\rho = A + BT + CT^2 + DT^3 + \dots$ or $\rho = [1 + 1.75(1 - T/T_c)^{1/3} + 0.75(1 - T/T_c)][\rho_c + A(T_c - T) + B(T_c - T)^2 + C(T_c - T)^3 + D(T_c - T)^4]$).

$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
280.00	1005.90 \pm 0.91	350.00	933.76 \pm 0.67	440.00	826.94 \pm 0.67
290.00	996.18 \pm 0.80	360.00	922.68 \pm 0.66	450.00	814.09 \pm 0.69
293.15	993.08 \pm 0.79	370.00	911.39 \pm 0.65	460.00	801.05 \pm 0.71
298.15	988.12 \pm 0.77	380.00	899.92 \pm 0.64	470.00	787.81 \pm 0.74
300.00	986.27 \pm 0.77	390.00	888.24 \pm 0.64	480.00	774.37 \pm 0.77
310.00	976.16 \pm 0.74	400.00	876.37 \pm 0.64	490.00	760.74 \pm 0.82
320.00	965.85 \pm 0.72	410.00	864.31 \pm 0.65	500.00	746.92 \pm 0.90
330.00	955.35 \pm 0.70	420.00	852.04 \pm 0.65		
340.00	944.66 \pm 0.68	430.00	839.59 \pm 0.66		

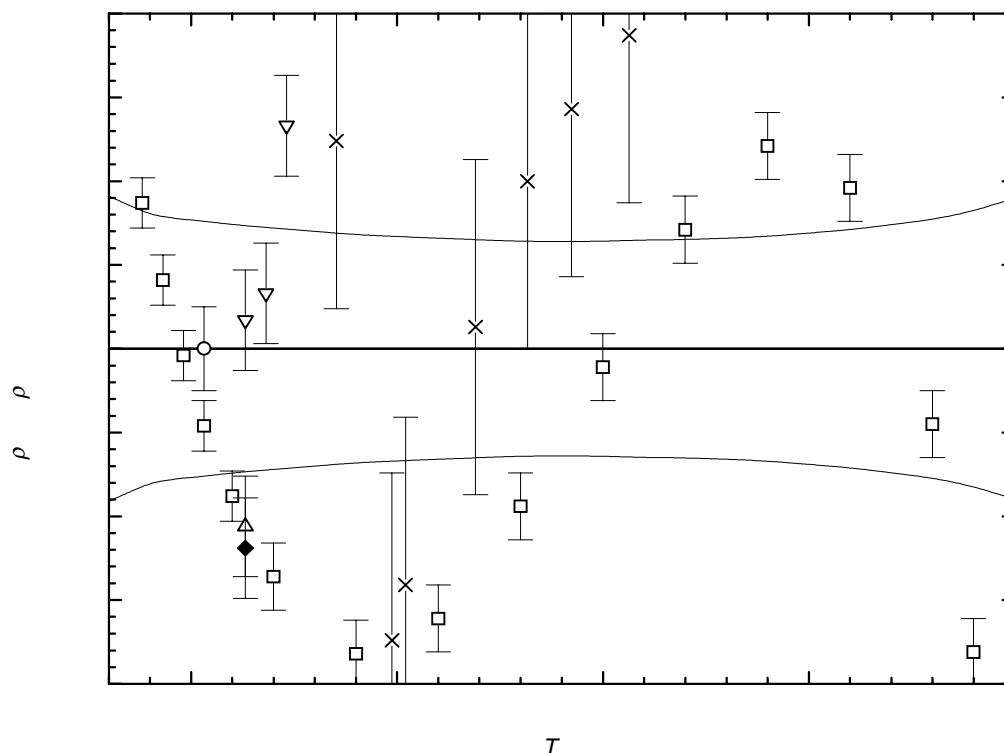


Fig. 1. The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the symbols are omitted for clarity of the figure.)

Butanoic acid**[107-92-6]****MW = 88.11****350****Table 1.** Coefficients of the polynomial expansion equation. Standard deviations (see introduction): $\sigma_{c,w} = 1.0244$ (combined temperature ranges, weighted), $\sigma_{c,uw} = 2.1671 \cdot 10^{-1}$ (combined temperature ranges, unweighted).

Coefficient	T = 273.15 to 493.15 K $\rho = A + BT + CT^2 + DT^3 + \dots$
A	$1.19986 \cdot 10^3$
B	$-7.05935 \cdot 10^{-1}$
C	$-4.10025 \cdot 10^{-4}$

Table 2. Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
<i>crystal</i>				273.25	979.20 ± 1.00	2.85	1929-hun/maa ¹⁾
90.15	1194.0 ± 3.0		1930-bil/fis-1	274.75	977.30 ± 1.00	2.35	1929-hun/maa ¹⁾
194.15	1146.0 ± 3.0		1930-bil/fis-1	281.75	970.70 ± 1.00	2.29	1929-hun/maa ¹⁾
<i>liquid</i>				282.85	969.50 ± 1.00	2.12	1929-hun/maa ¹⁾
434.65	814.10 ± 1.00	-1.46	1883-sch-3(×)	291.55	961.50 ± 1.00	2.31	1929-hun/maa ¹⁾
283.15	968.20 ± 0.60	1.10	1890-gar(×)	292.65	959.70 ± 1.00	1.55	1929-hun/maa ¹⁾
293.15	958.00 ± 0.60	0.32	1890-gar ¹⁾	299.65	952.70 ± 1.00	1.19	1929-hun/maa ¹⁾
303.15	947.90 ± 0.60	-0.27	1890-gar ¹⁾	310.65	942.10 ± 1.00	1.11	1929-hun/maa ¹⁾
313.15	937.70 ± 0.60	-0.89	1890-gar(×)	312.05	940.80 ± 1.00	1.15	1929-hun/maa ¹⁾
323.15	927.40 ± 0.60	-1.52	1890-gar(×)	317.95	934.90 ± 1.00	0.94	1929-hun/maa ¹⁾
292.25	959.90 ± 1.00	1.37	1893-eyk ¹⁾	323.45	929.20 ± 1.00	0.57	1929-hun/maa ¹⁾
354.05	898.30 ± 1.00	-0.23	1893-eyk(×)	333.85	918.70 ± 1.50	0.22	1929-hun/maa ¹⁾
297.85	953.40 ± 0.70	0.18	1909-fal-1 ¹⁾	341.25	911.90 ± 1.50	0.69	1929-hun/maa ¹⁾
297.85	953.40 ± 0.70	0.18	1909-fal-1 ¹⁾	346.35	906.60 ± 1.50	0.43	1929-hun/maa(×)
305.55	945.70 ± 0.70	-0.18	1909-fal-1 ¹⁾	350.35	903.00 ± 2.00	0.79	1929-hun/maa ¹⁾
305.55	945.70 ± 0.70	-0.18	1909-fal-1 ¹⁾	364.85	883.80 ± 2.00	-3.92	1929-hun/maa(×)
313.95	937.30 ± 0.70	-0.52	1909-fal-1 ¹⁾	283.15	970.30 ± 1.00	3.20	1930-smy/rog ¹⁾
313.95	937.30 ± 0.70	-0.52	1909-fal-1 ¹⁾	293.15	959.10 ± 1.00	1.42	1930-smy/rog ¹⁾
321.15	930.20 ± 0.70	-0.66	1909-fal-1(×)	313.15	938.90 ± 1.00	0.31	1930-smy/rog ¹⁾
321.15	930.20 ± 0.70	-0.66	1909-fal-1(×)	343.15	911.90 ± 1.00	2.56	1930-smy/rog(×)
331.95	919.80 ± 0.70	-0.54	1909-fal-1(×)	273.15	977.62 ± 0.60	1.18	1932-tim/hen(×)
331.95	919.80 ± 1.00	-0.54	1909-fal-1(×)	288.15	962.86 ± 0.60	0.46	1932-tim/hen ¹⁾
340.55	911.30 ± 1.00	-0.60	1909-fal-1(×)	303.15	947.97 ± 0.60	-0.20	1932-tim/hen ¹⁾
340.55	911.30 ± 0.70	-0.60	1909-fal-1(×)	298.15	953.50 ± 0.30	0.56	1948-jon/bow(Δ)
273.15	978.44 ± 0.60	2.00	1928-gri(×)	293.15	956.30 ± 1.00	-1.38	1948-vog-2 ¹⁾
288.15	963.44 ± 0.60	1.04	1928-gri ¹⁾	314.35	937.30 ± 1.00	-0.13	1948-vog-2 ¹⁾
273.15	978.44 ± 0.60	2.00	1929-gri/bur(×)	334.15	918.70 ± 1.00	0.51	1948-vog-2(×)
285.15	966.42 ± 0.60	1.20	1929-gri/bur ¹⁾	359.95	893.80 ± 1.00	1.17	1948-vog-2(×)
291.15	960.45 ± 0.60	0.88	1929-gri/bur ¹⁾	293.15	957.67 ± 0.20	-0.01	1949-dre/mar(□)
298.15	953.50 ± 0.60	0.56	1929-gri/bur ¹⁾	298.15	952.71 ± 0.20	-0.23	1949-dre/mar(□)
308.09	943.67 ± 0.60	0.22	1929-gri/bur ¹⁾	273.15	976.70 ± 0.50	0.26	1958-cos/bow-1(×)

¹⁾ Not included in Fig. 1.

cont.

