

SELECTED DATA ON MIXTURES

International DATA Series\*

2c. EXCESS VOLUME

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

**Components:** 1. 1,5-Diiodopentane, C<sub>5</sub>H<sub>10</sub>I<sub>2</sub> [628-66-3]  
2. Pentane, C<sub>5</sub>H<sub>12</sub> [109-66-0]  
**State:** Binary system, single-phase liquid; pure components, both liquid  
**Variables:** V<sup>E</sup>, molar excess volume  
x<sub>i</sub>, mole fraction of component i  
**Parameters:** T, temperature  
**Constants:** P, pressure  
**Method:** Calculation of V<sup>E</sup> from density measurements at constant T and P and variable x<sub>i</sub>; ref. 1

**Author(s) of table:** Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain)

**Edited by:** Mączynski, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)

SOURCE OF DATA

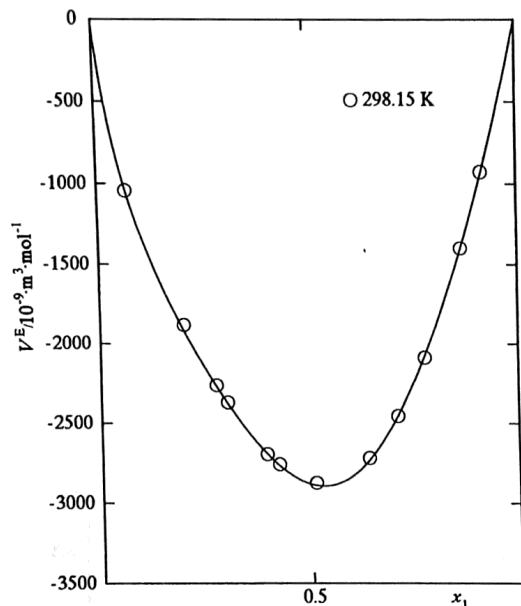
Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P, atm.

T/K = 298.15

x <sub>1</sub>	V <sup>E</sup> /10 <sup>-9</sup> m <sup>3</sup> ·mol <sup>-1</sup>
0.0681	-1043.0
0.1998	-1879.8
0.2750	-2259.0
0.3008	-2366.3
0.3934	-2690.5
0.4235	-2756.3
0.5113	-2871.7
0.6397	-2716.6
0.7101	-2452.2
0.7763	-2081.0
0.8667	-1397.0
0.9163	-927.0



Points, direct experimental V<sup>E</sup> values, curve, V<sup>E</sup><sub>calc</sub> calculated from the equation.

SMOOTHING EQUATION

$$V_{\text{calc}}^E = x_1 x_2 a_1 / [1 + \sum_{i=2}^n a_i (x_1 - x_2)^{i-1}]$$

Coeffs. a<sub>i</sub> in the smoothing eq., std. deviation σ<sub>d</sub>, and max. deviation δ<sub>m</sub> detd. by least-squares anal.

T/K	a <sub>1</sub>	a <sub>2</sub>	a <sub>3</sub>	a <sub>4</sub>	a <sub>5</sub>	σ <sub>d</sub>	δ <sub>m</sub>
	10 <sup>-9</sup> ·m <sup>3</sup> ·mol <sup>-1</sup>						
298.15	-11497 (36)	-0.1267 (0.0088)	0.030 (0.029)	0.343 (0.022)	-0.362 (0.047)	14.0	23.7

The std. deviations σa<sub>i</sub> of the coeffs. a<sub>i</sub> are given in parentheses  
δ<sub>m</sub> = max |V<sup>E</sup><sub>calc</sub> - V<sup>E</sup>|; σ<sub>d</sub> = [Σ(V<sup>E</sup><sub>calc</sub> - V<sup>E</sup>)<sup>2</sup>/(N - n)]<sup>1/2</sup>  
N, no. of direct exptl. values; n, no. of coeffs. a<sub>i</sub>  
All direct exptl. values equally weighted.

AUXILIARY INFORMATION

**Apparatus:** Vibrating tube densimeter type DMA 60 equipped with a cell model 602, (Anton-Paar, Graz, Austria). Temperature was controlled to within 0.01 K with a Heto Thermostat and was measured by means of a calibrated Pt thermometer.  
**Procedure:** Density, ρ, was calcd. from period of vibration, τ: ρ = a + bτ<sup>2</sup>. Consts. a and b were detd. by calibrating the app. (ref. 2) with doubly distd. and degassed H<sub>2</sub>O, ρ(298.15 K)/kg·m<sup>-3</sup> = 997.043 (ref. 3), and nonane (Fluka AG), "purum" grade material of stated purity > 99 mole %, ρ(298.15 K)/kg·m<sup>-3</sup> = 713.855 (ref. 4). Mixtures were prepd. by mass. V<sup>E</sup> was calcd. from V<sup>E</sup> = V - (x<sub>1</sub>V<sub>1</sub><sup>0</sup> + x<sub>2</sub>V<sub>2</sub><sup>0</sup>), where V = (x<sub>1</sub>M<sub>1</sub> + x<sub>2</sub>M<sub>2</sub>)/ρ is the molar vol. of the mixt. and V<sub>i</sub><sup>0</sup> = V(x<sub>i</sub> = 1) and M<sub>i</sub> are resp., the molar vol. and molar mass of component i.  
**Materials:** 1. Aldrich Chemicals Co., Inc. (Milwaukee, WI, USA), material of stated purity > 97 mole %, dried over mol. sieve type 3A (Fluka AG), and used without further purification; ρ(298.15 K)/kg·m<sup>-3</sup> = 2169.16; n<sub>D</sub>(298.15 K) = 1.5987.  
2. Fluka AG (Busch, St. Gallen, Switzerland), "puriss." grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve type 3A (Fluka AG), degassed with ultrasound and used without further purification; ρ(298.15 K)/kg·m<sup>-3</sup> = 621.31; n<sub>D</sub>(298.15 K) = 1.3547.  
**Errors:** δT(reproducibility)/K < 0.01; δT(IPTS-68)/K = 0.01; δx<sub>1</sub> < 0.0001; δV<sup>E</sup>/10<sup>-9</sup>·m<sup>3</sup>·mol<sup>-1</sup> < 1.

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1994, 22(1).
2. Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jimenez, E. J. *J. Chem. Thermodyn.* 1985, 17, 1127.
3. Riddick, J. A.; Bunger, W. B.; Sakano, T. K. *Organic Solvents. Techniques of Chemistry*, Vol. II. 4th ed., Wiley-Interscience, New York, 1986.
4. *Anton Paar Information Bull.* No. 6, March 1982.

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68

Int. DATA Ser., Sel. Data Mixtures, Ser. A 1996, 24(1), 68-79

SELECTED DATA ON MIXTURES  
International DATA Series\*

2c. EXCESS VOLUME

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

**Components:** 1. 1,5-Diiodopentane, C<sub>5</sub>H<sub>10</sub>I<sub>2</sub> [628-66-3]  
2. Heptane, C<sub>7</sub>H<sub>16</sub> [142-82-5]  
**State:** Binary system, single-phase liquid; pure components, both liquid  
**Variables:** V<sup>E</sup>, molar excess volume  
x<sub>i</sub>, mole fraction of component i  
**Parameters:** T, temperature  
**Constants:** P, pressure  
**Method:** Calculation of V<sup>E</sup> from density measurements at constant T and P and variable x<sub>i</sub>; ref. 1

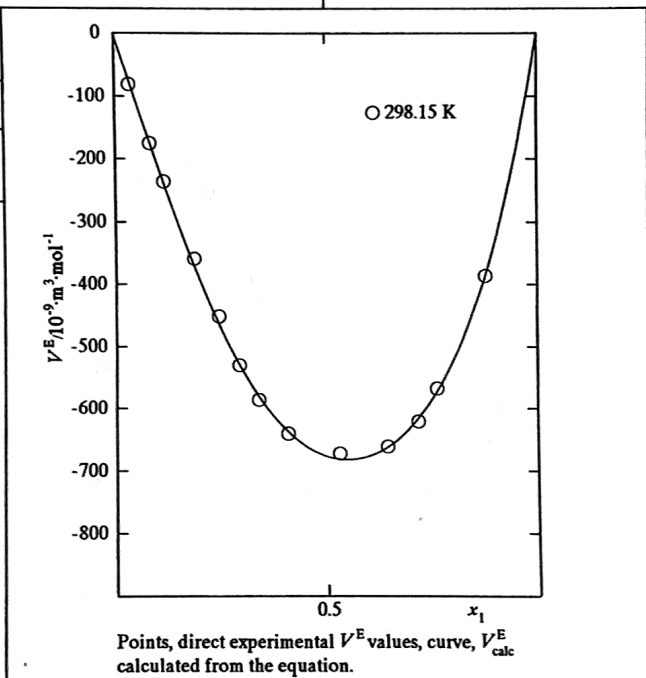
**Author(s) of table:** Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 -University of Las Palmas de G. C., Canary Islands, Spain)  
**Edited by:** Mączyski, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01 -224 Warszawa, Poland)

**SOURCE OF DATA**  
Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 -University of Las Palmas de G. C., Canary Islands, Spain); FIRST PUBLISHED RESULTS

**DIRECT EXPERIMENTAL VALUES**

Notes: P, atm.

