

2.5 Haloalkanes of General Formula $C_nH_{2n+2-(k+l)}A_kB_l$ (A,B - elements of halogen series)

2.5.1 Bromochloroalkanes

Bromotrichloromethane [75-62-7] $CBrCl_3$ MW = 198.27 480

Table . Experimental values with uncertainties.

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
281.56	2036.29 ± 0.30	1880-tho
282.46	2034.37 ± 0.30	1880-tho
293.15	1994.20 ± 0.70	1952-zak-1

Bromodichloromethane [75-27-4] $CHBrCl_2$ MW = 163.83 481

Table 1. Fit with estimated B coefficient for 3 accepted points. Deviation $\sigma_w = 0.047$.

Coefficient	$\rho = A + BT$
A	2639.40
B	-2.200

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

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{\rho_{\text{exp}} - \rho_{\text{cal}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
273.15	2038.50 ± 1.00	0.03	1926-tim/mar-1
288.15	2005.50 ± 1.00	0.03	1926-tim/mar-1
303.15	1972.40 ± 1.00	-0.07	1926-tim/mar-1

Table 3. Recommended values.

$\frac{T}{K}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$
270.00	2045.4 ± 1.6
280.00	2023.4 ± 1.1
290.00	2001.4 ± 0.9
293.15	1994.5 ± 1.0
298.15	1983.5 ± 1.1
310.00	1957.4 ± 1.8

Bromochloromethane**[74-97-5]****CH₂BrCl****MW = 129.38****482**

Table 1. Coefficients of the polynomial expansion equation. Standard deviations (see introduction): $\sigma_{c,w} = 2.7573$ (combined temperature ranges, weighted), $\sigma_{c,uw} = 1.2331$ (combined temperature ranges, unweighted).

Coefficient	$T = 213.13 \text{ to } 267.24 \text{ K}$ $\rho = A + BT + CT^2 + DT^3 + \dots$
<i>A</i>	$1.19636 \cdot 10^3$
<i>B</i>	9.26874
<i>C</i>	$-2.45314 \cdot 10^{-2}$

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)
213.13	2060.00 ± 2.00	2.52	1977-gun/kar(□)	253.07	1971.00 ± 2.00	0.10	1977-gun/kar(□)
221.08	2044.00 ± 2.00	-2.49	1977-gun/kar(□)	262.23	1939.00 ± 2.00	-1.01	1977-gun/kar(□)
231.79	2023.00 ± 2.00	-3.77	1977-gun/kar(□)	267.24	1921.00 ± 2.00	-0.37	1977-gun/kar(□)
244.17	2002.00 ± 2.00	5.03	1977-gun/kar(□)				

Further references: [1995-art/mun, 1995-art/mun-3].

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

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

$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$	$\frac{T}{\text{K}}$	$\frac{\rho \pm \sigma_{\text{fit}}}{\text{kg} \cdot \text{m}^{-3}}$
210.00	2060.96 ± 3.23	240.00	2007.85 ± 1.92	270.00	1910.58 ± 3.47
220.00	2048.16 ± 2.38	250.00	1980.33 ± 1.85	280.00	1868.35 ± 5.79
230.00	2030.46 ± 2.05	260.00	1947.91 ± 2.18		

cont.

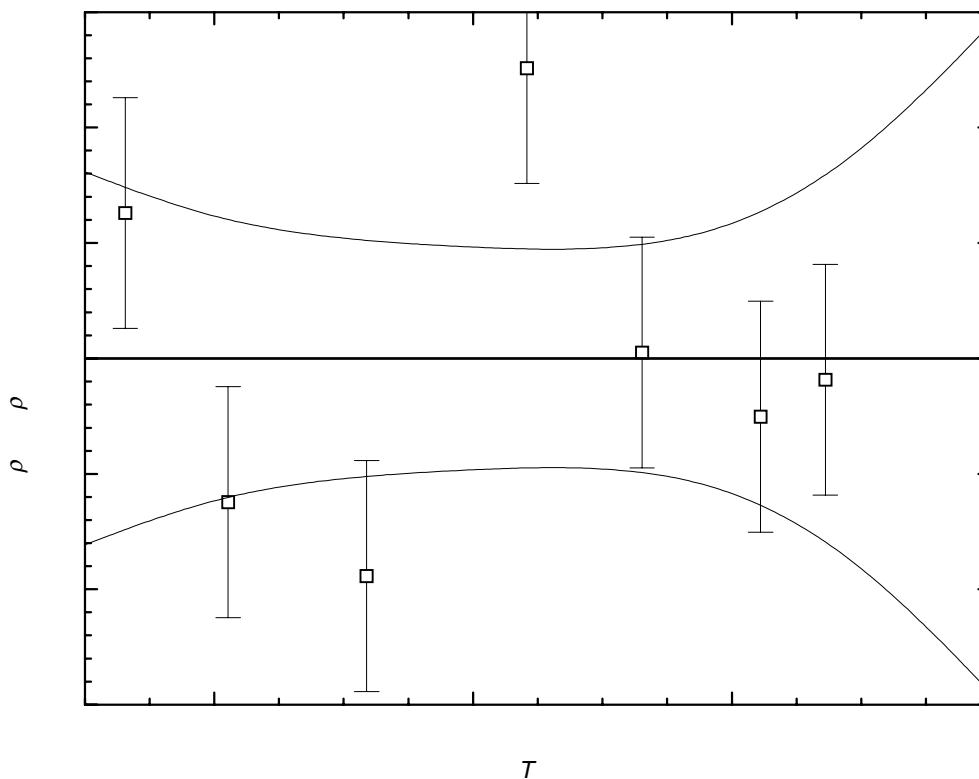


Fig. 1. The symbols show the deviation of the calculated from the experimental values from Table 2. The curves above and below the zero line indicate the calculated error region of the recommended values given in Table 3. The error bars represent the experimental errors. (Error bars smaller than the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