Butanoic acid (cont.)**Table 2.** (cont.)

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
293.15	957.20 ± 0.50	-0.48	1958-cos/bow-1 ¹⁾	493.15	749.00 ± 0.60	-3.01	1958-cos/bow-1(×)
313.15	938.00 ± 0.50	-0.59	1958-cos/bow-1(×)	513.15	722.10 ± 1.00	-7.54	1958-cos/bow-1 ¹⁾
333.15	918.20 ± 0.50	-0.97	1958-cos/bow-1(×)	533.15	691.10 ± 2.00	-15.84	1958-cos/bow-1 ¹⁾
353.15	899.00 ± 0.50	-0.42	1958-cos/bow-1(×)	283.15	966.90 ± 0.50	-0.20	1971-bar/hsu(×)
373.15	879.60 ± 0.50	0.25	1958-cos/bow-1(×)	293.15	956.50 ± 0.50	-1.18	1971-bar/hsu ¹⁾
393.15	860.00 ± 0.50	1.06	1958-cos/bow-1(×)	298.15	952.71 ± 0.20	-0.23	1976-rad/han(○)
413.15	839.90 ± 0.60	1.69	1958-cos/bow-1(×)	303.16	947.75 ± 0.30	-0.41	1985-jan/pan-1(×)
433.15	819.30 ± 0.60	2.15	1958-cos/bow-1(×)	303.15	947.80 ± 0.30	-0.37	1985-ven/ram(∇)
453.15	797.30 ± 0.60	1.53	1958-cos/bow-1(×)	303.15	947.82 ± 0.30	-0.35	1989-bha/nai(◆)
473.15	774.00 ± 0.60	-0.05	1958-cos/bow-1(×)				

¹⁾ Not included in Fig. 1.

Further references: [1862-lan, 1871-lin, 1880-bru-1, 1884-per, 1884-zan, 1886-gar, 1886-tra, 1888-beh-1, 1893-ram/shi-3, 1894-jah/mol, 1898-kah, 1899-sch-1, 1908-tsa-1, 1914-low, 1914-mer/tur, 1919-eyk, 1922-tro, 1924-pou/rus, 1925-dem, 1926-han, 1928-ipa/raz, 1929-vog-1, 1930-bil/fis-1, 1934-bro-1, 1936-ang/eus, 1936-pri/col, 1944-ira, 1947-fre, 1949-tsv/mar, 1950-mum/phi, 1952-coo, 1952-gin/kaz, 1954-ano-2, 1954-pur/bow, 1955-hil/pri, 1958-ano-5, 1958-ano-3, 1962-cha/rao, 1968-ano, 1975-rad/kac, 1981-cas/wil, 1990-ber/esq].

Table 3. Recommended values (fit to the reliable experimental values according to the equations

$$\rho = A + BT + CT^2 + DT^3 + \dots \text{ or } \rho = [1 + 1.75(1 - T/T_c)^{1/3} + 0.75(1 - T/T_c)][\rho_c + A(T_c - T) + B(T_c - T)^2 + C(T_c - T)^3 + D(T_c - T)^4].$$

$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
270.00	979.37 ± 0.59	340.00	912.44 ± 0.75	430.00	820.49 ± 0.88
280.00	970.05 ± 0.57	350.00	902.55 ± 0.78	440.00	809.87 ± 0.88
290.00	960.65 ± 0.56	360.00	892.58 ± 0.80	450.00	799.16 ± 0.88
293.15	957.68 ± 0.57	370.00	882.53 ± 0.83	460.00	788.37 ± 0.88
298.15	952.94 ± 0.59	380.00	872.40 ± 0.84	470.00	777.49 ± 0.88
300.00	951.18 ± 0.60	390.00	862.18 ± 0.86	480.00	766.54 ± 0.89
310.00	941.62 ± 0.64	400.00	851.88 ± 0.87	490.00	755.50 ± 0.89
320.00	931.97 ± 0.68	410.00	841.50 ± 0.88	500.00	744.38 ± 0.90
330.00	922.25 ± 0.71	420.00	831.04 ± 0.88		

cont.

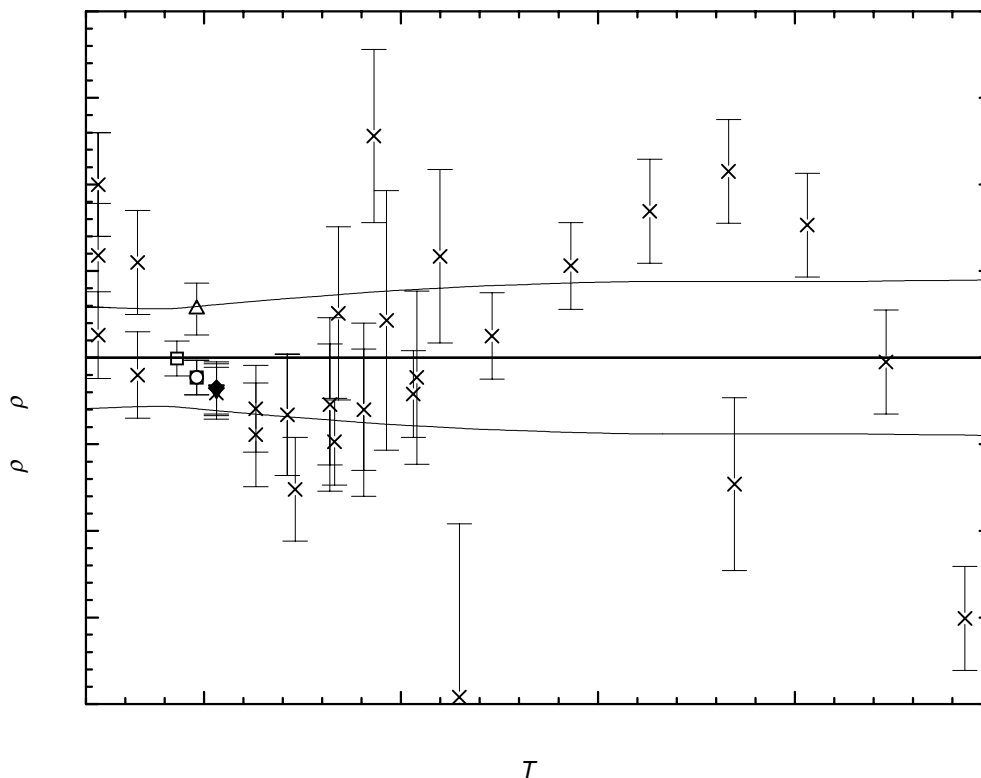


Fig. 1. The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the symbols are omitted for clarity of the figure.)

2-Methylpropanoic acid

[79-31-2]

C₄H₈O₂

MW = 88.11

351

Table 1. Coefficients of the polynomial expansion equation. Standard deviations (see introduction): $\sigma_{c,w} = 9.3980 \cdot 10^{-1}$ (combined temperature ranges, weighted), $\sigma_{c,uw} = 1.8318 \cdot 10^{-1}$ (combined temperature ranges, unweighted).

Coefficient	T = 213.15 to 473.15 K
	$\rho = A + BT + CT^2 + DT^3 + \dots$
A	$1.19643 \cdot 10^3$
B	$-7.11007 \cdot 10^{-1}$
C	$-4.56185 \cdot 10^{-4}$

cont.