T/K = 298.15							
x <sub>1</sub>	V <sup>E</sup> /10 <sup>-9</sup> m <sup>3</sup> ·mol <sup>-1</sup>						
0.0344	-79.9						
0.0818	-173.6						
0.1135	-235.1						
0.1844	-358.1						
0.2429	-451.3						
0.2907	-530.1						
0.3367	-584.9						
0.4068	-640.2						
0.5291	-671.3						
0.6429	-659.9						
0.7169	-620.4						
0.7608	-566.9						
0.8769	-386.1						



**SMOOTHING EQUATION**

$$V_{\text{calc}}^E = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a<sub>i</sub> in the smoothing eq., std. deviation σ<sub>d</sub>, and max. deviation δ<sub>m</sub> detd. by least-squares anal.

T/K	a <sub>1</sub>	a <sub>2</sub>	a <sub>3</sub>	a <sub>4</sub>	a <sub>5</sub>	σ <sub>d</sub>	δ <sub>m</sub>
	10 <sup>-9</sup> ·m <sup>3</sup> ·mol <sup>-1</sup>						
298.15	-2700 (17)	-429 (54)	-447 (76)	-673 (150)		7.4	9.6

The std. deviations σa<sub>i</sub> of the coeffs. a<sub>i</sub> are given in parentheses  
δ<sub>m</sub> = max |V<sup>E</sup><sub>calc</sub> - V<sup>E</sup>|; σ<sub>d</sub> = [Σ(V<sup>E</sup><sub>calc</sub> - V<sup>E</sup>)<sup>2</sup>/(N - n)]<sup>1/2</sup>  
N, no. of direct exptl. values; n, no. of coeffs. a<sub>i</sub>  
All direct exptl. values equally weighted.

**AUXILIARY INFORMATION**

**Apparatus:** Vibrating tube densimeter type DMA 60 equipped with a cell model 602, (Anton-Paar, Graz, Austria). Temperature was controlled to within 0.01 K with a Heto Thermostat and was measured by means of a calibrated Pt thermometer.

**Procedure:** Density, ρ, was calcd. from period of vibration, τ: ρ = a + bτ<sup>2</sup>. Consts. a and b were detd. by calibrating the app.(ref. 2) with doubly distd. and degassed H<sub>2</sub>O, ρ(298.15 K)/kg·m<sup>-3</sup> = 997.043 (ref. 3), and nonane (Fluka AG), "purum" grade material of stated purity > 99 mole %, ρ(298.15 K)/kg·m<sup>-3</sup> = 713.855 (ref. 4). Mixtures were prepd. by mass. V<sup>E</sup> was calcd. from V<sup>E</sup> = V - (x<sub>1</sub>V<sub>1</sub><sup>o</sup> + x<sub>2</sub>V<sub>2</sub><sup>o</sup>), where V = (x<sub>1</sub>M<sub>1</sub> + x<sub>2</sub>M<sub>2</sub>)/ρ is the molar vol. of the mixt. and V<sub>i</sub><sup>o</sup> = V(x<sub>i</sub> = 1) and M<sub>i</sub> are resp., the molar vol. and molar mass of component i.

**Materials:** 1. Aldrich Chemicals Co., Inc. (Milwaukee, WI, USA), material of stated purity > 97 mole %, dried over mol. sieve type 3A (Fluka AG), and used without further purification; ρ(298.15 K)/kg·m<sup>-3</sup> = 2169.16; n<sub>D</sub>(298.15 K) = 1.5987.  
2. Fluka AG (Busch, St. Gallen, Switzerland), "puriss." grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve type 3A (Fluka AG), degassed with ultrasound and used without further purification; ρ(298.15 K)/kg·m<sup>-3</sup> = 679.46; n<sub>D</sub>(298.15 K) = 1.3581.

**Errors:** δT(reproducibility)/K < 0.01; δT(IPTS-68)/K = 0.01; δx<sub>1</sub> < 0.0001; δV<sup>E</sup>/10<sup>-9</sup>·m<sup>3</sup>·mol<sup>-1</sup> < 1.

**REFERENCES**

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1994, 22(1).
2. Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jimenez, E. J. *J. Chem. Thermodyn.* 1985, 17, 1127.
3. Riddick, J. A.; Bunger, W. B.; Sakano, T. K. *Organic Solvents. Techniques of Chemistry*, Vol. II, 4th ed., Wiley-Interscience, New York, 1986.
4. *Anton Paar Information Bull.* No. 6, March 1982.

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69

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SELECTED DATA ON MIXTURES

International DATA Series\*

2c. EXCESS VOLUME

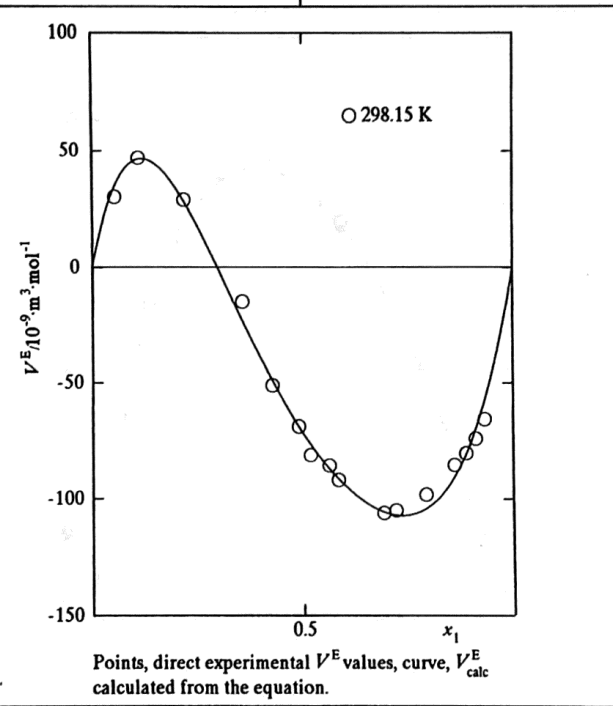
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The Texas A&M University System, College Station, TX 77843-3111

0147-1503/96/9601-7084.00

<b>Components:</b>	1. 1,5-Dilodopentane, C <sub>5</sub> H <sub>10</sub> <sup>1</sup> <sub>2</sub> [628-66-3] 2. Nonane, C <sub>9</sub> H <sub>20</sub> [111-84-2]	<b>Author(s)</b>	Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain)
<b>State:</b>	Binary system, single-phase liquid; pure components, both liquid	<b>Edited by:</b>	Mączyński, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)
<b>Variables:</b>	V <sup>E</sup> , molar excess volume x <sub>i</sub> , mole fraction of component i	<b>SOURCE OF DATA</b> Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain); FIRST PUBLISHED RESULTS	
<b>Parameters:</b>	T, temperature		
<b>Constants:</b>	P, pressure		
<b>Method:</b>	Calculation of V <sup>E</sup> from density measurements at constant T and P and variable x <sub>i</sub> ; ref. 1		

DIRECT EXPERIMENTAL VALUES						
Notes: P, atm.						
T/K = 298.15						
x <sub>1</sub>	V <sup>E</sup> /10 <sup>-9</sup> m <sup>3</sup> ·mol <sup>-1</sup>					
0.0541	30.2					
0.1105	47.2					
0.2184	29.2					
0.3551	-14.5					
0.4267	-50.8					
0.4886	-68.5					
0.5175	-80.7					
0.5617	-85.4					
0.5826	-91.7					
0.6904	-105.9					
0.7195	-104.9					
0.7919	-98.0					
0.8605	-85.0					
0.8875	-80.0					
0.9114	-73.7					
0.9317	-65.3					



SMOOTHING EQUATION							
$V_{\text{calc}}^E = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$							
Coeffs. a <sub>i</sub> in the smoothing eq., std. deviation σ <sub>d</sub> , and max. deviation δ <sub>m</sub> detd. by least-squares anal.							
T/K	a <sub>1</sub>	a <sub>2</sub>	a <sub>3</sub>	a <sub>4</sub>	a <sub>5</sub>	σ <sub>d</sub>	δ <sub>m</sub>
	10 <sup>-9</sup> m <sup>3</sup> ·mol <sup>-1</sup>						
298.15	-283.5 (7.7)	-555 (35)	195 (36)	-443 (80)		4.6	7.9
The std. deviations σ <sub>a</sub> of the coeffs. a <sub>i</sub> are given in parentheses δ <sub>m</sub> = max  V <sup>E</sup> <sub>calc</sub> - V <sup>E</sup>  ; σ <sub>d</sub> = [Σ(V <sup>E</sup> <sub>calc</sub> - V <sup>E</sup> ) <sup>2</sup> /(N - n)] <sup>1/2</sup> N, no. of direct exptl. values; n, no. of coeffs. a <sub>i</sub> All direct exptl. values equally weighted.							

