COMPONENTS:	EVALUATOR:
(1) Mercury; Hg; [7439-97-6] (2) Cycloalkanes	H. Lawrence Clever Chemistry Department Emory University Atlanta, Georgia 30322 USA 1985, July

CRITICAL EVALUATION:

An Evaluation of the Solubility of Mercury in Cycloalkanes.

There are data on the solubility of mercury in six cycloalkanes. A. F. Voigt and co-workers (ref. 1 - 4) have measured all but one of the reported cycloalkane solubilities by a radioactive tracer technique. A single value is reported by Vogel and Gjaldbaek (ref. 5) by atomic absorption spectroscopy. The data on the six cycloalkanes are discussed below.

Mercury + Cyclohexane; C_6H_{12}; [110-82-7]

There are four values of the solubility of mercury in cyclohexane at 298.15 K. They are:

$(12.1 \pm 0.3) \times 10^{-6}$ mol dm^{-3}	Spencer and Voigt (ref. 3)
$(11.0 \pm 0.2) \times 10^{-6}$ mol dm^{-3}	Moser and Voigt (ref. 1)
9.7×10^{-6} mol dm^{-3}	Moser and Voigt (ref. 2)
$(9.6 \pm 0.4) \times 10^{-6}$ mol dm^{-3}	Vogel and Gjaldbaek (ref. 5)

In addition, Spencer and Voigt (ref. 3) report five additional values in the 288.15 to 313.15 K interval. The Moser and Voigt (ref. 2) value was calculated from their cyclohexane/water distribution coefficient by the evaluator. It is of lesser reliability than the other values since it assumes unit activity coefficients and depends on the value chosen for the solubility of mercury in water.

The agreement among the values at 298.15 K is not as good as one would like. They differ by about 25 percent. Vogel and Gjaldbaek (ref. 5) took special care to see that the glassware surface of the sampling pipet was equilibrated with a saturated solution of mercury to prevent loss of mercury by adsorption on the surface and that colloidal mercury did not form in the sampled saturated solution. Their first precaution would result in a larger solubility and the second would result in a smaller solubility if adsorption of mercury by glass and colloidal mercury formation were problems. Vogel and Gjaldbaek suggest their smaller value is due to the precaution about colloidal mercury. Vogel and Gjaldbaek did four determinations of the solubility of mercury in cyclohexane by direct shaking without the precaution to remove colloidal mercury. The average solubility was $(12.4 \pm 1.5) \times 10^{-6}$ mol dm^{-3} which does agree with the Spencer and Voigt value. However, Vogel and Gjaldbaek also measured the solubility of mercury in octane and in 2,2,4-trimethylpentane. Their solubility values in these solvents agree well with the Spencer and Voigt values. At present, there is no reason why colloidal mercury would be a problem in cyclohexane but not with the octanes. It is a point that deserves futher experimental investigation. Vogel and Gjaldbaek also show that they obtain the same solubility value with an oxygen atmosphere or with a nitrogen atmosphere. They obtained equilibrium within 48 hours and found the same result after equilibrating for one month.

For this evaluation we prefer the Spencer and Voigt data because it is a self-consistent set of data over a 25 degree temperature interval. If Vogel and Gjaldbaek are correct, then the values from the Spencer and Voigt experiments should be reduced by about 20 percent. The six experimental values of Spencer and Voigt (ref. 3) and the one value of Moser and Voigt (ref. 1) were combined in a linear regression to obtain the equations for the 288.15 to 313.15 K interval.

$$\ln(c_1/\text{mol dm}^{-3}) = (1.6014 \pm 0.5296) - (38.6262 \pm 1.5886)/(T/100\ \text{K})$$

with a standard error about the regression line of 4.9×10^{-7}.

$$\ln x_1 = (0.2949 \pm 0.5246) - (39.5782 \pm 1.5740)/(T/100\ \text{K})$$

with a standard error about the regression line of 5.3×10^{-8}.

$$\ln(m_1/\text{mol kg}^{-1}) = (2.2128 \pm 0.5213) - (39.6850 \pm 1.5639)/(T/100\ \text{K})$$

with a standard error about the regression line of 6.2×10^{-7}.

Smoothed data from the equations are in Table 1 below. Also in the table are the values of the enthalpy and entropy changes for the transfer of one mole of mercury from liquid mercury to the hypothetical unit concentration solution.

Table 1. Solubility of mercury in cyclohexane. Tentative values of c_1/mol dm^{-3}, m_1/mol kg^{-1}, and mole fraction, x_1, solubility as a function of temperature.

