

Compiled by Thermodynamics Research Center

Components: 1. Hexane, C₆H₁₄ [110-54-3]
2. Methyl hexanoate, C₇H₁₄O₂ [106-70-7]
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: Ortega, J. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, 35071 Las Palmas de Gran Canaria, Canary Islands, Spain)

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

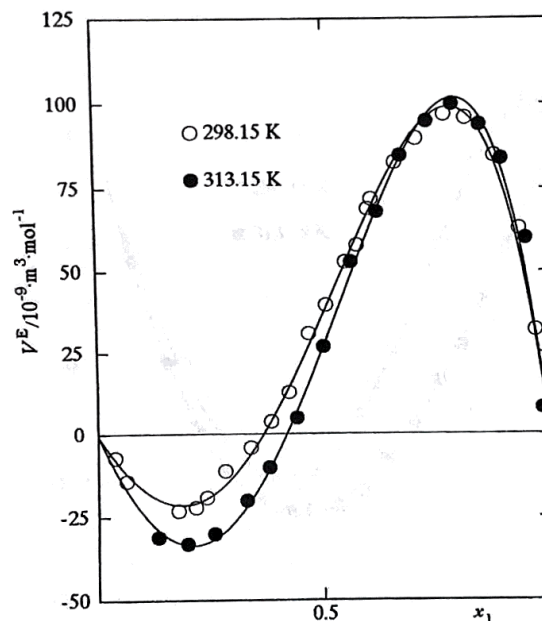
SOURCE OF DATA

Ortega, J.; Sabater, G.; Dieppa, R.; Navas, A.; Marrero, E.; Espiau, F. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P = 101.325 kPa

T/K = 298.15				T/K = 313.15	
x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹
0.0370	-7	0.8748	85	0.1312	-31
0.0610	-14	0.9306	63	0.1960	-33
0.1759	-23	0.9684	32	0.2552	-30
0.2138	-22			0.3275	-20
0.2392	-19			0.3784	-10
0.2801	-11			0.4402	5
0.3373	-4			0.4999	27
0.3825	4			0.5613	53
0.4230	13			0.6179	68
0.4682	31			0.6713	85
0.5067	40			0.7270	95
0.5490	53			0.7828	100
0.5751	58			0.8437	94
0.5986	69			0.8902	84
0.6055	72			0.9444	60
0.6587	83			0.9834	8
0.7048	90				
0.7658	97				
0.8119	96				



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

SMOOTHING EQUATION

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

Coefficients a_i in the smoothing equation, standard deviation σ_d, and maximum deviation δ_m determined by least-squares analysis.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	10 ⁻⁹ m ³ ·mol ⁻¹						
298.15	150.1 (3.7)	621.5 (8.3)	258.0 (19.4)			2.6	6.4
313.15	109.6 (7.3)	702.2 (15.0)	291.5 (35.1)			4.2	9.4

The standard deviations σ(a_i) of the coefficients a_i are given in parentheses
δ_m = max |V^E_{calc} - V^E|; σ_d = [Σ(V^E_{calc} - V^E)² / (N - n)]^{1/2}
N, number of direct experimental values; n, number of coefficients a_i
All direct experimental values equally weighted

AUXILIARY INFORMATION

Apparatus: The density was determined by an Anton Paar Model DMA-58 vibrating-tube digital densimeter with a precision of ±0.02 kg·m⁻³. The temperature was controlled to ±0.01 K with a Heto ultrathermostat.

Procedure: The procedure was described in ref. 2. Mixtures were prepared by weighing in hermetically sealed 2.5 cm³ glass vials. The apparatus was calibrated with doubly distilled and degassed water and nonane.

Materials: 1. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.5 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.3725, n(D, 313.15 K) = 1.3650, ρ(298.15 K)/kg·m⁻³ = 654.92, ρ(313.15 K)/kg·m⁻³ = 640.98.
2. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4030, n(D, 313.15 K) = 1.3970, ρ(298.15 K)/kg·m⁻³ = 879.45, ρ(313.15 K)/kg·m⁻³ = 865.10.