AUXILIARY INFORMATION	
<b>Apparatus:</b>	Vibrating tube densimeter type DMA 60 equipped with a cell model 602, (Anton-Paar, Graz, Austria). Temperature was controlled to within 0.01 K with a Heto Thermostat and was measured by means of a calibrated Pt thermometer.
<b>Procedure:</b>	Density, ρ, was calcd. from period of vibration, τ: ρ = a + bτ <sup>2</sup> . Consts. a and b were detd. by calibrating the app. (ref. 2) with doubly distd. and degassed H <sub>2</sub> O, ρ(298.15 K)/kg·m <sup>-3</sup> = 997.043 (ref. 3), and nonane (Fluka AG), "purum" grade material of stated purity > 99 mole %, ρ(298.15 K)/kg·m <sup>-3</sup> = 713.855 (ref. 4). Mixtures were prepd. by mass. V <sup>E</sup> was calcd. from V <sup>E</sup> = V - (x <sub>1</sub> V <sub>1</sub> <sup>0</sup> + x <sub>2</sub> V <sub>2</sub> <sup>0</sup> ), where V = (x <sub>1</sub> M <sub>1</sub> + x <sub>2</sub> M <sub>2</sub> )/ρ is the molar vol. of the mixt. and V <sub>i</sub> <sup>0</sup> = V(x <sub>i</sub> = 1) and M <sub>i</sub> are resp., the molar vol. and molar mass of component i.
<b>Materials:</b>	1. Aldrich Chemicals Co., Inc. (Milwaukee, WI, USA), material of stated purity > 97 mole %, dried over mol. sieve type 3A (Fluka AG), and used without further purification; ρ(298.15 K)/kg·m <sup>-3</sup> = 2169.16; n(v, 298.15 K) = 1.5987. 2. Fluka AG (Busch, St. Gallen, Switzerland), "purum" grade material of stated GLC purity > 99 mole %, dried over mol. sieve type 3A (Fluka AG), degassed with ultrasound and used without further purification; ρ(298.15 K)/kg·m <sup>-3</sup> = 713.85; n(v, 298.15 K) = 1.4033.
<b>Errors:</b>	δT(reproducibility)/K < 0.01; δT(IPTS-68)/K = 0.01; δx <sub>1</sub> < 0.0001; δV <sup>E</sup> /10 <sup>-9</sup> m <sup>3</sup> ·mol <sup>-1</sup> < 1.

REFERENCES
1. <i>Int. DATA Ser., Ser. A, Guideline 1a</i> , 1994, 22(1).
2. Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jimenez, E. J. <i>J. Chem. Thermodyn.</i> 1985, 17, 1127.
3. Riddick, J. A.; Bunger, W. B.; Sakano, T. K. <i>Organic Solvents. Techniques of Chemistry</i> , Vol. II. 4th ed., Wiley-Interscience, New York, 1986.
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70

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SELECTED DATA ON MIXTURES

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2c. EXCESS VOLUME

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

**Components:** 1. 1,5-Dilodopentane, C<sub>5</sub>H<sub>10</sub>I<sub>2</sub> [628-66-3]  
2. Tridecane, C<sub>13</sub>H<sub>28</sub> [629-50-5]  
**State:** Binary system, single-phase liquid; pure components, both liquid  
**Variables:** V<sup>E</sup>, molar excess volume  
x<sub>i</sub>, mole fraction of component i  
**Parameters:** T, temperature  
**Constants:** P, pressure  
**Method:** Calculation of V<sup>E</sup> from density measurements at constant T and P and variable x<sub>i</sub>; ref. 1

**Author(s) of table:** Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain)

**Edited by:** Mączynski, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)

SOURCE OF DATA

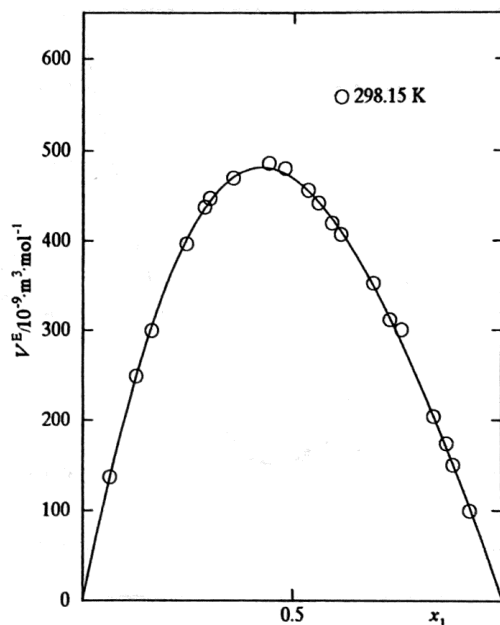
Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P, atm.

T/K = 298.15

x <sub>1</sub>	V <sup>E</sup> /10 <sup>-9</sup> m <sup>3</sup> ·mol <sup>-1</sup>						
0.0639	136.7						
0.1274	249.3						
0.1642	299.4						
0.2471	397.3						
0.2903	437.9						
0.3037	447.7						
0.3588	470.1						
0.4428	486.7						
0.4813	480.2						
0.5374	456.7						
0.5621	442.4						
0.5942	419.9						
0.6156	407.3						
0.6939	352.8						
0.7341	311.6						
0.7614	300.8						
0.8392	204.6						
0.8687	173.9						
0.8849	150.4						
0.9233	99.6						



Points, direct experimental V<sup>E</sup> values, curve, V<sup>E</sup><sub>calc</sub> calculated from the equation.

SMOOTHING EQUATION

$$V_{\text{calc}}^E = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a<sub>i</sub> in the smoothing eq., std. deviation σ<sub>d</sub>, and max. deviation δ<sub>m</sub> detd. by least-squares anal.

T/K	a <sub>1</sub>	a <sub>2</sub>	a <sub>3</sub>	a <sub>4</sub>	a <sub>5</sub>	σ <sub>d</sub>	δ <sub>m</sub>
	10 <sup>-9</sup> m <sup>3</sup> ·mol <sup>-1</sup>						
298.15	1883.5 (7.4)	-615 (30)	-32 (35)	233 (77)		4.8	12.6

The std. deviations σ<sub>a</sub> of the coeffs. a<sub>i</sub> are given in parentheses  
δ<sub>m</sub> = max |V<sup>E</sup><sub>calc</sub> - V<sup>E</sup>|; σ<sub>d</sub> = [Σ(V<sup>E</sup><sub>calc</sub> - V<sup>E</sup>)<sup>2</sup>/(N - n)]<sup>1/2</sup>  
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All direct exptl. values equally weighted.

AUXILIARY INFORMATION

**Apparatus:** Vibrating tube densimeter type DMA 60 equipped with a cell model 602, (Anton-Paar, Graz, Austria). Temperature was controlled to within 0.01 K with a Heto Thermostat and was measured by means of a calibrated Pt thermometer.  
**Procedure:** Density, ρ, was calcd. from period of vibration, τ: ρ = a + bτ<sup>2</sup>. Consts. a and b were detd. by calibrating the app.(ref. 2) with doubly distd. and degassed H<sub>2</sub>O, ρ(298.15 K)/kg·m<sup>-3</sup> = 997.043 (ref. 3), and nonane (Fluka AG), "purum" grade material of stated purity > 99 mole %, ρ(298.15 K)/kg·m<sup>-3</sup> = 713.855 (ref. 4). Mixtures were prepd. by mass. V<sup>E</sup> was calcd. from V<sup>E</sup> = V - (x<sub>1</sub>V<sub>1</sub><sup>0</sup> + x<sub>2</sub>V<sub>2</sub><sup>0</sup>), where V = (x<sub>1</sub>M<sub>1</sub> + x<sub>2</sub>M<sub>2</sub>)/ρ is the molar vol. of the mixt and V<sub>i</sub><sup>0</sup> = V(x<sub>i</sub> = 1) and M<sub>i</sub> are resp., the molar vol. and molar mass of component i.  
**Materials:** 1. Aldrich Chemicals Co., Inc. (Milwaukee, WI, USA), material of stated purity > 97 mole %, dried over mol. sieve type 3A (Fluka AG), and used without further purification; ρ(298.15 K)/kg·m<sup>-3</sup> = 2169.16; n<sub>D</sub>(298.15 K) = 1.5987.  
2. Fluka AG (Busch, St. Gallen, Switzerland), "puriss." grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve type 3A (Fluka AG), degassed with ultrasound and used without further purification; ρ(298.15 K)/kg·m<sup>-3</sup> = 752.79; n<sub>D</sub>(298.15 K) = 1.4238.  
**Errors:** δT(reproducibility)/K < 0.01; δT(IPTS-68)/K = 0.01; dx<sub>1</sub> < 0.0001; δV<sup>E</sup>/10<sup>-9</sup> m<sup>3</sup>·mol<sup>-1</sup> < 1.