T/K	Mercury Solubility		
	Concentration $10^6 c_1$/mol dm^{-3}	Mole Fraction $10^7 x_1$	Molality $10^6 m_1$/mol kg^{-1}
288.15	7.5	8.1	9.5
293.15	9.4	10.2	12.1
298.15	11.7	12.8	15.1
303.15	14.5	15.9	18.9
308.15	17.9	19.7	23.3
313.15	21.8	24.2	28.7
ΔH_1[a]	32.1 ± 1.3	32.9 ± 1.3	33.0 ± 1.3
ΔS_1[b]	13.3 ± 4.4	2.5 ± 4.4	18.4 ± 4.3

[a] units kJ mol^{-1}
[b] units J K^{-1} mol^{-1}

Mercury + Methylcyclohexane; C_7H_{14}; [108-87-2]
cis-1,2-Dimethylcyclohexane; C_8H_{16}; [2207-01-4]
trans-1,2-Dimethylcyclohexane; C_8H_{16}; [6876-23-9]
cis-1,4-Dimethylcyclohexane; C_8H_{16}; [624-29-3]
trans-1,4-Dimethylcyclohexane; C_8H_{16}; [2207-04-7]

Spencer and Voigt (ref. 3 and 4) made the only measurements on these systems. The data are classed as tentative. The data were fit by a linear regression in the solubility units of concentration, c_1/mol dm^{-3}, mole fraction, x_1, and molality, m_1/mol kg^{-1} to a two constant equation. The constants of the equations and the smoothed data are given in Tables 2 - 7.

The solubility of mercury in the substituted cyclohexanes has a significantly more positive enthalpy of solution than in cyclohexane, but less positive enthalpy than for normal alkanes of the same carbon number. The enthalpy of solution of mercury in the substituted cyclohexanes is the same within experimental error for the five solvents. The solubility of mercury parallels closely for methylcyclohexane and the *cis*-1,2- and *cis*-1,4-dimethylcyclohexanes as a function of temperatures. The *trans*-1,2- and *trans*-1,4-dimethylcyclohexanes mercury solubilities parallel quite closely, but at about a 10 percent lower value than the solubility in the other three substituted cyclohexanes at a corresponding temperature.

COMPONENTS:	EVALUATOR:
(1) Mercury; Hg; [7439-97-6] (2) Cycloalkanes	H. Lawrence Clever Chemistry Department Emory University Atlanta, Georgia 30322 USA 1985, July

CRITICAL EVALUATION:

Table 2. Constants for the equation $\ln(c_1/\text{mol dm}^{-3}) = A(1) + A(2)/(T/100\ \text{K})$.

Compound	A(1) ± Error	A(2) ± Error	Std. error about the Regression Line
Methylcyclohexane	3.6095 ± 0.1461	-45.4364 ± 0.4285	1.33×10^{-7}
cis-1,2-DMC	2.6380 ± 0.6568	-42.3938 ± 1.9581	3.33×10^{-7}
trans-1,2-DMC	2.9009 ± 0.7042	-43.5886 ± 2.0979	3.76×10^{-7}
cis-1,4-DMC	3.3771 ± 0.4927	-43.7188 ± 1.4679	2.14×10^{-7}
trans-1,4-DMC	2.9205 ± 0.6169	-43.7078 ± 1.8378	3.30×10^{-7}

Table 3. Solubility of mercury in cycloalkanes. Tentative values of the concentration as a function of temperature at 0.1 MPa.

T/K	Concentration, $10^6 c_1$/mol dm^{-3}, in				
	Methyl-cyclohexane	*cis*-1,2-dimethyl-cyclohexane	*trans*-1,2-dimethyl-cyclohexane	*cis*-1,4-dimethyl-cyclohexane	*trans*-1,4-dimethyl-cyclohexane
273.15	2.2	-	-	-	-
278.15	3.0	-	-	-	-
283.15	4.0	-	-	-	-
288.15	5.2	5.7	4.9	5.3	4.8
293.15	6.9	7.3	6.3	6.9	6.2
298.15	8.9	9.3	8.1	9.0	8.0
303.15	11.4	11.8	10.4	11.5	10.2
308.15	14.6	14.8	13.1	14.6	12.8
ΔH_1[a]	37.8 ± 0.4	35.2 ± 1.6	36.2 ± 1.7	37.2 ± 1.2	36.3 ± 1.5
ΔS_1[b]	30.0 ± 1.2	21.9 ± 5.5	24.1 ± 5.8	28.1 ± 4.1	24.3 ± 5.1

[a] units kJ mol^{-1}
[b] units J K^{-1} mol^{-1}

Table 4. Constants for the equation $\ln x_1 = A(1) + A(2)/(T/100\ K)$.