1,2-Dibromo-1,1-dichloroethane

[75-81-0]

 $\text{C}_2\text{H}_2\text{Br}_2\text{Cl}_2$ MW = 256.75

483

Table 1. Experimental value with uncertainty.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
273.15	2298.00 ± 2.00	1925-van-3

1-Bromo-1,1-dichloroethane

[676-92-6]

 $\text{C}_2\text{H}_3\text{BrCl}_2$ MW = 177.86

484

Table 1. Experimental value with uncertainty.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	1746.50 ± 2.00	1961-kos/fre

1-Bromo-2-chloroethane [107-04-0] $\text{C}_2\text{H}_4\text{BrCl}$ MW = 143.41 485

Table 1. Experimental values with uncertainties.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
293.15	1739.20 ± 1.00	1931-smy/dor
298.15	1726.33 ± 0.80	1995-art/mun
298.15	1726.33 ± 0.80	1995-art/mun-3

1,3-Dibromo-1,1-dichloropropane [53074-35-4] $\text{C}_3\text{H}_4\text{Br}_2\text{Cl}_2$ MW = 270.78 486

Table 1. Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
293.15	2077.20 ± 2.00	1961-kos/fre

1-Bromo-3,3-dichloropropane [36668-45-8] $\text{C}_3\text{H}_5\text{BrCl}_2$ MW = 191.88 487

Table 1. Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
293.15	1708.40 ± 2.00	1961-fre/kos

1,2,3,4-Tetrabromo-2-chlorobutane [6108-68-5] $\text{C}_4\text{H}_5\text{Br}_4\text{Cl}$ MW = 408.15 488

Table 1. Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
298.15	2619.00 ± 2.00	1965-han/tan

1-Bromo-2,3,3-trichloro-2-methylpropane [80345-53-5] $\text{C}_4\text{H}_6\text{BrCl}_3$ MW = 240.35 489

Table 1. Experimental value with uncertainty.

$\frac{T}{\text{K}}$	$\frac{\rho_{\text{exp}} \pm 2\sigma_{\text{est}}}{\text{kg} \cdot \text{m}^{-3}}$	Ref.
293.15	1726.40 ± 2.00	1959-nes/fre

1-Bromo-2,3-dichlorobutane [38585-79-4] $\text{C}_4\text{H}_7\text{BrCl}_2$ MW = 205.91 490

Table 1. Experimental value with uncertainty.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	1598.50 ± 2.00	1961-fre/kos

1-Bromo-3,3-dichlorobutane [89089-23-6] $\text{C}_4\text{H}_7\text{BrCl}_2$ MW = 205.91 491

Table 1. Experimental value with uncertainty.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	1576.80 ± 2.00	1961-kos/fre

1-Bromo-2,3-dichloro-2-methylpropane [1871-60-9] $\text{C}_4\text{H}_7\text{BrCl}_2$ MW = 205.91 492

Table 1. Experimental value with uncertainty.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	1612.40 ± 2.00	1961-fre/kos

1-Bromo-1,1,5-trichloropentane [89280-11-5] $\text{C}_5\text{H}_8\text{BrCl}_3$ MW = 254.38 493

Table 1. Experimental value with uncertainty.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	1609.00 ± 2.00	1961-kos/fre

1-Bromo-5,5-dichlorohexane [80345-55-7] $\text{C}_6\text{H}_{11}\text{BrCl}_2$ MW = 233.96 494

Table 1. Experimental value with uncertainty.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	1428.40 ± 2.00	1961-kos/fre

1-Bromo-1-chloro-3,3-dimethylbutane [53268-47-6] $\text{C}_6\text{H}_{12}\text{BrCl}$ MW = 199.52 495

Table 1. Experimental value with uncertainty.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	1263.80 ± 20.00	1946-sch

2-Bromo-2-chloro-3,3-dimethylbutane [33840-41-4] $\text{C}_6\text{H}_{12}\text{BrCl}$ MW = 199.52 496

Table 1. Experimental value with uncertainty.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	1250.00 ± 20.00	1946-sch

1-Bromo-3,3,7-trichloroheptane [90009-25-9] $\text{C}_7\text{H}_{12}\text{BrCl}_3$ MW = 282.43 497

Table 1. Experimental value with uncertainty.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	1506.10 ± 2.00	1961-kos/fre

1,7-Dibromo-3,3-dichloroheptane [89774-16-3] $\text{C}_7\text{H}_{12}\text{Br}_2\text{Cl}_2$ MW = 326.89 498

Table 1. Experimental value with uncertainty.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	1707.50 ± 2.00	1961-kos/fre

1-Bromo-7,7-dichlorooctane [90201-96-0] $\text{C}_8\text{H}_{15}\text{BrCl}_2$ MW = 262.02 499

Table 1. Experimental value with uncertainty.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	1345.20 ± 2.00	1961-kos/fre

1-Bromo-5,5,9-trichlorononane [90435-91-9] $\text{C}_9\text{H}_{16}\text{BrCl}_3$ MW = 310.49 500

Table 1. Experimental value with uncertainty.

T K	$\rho_{\text{exp}} \pm 2\sigma_{\text{est}}$ $\text{kg} \cdot \text{m}^{-3}$	Ref.
293.15	1411.90 ± 2.00	1961-kos/fre