2-Methylpropanoic acid (cont.)**Table 2.** Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{cal}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
426.15	808.70 ± 1.00	-1.88	1883-sch-3(×)	253.15	987.00 ± 0.50	-0.20	1958-cos/bow-1(Δ)
287.81	953.50 ± 0.60	-0.50	1901-fri ¹⁾	273.15	968.00 ± 0.50	-0.18	1958-cos/bow-1(Δ)
293.28	948.00 ± 0.60	-0.66	1901-fri ¹⁾	293.15	948.50 ± 0.50	-0.29	1958-cos/bow-1 ¹⁾
299.12	942.10 ± 0.60	-0.83	1901-fri ¹⁾	313.15	928.50 ± 0.50	-0.54	1958-cos/bow-1(Δ)
305.43	935.70 ± 0.60	-1.01	1901-fri(×)	333.15	908.60 ± 0.50	-0.32	1958-cos/bow-1(Δ)
311.38	929.70 ± 0.60	-1.10	1901-fri(×)	353.15	888.60 ± 0.50	0.16	1958-cos/bow-1(Δ)
318.26	922.80 ± 0.60	-1.13	1901-fri(×)	373.15	868.00 ± 0.50	0.41	1958-cos/bow-1(Δ)
234.46	1007.39 ± 0.60	2.74	1907-tim(×)	393.15	847.20 ± 0.50	0.82	1958-cos/bow-1(Δ)
273.55	967.84 ± 0.60	0.05	1907-tim(×)	413.15	826.60 ± 0.50	1.79	1958-cos/bow-1(Δ)
273.15	968.16 ± 0.60	-0.02	1910-tim(×)	433.15	804.40 ± 0.50	1.54	1958-cos/bow-1(Δ)
288.15	953.08 ± 0.60	-0.59	1910-tim ¹⁾	453.15	780.80 ± 0.50	0.24	1958-cos/bow-1(Δ)
291.15	950.10 ± 0.60	-0.65	1910-tim ¹⁾	473.15	756.00 ± 0.50	-1.89	1958-cos/bow-1(Δ)
298.15	943.02 ± 0.60	-0.87	1910-tim ¹⁾	493.15	728.30 ± 0.50	-6.55	1958-cos/bow-1 ¹⁾
273.15	968.18 ± 0.60	0.00	1912-tim(×)	513.15	698.20 ± 0.50	-13.25	1958-cos/bow-1 ¹⁾
273.15	968.19 ± 0.60	0.01	1922-tim(×)	283.15	958.40 ± 0.50	-0.13	1971-bar/hsu(◆)
273.15	968.15 ± 0.60	-0.03	1934-tim/del(×)	293.15	948.20 ± 0.50	-0.59	1971-bar/hsu ¹⁾
288.15	952.96 ± 0.60	-0.71	1934-tim/del ¹⁾	303.15	937.90 ± 0.50	-1.06	1971-bar/hsu(◆)
303.15	937.82 ± 0.60	-1.14	1934-tim/del ¹⁾	313.15	930.50 ± 0.50	1.46	1971-bar/hsu(◆)
293.15	948.30 ± 0.60	-0.49	1948-vog-2 ¹⁾	298.15	943.00 ± 0.50	-0.89	1971-kor ¹⁾
314.45	927.60 ± 0.60	-0.14	1948-vog-2(×)	313.15	927.90 ± 0.50	-1.14	1971-kor(∇)
333.95	909.00 ± 0.60	0.89	1948-vog-2(×)	328.15	912.60 ± 0.50	-1.39	1971-kor(∇)
358.35	884.30 ± 0.60	1.25	1948-vog-2(×)	298.15	944.28 ± 0.30	0.39	1985-lar/ban(○)
213.15	1024.00 ± 0.50	-0.15	1958-cos/bow-1(Δ)	298.15	944.28 ± 0.30	0.39	1987-lar/ban(□)
233.15	1006.00 ± 0.50	0.14	1958-cos/bow-1(Δ)				

¹⁾ Not included in Fig. 1.

Further references: [1866-mar, 1880-bru-3, 1884-per, 1884-zan, 1886-tra, 1890-gar, 1894-jah/mol, 1898-kah, 1909-tsa-1, 1912-sch, 1914-low, 1919-eyk, 1927-del, 1936-all/wil, 1951-hau, 1952-coo, 1958-ano-3, 1967-rab/leb, 1976-rad/han].

Table 3. Recommended values (fit to the reliable experimental values according to the equations

$$\rho = A + BT + CT^2 + DT^3 + \dots \text{ or } \rho = [1 + 1.75(1 - T/T_c)^{1/3} + 0.75(1 - T/T_c)][\rho_c + A(T_c - T) + B(T_c - T)^2 + C(T_c - T)^3 + D(T_c - T)^4].$$

$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
210.00	1027.00 ± 0.70	270.00	971.20 ± 0.54	310.00	932.17 ± 0.52
220.00	1017.92 ± 0.66	280.00	961.58 ± 0.53	320.00	922.19 ± 0.52
230.00	1008.76 ± 0.63	290.00	951.87 ± 0.52	330.00	912.11 ± 0.52
240.00	999.51 ± 0.60	293.15	948.79 ± 0.52	340.00	901.95 ± 0.53
250.00	990.16 ± 0.57	298.15	943.89 ± 0.52	350.00	891.69 ± 0.53
260.00	980.73 ± 0.56	300.00	942.07 ± 0.52	360.00	881.34 ± 0.54

cont.

Table 3. (cont.)

$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
370.00	870.90 \pm 0.55	410.00	828.23 \pm 0.61	450.00	784.09 \pm 0.72
380.00	860.37 \pm 0.56	420.00	817.33 \pm 0.63	460.00	772.83 \pm 0.76
390.00	849.75 \pm 0.57	430.00	806.34 \pm 0.66	470.00	761.48 \pm 0.80
400.00	839.03 \pm 0.59	440.00	795.26 \pm 0.69	480.00	750.04 \pm 0.85

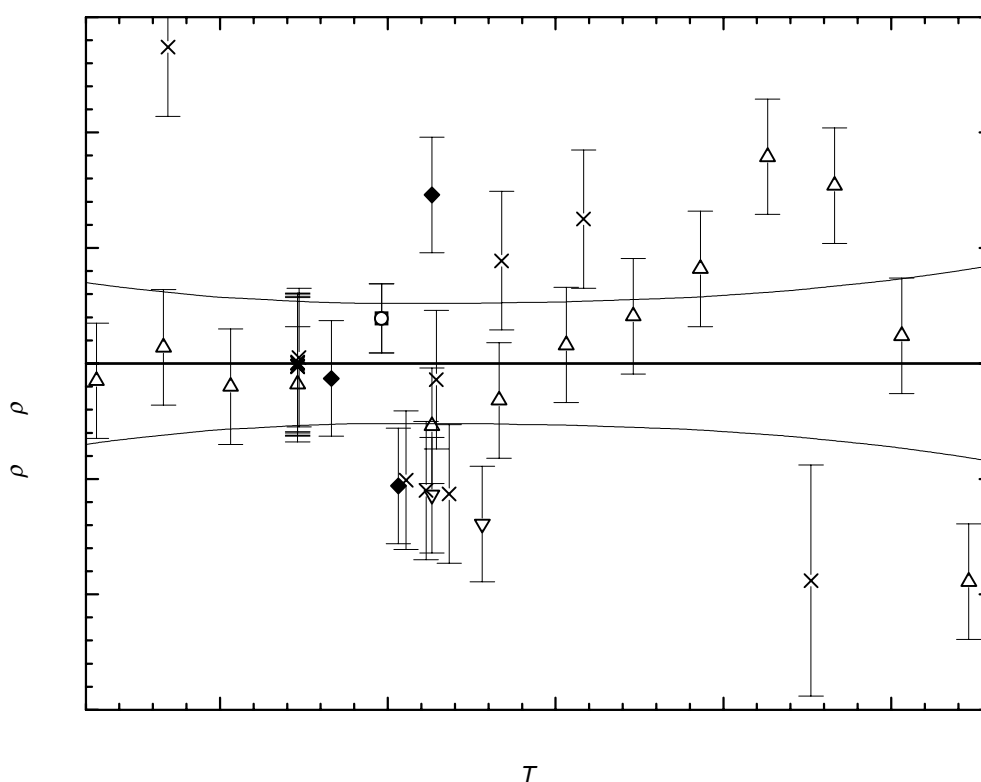


Fig. 1. The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the symbols are omitted for clarity of the figure.)