Errors: |δT|/K = 0.02; |δx₁| = 0.0005; |δV^E|/10⁻⁹·m³·mol⁻¹ < 4.

REFERENCES

1. Int. DATA Ser., Ser. A, Guideline 3b, 1994, 22(1).
2. Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jiménez, E. *J. Chem. Thermodyn.*, 1985, 17, 1127.

0147-1503/04/01-61\$4.00

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Int. DATA Ser., Ser. A 2004, 32(1), 61-75

Components: 1. Hexane, C₆H₁₄ [110-54-3]
2. Methyl heptanoate, C₈H₁₆O₂ [106-73-0]
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: Ortega, J. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, 35071 Las Palmas de Gran Canaria, Canary Islands, Spain)
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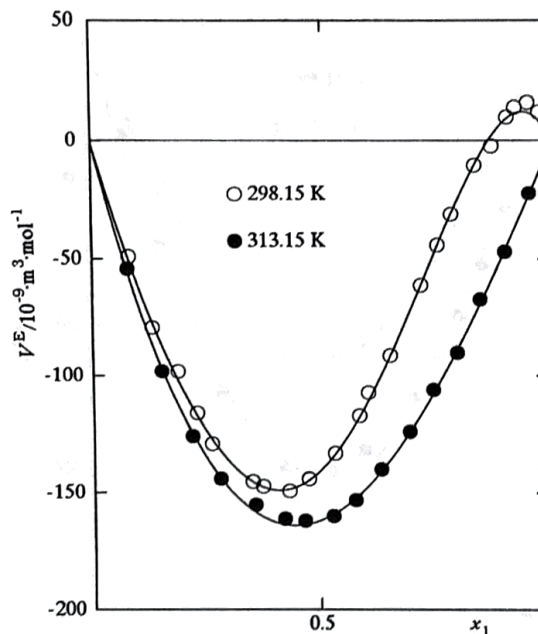
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DIRECT EXPERIMENTAL VALUES

Notes: P = 101.325 kPa

T/K = 298.15				T/K = 313.15	
x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹
0.0804	-49	0.9193	14	0.0763	-54
0.1306	-79	0.9483	16	0.1508	-98
0.1865	-98	0.9723	12	0.2171	-126
0.2283	-116			0.2778	-144
0.2602	-129			0.3549	-155
0.3488	-145			0.4198	-161
0.3716	-147			0.4649	-162
0.4306	-149			0.5272	-160
0.4743	-144			0.5766	-153
0.5323	-133			0.6335	-140
0.5856	-117			0.6966	-124
0.6054	-107			0.7499	-106
0.6542	-91			0.8013	-90
0.7195	-61			0.8513	-67
0.7553	-44			0.9038	-47
0.7847	-31			0.9536	-22
0.8345	-10				
0.8711	-2				
0.9028	10				



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

SMOOTHING EQUATION

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

Coefficients a_i in the smoothing equation, standard deviation σ_d, and maximum deviation δ_m determined by least-squares analysis.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	10 ⁻⁹ m ³ ·mol ⁻¹						
298.15	-559.9 (3.6)	365.6 (13.7)	427.1 (15.8)	190 (34)		2.3	4.8
313.15	-645.0 (2.0)	151.2 (5.4)				1.5	2.7

The standard deviations σ(a_i) of the coefficients a_i are given in parentheses
δ_m = max |V^E_{calc} - V^E|; σ_d = [Σ(V^E_{calc} - V^E)² / (N - n)]^{1/2}
N, number of direct experimental values; n, number of coefficients a_i
All direct experimental values equally weighted

AUXILIARY INFORMATION

Apparatus: The density was determined by an Anton Paar Model DMA-58 vibrating-tube digital densimeter with a precision of ±0.02 kg·m⁻³. The temperature was controlled to ±0.01 K with a Heto ultrathermostat.