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3. Riddick, J. A.; Bunger, W. B.; Sakano, T. K. *Organic Solvents. Techniques of Chemistry*, Vol. II. 4th ed., Wiley-Interscience, New York, 1986.
4. *Anton Paar Information Bull.* No. 6, March 1982.

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72

Int. DATA Ser., Sel. Data Mixtures, Ser. A 1996, 24(1), 68-79

SELECTED DATA ON MIXTURES

International DATA Series\*

2c. EXCESS VOLUME

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

**Components:** 1. 1,6-Dilodohexane, C<sub>6</sub>H<sub>12</sub>l<sub>2</sub> [629-09-4]  
 2. Pentane, C<sub>5</sub>H<sub>12</sub> [109-66-0]  
**State:** Binary system, single-phase liquid; pure components, both liquid  
**Variables:** V<sup>E</sup>, molar excess volume  
 x<sub>i</sub>, mole fraction of component i  
**Parameters:** T, temperature  
**Constants:** P, pressure  
**Method:** Calculation of V<sup>E</sup> from density measurements at constant T and P and variable x<sub>i</sub>; ref. 1

**Author(s) of table:** Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain)

**Edited by:** Mączyński, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)

SOURCE OF DATA

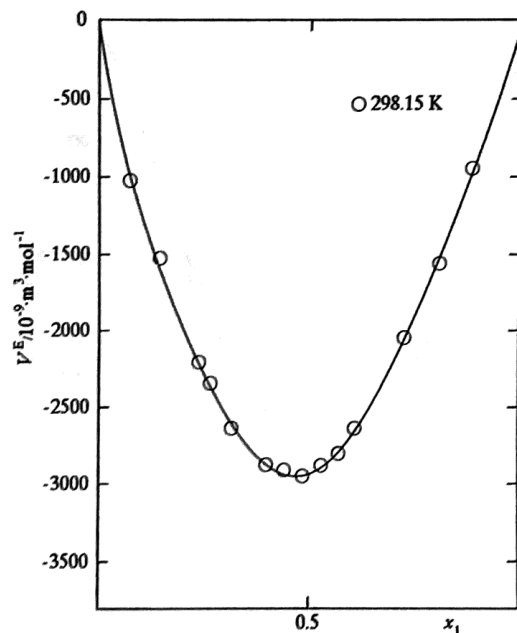
Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P, atm.

T/K = 298.15

x <sub>1</sub>	V <sup>E</sup> /10 <sup>-9</sup> m <sup>3</sup> ·mol <sup>-1</sup>						
0.0721	-1019.6						
0.1428	-1520.9						
0.2375	-2204.9						
0.2641	-2341.4						
0.3158	-2634.1						
0.3992	-2873.4						
0.4418	-2909.9						
0.4854	-2947.5						
0.5307	-2879.1						
0.5729	-2800.9						
0.6107	-2634.1						
0.7284	-2043.9						
0.8107	-1554.7						
0.8867	-945.4						



Points, direct experimental V<sup>E</sup> values, curve, V<sup>E</sup><sub>calc</sub> calculated from the equation.

SMOOTHING EQUATION

$$V_{\text{calc}}^E = x_1 x_2 a_1 / [1 + \sum_{i=2}^n a_i (x_1 - x_2)^{i-1}]$$

Coeffs. a<sub>i</sub> in the smoothing eq., std. deviation σ<sub>d</sub>, and max deviation δ<sub>m</sub> detd. by least-squares anal.

T/K	a <sub>1</sub>	a <sub>2</sub>	a <sub>3</sub>	a <sub>4</sub>	a <sub>5</sub>	σ <sub>d</sub>	δ <sub>m</sub>
	10 <sup>-9</sup> ·m <sup>3</sup> ·mol <sup>-1</sup>						
298.15	-11721 (67)	0.153 (0.025)	0.335 (0.075)	0.108 (0.070)	-0.44 (0.14)	35.2	60.2

The std. deviations σ<sub>a</sub> of the coeffs. a<sub>i</sub> are given in parentheses  
 δ<sub>m</sub> = max |V<sup>E</sup><sub>calc</sub> - V<sup>E</sup>|; σ<sub>d</sub> = [Σ(V<sup>E</sup><sub>calc</sub> - V<sup>E</sup>)<sup>2</sup>/(N - n)]<sup>1/2</sup>  
 N, no. of direct exptl. values; n, no. of coeffs. a<sub>i</sub>  
 All direct exptl. values equally weighted.

AUXILIARY INFORMATION

**Apparatus:** Vibrating tube densimeter type DMA 60 equipped with a cell model 602, (Anton-Paar, Graz, Austria). Temperature was controlled to within 0.01 K with a Heto Thermostat and was measured by means of a calibrated Pt thermometer.  
**Procedure:** Density, ρ, was calcd. from period of vibration, τ: ρ = a + bτ<sup>2</sup>. Consts. a and b were detd. by calibrating the app.(ref. 2) with doubly dist. and degassed H<sub>2</sub>O, ρ(298.15 K)/kg·m<sup>-3</sup> = 997.043 (ref. 3), and nonane (Fluka AG), "purum" grade material of stated purity > 99 mole %, ρ(298.15 K)/kg·m<sup>-3</sup> = 713.855 (ref. 4). Mixtures were prepd. by mass. V<sup>E</sup> was calcd. from V<sup>E</sup> = V - (x<sub>1</sub>V<sub>1</sub><sup>0</sup> + x<sub>2</sub>V<sub>2</sub><sup>0</sup>), where V = (x<sub>1</sub>M<sub>1</sub> + x<sub>2</sub>M<sub>2</sub>)/ρ is the molar vol. of the mixt. and V<sub>i</sub><sup>0</sup> = V(x<sub>i</sub> = 1) and M<sub>i</sub> are resp., the molar vol. and molar mass of component i.  
**Materials:** 1. Aldrich Chemicals Co., Inc. (Milwaukee, WI, USA), material of stated purity > 99 mole %, dried over mol. sieve type 3A (Fluka AG), and used without further purification; ρ(298.15 K)/kg·m<sup>-3</sup> = 2034.19; n<sub>D</sub>(298.15 K) = 1.5837.  
 2. Fluka AG (Busch, St. Gallen, Switzerland), "puriss." grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve type 3A (Fluka AG), degassed with ultrasound and used without further purification; ρ(298.15 K)/kg·m<sup>-3</sup> = 621.31; n<sub>D</sub>(298.15 K) = 1.3547.  
**Errors:** δT(reproducibility)/K < 0.01; δT(IPTS-68)/K = 0.01; δx<sub>1</sub> < 0.0001; δV<sup>E</sup>/10<sup>-9</sup>·m<sup>3</sup>·mol<sup>-1</sup> < 1.

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1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1994, 22(1).
2. Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jimenez, E. J. *J. Chem. Thermodyn.* 1985, 17, 1127.
3. Riddick, J. A.; Bunger, W. B.; Sakano, T. K. *Organic Solvents. Techniques of Chemistry*, Vol. II. 4th ed., Wiley-Interscience, New York, 1986.
4. *Anton Paar Information Bull.* No. 6, March 1982.

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73

Int. DATA Ser., Sel. Data Mixtures, Ser. A 1996, 24(1), 68-79



SELECTED DATA ON MIXTURES  
International Data Series\*

2c. EXCESS VOLUME

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

**Components:** 1. 1,6-Dilodohexane,  $C_6H_{12}L_2$  [629-09-4]  
2. Heptane,  $C_7H_{16}$  [142-82-5]  
**State:** Binary system, single-phase liquid; pure components, both liquid  
**Variables:**  $V^E$ , molar excess volume  
 $x_i$ , mole fraction of component  $i$   
**Parameters:**  $T$ , temperature  
**Constants:**  $P$ , pressure  
**Method:** Calculation of  $V^E$  from density measurements at constant  $T$  and  $P$  and variable  $x_i$ ; ref. 1

**Author(s) of table:** Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain)  
**Edited by:** Mączynski, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)

SOURCE OF DATA

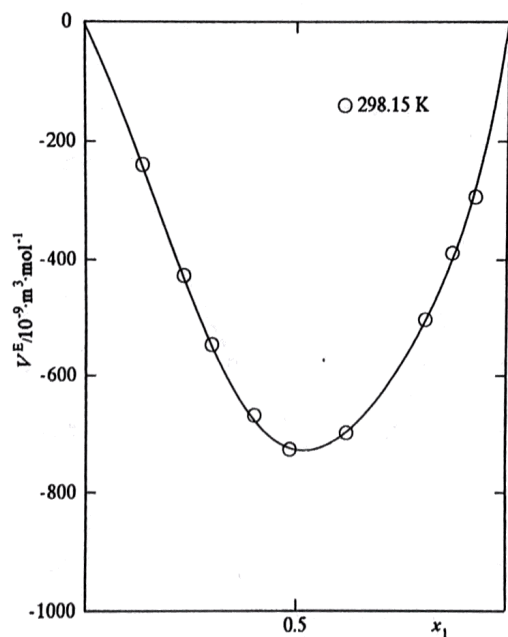
Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes:  $P$ , atm.