2,2-Dimethylpropanoic acid

[75-98-9]

C5H10O2

MW = 102.13

352

Table 1. Fit with estimated B coefficient for 5 accepted points. Deviation $\sigma_w = 0.170$.

Coefficient	$\rho = A + BT$
A	1217.27
B	-1.000

cont.

2,2-Dimethylpropanoic acid (cont.)**Table 2.** Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
293.15	868.5 ± 6.0	-55.62	1960-eid/puz ¹⁾	313.15	904.01 ± 0.2	-0.11	1981-koh/atr
293.15	873.3 ± 6.0	-50.82	1960-eid/puz ¹⁾	323.15	894.34 ± 0.2	0.22	1981-koh/atr
293.15	873.0 ± 6.0	-51.12	1960-eid/puz ¹⁾	313.15	903.96 ± 0.3	-0.16	1985-lar/ban
323.15	894.3 ± 0.6	0.18	1981-atr	313.15	903.96 ± 0.3	-0.16	1987-lar/ban

¹⁾ Not included in calculation of linear coefficients.**Table 3.** Recommended values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
310.00	907.3 ± 0.4
320.00	897.3 ± 0.3
330.00	887.3 ± 0.7

2-Methylbutanoic acid

[116-53-0]

C₅H₁₀O₂

MW = 102.13

353

Table 1. Experimental and recommended values with uncertainties.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
273.15	950.5 ± 2.0	1871-erl/hel ¹⁾	293.15	941.9 ± 4.0	1914-low ¹⁾
292.65	933.1 ± 2.0	1871-erl/hel ¹⁾	286.75	943.2 ± 2.0	1919-eyk ¹⁾
288.15	932.7 ± 3.0	1884-per ¹⁾	293.15	934.0 ± 2.0	1935-ken/phi ¹⁾
298.15	923.3 ± 3.0	1884-per ¹⁾	293.15	933.2 ± 2.0	1936-hop/nen ¹⁾
293.15	936.5 ± 2.0	1890-gar ¹⁾	289.15	934.0 ± 2.0	1944-pre/zal ¹⁾
293.15	934.3 ± 2.0	1896-sch/mar ¹⁾	293.15	936.1 ± 1.0	1952-coo
294.15	939.2 ± 4.0	1912-pow/rog ¹⁾	293.15	937.7 ± 0.6	1968-ano
298.15	934.7 ± 4.0	1912-pow/rog ¹⁾	293.15	937.3 ± 0.7	Recommended

¹⁾ Not included in calculation of recommended value.**3-Methylbutanoic acid**

[503-74-2]

C₅H₁₀O₂

MW = 102.13

354

Table 1. Coefficients of the polynomial expansion equation. Standard deviations (see introduction):

$\sigma_{\text{c,w}} = 1.0533$ (combined temperature ranges, weighted), $\sigma_{\text{c,uw}} = 2.2359 \cdot 10^{-1}$ (combined temperature ranges, unweighted).

Coefficient	$T = 233.15 \text{ to } 493.15 \text{ K}$ $\rho = A + BT + CT^2 + DT^3 + \dots$
A	$1.14551 \cdot 10^3$
B	$-6.02125 \cdot 10^{-1}$
C	$-4.71679 \cdot 10^{-4}$

cont.

Table 2. Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
273.15	946.20 ± 1.00	0.35	1871-erl/hel(□)	253.15	962.70 ± 0.50	-0.16	1958-cos/bow-1(◆)
273.15	946.50 ± 1.00	0.65	1871-erl/hel(□)	273.15	945.00 ± 0.50	-0.85	1958-cos/bow-1(◆)
273.15	946.80 ± 1.00	0.95	1871-erl/hel(□)	293.15	927.00 ± 0.50	-1.47	1958-cos/bow-1(◆)
291.95	930.90 ± 1.00	1.38	1871-erl/hel(□)	313.15	909.10 ± 0.50	-1.60	1958-cos/bow-1(◆)
292.85	929.50 ± 1.00	0.77	1871-erl/hel(□)	333.15	891.10 ± 0.50	-1.46	1958-cos/bow-1(◆)
293.35	928.50 ± 1.00	0.21	1871-erl/hel(□)	353.15	873.20 ± 0.50	-0.85	1958-cos/bow-1(◆)
290.55	929.69 ± 1.00	-1.06	1878-sch/sac(Δ)	373.15	854.80 ± 0.50	-0.35	1958-cos/bow-1(◆)
286.75	934.60 ± 2.00	0.53	1919-eyk ¹⁾	393.15	836.20 ± 0.50	0.32	1958-cos/bow-1(◆)
350.95	874.50 ± 2.00	-1.60	1919-eyk(∇)	413.15	817.40 ± 0.60	1.17	1958-cos/bow-1(◆)
293.15	928.60 ± 1.00	0.13	1948-vog-2(O)	433.15	798.00 ± 0.60	1.79	1958-cos/bow-1(◆)
298.15	924.20 ± 1.00	0.14	1948-vog-2(O)	453.15	777.20 ± 0.60	1.40	1958-cos/bow-1(◆)
313.95	910.20 ± 1.00	0.21	1948-vog-2(O)	473.15	755.00 ± 0.60	-0.02	1958-cos/bow-1(◆)
333.95	892.60 ± 1.00	0.77	1948-vog-2(O)	493.15	731.00 ± 0.60	-2.86	1958-cos/bow-1(◆)
360.05	868.70 ± 1.00	1.13	1948-vog-2(O)	513.15	705.70 ± 1.00	-6.63	1958-cos/bow-1 ¹⁾
233.15	980.40 ± 0.50	0.91	1958-cos/bow-1(◆)	533.15	678.50 ± 2.00	-11.92	1958-cos/bow-1 ¹⁾

¹⁾ Not included in Fig. 1.

Further references: [1886-tra, 1898-kah, 1912-sch, 1920-har/cia, 1922-tro, 1927-del, 1932-tim/hen, 1936-pri/col].

Table 3. Recommended values (fit to the reliable experimental values according to the equations $\rho = A + BT + CT^2 + DT^3 + \dots$ or $\rho = [1 + 1.75(1 - T/T_c)^{1/3} + 0.75(1 - T/T_c)][\rho_c + A(T_c - T) + B(T_c - T)^2 + C(T_c - T)^3 + D(T_c - T)^4]$).

$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
230.00	982.07 ± 0.90	310.00	913.53 ± 0.82	410.00	819.35 ± 0.81
240.00	973.83 ± 0.87	320.00	904.53 ± 0.82	420.00	809.42 ± 0.81
250.00	965.50 ± 0.86	330.00	895.45 ± 0.82	430.00	799.39 ± 0.81
260.00	957.08 ± 0.85	340.00	886.26 ± 0.82	440.00	789.26 ± 0.81
270.00	948.55 ± 0.84	350.00	876.99 ± 0.82	450.00	779.04 ± 0.82
280.00	939.94 ± 0.83	360.00	867.62 ± 0.82	460.00	768.73 ± 0.82
290.00	931.23 ± 0.83	370.00	858.15 ± 0.82	470.00	758.32 ± 0.83
293.15	928.47 ± 0.82	380.00	848.60 ± 0.82	480.00	747.82 ± 0.85
298.15	924.06 ± 0.82	390.00	838.94 ± 0.81	490.00	737.22 ± 0.87
300.00	922.42 ± 0.82	400.00	829.19 ± 0.81	500.00	726.53 ± 0.90

cont.