Procedure: The procedure was described in ref. 2. Mixtures were prepared by weighing in hermetically sealed 2.5 cm³ glass vials. The apparatus was calibrated with doubly distilled and degassed water and nonane.

Materials: 1. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.5 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.3725, n(D, 313.15 K) = 1.3650, ρ(298.15 K)/kg·m⁻³ = 654.92, ρ(313.15 K)/kg·m⁻³ = 640.98.
2. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4094, n(D, 313.15 K) = 1.4035, ρ(298.15 K)/kg·m⁻³ = 875.43, ρ(313.15 K)/kg·m⁻³ = 861.93.

Errors: |δT|/K = 0.02; |δx₁| = 0.0005; |δV^E|/10⁻⁹·m³·mol⁻¹ < 4.

REFERENCES

1. Int. DATA Ser., Ser. A, Guideline 3b, 1994, 22(1).
2. Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jiménez, E. J. Chem. Thermodyn., 1985, 17, 1127.

Compiled by Thermodynamics Research Center

Components: 1. Hexane, C₆H₁₄ [110-54-3]
2. Methyl octanoate, C₉H₁₈O₂ [111-11-5]
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: Ortega, J. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, 35071 Las Palmas de Gran Canaria, Canary Islands, Spain)

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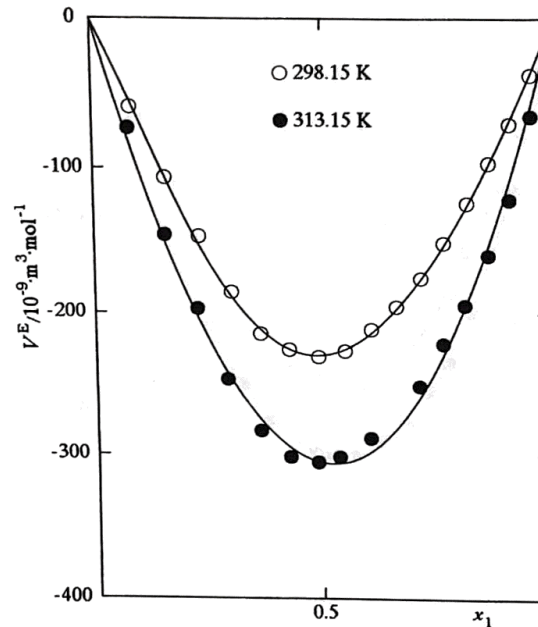
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Ortega, J.; Sabater, G.; Dieppa, R.; Navas, A.; Marrero, E.; Espiau, F. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P = 101.325 kPa

T/K = 298.15		T/K = 313.15	
x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹
0.0828	-59	0.0790	-73
0.1573	-106	0.1552	-145
0.2311	-146	0.2263	-197
0.3009	-185	0.2912	-246
0.3652	-214	0.3631	-283
0.4284	-225	0.4277	-301
0.4916	-230	0.4897	-305
0.5511	-226	0.5367	-301
0.6092	-211	0.6065	-288
0.6642	-195	0.7149	-251
0.7180	-175	0.7681	-221
0.7680	-150	0.8159	-194
0.8178	-123	0.8662	-159
0.8644	-96	0.9107	-121
0.9091	-70	0.9555	-65
0.9543	-37		



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

SMOOTHING EQUATION

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

Coefficients a_i in the smoothing equation, standard deviation σ_d, and maximum deviation δ_m determined by least-squares analysis.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	10 ⁻⁹ m ³ ·mol ⁻¹						
298.15	-913.5 (5.1)	51.5 (19.4)	216.3 (23.3)	-160.2 (50.2)		2.8	5.7
313.15	-1217.1 (11.0)	-120.5 (28.5)				7.8	14.0

The standard deviations σ(a_i) of the coefficients a_i are given in parentheses
δ_m = max |V^E_{calc} - V^E|; σ_d = [Σ(V^E_{calc} - V^E)² / (N - n)]^{1/2}
N, number of direct experimental values; n, number of coefficients a_i
All direct experimental values equally weighted

AUXILIARY INFORMATION

Apparatus: The density was determined by an Anton Paar Model DMA-58 vibrating-tube digital densimeter with a precision of ±0.02 kg·m⁻³. The temperature was controlled to ±0.01 K with a Heto ultrathermostat.