$T/K = 298.15$

$x_1$	$V^E/10^{-9}$ $m^3 \cdot mol^{-1}$						
0.1352	-239.6						
0.2325	-426.7						
0.2984	-546.2						
0.4001	-667.1						
0.4839	-725.6						
0.6203	-696.6						
0.8076	-501.8						
0.8704	-387.7						
0.9244	-292.5						



Points, direct experimental  $V^E$  values, curve,  $V_{calc}^E$  calculated from the equation.

SMOOTHING EQUATION

$$V_{calc}^E = x_1 x_2 \rho_1 / [1 + \sum_{i=2}^n a_i (x_1 - x_2)^{i-1}]$$

Coeffs.  $a_i$  in the smoothing eq., std. deviation  $\sigma_d$ , and max. deviation  $\delta_m$  detd. by least-squares anal.

$T/K$	$a_1$	$a_2$	$a_3$	$a_4$	$a_5$	$\sigma_d$	$\delta_m$
	$10^{-9} m^3 \cdot mol^{-1}$						
298.15	-2896 (22)	-0.092 (0.033)	0.234 (0.038)	-0.596 (0.083)		9.0	13.9

The std. deviations  $\sigma a_i$  of the coeffs.  $a_i$  are given in parentheses  
 $\delta_m = \max |V_{calc}^E - V^E|$ ;  $\sigma_d = [\sum (V_{calc}^E - V^E)^2 / (N - n)]^{1/2}$   
 $N$ , no. of direct exptl. values;  $n$ , no. of coeffs.  $a_i$   
All direct exptl. values equally weighted.

AUXILIARY INFORMATION

**Apparatus:** Vibrating tube densimeter type DMA 60 equipped with a cell model 602, (Anton-Paar, Graz, Austria). Temperature was controlled to within 0.01 K with a Heto Thermostat and was measured by means of a calibrated Pt thermometer.  
**Procedure:** Density,  $\rho$ , was calcd. from period of vibration,  $\tau$ :  $\rho = a + b \cdot \tau^2$ . Consts.  $a$  and  $b$  were detd. by calibrating the app. (ref. 2) with doubly distd. and degassed  $H_2O$ ,  $\rho(298.15 K)/kg \cdot m^{-3} = 997.043$  (ref. 3), and nonane (Fluka AG), "purum" grade material of stated purity > 99 mole %,  $\rho(298.15 K)/kg \cdot m^{-3} = 713.855$  (ref. 4). Mixtures were prepd. by mass.  $V^E$  was calcd. from  $V^E = V - (x_1 V_1^0 + x_2 V_2^0)$ , where  $V = (x_1 M_1 + x_2 M_2) / \rho$  is the molar vol. of the mixt. and  $V_i^0 = V(x_i = 1)$  and  $M_i$  are resp., the molar vol. and molar mass of component  $i$ .  
**Materials:** 1. Aldrich Chemicals Co., Inc. (Milwaukee, WI, USA), material of stated purity > 99 mole %, dried over mol. sieve type 3A (Fluka AG), and used without further purification;  $\rho(298.15 K)/kg \cdot m^{-3} = 2034.19$ ;  $n(D, 298.15 K) = 1.5837$ .  
2. Fluka AG (Busch, St. Gallen, Switzerland), "puriss." grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve type 3A (Fluka AG), degassed with ultrasound and used without further purification;  $\rho(298.15 K)/kg \cdot m^{-3} = 679.46$ ;  $n(D, 298.15 K) = 1.3851$ .  
**Errors:**  $\delta T$  (reproducibility)/K < 0.01;  $\delta T$  (IPTS-68)/K = 0.01;  $\delta x_1$  < 0.0001;  $\delta V^E/10^{-9} m^3 \cdot mol^{-1}$  < 1.

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- Int. DATA Ser., Ser. A, Guideline 1a, 1994, 22(1).
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- Anton Paar Information Bull. No. 6, March 1982.

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74

Int. DATA Ser., Sel. Data Mixtures, Ser. A 1996, 24(1), 68-79

SELECTED DATA ON MIXTURES  
International Data Series\*

2c. EXCESS VOLUME

The Texas A&M University System, College Station, TX 77843-3111

Published by Thermodynamics Research Center

**Components:** 1. 1,6-Diiodohexane,  $C_6H_{12}I_2$  [629-09-4]  
2. Nonane,  $C_9H_{20}$  [111-84-2]  
**State:** Binary system, single-phase liquid; pure components, both liquid  
**Variables:**  $V^E$ , molar excess volume  
 $x_i$ , mole fraction of component  $i$   
**Parameters:**  $T$ , temperature  
**Constants:**  $P$ , pressure  
**Method:** Calculation of  $V^E$  from density measurements at constant  $T$  and  $P$  and variable  $x_i$ ; ref. 1

**Author(s) of table:** Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain)

**Edited by:** Mączynski, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)

SOURCE OF DATA

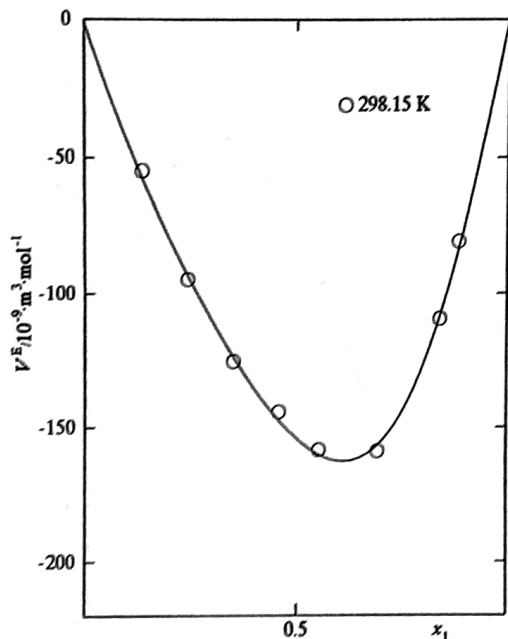
Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes:  $P$ , atm.

$T/K = 298.15$

$x_1$	$V^E/10^{-9}$ $m^3 \cdot mol^{-1}$						
0.1360	-54.6						
0.2416	-94.3						
0.3498	-125.1						
0.4572	-144.1						
0.5524	-158.3						
0.6927	-158.8						
0.8396	-109.2						
0.8848	-80.2						



Points, direct experimental  $V^E$  values, curve,  $V^E_{calc}$  calculated from the equation.

SMOOTHING EQUATION

$$V^E_{calc} = x_1 x_2 a_1 / [1 + \sum_{i=2}^n a_i (x_1 - x_2)^{i-1}]$$

Coeffs.  $a_i$  in the smoothing eq., std. deviation  $\sigma_d$ , and max. deviation  $\delta_m$  detd. by least-squares anal.

$T/K$	$a_1$	$a_2$	$a_3$	$a_4$	$a_5$	$\sigma_d$	$\delta_m$
	$10^{-9} m^3 \cdot mol^{-1}$						
298.15	-614.8 (7.3)	-0.465 (0.049)	0.030 (0.057)	0.21 (0.13)		3.0	2.6

The std. deviations  $\sigma_d$  of the coeffs.  $a_i$  are given in parentheses  
 $\delta_m = \max |V^E_{calc} - V^E|$ ;  $\sigma_d = [\sum (V^E_{calc} - V^E)^2 / (N - n)]^{1/2}$   
 $N$ , no. of direct exptl. values;  $n$ , no. of coeffs.  $a_i$   
All direct exptl. values equally weighted.

AUXILIARY INFORMATION

**Apparatus:** Vibrating tube densimeter type DMA 60 equipped with a cell model 602, (Anton -Paar, Graz, Austria). Temperature was controlled to within 0.01 K with a Heto Thermostat and was measured by means of a calibrated Pt thermometer.  
**Procedure:** Density,  $\rho$ , was calcd. from period of vibration,  $\tau$ :  $\rho = a + b\tau^2$ . Consts.  $a$  and  $b$  were detd. by calibrating the app.(ref. 2) with doubly distd. and degassed  $H_2O$ ,  $\rho(298.15 K)/kg \cdot m^{-3} = 997.043$  (ref. 3), and nonane (Fluka AG), "purum" grade material of stated purity > 99 mole %,  $\rho(298.15 K)/kg \cdot m^{-3} = 713.855$  (ref. 4). Mixtures were prepd. by mass.  $V^E$  was calcd. from  $V^E = V - (x_1 V_1^0 + x_2 V_2^0)$ , where  $V = (x_1 M_1 + x_2 M_2) / \rho$  is the molar vol. of the mixt. and  $V_i^0 = V(x_i = 1)$  and  $M_i$  are resp. the molar vol. and molar mass of component  $i$ .  
**Materials:** 1. Aldrich Chemicals Co., Inc. (Milwaukee, WI, USA), material of stated purity > 99 mole %, dried over mol. sieve type 3A (Fluka AG), and used without further purification;  $\rho(298.15 K)/kg \cdot m^{-3} = 2034.19$ ;  $n_D(298.15 K) = 1.5837$ .  
2. Fluka AG (Busch, St. Gallen, Switzerland), "purum" grade material of stated GLC purity > 99 mole %, dried over mol. sieve type 3A (Fluka AG), degassed with ultrasound and used without further purification;  $\rho(298.15 K)/kg \cdot m^{-3} = 713.85$ ;  $n_D(298.15 K) = 1.4033$ .  
**Errors:**  $\delta T(\text{reproducibility})/K < 0.01$ ;  $\delta T(\text{IPTS-68})/K = 0.01$ ;  $\delta x_i < 0.0001$ ;  $\delta V^E/10^{-9} m^3 \cdot mol^{-1} < 1$ .