Compound	A(1) ± Error	A(2) ± Error	Std. error about the Regression Line
Methylcyclohexane	2.0035 ± 0.1608	-46.7699 ± 0.4716	1.98×10^{-3}
cis-1,2-DMC	1.0312 ± 0.7068	-43.4305 ± 2.1072	5.00×10^{-3}
trans-1,2-DMC	1.2975 ± 0.7096	-44.5584 ± 2.1139	5.56×10^{-3}
cis-1,4-DMC	1.7676 ± 0.5097	-45.6945 ± 1.5185	3.14×10^{-3}
trans-1,4-DMC	1.3569 ± 0.5931	-44.7394 ± 1.7669	4.78×10^{-3}

Table 5. Solubility of mercury in cycloalkanes. Tentative values of the mole fraction solubility as a function of temperature at 0.1 MPa.

T/K	Mole Fraction, $10^7 x_1$, in				
	Methyl-cyclohexane	*cis*-1,2-dimethyl-cyclohexane	*trans*-1,2-dimethyl-cyclohexane	*cis*-1,4-dimethyl-cyclohexane	*trans*-1,4-dimethyl-cyclohexane
273.15	2.7	-	-	-	-
278.15	3.7	-	-	-	-
283.15	5.0	-	-	-	-
288.15	6.6	8.0	7.0	7.6	7.0
293.15	8.7	10.3	9.2	10.0	9.1
298.15	11.4	13.2	11.8	12.9	11.8
303.15	14.8	16.8	15.1	16.6_5	15.1
308.15	19.0	21.2	19.2	21.3	19.2
ΔH_1[a]	38.9 ± 0.4	36.1 ± 1.8	37.0 ± 1.8	38.0 ± 1.3	37.2 ± 1.5
ΔS_1[b]	16.7 ± 1.3	8.6 ± 5.9	10.8 ± 5.9	14.7 ± 4.2	11.3 ± 4.9

[a] units kJ mol^{-1}
[b] units J K^{-1} mol^{-1}

COMPONENTS:	EVALUATOR:
(1) Mercury; Hg; [7439-97-6] (2) Cycloalkanes	H. Lawrence Clever Chemistry Department Emory University Atlanta, Georgia 30322 USA 1985, July

CRITICAL EVALUATION:

Table 6. Constants for the equation $\ln(m_1/\text{mol kg}^{-1}) = A(1) + A(2)/(T/100\ \text{K})$.

Compound	A(1) ± Error	A(2) ± Error	Std. error about the Regression Line
Methylcyclohexane	4.2093 ± 0.1477	-46.4212 ± 0.4331	1.67×10^{-7}
cis-1,2-DMC	3.2107 ± 0.6326	-43.4077 ± 1.8858	4.03×10^{-7}
trans-1,2-DMC	3.3971 ± 0.6784	-44.2926 ± 2.0210	4.72×10^{-7}
cis-1,4-DMC	3.9300 ± 0.5118	-45.6200 ± 1.5245	2.80×10^{-7}
trans-1,4-DMC	3.5862 ± 0.6524	-44.8727 ± 1.9436	4.63×10^{-7}

Table 7. Solubility of mercury in cycloalkanes. Tentative values of molality as a function of temperature at 0.1 MPa.

T/K	Molality, $10^6 m_1$/mol kg^{-1}, in				
	Methyl-cyclohexane	*cis*-1,2-dimethyl-cyclohexane	*trans*-1,2-dimethyl-cyclohexane	*cis*-1,4-dimethyl-cyclohexane	*trans*-1,4-dimethyl-cyclohexane
273.15	2.8	-	-	-	-
278.15	3.8	-	-	-	-
283.15	5.1	-	-	-	-
288.15	6.8	7.1	6.3	6.8	6.2
293.15	8.9	9.2	8.2	8.9	8.1
298.15	11.6	11.8	10.6	11.5	10.5
303.15	15.1	15.0	13.5	14.8	13.5
308.15	19.3	18.9	17.1	18.9	17.1
ΔH_1[a]	38.6 ± 0.4	36.1 ± 1.6	36.8 ± 1.7	37.9 ± 1.3	37.3 ± 1.6
ΔS_1[b]	35.0 ± 1.2	26.7 ± 5.3	28.2 ± 5.6	32.7 ± 4.3	29.8 ± 5.4

[a] units kJ mol^{-1}
[b] units J K^{-1} mol^{-1}

REFERENCES:

1. Moser, H. C.; Voigt, A. F. *USAEC Report* 1957, *ISC-892*, 65 pp. Chem. Abstr. 1958, 52, 10691h.

2. Moser, H. C.; Voigt, A. F. *J. Am. Chem. Soc.* 1957, *79*, 1837 - 9.

3. Spencer, J. N.; Voigt, A. F. *J. Phys. Chem.* 1968, *72*, 464 - 70. Spencer, J. N. Dissertation, Iowa State University, 1967.