Procedure: The procedure was described in ref. 2. Mixtures were prepared by weighing in hermetically sealed 2.5 cm³ glass vials. The apparatus was calibrated with doubly distilled and degassed water and nonane.

Materials: 1. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.5 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.3725, n(D, 313.15 K) = 1.3650, ρ(298.15 K)/kg·m⁻³ = 654.92, ρ(313.15 K)/kg·m⁻³ = 640.98.
2. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4150, n(D, 313.15 K) = 1.4090, ρ(298.15 K)/kg·m⁻³ = 872.31, ρ(313.15 K)/kg·m⁻³ = 859.28.

Errors: |δT|/K = 0.02; |δx₁| = 0.0005; |δV^E/10⁻⁹·m³·mol⁻¹ < 10.

REFERENCES

- Int. DATA Ser., Ser. A, Guideline 3b, 1994, 22(1).
- Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jiménez, E. *J. Chem. Thermodyn.*, 1985, 17, 1127.

Compiled by Thermodynamics Research Center

Components: 1. Hexane, C₆H₁₄ [110-54-3]
2. Methyl nonanoate, C₁₀H₂₀O₂ [1731-84-6]
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

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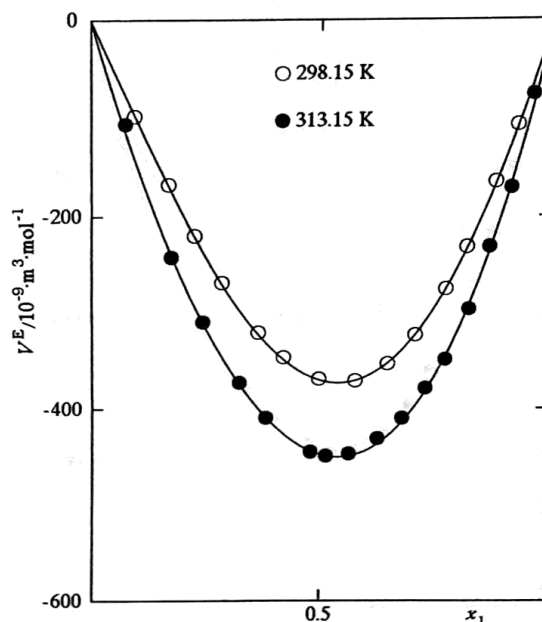
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DIRECT EXPERIMENTAL VALUES

Notes: P = 101.325 kPa

T/K = 298.15		T/K = 313.15					
x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹				
0.0943	-97	0.0741	-105				
0.1676	-167	0.1732	-241				
0.2239	-219	0.2438	-308				
0.2839	-267	0.3235	-372				
0.3652	-319	0.3811	-409				
0.4204	-345	0.4795	-445				
0.4988	-368	0.5132	-449				
0.5785	-370	0.5644	-447				
0.6489	-352	0.6275	-431				
0.7098	-322	0.6810	-410				
0.7758	-274	0.7318	-378				
0.8203	-231	0.7758	-348				
0.8793	-164	0.8263	-295				
0.9259	-106	0.8696	-231				
		0.9139	-170				
		0.9583	-75				