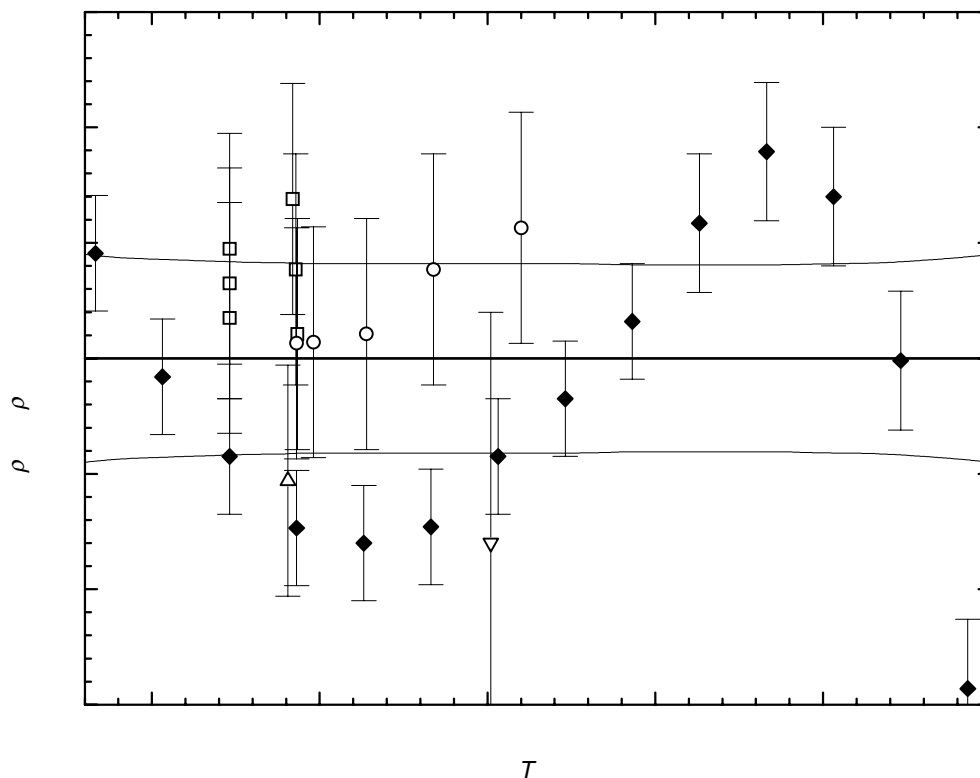
3-Methylbutanoic acid (cont.)

Fig. 1. The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the symbols are omitted for clarity of the figure.)

Pentanoic acid**[109-52-4]****C₅H₁₀O₂****MW = 102.13****355**

Table 1. Coefficients of the polynomial expansion equation. Standard deviations (see introduction):

$\sigma_{c,w} = 1.1312$ (combined temperature ranges, weighted), $\sigma_{c,uw} = 1.9649 \cdot 10^{-1}$ (combined temperature ranges, unweighted).

Coefficient	T = 233.15 to 493.15 K
	$\rho = A + BT + CT^2 + DT^3 + \dots$
A	$1.14834 \cdot 10^3$
B	$-5.72173 \cdot 10^{-1}$
C	$-4.87386 \cdot 10^{-4}$

cont.

Table 2. Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
<i>crystal</i>				313.15	919.90 ± 0.50	-1.47	1958-cos/bow-1(×)
90.15	1176.0 ± 3.0		1930-bil/fis-1	333.15	902.00 ± 0.50	-1.62	1958-cos/bow-1(×)
194.15	1134.0 ± 3.0		1930-bil/fis-1	353.15	884.50 ± 0.50	-0.99	1958-cos/bow-1(×)
<i>liquid</i>				373.15	866.30 ± 0.50	-0.67	1958-cos/bow-1(×)
273.15	957.60 ± 1.00	1.91	1871-lie/ros-1 ¹⁾	393.15	847.80 ± 0.50	-0.26	1958-cos/bow-1(×)
293.15	939.80 ± 1.00	1.08	1871-lie/ros-1 ¹⁾	413.15	829.20 ± 0.60	0.45	1958-cos/bow-1(×)
298.15	935.10 ± 1.00	0.68	1871-lie/ros-1 ¹⁾	433.15	810.20 ± 0.60	1.14	1958-cos/bow-1(×)
313.15	921.20 ± 1.00	-0.17	1871-lie/ros-1 ¹⁾	453.15	790.00 ± 0.60	1.02	1958-cos/bow-1(×)
372.45	866.30 ± 1.00	-1.32	1871-lie/ros-1(×)	473.15	768.60 ± 0.60	0.10	1958-cos/bow-1(×)
288.15	943.80 ± 0.60	0.80	1884-per(×)	493.15	746.20 ± 0.60	-1.44	1958-cos/bow-1(×)
298.15	934.75 ± 0.60	0.33	1884-per ¹⁾	513.15	721.30 ± 1.00	-5.09	1958-cos/bow-1 ¹⁾
273.15	957.30 ± 0.60	1.61	1924-lie(×)	533.15	693.80 ± 2.00	-10.95	1958-cos/bow-1 ¹⁾
288.15	943.54 ± 0.60	0.54	1924-lie(×)	273.15	954.90 ± 0.50	-0.79	1971-bar/hsu(◆)
273.15	957.44 ± 0.60	1.75	1932-tim/hen(×)	283.15	945.90 ± 0.50	-1.35	1971-bar/hsu(◆)
288.15	943.74 ± 0.60	0.74	1932-tim/hen(×)	293.15	937.30 ± 0.50	-1.42	1971-bar/hsu ¹⁾
303.15	930.17 ± 0.60	0.08	1932-tim/hen ¹⁾	303.15	927.80 ± 0.50	-2.29	1971-bar/hsu(◆)
298.15	934.40 ± 0.40	-0.02	1948-jon/bow(Δ)	313.15	919.00 ± 0.50	-2.37	1971-bar/hsu(◆)
293.15	939.00 ± 0.60	0.28	1948-vog-2 ¹⁾	303.16	929.62 ± 0.30	-0.47	1985-jan/pan-1(□)
314.15	921.10 ± 0.60	0.61	1948-vog-2(×)	293.15	938.20 ± 0.40	-0.52	1990-ber/esq(○)
333.95	903.90 ± 0.60	0.99	1948-vog-2(×)	298.15	934.00 ± 0.40	-0.42	1990-ber/esq(○)
358.65	881.90 ± 0.60	1.46	1948-vog-2(×)	303.15	930.30 ± 0.40	0.21	1990-ber/esq(○)
293.15	938.50 ± 0.40	-0.22	1956-ano-4(∇)	308.15	926.30 ± 0.40	0.56	1990-ber/esq(○)
233.15	989.40 ± 0.50	0.96	1958-cos/bow-1(×)	313.15	922.20 ± 0.40	0.83	1990-ber/esq(○)
253.15	972.00 ± 0.50	-0.26	1958-cos/bow-1(×)	318.15	918.60 ± 0.40	1.63	1990-ber/esq(○)
273.15	954.70 ± 0.50	-0.99	1958-cos/bow-1(×)	323.15	914.60 ± 0.40	2.05	1990-ber/esq(○)
293.15	937.40 ± 0.50	-1.32	1958-cos/bow-1 ¹⁾				

¹⁾ Not included in Fig. 1.

Further references: [1862-lan, 1884-zan, 1886-gar, 1890-gar, 1894-jah/mol, 1908-ric/mat, 1908-zel/prz, 1915-dun, 1919-eyk, 1925-han-1, 1930-bil/fis-1, 1950-mum/phi, 1950-sac/sau, 1952-coo, 1952-gin/kaz, 1956-ano-3, 1964-adr/dek, 1967-lod/sch, 1968-anoj].

Table 3. Recommended values (fit to the reliable experimental values according to the equations

$$\rho = A + BT + CT^2 + DT^3 + \dots \text{ or } \rho = [1 + 1.75(1 - T/T_c)^{1/3} + 0.75(1 - T/T_c)][\rho_c + A(T_c - T) + B(T_c - T)^2 + C(T_c - T)^3 + D(T_c - T)^4].$$

$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
230.00	990.96 ± 0.67	290.00	941.42 ± 0.50	330.00	906.45 ± 0.49
240.00	982.94 ± 0.63	293.15	938.72 ± 0.50	340.00	897.46 ± 0.50
250.00	974.83 ± 0.59	298.15	934.42 ± 0.49	350.00	888.37 ± 0.51
260.00	966.63 ± 0.56	300.00	932.82 ± 0.49	360.00	879.19 ± 0.52
270.00	958.32 ± 0.53	310.00	924.13 ± 0.49	370.00	869.91 ± 0.53
280.00	949.92 ± 0.52	320.00	915.34 ± 0.49	380.00	860.53 ± 0.54

cont.

Pentanoic acid (cont.)

Table 3. (cont.)