4. Spencer, J. N.; Voigt, A. F. *J. Phys. Chem.* 1968, *72*, 1913 - 7; Voigt, A. F. Personal communication.

5. Vogel, A.; Gjaldbaek, J. C. *Arch. Pharm. Chem. Sci. Ed.* 1974, *2*, 25 - 9.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Mercury; Hg; [7439-97-6] Mercury-203; ^{203}Hg; [13982-78-0] (2) Cyclohexane; C_6H_{12}; [110-82-7]	Moser, H. C.; Voigt, A. F. USAEC Report 1957, ISC-892. Chem. Abstr. 1958, *52*, 10691h.
VARIABLES: T/K = 298.15	PREPARED BY: H. L. Clever M. Iwamoto

EXPERIMENTAL VALUES:

Temperature		Mercury Solubility		
t/°C	T/K[a]	Concentration $10^6 c_1$/mol dm^{-3}	Mole Fraction[a] $10^7 x_1$	Molality[a] $10^6 m_1$/mol kg^{-1}
25	298.15	11.0 ± 0.2	12.0	14.2

[a]Calculated by compilers.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A globule of Hg metal prepared from radioactive mercury(II) nitrate by reduction with hypophosphorous acid was equilibrated with 5 - 10 ml of liquid by shaking in a thermostat. Aliquotes of the liquid were withdrawn periodically for up to two weeks and the Hg concentration determined radiochemically.

The aliquot was diluted with acetone and equilibrated with $Hg(NO_3)_2$ carrier to exchange the radioactive mercury. The mercury was precipitated as HgS, mounted on a stainless steel planchet and counted with a Geiger-Mueller tube.

SOURCE AND PURITY OF MATERIALS:

(1) Mercury and Mercury-203. Oak Ridge National Lab; recieved as 0.31 M $Hg(NO_3)_2$ in 1.56 HNO_3 solution. Initial activity 50 millicuries g^{-1}; half-life 48 days. Reduced to Hg by hypophosphorous acid; coagulated to a Hg droplet by addition of concentrated HI.

(2) Cyclohexane. Eastman Co. Spectro-Grade; shaken with concentrated H_2SO_4 and alkaline $KMnO_4$ passed through a column of dry activated Al_2O_3 and redistilled.

ESTIMATED ERROR:

δT/K = ±0.1

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Mercury; Hg; [7439-97-6] Mercury-203; ^{203}Hg; [13982-78-0] (2) Cyclohexane; C_6H_{12}; [110-82-7]	Moser, H. C.; Voigt, A. F. *J. Am. Chem. Soc.* 1957, *79*, 1837 - 9.
VARIABLES:	PREPARED BY:
T/K = 298.15	H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Distribution Constant	Mercury Solubility		
t/°C	T/K[a]	$E°=c_1$aq/$c_1$org	Concentration[a] $10^6 c_1$/mol dm^{-3}	Mole Fraction[a] $10^7 x_1$	Molality[a] $10^6 m_1$/mol kg^{-1}
25.0	298.15	0.031	9.7	10.5	12.5

[a]Calculated by compiler, assuming activity coefficients are unity.

The above mercury solubility value was calculated using the free mercury solubility in water of 3.0×10^{-7} mol dm^{-3}

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The distribution of mercury-203 between aqueous and organic phases was measured. Dilute solutions of 0.01 molar HNO_3 containing a known amount of pure mercurous nitrate were shaken with an equal volume of organic liquid for about 12 hours. Both phases were analyzed for total mercury by first converting to Hg^{2+}, precipitation as HgS, and counting in a thin window Geiger counter.

In the aqueous phase the disproportionation

$$Hg_2^{2+}(aq) = Hg^{2+}(aq) + Hg(aq)$$

and possibly the dissociation

$$Hg_2^{2+}(aq) = 2\ Hg^{+}(aq)$$

take place. It is assumed that only metallic Hg is extracted into the organic phase.