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1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1994, 22(1).
2. Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jimenez, E. J. *J. Chem. Thermodyn.* 1985, 17, 1127.
3. Riddick, J. A.; Bunger, W. B.; Sakano, T. K. *Organic Solvents. Techniques of Chemistry*, Vol. II. 4th ed., Wiley-Interscience, New York, 1986.
4. *Anton Paar Information Bull.* No. 6, March 1982.

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75

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SELECTED DATA ON MIXTURES

International DATA Series\*

2c. EXCESS VOLUME

Published by Thermodynamics Research Center

The Texas A&M University System, College Station, TX 77843-3111

**Components:** 1. 1,6-Diiodohexane,  $C_6H_{12}I_2$  [629-09-4]  
2. Undecane,  $C_{11}H_{24}$  [1120-21-4]  
**State:** Binary system, single-phase liquid; pure components, both liquid  
**Variables:**  $V^E$ , molar excess volume  
 $x_i$ , mole fraction of component  $i$   
**Parameters:**  $T$ , temperature  
**Constants:**  $P$ , pressure  
**Method:** Calculation of  $V^E$  from density measurements at constant  $T$  and  $P$  and variable  $x_i$ ; ref. 1

**Author(s) of table:** Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 -University of Las Palmas de G. C., Canary Islands, Spain)

**Edited by:** Mączyski, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)

SOURCE OF DATA

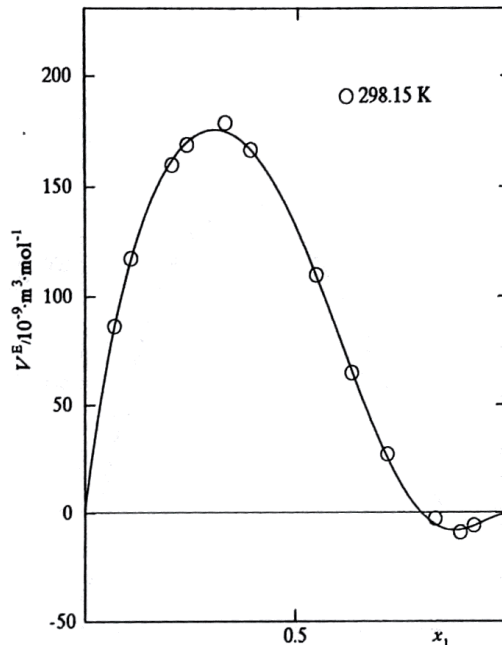
Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 -University of Las Palmas de G. C., Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes:  $P$ , atm.

$T/K = 298.15$

$x_1$	$V^E/10^{-9}$ $m^3 \cdot mol^{-1}$						
0.0696	86.5						
0.1075	117.5						
0.2051	160.1						
0.2403	169.1						
0.3289	179.2						
0.3899	166.8						
0.5466	110.3						
0.6322	65.1						
0.7189	27.1						
0.8323	-2.7						
0.8919	-8.9						
0.9253	-5.9						



Points, direct experimental  $V^E$  values, curve,  $V_{calc}^E$  calculated from the equation.

SMOOTHING EQUATION

$$V_{calc}^E = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs.  $a_i$  in the smoothing eq., std. deviation  $\sigma_d$ , and max. deviation  $\delta_m$  detd. by least-squares anal.

$T/K$	$a_1$	$a_2$	$a_3$	$a_4$	$a_5$	$\sigma_d$	$\delta_m$
	$10^{-9} \cdot m^3 \cdot mol^{-1}$						
298.15	526.9 (6.5)	-853 (17)	-241 (62)	52 (40)	501 (97)	2.2	3.6

The std. deviations  $\sigma a_i$  of the coeffs.  $a_i$  are given in parentheses  
 $\delta_m = \max |V_{calc}^E - V^E|$ ;  $\sigma_d = [\sum (V_{calc}^E - V^E)^2 / (N - n)]^{1/2}$   
 $N$ , no. of direct exptl. values;  $n$ , no. of coeffs.  $a_i$   
All direct exptl. values equally weighted.

AUXILIARY INFORMATION

**Apparatus:** Vibrating tube densimeter type DMA 60 equipped with a cell model 602, (Anton-Paar, Graz, Austria). Temperature was controlled to within 0.01 K with a Heto Thermostat and was measured by means of a calibrated Pt thermometer.  
**Procedure:** Density,  $\rho$ , was calcd. from period of vibration,  $\tau$ :  $\rho = a + b\tau^2$ . Consts.  $a$  and  $b$  were detd. by calibrating the app. (ref. 2) with doubly distd. and degassed  $H_2O$ ,  $\rho(298.15 K)/kg \cdot m^{-3} = 997.043$  (ref. 3), and nonane (Fluka AG), "purum" grade material of stated purity > 99 mole %,  $\rho(298.15 K)/kg \cdot m^{-3} = 713.855$  (ref. 4). Mixtures were prepd. by mass.  $V^E$  was calcd. from  $V^E = V - (x_1 V_1^0 + x_2 V_2^0)$ , where  $V = (x_1 M_1 + x_2 M_2) / \rho$  is the molar vol. of the mixt. and  $V_i^0 = V(x_i = 1)$  and  $M_i$  are resp., the molar vol. and molar mass of component  $i$ .  
**Materials:** 1. Aldrich Chemicals Co., Inc. (Milwaukee, WI, USA), material of stated purity > 99 mole %, dried over mol. sieve type 3A (Fluka AG), and used without further purification;  $\rho(298.15 K)/kg \cdot m^{-3} = 2034.19$ ;  $n(d, 298.15 K) = 1.5837$ .  
2. Fluka AG (Busch, St. Gallen, Switzerland), "purum" grade material of stated GLC purity > 97 mole %, dried over mol. sieve type 3A (Fluka AG), degassed with ultrasound and used without further purification;  $\rho(298.15 K)/kg \cdot m^{-3} = 736.80$ ;  $n(d, 298.15 K) = 1.4154$ .  
**Errors:**  $\delta T(\text{reproducibility})/K < 0.01$ ;  $\delta T(\text{IPTS-68})/K = 0.01$ ;  $\delta x_1 < 0.0001$ ;  $\delta V^E/10^{-9} \cdot m^3 \cdot mol^{-1} < 1$ .

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1994, 22(1).
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3. Riddick, J. A.; Bunger, W. B.; Sakano, T. K. *Organic Solvents. Techniques of Chemistry*, Vol. II. 4th ed., Wiley-Interscience, New York, 1986.
4. *Anton Paar Information Bull.* No. 6, March 1982.

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76

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SELECTED DATA ON MIXTURES  
International DATA Series\*

2c. EXCESS VOLUME

The Texas A&M University System, College Station, TX 77843-3111

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**Components:** 1. 1,6-Dilodohexane,  $C_6H_{12}I_2$  [629-09-4]  
2. Tridecane,  $C_{13}H_{28}$  [629-50-5]  
**State:** Binary system, single-phase liquid; pure components, both liquid  
**Variables:**  $V^E$ , molar excess volume  
 $x_i$ , mole fraction of component  $i$   
**Parameters:**  $T$ , temperature  
**Constants:**  $P$ , pressure  
**Method:** Calculation of  $V^E$  from density measurements at constant  $T$  and  $P$  and variable  $x_i$ ; ref. 1

**Author(s) of table:** Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain)

**Edited by:** Mączyski, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)

SOURCE OF DATA

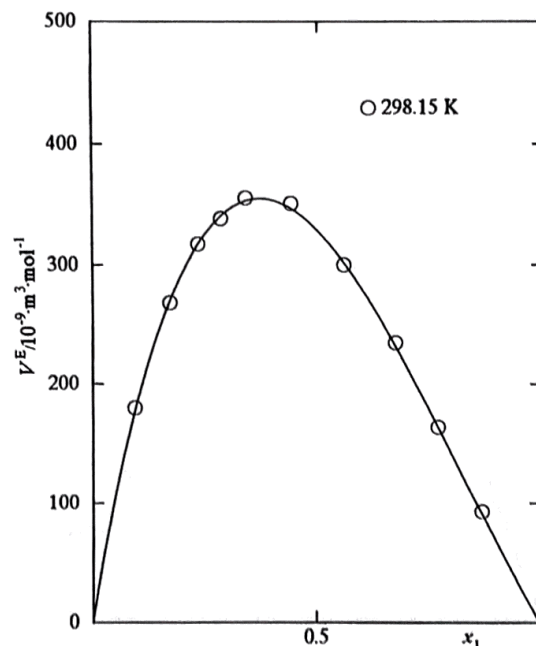
Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes:  $P$ , atm.