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

SMOOTHING EQUATION

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

Coefficients a_i in the smoothing equation, standard deviation σ_d, and maximum deviation δ_m determined by least-squares analysis.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	10 ⁻⁹ m ³ ·mol ⁻¹						
298.15	-1473.7 (3.1)	-281.7 (5.7)	203.0 (13.5)			1.6	2.7
313.15	-1785.3 (8.6)	-277.0 (17.8)	-117.6 (40.1)			4.9	10.4

The standard deviations σ(a_i) of the coefficients a_i are given in parentheses
δ_m = max |V^E_{calc} - V^E|; σ_d = [Σ(V^E_{calc} - V^E)² / (N - n)]^{1/2}
N, number of direct experimental values; n, number of coefficients a_i
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AUXILIARY INFORMATION

Apparatus: The density was determined by an Anton Paar Model DMA-58 vibrating-tube digital densimeter with a precision of ±0.02 kg·m⁻³. The temperature was controlled to ±0.01 K with a Heto ultrathermostat.

Procedure: The procedure was described in ref. 2. Mixtures were prepared by weighing in hermetically sealed 2.5 cm³ glass vials. The apparatus was calibrated with doubly distilled and degassed water and nonane.

Materials: 1. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.5 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.3725, n(D, 313.15 K) = 1.3650, ρ(298.15 K)/kg·m⁻³ = 654.92, ρ(313.15 K)/kg·m⁻³ = 640.98.
2. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4195, n(D, 313.15 K) = 1.4135, ρ(298.15 K)/kg·m⁻³ = 870.15, ρ(313.15 K)/kg·m⁻³ = 857.43.

Errors: |δT|/K = 0.02; |δx₁| = 0.0005; |δV^E|/10⁻⁹·m³·mol⁻¹ < 8.

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 3b*, 1994, 22(1).
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Int. DATA Ser., Ser. A Data Mixtures, Ser. A 2004, 32(1), 61-75

SELECTED DATA ON MIXTURES
International DATA Series*

2c. EXCESS VOLUME

National Institute of Standards and Technology, Boulder, CO 80305-3328

Compiled by Thermodynamics Research Center

Components: 1. Hexane, C₆H₁₄ [110-54-3]
2. Methyl decanoate, C₁₁H₂₂O₂ [110-42-9]
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

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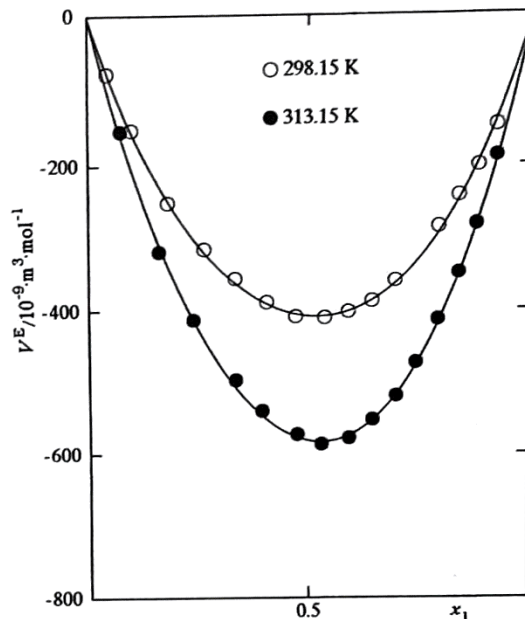
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DIRECT EXPERIMENTAL VALUES

Notes: P = 101.325 kPa

T/K = 298.15		T/K = 313.15	
x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹
0.0425	-76	0.0735	-153
0.0977	-151	0.1597	-318
0.1806	-251	0.2391	-413
0.2630	-314	0.3349	-496
0.3333	-355	0.3947	-539
0.4056	-388	0.4759	-572
0.4716	-408	0.5302	-586
0.5389	-410	0.5940	-578
0.5920	-402	0.6477	-552
0.6462	-387	0.7012	-519
0.6979	-359	0.7467	-473
0.7948	-285	0.7959	-414
0.8407	-243	0.8417	-349
0.8827	-201	0.8805	-282
0.9232	-146	0.9237	-189