The distribution of total Hg in the aqueous phase to total Hg in the organic phase is determined as a function of total Hg in the organic phase. From the slope and intercept, the authors obtain values of the metallic Hg distribution ratio.

SOURCE AND PURITY OF MATERIALS:

(1) Mercury and Mercury-203. Oak Ridge National Lab; obtained as a high specific activity solution of mercury(II) nitrate containing isotope 203. In the 0.01 molar HNO_3 solution of mercury(I) nitrate, the authors estimate 96% mercury(II) is Hg^{2+} and 99% of the mercury(I) is Hg_2^{2+}. At this acidity, there is no minimum hydrolysis and nitrato complex formation.

(2) Cyclohexane. Eastman Spectro Grade.

ESTIMATED ERROR:

δT/K = ±0.1

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Mercury; Hg; [7439-97-6]; Mercury-203; ^{203}Hg; [13982-78-0]	Spencer, J. N.; Voigt, A. F. *J. Phys. Chem.* 1968, *72*, 464 - 470.
(2) Cyclohexane; C_6H_{12}; [110-82-7]	Spencer, J. N. Dissertation, Iowa State University, 1967.
VARIABLES:	PREPARED BY:
T/K = 288.15 - 313.15	S. H. Johnson M. Iwamoto H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Mercury Solubility		
t/°C	T/K[a]	Concentration $10^6 c_1$/mol dm^{-3}	Mole Fraction[a] $10^7 x_1$	Molality[a] $10^6 m_1$/mol kg^{-1}
15	288.15	7.6 ± 0.2	8.2	9.7
20	293.15	9.4 ± 0.2	10.2	12.1
25	298.15	12.1 ± 0.3	13.2	15.6
30	303.15	14.8 ± 0.4	16.2	19.2
35	308.15	17.4 ± 0.2	19.2	22.8
40	313.15	22.3 ± 1.5	24.7	29.3

[a]Calculated by compilers.

The authors smoothed their data according to the equation:

$$\log x_1 = (13.140 \pm .359)\log(T/K) - 38.405$$

for the 288.15 to 313.15 temperature interval.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A radioactive tracer method was used. A high activity sample of mercury-203 nitrate was added to mercury(II) nitrate, reduced to metallic mercury by hypophosphorous acid, coagulated into a drop, washed and dried.

The mercury and solvent were shaken continuously in 25 ml glass stoppered volumetric flasks in a thermostat for 24 hours. Aliquots of the equilibrated solution were counted by a conventional single channel scintilation counter. The window width was set to count only the photopeak at 279 kev. The solubility values were the average of at least six determinations over a three day period.

SOURCE AND PURITY OF MATERIALS:

(1) Mercury and Mercury-203. The isotope decays by emission of a beta particle at an energy of 210 kev, accompanied by a gamma ray of 279 kev. The isotope half-life is 47 days.

(2) Cyclohexane. Phillips Petroleum Co., Research Grade, used as received.

ESTIMATED ERROR:

δT/K = ±0.1; See random error reported by authors with concentration values above.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Mercury; Hg; [7439-97-6];	Vogel, A.; Gjaldbaek, J. Chr.
(2) Cyclohexane; C_6H_{12}; [110-82-7]	*Arch. Pharm. Chem. Sci. Ed.* 1974, *2*, 25 - 9.
VARIABLES:	PREPARED BY:
T/K = 298.15	H. L. Clever M. Iwamoto

EXPERIMENTAL VALUES:

Temperature		Mercury Solubility			
t/°C	T/K[a]	No. of Exps.	Concentration $10^6 c_1$/mol dm^{-3}	Mole Fraction[a] $10^7 x_1$	Molality[a] $10^6 m_1$/mol kg^{-1}
25	298.15	24	9.6 ± 0.4	10.4	12.4

[a]Calculated by compilers.

The error is the standard deviation of an individual measurement.

ADDITIONAL COMMENTS:

The authors state that they found the same solubility after shaking mercury + solvent for 48 hours as for shaking times of up to one month.

The authors also found the same solubility within experimental error when the solvent was saturated with oxygen and with nitrogen.

The authors took special care to see that the glassware surface of the sampling pipet was equilibrated with the saturated solution of mercury. Special care was taken to see that colloidal mercury did not form in the solution.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The mercury was analyzed by cold vapor atomic absorption spectroscopy (ref. 1).

The solvent was saturated with Hg in a special glass container in which a few grams of mercury was kept in a cellulose extraction thimble. The container was shaken at least 48 hours at 25°C.