$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
390.00	851.06 ± 0.56	430.00	812.19 ± 0.66	470.00	771.75 ± 0.82
400.00	841.49 ± 0.58	440.00	802.22 ± 0.69	480.00	761.40 ± 0.87
410.00	831.82 ± 0.60	450.00	792.17 ± 0.73	490.00	750.95 ± 0.93
420.00	822.05 ± 0.63	460.00	782.01 ± 0.77	500.00	740.41 ± 0.99

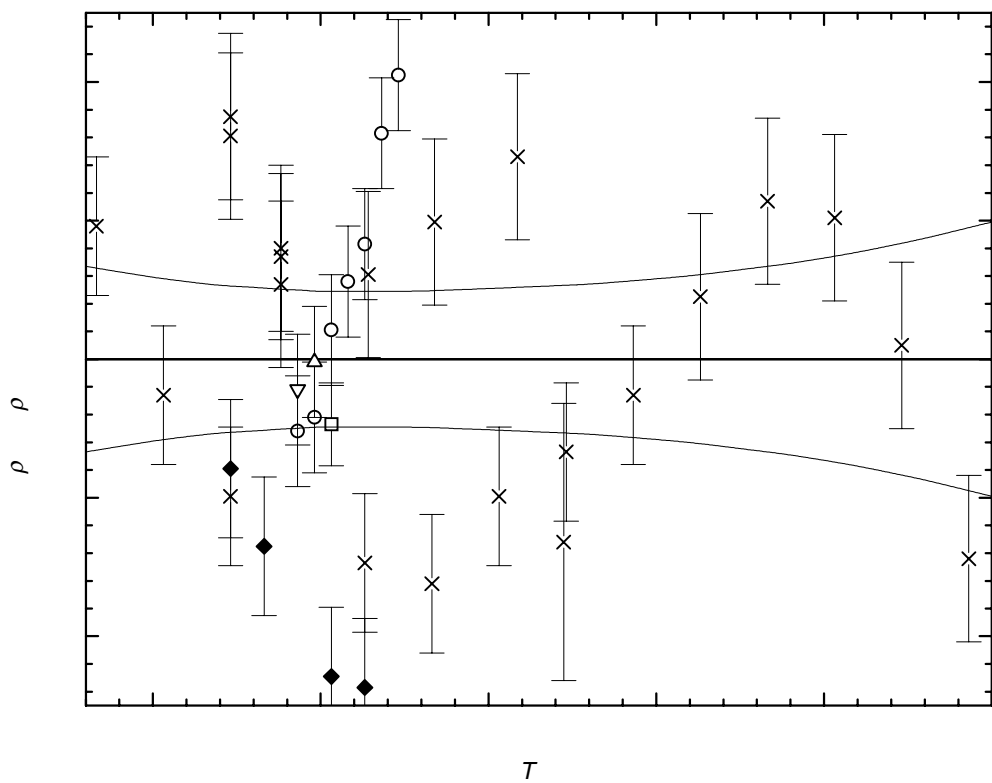


Fig. 1. The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the symbols are omitted for clarity of the figure.)

2,2-Dimethylbutanoic acid

[595-37-9]



MW = 116.16

356

Table 1. Fit with estimated *B* coefficient for 3 accepted points. Deviation $\sigma_w = 0.125$.

Coefficient	$\rho = A + BT$
<i>A</i>	1182.51
<i>B</i>	-0.870

cont.

Table 2. Experimental values with uncertainties and deviation from calculated values.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ kg · m ⁻³	$\rho_{\text{exp}} - \rho_{\text{calc}}$ kg · m ⁻³	Ref.
273.15	944.9 ± 1.0	0.03	1933-hom
293.15	927.6 ± 1.0	0.13	1933-hom
293.15	927.3 ± 1.0	-0.17	1961-eid/puz

Table 3. Recommended values.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ kg · m ⁻³
270.00	947.6 ± 1.9
280.00	938.9 ± 1.1
290.00	930.2 ± 1.0
293.15	927.5 ± 1.1
298.15	923.1 ± 1.5

2,3-Dimethylbutanoic acid

[14287-61-7]

C₆H₁₂O₂

MW = 116.16

357

Table 1. Fit with estimated B coefficient for 2 accepted points. Deviation $\sigma_w = 0.050$.

Coefficient	$\rho = A + BT$
A	1179.56
B	-0.860

Table 2. Experimental values with uncertainties and deviation from calculated values.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ kg · m ⁻³	$\rho_{\text{exp}} - \rho_{\text{calc}}$ kg · m ⁻³	Ref.
273.15	944.6 ± 1.0	-0.05	1933-hom
293.15	927.5 ± 1.0	0.05	1933-hom

Table 3. Recommended values.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ kg · m ⁻³
270.00	947.4 ± 1.6
280.00	938.8 ± 0.9
290.00	930.2 ± 1.1
293.15	927.5 ± 1.3
298.15	923.1 ± 1.7

3,3-Dimethylbutanoic acid

[1070-83-3]



MW = 116.16

358

Table 1. Fit with estimated *B* coefficient for 4 accepted points. Deviation $\sigma_w = 0.196$.

Coefficient	$\rho = A + BT$
<i>A</i>	1170.51
<i>B</i>	-0.880

Table 2. Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
273.15	930.3 ± 1.0	0.17	1933-hom
293.15	912.8 ± 1.0	0.27	1933-hom
293.15	912.4 ± 0.8	-0.13	1933-hom/whi
298.05	908.0 ± 1.0	-0.22	1951-gry/gry
293.15	915.0 ± 2.0	2.47	1957-tra/bat ¹⁾

¹⁾ Not included in calculation of linear coefficients.**Table 3.** Recommended values.

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
270.00	932.9 ± 2.1
280.00	924.1 ± 1.2
290.00	915.3 ± 0.7
293.15	912.5 ± 0.8
298.15	908.1 ± 1.1

2-Ethylbutanoic acid

[88-09-5]



MW = 116.16

359

Table 1. Experimental and recommended values with uncertainties.

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.	$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
273.15	935.4 ± 2.0	1878-say ¹⁾	298.15	923.5 ± 2.0	1949-oth/ser ¹⁾
291.15	919.5 ± 2.0	1878-say ¹⁾	293.15	923.9 ± 1.0	1952-coo ¹⁾
292.15	943.8 ± 2.0	1880-sch ¹⁾	293.15	920.9 ± 2.0	1953-ano-15 ¹⁾
293.15	924.1 ± 2.0	1890-gar ¹⁾	293.15	922.9 ± 0.6	1956-ano-14
289.35	925.6 ± 2.0	1919-eyk ¹⁾	293.15	922.9 ± 0.6	1958-ano-13
295.15	925.0 ± 2.0	1931-lev/mar-4 ¹⁾	293.15	922.8 ± 0.6	1968-ano
293.15	923.9 ± 1.0	1933-hom ¹⁾	293.15	922.9 ± 0.6	Recommended
273.15	940.1 ± 1.0	1933-hom ¹⁾			

¹⁾ Not included in calculation of recommended value.

Hexanoic acid**[142-62-1]****MW = 116.16****360****Table 1.** Coefficients of the polynomial expansion equation. Standard deviations (see introduction):
 $\sigma_{c,w} = 1.2224$ (combined temperature ranges, weighted), $\sigma_{c,uw} = 2.4112 \cdot 10^{-1}$ (combined temperature ranges, unweighted).

Coefficient	T = 273.15 to 533.15 K $\rho = A + BT + CT^2 + DT^3 + \dots$
A	$1.13478 \cdot 10^3$
B	$-5.89885 \cdot 10^{-1}$
C	$-4.05314 \cdot 10^{-4}$