$T/K = 298.15$

$x_1$	$V^E/10^{-9}$ $m^3 \cdot mol^{-1}$					
0.0943	180.2					
0.1722	268.1					
0.2351	317.4					
0.2857	338.4					
0.3409	355.6					
0.4411	351.2					
0.5598	300.3					
0.6752	235.2					
0.7708	164.2					
0.8693	93.4					



Points, direct experimental  $V^E$  values, curve,  $V^E_{calc}$  calculated from the equation.

SMOOTHING EQUATION

$$V^E_{calc} = x_1 x_2 a_1 / [1 + \sum_{i=2}^n a_i (x_1 - x_2)^{i-1}]$$

Coeffs.  $a_i$  in the smoothing eq., std. deviation  $\sigma_d$ , and max. deviation  $\delta_m$  detd. by least-squares anal.

$T/K$	$a_1$	$a_2$	$a_3$	$a_4$	$a_5$	$\sigma_d$	$\delta_m$
	$10^{-9} m^3 \cdot mol^{-1}$						
298.15	1320.9 (6.8)	0.578 (0.016)	0.262 (0.027)	0.128 (0.048)		2.7	3.1

The std. deviations  $\sigma a_i$  of the coeffs.  $a_i$  are given in parentheses  
 $\delta_m = \max |V^E_{calc} - V^E|$ ;  $\sigma_d = [\sum (V^E_{calc} - V^E)^2 / (N - n)]^{1/2}$   
 $N$ , no. of direct exptl. values;  $n$ , no. of coeffs.  $a_i$   
All direct exptl. values equally weighted.

AUXILIARY INFORMATION

**Apparatus:** Vibrating tube densimeter type DMA 60 equipped with a cell model 602, (Anton-Paar, Graz, Austria). Temperature was controlled to within 0.01 K with a Heto Thermostat and was measured by means of a calibrated Pt thermometer.  
**Procedure:** Density,  $\rho$ , was calcd. from period of vibration,  $\tau$ :  $\rho = a + b \cdot \tau^2$ . Consts.  $a$  and  $b$  were detd. by calibrating the app. (ref. 2) with doubly distd. and degassed  $H_2O$ ,  $\rho(298.15 K)/kg \cdot m^{-3} = 997.043$  (ref. 3), and nonane (Fluka AG), "purum" grade material of stated purity > 99 mole %,  $\rho(298.15 K)/kg \cdot m^{-3} = 713.855$  (ref. 4). Mixtures were prepd. by mass.  $V^E$  was calcd. from  $V^E = V - (x_1 V_1^0 + x_2 V_2^0)$ , where  $V = (x_1 M_1 + x_2 M_2) / \rho$  is the molar vol. of the mixt. and  $V_i^0 = V(x_i = 1)$  and  $M_i$  are resp., the molar vol. and molar mass of component  $i$ .  
**Materials:** 1. Aldrich Chemicals Co., Inc. (Milwaukee, WI, USA), material of stated purity > 99 mole %, dried over mol. sieve type 3A (Fluka AG), and used without further purification;  $\rho(298.15 K)/kg \cdot m^{-3} = 2034.19$ ;  $n(D, 298.15 K) = 1.5837$ .  
2. Fluka AG (Busch, St. Gallen, Switzerland), "puriss." grade material of stated GLC purity > 99.5 mole %, dried over mol. sieve type 3A (Fluka AG), degassed with ultrasound and used without further purification;  $\rho(298.15 K)/kg \cdot m^{-3} = 752.89$ ;  $n(D, 298.15 K) = 1.4238$ .  
**Errors:**  $\delta T(\text{reproducibility})/K < 0.01$ ;  $\delta T(\text{IPTS-68})/K = 0.01$ ;  $\delta x_i < 0.0001$ ;  $\delta V^E/10^{-9} m^3 \cdot mol^{-1} < 1$ .

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a, 1994*, 22(1).
2. Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jimenez, E. J. *J. Chem. Thermodyn.* 1985, 17, 1127.
3. Riddick, J. A.; Bunger, W. B.; Sakano, T. K. *Organic Solvents. Techniques of Chemistry*, Vol. II. 4th ed., Wiley-Interscience, New York, 1986.
4. *Anton Paar Information Bull.* No. 6, March 1982.

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77

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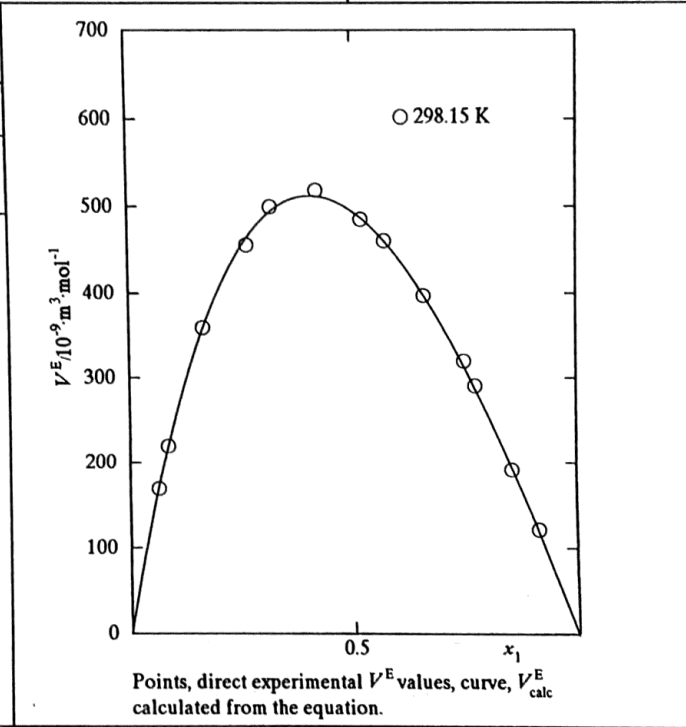
<p><b>Components:</b> 1. 1,6-Dilodohexane, C<sub>6</sub>H<sub>12</sub>L<sub>2</sub> [629-09-4] 2. Pentadecane, C<sub>15</sub>H<sub>32</sub> [629-62-9]</p> <p><b>State:</b> Binary system, single-phase liquid; pure components, both liquid</p> <p><b>Variables:</b> V<sup>E</sup>, molar excess volume x<sub>i</sub>, mole fraction of component i</p> <p><b>Parameters:</b> T, temperature</p> <p><b>Constants:</b> P, pressure</p> <p><b>Method:</b> Calculation of V<sup>E</sup> from density measurements at constant T and P and variable x<sub>i</sub>; ref. 1</p>	<p><b>Author(s) of table:</b> Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain)</p> <p><b>Edited by:</b> Mączyński, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)</p> <p style="text-align: center;"><b>SOURCE OF DATA</b></p> <p>Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain); FIRST PUBLISHED RESULTS</p>
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**DIRECT EXPERIMENTAL VALUES**

Notes: P, atm.

T/K = 298.15

x <sub>1</sub>	V <sup>E</sup> /10 <sup>-9</sup> m <sup>3</sup> ·mol <sup>-1</sup>						
0.0633	169.6						
0.0842	220.6						
0.1651	359.7						
0.2647	455.8						
0.3185	499.5						
0.4211	518.9						
0.5222	485.4						
0.5731	460.2						
0.6617	397.1						
0.7500	320.1						
0.7748	291.3						
0.8554	192.5						
0.9143	122.1						



**SMOOTHING EQUATION**

$$V_{\text{calc}}^E = x_1 x_2 \rho_1 / [1 + \sum_{i=2}^n a_i (x_1 - x_2)^{i-1}]$$

Coeffs. a<sub>i</sub> in the smoothing eq., std. deviation σ<sub>d</sub>, and max deviation δ<sub>m</sub> detd. by least-squares anal.

T/K	a <sub>1</sub>	a <sub>2</sub>	a <sub>3</sub>	a <sub>4</sub>	a <sub>5</sub>	σ <sub>d</sub>	δ <sub>m</sub>
	10 <sup>-9</sup> ·m <sup>3</sup> ·mol <sup>-1</sup>						
298.15	1986.8 (8.6)	0.3547 (0.0086)				4.3	8.4

The std. deviations σ<sub>a</sub> of the coeffs. a<sub>i</sub> are given in parentheses  
 δ<sub>m</sub> = max |V<sup>E</sup><sub>calc</sub> - V<sup>E</sup>|; σ<sub>d</sub> = [Σ(V<sup>E</sup><sub>calc</sub> - V<sup>E</sup>)<sup>2</sup> / (N - n)]<sup>1/2</sup>  
 N, no. of direct exptl. values; n, no. of coeffs. a<sub>i</sub>  
 All direct exptl. values equally weighted.