A 10.00 cm^3 sample of the saturated solution was taken. It was treated to convert the Hg to Hg^{2+} and extracted into an aqueous phase.

An aliquot of the aqueous phase was diluted, treated with tin(II) chloride to reduce the mercury, and the solution analyzed by cold vapor atomic absorption spectroscopy. The apparatus allowed measurements down to one part per billion of Hg.

Similtaneous measurements were made under the same conditions of samples containing a known amount of mercury.

SOURCE AND PURITY OF MATERIALS:

(1) Mercury. Source not given, purified by distillation.

(2) Cyclohexane. Merck; Uvasol grade spectroscopic quality, used without further purification.

ESTIMATED ERROR:

$\delta c_1/c_1 = \pm 0.07$
See standard deviation above.

REFERENCES:

1. Hatch, W. R.; Ott, W. L. *Anal. Chem.* 1968, *10*, 2085.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Mercury; Hg; [7439-97-6]; Mercury-203; ^{203}Hg; [13982-78-0]	Spencer, J. N.; Voigt, A. F. *J. Phys. Chem.* 1968, *72*, 464 - 470.
(2) Methylcyclohexane; C_7H_{14}; [108-87-2]	Spencer, J. N. Dissertation, Iowa State University, 1967.
VARIABLES:	PREPARED BY:
T/K = 273.15 - 308.15	S. H. Johnson M. Iwamoto H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Mercury Solubility		
t/°C	T/K[a]	Concentration $10^6 c_1$/mol dm^{-3}	Mole Fraction[a] $10^7 x_1$	Molality[a] $10^6 m_1$/mol kg^{-1}
0	273.15	2.2 ± 0.1	2.7	2.8
15	288.15	5.2 ± 0.1	6.6	6.7
20	293.15	6.9 ± 0.2	8.8	9.0
25	298.15	9.1 ± 0.1	11.7	11.9
30	303.15	11.3 ± 0.2	14.6	14.9
35	308.15	14.5 ± 0.4	18.8	19.2

[a]Calculated by compilers.

The authors smoothed their data according to the equation:

$$\log x_1 = (16.011 \pm .226)\log(T/K) - 45.563$$

for the 273.15 to 308.15 temperature interval.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

A radioactive tracer method was used. A high activity sample of mercury-203 nitrate was added to mercury(II) nitrate, reduced to metallic mercury by hypophosphorous acid, coagulated into a drop, washed and dried.

The mercury and solvent were shaken continuously in 25 ml glass stoppered volumetric flasks in a thermostat for 24 hours. Aliquots of the equilibrated solution were counted by a conventional single channel scintilation counter. The window width was set to count only the photopeak at 279 kev. The solubility values were the average of at least six determinations over a three day period.

SOURCE AND PURITY OF MATERIALS:

(1) Mercury and Mercury-203. The isotope decays by emission of a beta particle at an energy of 210 kev, accompanied by a gamma ray of 279 kev. The isotope half-life is 47 days.

(2) Methylcyclohexane. Phillips Petroleum Co., Research Grade, used as received.

ESTIMATED ERROR:

δT/K = ±0.1; See random error reported by authors with concentration values above.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Mercury; Hg; [7439-97-6]; Mercury-203; ^{203}Hg; [13982-78-0]	Spencer, J. N.; Voigt, A. F. *J. Phys. Chem.* 1968, *72*, 1913 - 7.
(2) *cis*-1,2-Dimethylcyclohexane; C_8H_{16}; [2207-01-4]	Voigt, A. F. Personal communication
VARIABLES:	PREPARED BY:
T/K = 289.15 - 308.15	S. H. Johnson M. Iwamoto H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Mercury Solubility		
t/°C	T/K[a]	Concentration $10^6 c_1$/mol dm^{-3}	Mole Fraction[a] $10^7 x_1$	Molality[a] $10^6 m_1$/mol kg^{-1}
16	289.15	5.8 ± 0.1	8.1	7.25
20	293.15	7.5 ± 0.2	10.6	9.4
25	298.15	9.57 ± 0.14	13.56	12.08
30	303.15	12.0 ± 0.2	17.1	15.2
35	308.15	14.4 ± 0.9	20.6	18.4

[a]Calculated by compilers.

Professor Voigt provided the experimental molar solubility values from J. N. Spencer's research notebook that do not appear in the published paper.

The authors smoothed their data according to the equation:

$$\log x_1 = (14.57 \pm .73)\log(T/\mathrm{K}) - 41.93$$

for the 289.15 to 308.15 temperature interval.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method and procedure are reported in an earlier paper (ref. 1).