Table 2. Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
288.15	932.00 ± 0.60	0.85	1922-tro(X)	373.15	860.50 ± 1.00	2.27	1952-pha(X)
298.15	923.00 ± 0.60	0.12	1922-tro(X)	393.15	844.00 ± 1.50	3.78	1952-pha(X)
273.15	944.23 ± 0.60	0.82	1929-sim(X)	413.15	827.50 ± 1.50	5.61	1952-pha ¹⁾
288.15	931.36 ± 0.60	0.21	1929-sim(X)	433.15	811.00 ± 1.50	7.77	1952-pha ¹⁾
293.15	927.02 ± 0.60	-0.01	1929-sim(X)	273.15	941.40 ± 0.70	-2.01	1958-cos/bow-1(X)
303.15	918.32 ± 0.60	-0.39	1929-sim(X)	293.15	924.30 ± 0.70	-2.73	1958-cos/bow-1 ¹⁾
298.15	923.00 ± 0.50	0.12	1936-pri/col(◆)	313.15	907.80 ± 0.50	-2.51	1958-cos/bow-1(X)
298.15	923.80 ± 0.40	0.92	1948-jon/bow(O)	333.15	890.50 ± 0.50	-2.78	1958-cos/bow-1(X)
293.15	927.00 ± 0.60	-0.03	1949-tsv/mar(X)	353.15	873.80 ± 0.60	-2.12	1958-cos/bow-1(X)
293.15	927.10 ± 0.50	0.07	1950-mum/phi(Δ)	373.15	856.90 ± 0.60	-1.33	1958-cos/bow-1(X)
298.15	923.00 ± 0.50	0.12	1950-mum/phi(Δ)	393.15	839.60 ± 0.60	-0.62	1958-cos/bow-1(X)
293.15	927.60 ± 0.60	0.57	1952-coo(X)	413.15	822.00 ± 0.60	0.11	1958-cos/bow-1(X)
298.15	923.00 ± 0.60	0.12	1952-coo(X)	433.15	804.00 ± 0.60	0.77	1958-cos/bow-1(X)
293.15	927.15 ± 0.50	0.12	1952-gin/kaz(∇)	453.15	785.70 ± 0.60	1.45	1958-cos/bow-1(X)
348.15	879.60 ± 1.00	-0.69	1952-gro/feu(X)	473.15	766.20 ± 0.70	1.26	1958-cos/bow-1(X)
298.15	922.50 ± 1.00	-0.38	1952-pha ¹⁾	493.15	746.40 ± 0.70	1.09	1958-cos/bow-1(X)
303.15	918.50 ± 1.00	-0.21	1952-pha ¹⁾	513.15	725.00 ± 0.70	-0.35	1958-cos/bow-1(X)
313.15	910.00 ± 1.00	-0.31	1952-pha(X)	533.15	702.10 ± 0.70	-2.98	1958-cos/bow-1(X)
333.15	893.50 ± 1.00	0.22	1952-pha(X)	553.15	677.80 ± 0.70	-6.67	1958-cos/bow-1 ¹⁾
353.15	877.00 ± 1.00	1.08	1952-pha(X)	303.16	918.75 ± 0.30	0.05	1985-jan/pan-1(□)

¹⁾ Not included in Fig. 1.

Further references: [1845-feh, 1862-lan, 1871-lie/ros-3, 1877-lie/jan, 1884-zan, 1886-gar, 1890-gar, 1899-sch-1, 1910-eis, 1915-dun, 1929-hun/maa, 1934-car/jon, 1940-low/low, 1942-dor/mcc, 1943-que/was, 1948-vog-2, 1949-oth/ser, 1950-sac/sau, 1953-ano-5, 1954-ano-2, 1990-ber/esq].

cont.

Hexanoic acid (cont.)

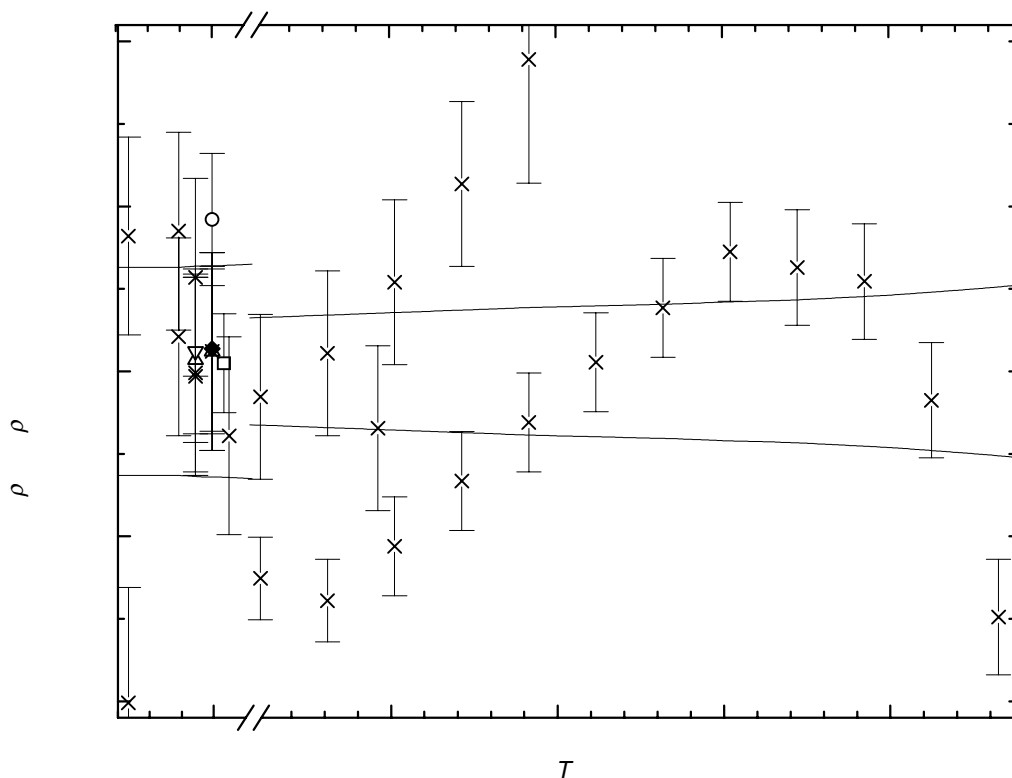


Fig. 1. The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the symbols are omitted for clarity of the figure.)

Table 3. Recommended values (fit to the reliable experimental values according to the equations $\rho = A + BT + CT^2 + DT^3 + \dots$ or $\rho = [1 + 1.75(1 - T/T_c)^{1/3} + 0.75(1 - T/T_c)][\rho_c + A(T_c - T) + B(T_c - T)^2 + C(T_c - T)^3 + D(T_c - T)^4]$).

$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
270.00	945.97 ± 0.69	350.00	878.67 ± 0.71	450.00	787.26 ± 0.84
280.00	937.84 ± 0.67	360.00	869.90 ± 0.72	460.00	777.67 ± 0.85
290.00	929.63 ± 0.66	370.00	861.04 ± 0.74	470.00	768.00 ± 0.86
293.15	927.03 ± 0.65	380.00	852.10 ± 0.75	480.00	758.25 ± 0.88
298.15	922.88 ± 0.64	390.00	843.08 ± 0.77	490.00	748.42 ± 0.90
300.00	921.34 ± 0.64	400.00	833.98 ± 0.78	500.00	738.51 ± 0.92
310.00	912.97 ± 0.65	410.00	824.80 ± 0.79	510.00	728.52 ± 0.95
320.00	904.52 ± 0.66	420.00	815.53 ± 0.80	520.00	718.45 ± 0.98
330.00	895.98 ± 0.68	430.00	806.19 ± 0.81	530.00	708.29 ± 1.01
340.00	887.37 ± 0.69	440.00	796.76 ± 0.82	540.00	698.06 ± 1.05

2-Methylpentanoic acid [97-61-0] C₆H₁₂O₂ MW = 116.16 361**Table 1.** Fit with estimated *B* coefficient for 5 accepted points. Deviation $\sigma_w = 0.226$.

Coefficient	$\rho = A + BT$
<i>A</i>	1180.59
<i>B</i>	-0.880

Table 2. Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.	$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
273.15	941.3 ± 2.0	1.09	1878-say ¹⁾	293.15	921.9 ± 2.0	-0.71	1943-que/was ¹⁾
291.15	927.8 ± 2.0	3.43	1878-say ¹⁾	296.15	892.0 ± 2.0	-27.98	1951-hau ¹⁾
298.15	923.1 ± 2.0	4.89	1883-lie/sch ¹⁾	293.15	922.7 ± 0.6	0.09	1956-ano-14
288.15	928.6 ± 2.0	1.59	1884-lie/kle ¹⁾	293.15	922.6 ± 0.6	-0.01	1958-ano-13
273.15	940.5 ± 1.0	0.29	1933-hom	293.15	922.3 ± 0.6	-0.31	1968-ano
293.15	923.0 ± 1.0	0.39	1933-hom				

¹⁾ Not included in calculation of linear coefficients.**Table 3.** Recommended values.

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
270.00	943.0 ± 2.2
280.00	934.2 ± 1.2
290.00	925.4 ± 0.4
293.15	922.6 ± 0.4
298.15	918.2 ± 0.8

***l*-(*-*)-2-Methylpentanoic acid** [500004-78-4] C₆H₁₂O₂ MW = 116.16 362**Table 1.** Experimental value with uncertainty.