**AUXILIARY INFORMATION**

**Apparatus:** Vibrating tube densimeter type DMA 60 equipped with a cell model 602, (Anton-Paar, Graz, Austria). Temperature was controlled to within 0.01 K with a Heto Thermostat and was measured by means of a calibrated Pt thermometer.

**Procedure:** Density, ρ, was calcd. from period of vibration, τ: ρ = a + b·τ<sup>-2</sup>. Consts. a and b were detd. by calibrating the app. (ref. 2) with doubly distd. and degassed H<sub>2</sub>O, ρ(298.15 K)/kg·m<sup>-3</sup> = 997.043 (ref. 3), and nonane (Fluka AG), "purum" grade material of stated purity > 99 mole %, ρ(298.15 K)/kg·m<sup>-3</sup> = 713.855 (ref. 4). Mixtures were prepd. by mass. V<sup>E</sup> was calcd. from V<sup>E</sup> = V · (x<sub>1</sub>V<sub>1</sub><sup>0</sup> + x<sub>2</sub>V<sub>2</sub><sup>0</sup>), where V = (x<sub>1</sub>M<sub>1</sub> + x<sub>2</sub>M<sub>2</sub>)/ρ is the molar vol. of the mixt. and V<sub>i</sub><sup>0</sup> = V(x<sub>i</sub> = 1) and M<sub>i</sub> are resp., the molar vol. and molar mass of component i.

**Materials:** 1. Aldrich Chemicals Co., Inc. (Milwaukee, WI, USA), material of stated purity > 99 mole %, dried over mol. sieve type 3A (Fluka AG), and used without further purification; ρ(298.15 K)/kg·m<sup>-3</sup> = 2034.19; n<sub>D</sub>(298.15 K) = 1.5837.  
2. Fluka AG (Busch, St. Gallen, Switzerland), "purum" grade material of stated GLC purity > 98 mole %, dried over mol. sieve type 3A (Fluka AG), degassed with ultrasound and used without further purification; ρ(298.15 K)/kg·m<sup>-3</sup> = 764.80; n<sub>D</sub>(298.15 K) = 1.4298.

**Errors:** δT(reproducibility)/K < 0.01; δT(IPTS-68)/K = 0.01; δx<sub>1</sub> < 0.0001; δV<sup>E</sup>/10<sup>-9</sup>·m<sup>3</sup>·mol<sup>-1</sup> < 1.

**REFERENCES**

1. *Int. DATA Ser., Ser. A, Guideline 1a*, 1994, 22(1).
2. Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jimenez, E. J. *J. Chem. Thermodyn.* 1985, 17, 1127.
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4. *Anton Paar Information Bull.* No. 6, March 1982.

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78

Int. DATA Ser., Sel. Data Mixtures, Ser. A 1996, 24(1), 68-79

**Components:** 1. 1,6-Diiodohexane, C<sub>6</sub>H<sub>12</sub>I<sub>2</sub> [629-09-4]  
 2. Heptadecane, C<sub>17</sub>H<sub>36</sub> [629-78-7]  
**State:** Binary system, single-phase liquid; pure components, both liquid  
**Variables:** V<sup>E</sup>, molar excess volume  
 x<sub>i</sub>, mole fraction of component i  
**Parameters:** T, temperature  
**Constants:** P, pressure  
**Method:** Calculation of V<sup>E</sup> from density measurements at constant T and P and variable x<sub>i</sub>; ref. 1

**Author(s) of table:** Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain)

**Edited by:** Mączynski, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)

SOURCE OF DATA

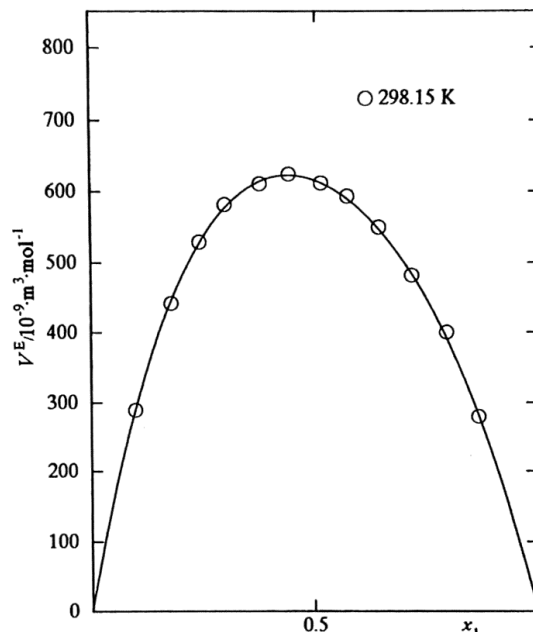
Placido, J.; Ortega, J.; Pena, J. (Laboratorio de Termodinamica y Fisicoquimica, 35071 - University of Las Palmas de G. C., Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P, atm.

T/K = 298.15

x <sub>1</sub>	V <sup>E</sup> /10 <sup>-9</sup> m <sup>3</sup> ·mol <sup>-1</sup>						
0.0979	289.6						
0.1803	442.4						
0.2436	530.5						
0.2994	582.4						
0.3785	611.8						
0.4429	625.5						
0.5149	612.6						
0.5736	594.7						
0.6439	550.2						
0.7190	482.6						
0.7964	400.8						
0.8691	280.3						



Points, direct experimental V<sup>E</sup> values, curve, V<sup>E</sup><sub>calc</sub> calculated from the equation.

SMOOTHING EQUATION

$$V_{\text{calc}}^E = x_1 x_2 \sum_{i=1}^n a_i (x_1 - x_2)^{i-1}$$

Coeffs. a<sub>i</sub> in the smoothing eq., std. deviation σ<sub>d</sub>, and max. deviation δ<sub>m</sub> detd. by least-squares anal.

T/K	a <sub>1</sub>	a <sub>2</sub>	a <sub>3</sub>	a <sub>4</sub>	a <sub>5</sub>	σ <sub>d</sub>	δ <sub>m</sub>
	10 <sup>-9</sup> m <sup>3</sup> ·mol <sup>-1</sup>						
298.15	2472.5 (7.3)	-444 (15)	651 (36)			3.8	5.5

The std. deviations σ<sub>a</sub> of the coeffs. a<sub>i</sub> are given in parentheses  
 δ<sub>m</sub> = max |V<sup>E</sup><sub>calc</sub> - V<sup>E</sup>|; σ<sub>d</sub> = [Σ(V<sup>E</sup><sub>calc</sub> - V<sup>E</sup>)<sup>2</sup>/(N - n)]<sup>1/2</sup>  
 N, no. of direct exptl. values; n, no. of coeffs. a<sub>i</sub>  
 All direct exptl. values equally weighted.

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**Procedure:** Density, ρ, was calcd. from period of vibration, τ: ρ = a + bτ<sup>2</sup>. Consts. a and b were detd. by calibrating the app. (ref. 2) with doubly distd. and degassed H<sub>2</sub>O, ρ(298.15 K)/kg·m<sup>-3</sup> = 997.043 (ref. 3), and nonane (Fluka AG), "purum" grade material of stated purity > 99 mole %, ρ(298.15 K)/kg·m<sup>-3</sup> = 713.855 (ref. 4). Mixtures were prepd. by mass. V<sup>E</sup> was calcd. from V<sup>E</sup> = V - (x<sub>1</sub>V<sup>0</sup><sub>1</sub> + x<sub>2</sub>V<sup>0</sup><sub>2</sub>), where V = (x<sub>1</sub>M<sub>1</sub> + x<sub>2</sub>M<sub>2</sub>)/ρ is the molar vol. of the mixt. and V<sup>0</sup><sub>i</sub> = V(x<sub>i</sub> = 1) and M<sub>i</sub> are resp., the molar vol. and molar mass of component i.  
**Materials:** 1. Aldrich Chemicals Co., Inc. (Milwaukee, WI, USA), material of stated purity > 99 mole %, dried over mol. sieve type 3A (Fluka AG), and used without further purification; ρ(298.15 K)/kg·m<sup>-3</sup> = 2034.19; n<sub>D</sub>(298.15 K) = 1.5837.  
 2. Fluka AG (Busch, St. Gallen, Switzerland), "purum" grade material of stated GLC purity > 99 mole %, dried over mol. sieve type 3A (Fluka AG), degassed with ultrasound and used without further purification; ρ(298.15 K)/kg·m<sup>-3</sup> = 774.33; n<sub>D</sub>(298.15 K) = 1.4347.  
**Errors:** δT(reproducibility)/K < 0.01; δT(IPTS-68)/K = 0.01; δx<sub>1</sub> < 0.0001; δV<sup>E</sup>/10<sup>-9</sup>m<sup>3</sup>·mol<sup>-1</sup> < 1.

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 1a, 1994*, 22(1).
2. Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jimenez, E. J. *J. Chem. Thermodyn.* 1985, 17, 1127.
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