A radioactive tracer method was used. A high activity sample of mercury-203 nitrate was added to mercury(II) nitrate, reduced to metallic mercury by hypophosphorous acid, coagulated into a drop, washed and dried.

The mercury and solvent were shaken continuously in glass stoppered volumetric flasks in a thermostat for 24 hours. Aliquots of the equilibrated solution were counted by a conventional single channel scintilation counter. The window width was set to count only the photopeak at 279 kev. The solubility values were the average of at least six determinations over a 3 day period.

At some temperatures the solubility increased with time unless the system was protected from light.

SOURCE AND PURITY OF MATERIALS:

(1) Mercury and Mercury-203. The isotope decays by emission of a beta particle at an energy of 210 kev, accompanied by a gamma ray of 279 kev. The isotope half-life is 47 days.

(2) *cis*-1,2-Dimethylcyclohexane. Matheson Coleman and Bell. Distilled, refluxed twice with NaOH and hydroquinone to reduce peroxides.

ESTIMATED ERROR:

δT/K = ±0.1; See random error reported by authors with concentration values above.

REFERENCES:

1. Spencer, J. N.; Voigt, A. F. *J. Phys. Chem.* 1968, *72*, 464.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Mercury; Hg; [7439-97-6]; Mercury-203; ^{203}Hg; [13982-78-0]	Spencer, J. N.; Voigt, A. F. *J. Phys. Chem.* 1968, *72*, 1913 - 7.
(2) *trans*-1,2-Dimethylcyclohexane; C_8H_{16}; [6876-23-9]	Voigt, A. F. Personal communication
VARIABLES:	PREPARED BY:
T/K = 288.15 - 308.15	S. H. Johnson M. Iwamoto H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Mercury Solubility		
t/°C	T/K[a]	Concentration $10^6 c_1$/mol dm^{-3}	Mole Fraction[a] $10^7 x_1$	Molality[a] $10^6 m_1$/mol kg^{-1}
15	288.15	4.8 ± 0.2	6.9	6.2
20	293.15	6.3 ± 0.2	9.1	8.1
25	298.15	8.49 ± 0.30	12.34	11.00
30	303.15	10.6 ± 0.1	15.5	13.8
35	308.15	12.6 ± 0.5	18.5	16.5

[a]Calculated by compilers.

Professor Voigt provided the experimental molar solubility values from J. N. Spencer's research notebook that do not appear in the published paper.

The authors smoothed their data according to the equation:

$$\log x_1 = (15.12 \pm .80)\log(T/\mathrm{K}) - 43.29$$

for the 288.15 to 308.15 temperature interval.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method and procedure are reported in an earlier paper (ref. 1).

A radioactive tracer method was used. A high activity sample of mercury-203 nitrate was added to mercury(II) nitrate, reduced to metallic mercury by hypophosphorous acid, coagulated into a drop, washed and dried.

The mercury and solvent were shaken continuously in 25 ml glass stoppered volumetric flasks in a thermostat for 24 hours. Aliquots of the equilibrated solution were counted by a conventional single channel scintilation counter. The window width was set to count only the photopeak at 279 kev. The solubility values were the average of at least six determinations over a three day period.

SOURCE AND PURITY OF MATERIALS:

(1) Mercury and Mercury-203. The isotope decays by emission of a beta particle at an energy of 210 kev, accompanied by a gamma ray of 279 kev. The isotope half-life is 47 days.

(2) *trans*-1,2-Dimethylcyclohexane. Phillips Petroleum Co., Research Grade, used as received.

ESTIMATED ERROR:

δT/K = ±0.1; See random error reported by authors with concentration values above.

REFERENCES:

1. Spencer, J. N.; Voigt, A. F. *J. Phys. Chem.* 1968, *72*, 464.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Mercury; Hg; [7439-97-6]; Mercury-203; ^{203}Hg; [13982-78-0]	Spencer, J. N.; Voigt, A. F. *J. Phys. Chem.* 1968, *72*, 1913 - 7.
(2) *cis*-1,4-Dimethylcyclohexane; C_8H_{16}; [624-29-3]	Voigt, A. F. Personal communication
VARIABLES:	PREPARED BY:
T/K = 288.15 - 308.15	S. H. Johnson M. Iwamoto H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Mercury Solubility		
t/°C	T/K[a]	Concentration $10^6 c_1$/mol dm^{-3}	Mole Fraction[a] $10^7 x_1$	Molality[a] $10^6 m_1$/mol kg^{-1}
15	288.15	5.2 ± 0.3	7.4	6.6
20	293.15	7.1 ± 0.4	10.2	9.1
25	298.15	9.20 ± 0.18	13.26	11.81
30	303.15	11.3 ± 0.5	16.4	14.6
35	308.15	14.5 ± 0.5	21.1	18.8

[a]Calculated by compilers.