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
298.15	920.0 ± 2.0	1932-lev/mar-2

3-Methylpentanoic acid [105-43-1] C₆H₁₂O₂ MW = 116.16 363**Table 1.** Fit with estimated *B* coefficient for 9 accepted points. Deviation $\sigma_w = 0.831$.

Coefficient	$\rho = A + BT$
<i>A</i>	1187.71
<i>B</i>	-0.890

cont.

3-Methylpentanoic acid (cont.)**Table 2.** Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
288.15	930.0 ± 2.0	-1.26	1886-van	302.15	919.2 ± 2.0	0.40	1943-que/was
299.15	923.0 ± 2.0	1.53	1931-lev/mar-2	293.65	927.6 ± 2.0	1.24	1947-sab/par
273.15	944.1 ± 1.0	-0.51	1933-hom	297.15	924.0 ± 2.0	0.75	1950-sta-1
293.15	926.2 ± 1.0	-0.61	1933-hom	298.15	923.0 ± 2.0	0.64	1955-wib/row
291.15	929.7 ± 2.0	1.11	1941-boh				

Table 3. Recommended values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
270.00	947.4 ± 2.6
280.00	938.5 ± 2.0
290.00	929.6 ± 1.8
293.15	926.8 ± 1.8
298.15	922.4 ± 2.0
310.00	911.8 ± 2.8

4-Methylpentanoic acid

[646-07-1]

C₆H₁₂O₂

MW = 116.16

364

Table 1. Coefficients of the polynomial expansion equation. Standard deviations (see introduction):

$\sigma_{\text{c,w}} = 5.3311 \cdot 10^{-1}$ (combined temperature ranges, weighted), $\sigma_{\text{c,uw}} = 2.0067 \cdot 10^{-1}$ (combined temperature ranges, unweighted).

Coefficient	$T = 253.15 \text{ to } 513.15 \text{ K}$ $\rho = A + BT + CT^2 + DT^3 + \dots$
A	$1.12741 \cdot 10^3$
B	$-5.96679 \cdot 10^{-1}$
C	$-3.65774 \cdot 10^{-4}$

Table 2. Experimental values with uncertainties and deviation from calculated values.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
290.15	923.90 ± 2.00	0.41	1893-ram/shi-3(Δ)	253.15	953.50 ± 0.50	0.58	1958-cos/bow-1(V)
319.65	899.50 ± 2.00	0.19	1893-ram/shi-3(Δ)	273.15	937.10 ± 0.50	-0.03	1958-cos/bow-1(V)
351.35	871.40 ± 2.00	-1.21	1893-ram/shi-3(Δ)	293.15	920.90 ± 0.50	-0.16	1958-cos/bow-1(V)
405.45	824.50 ± 2.00	-0.85	1893-ram/shi-3(Δ)	313.15	904.10 ± 0.50	-0.59	1958-cos/bow-1(V)
294.65	919.00 ± 1.00	-0.84	1919-eyk(□)	333.15	887.60 ± 0.50	-0.43	1958-cos/bow-1(V)
273.15	939.20 ± 2.00	2.07	1933-hom(O)	353.15	870.40 ± 0.50	-0.67	1958-cos/bow-1(V)
293.15	922.50 ± 2.00	1.44	1933-hom(O)	373.15	853.70 ± 0.50	-0.13	1958-cos/bow-1(V)

¹⁾ Not included in Fig. 1.

cont.

Table 2. (cont.)

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)	$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{calc}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref. (Symbol in Fig. 1)
393.15	836.70 ± 0.50	0.41	1958-cos/bow-1(V)	493.15	743.80 ± 0.60	-0.40	1958-cos/bow-1(V)
413.15	819.10 ± 0.60	0.65	1958-cos/bow-1(V)	513.15	723.00 ± 1.00	-1.90	1958-cos/bow-1(V)
433.15	801.10 ± 0.60	0.77	1958-cos/bow-1(V)	533.15	701.10 ± 1.00	-4.22	1958-cos/bow-1 ¹⁾
453.15	782.40 ± 0.60	0.49	1958-cos/bow-1(V)	553.15	674.40 ± 2.00	-11.04	1958-cos/bow-1 ¹⁾
473.15	763.40 ± 0.60	0.20	1958-cos/bow-1(V)				

Further references: [1898-kah, 1950-cro/van].

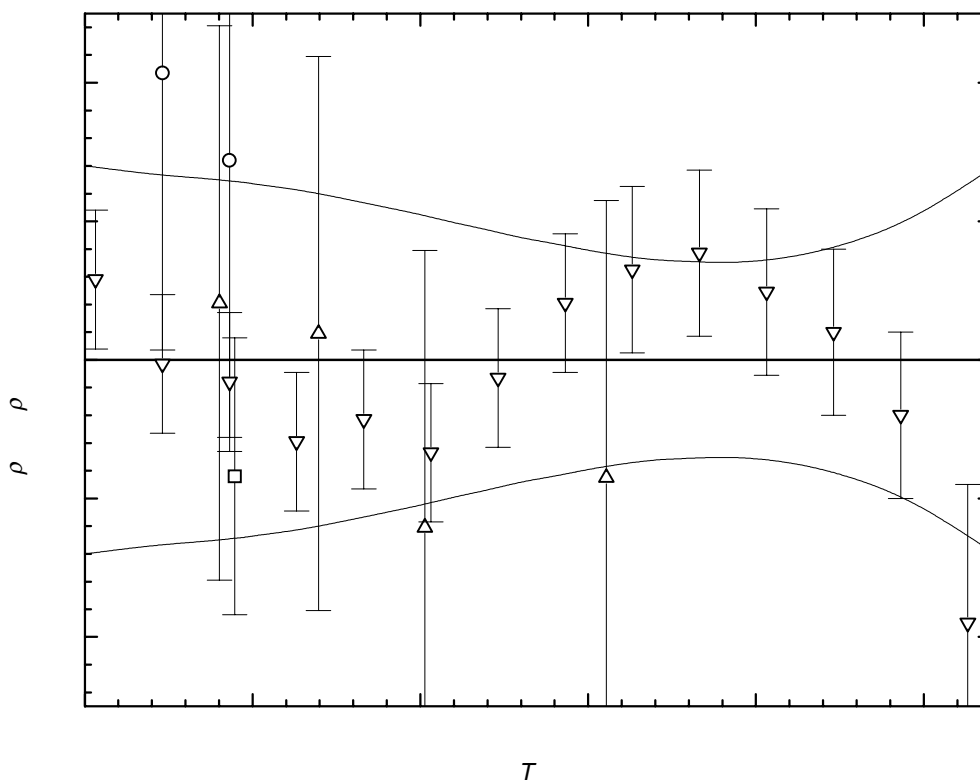


Fig. 1. The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the symbols are omitted for clarity of the figure.)

cont.

4-Methylpentanoic acid (cont.)

Table 3. Recommended values (fit to the reliable experimental values according to the equations
 $\rho = A + BT + CT^2 + DT^3 + \dots$ or $\rho = [1 + 1.75(1 - T/T_c)^{1/3} + 0.75(1 - T/T_c)][\rho_c + A(T_c - T) + B(T_c - T)^2 + C(T_c - T)^3 + D(T_c - T)^4]$).

$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{K}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
250.00	955.38 ± 1.40	330.00	890.67 ± 1.15	430.00	803.20 ± 0.71
260.00	947.54 ± 1.37	340.00	882.25 ± 1.10	440.00	794.05 ± 0.70
270.00	939.64 ± 1.34	350.00	873.76 ± 1.05	450.00	784.83 ± 0.71
280.00	931.66 ± 1.32	360.00	865.20 ± 0.99	460.00	775.54 ± 0.74
290.00	923.61 ± 1.30	370.00	856.56 ± 0.94	470.00	766.17 ± 0.79
293.15	921.06 ± 1.29	380.00	847.85 ± 0.88	480.00	756.73 ± 0.86
298.15	916.99 ± 1.28	390.00	839.07 ± 0.84	490.00	747.21 ± 0.95
300.00	915.48 ± 1.27	400.00	830.21 ± 0.79	500.00	737.62 ± 1.07
310.00	907.29 ± 1.24	410.00	821.28 ± 0.75	510.00	727.96 ± 1.22
320.00	899.01 ± 1.20	420.00	812.28 ± 0.72	520.00	718.23 ± 1.38