Professor Voigt provided the experimental molar solubility values from J. N. Spencer's research notebook that do not appear in the published paper.

The authors smoothed their data according to the equation:

$$\log x_1 = (15.38 \pm .61)\log(T/\mathrm{K}) - 43.96$$

for the 288.15 to 308.15 temperature interval.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method and procedure are reported in an earlier paper (ref. 1).

A radioactive tracer method was used. A high activity sample of mercury-203 nitrate was added to mercury(II) nitrate, reduced to metallic mercury by hypophosphorous acid, coagulated into a drop, washed and dried.

The mercury and solvent were shaken continuously in 25 ml glass stoppered volumetric flasks in a thermostat for 24 hours. Aliquots of the equilibrated solution were counted by a conventional single channel scintilation counter. The window width was set to count only the photopeak at 279 kev. The solubility values were the average of at least six determinations over a three day period.

SOURCE AND PURITY OF MATERIALS:

(1) Mercury and Mercury-203. The isotope decays by emission of a beta particle at an energy of 210 kev, accompanied by a gamma ray of 279 kev. The isotope half-life is 47 days.

(2) *cis*-1,4-Dimethylcyclohexane. Matheson Coleman and Bell. Refluxed with NaOH and hydroquinone, distilled twice to remove peroxides.

ESTIMATED ERROR:

δT/K = ±0.1; See random error reported by authors with concentration values above.

REFERENCES:

1. Spencer, J. N.; Voigt, A. F. *J. Phys. Chem.* 1968, *72*, 464.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Mercury; Hg; [7439-97-6]; Mercury-203; ^{203}Hg; [13982-78-0]	Spencer, J. N.; Voigt, A. F. *J. Phys. Chem.* 1968, *72*, 1913 - 7.
(2) *trans*-1,4-Dimethylcyclohexane; C_8H_{16}; [2270-04-7]	Voigt, A. F. Personal communication
VARIABLES:	PREPARED BY:
T/K = 288.15 - 308.15	S. H. Johnson M. Iwamoto H. L. Clever

EXPERIMENTAL VALUES:

Temperature		Mercury Solubility		
t/°C	T/K[a]	Concentration $10^6 c_1$/mol dm^{-3}	Mole Fraction[a] $10^7 x_1$	Molality[a] $10^6 m_1$/mol kg^{-1}
15	288.15	4.7 ± 0.2	6.9	6.1
20	293.15	6.2 ± 0.2	9.1	8.1
25	298.15	8.24 ± 0.20	12.19	10.87
30	303.15	10.4 ± 0.4	15.5	13.8
35	308.15	12.4 ± 0.4	18.6	16.5

[a]Calculated by compilers.

Professor Voigt provided the experimental molar solubility values from J. N. Spencer's research notebook that do not appear in the published paper.

The authors smoothed their data according to the equation:

$$\log x_1 = (15.06 \pm .73)\log(T/K) - 43.19$$

for the 288.15 to 308.15 temperature interval.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The method and procedure are reported in an earlier paper (ref. 1).

A radioactive tracer method was used. A high activity sample of mercury-203 nitrate was added to mercury(II) nitrate, reduced to metallic mercury by hypophosphorous acid, coagulated into a drop, washed and dried.

The mercury and solvent were shaken continuously in 25 ml glass stoppered volumetric flasks in a thermostat for 24 hours. Aliquots of the equilibrated solution were counted by a conventional single channel scintilation counter. The window width was set to count only the photopeak at 279 kev. The solubility values were the average of at least six determinations over a three day period.

SOURCE AND PURITY OF MATERIALS:

(1) Mercury and Mercury-203. The isotope decays by emission of a beta particle at an energy of 210 kev, accompanied by a gamma ray of 279 kev. The isotope half-life is 47 days.

(2) *trans*-1,4-Dimethylcyclohexane. Matheson Coleman and Bell. Refluxed with NaOH and hydroquinone, distilled twice to remove peroxides.

ESTIMATED ERROR:

δT/K = ±0.1; See random error reported by authors with concentration values above.

REFERENCES:

1. Spencer, J. N.; Voigt, A. F. *J. Phys. Chem.* 1968, *72*, 464.