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

SMOOTHING EQUATION

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

Coefficients a_i in the smoothing equation, standard deviation σ_d, and maximum deviation δ_m determined by least-squares analysis.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	10 ⁻⁹ m ³ ·mol ⁻¹						
298.15	-1625.1 (9.0)	-117.1 (18.7)	-299.7 (40.7)			5.0	8.5
313.15	-2315.8 (10.0)	-249.2 (20.3)	-293.1 (45.7)			5.5	11.8

The standard deviations σ(a_i) of the coefficients a_i are given in parentheses
δ_m = max |V^E_{calc} - V^E|; σ_d = [Σ(V^E_{calc} - V^E)²/(N - n)]^{1/2}
N, number of direct experimental values; n, number of coefficients a_i
All direct experimental values equally weighted

AUXILIARY INFORMATION

Apparatus: The density was determined by an Anton Paar Model DMA-58 vibrating-tube digital densimeter with a precision of ±0.02 kg·m⁻³. The temperature was controlled to ±0.01 K with a Heto ultrathermostat.

Procedure: The procedure was described in ref. 2. Mixtures were prepared by weighing in hermetically sealed 2.5 cm³ glass vials. The apparatus was calibrated with doubly distilled and degassed water and nonane.

Materials: 1. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.5 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.3725, n(D, 313.15 K) = 1.3650, ρ(298.15 K)/kg·m⁻³ = 654.92, ρ(313.15 K)/kg·m⁻³ = 640.98.
2. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4233, n(D, 313.15 K) = 1.4181, ρ(298.15 K)/kg·m⁻³ = 868.19, ρ(313.15 K)/kg·m⁻³ = 856.35.

Errors: |δT|/K = 0.02; |δx₁| = 0.0005; |δV^E|/10⁻⁹·m³·mol⁻¹ < 8.

REFERENCES

- Int. DATA Ser., Ser. A, Guideline 3b, 1994, 22(1).
- Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jiménez, E. *J. Chem. Thermodyn.*, 1985, 17, 1127.

Components: 1. Methyl hexanoate, C₇H₁₄O₂ [106-70-7]
2. Octane, C₈H₁₈ [111-65-9]
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: Ortega, J. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, 35071 Las Palmas de Gran Canaria, Canary Islands, Spain)
Edited by: Skrzecz, A.; Mączynski, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)

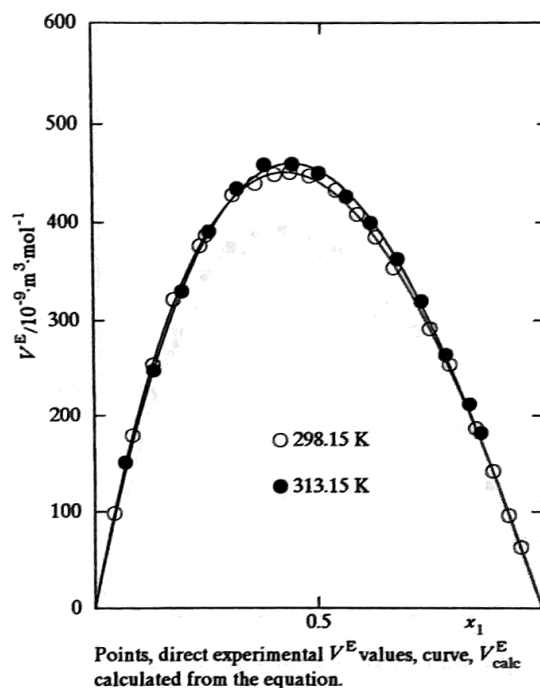
SOURCE OF DATA

Ortega, J.; Sabater, G.; Dieppa, R.; Navas, A.; Marrero, E.; Espiau, F. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P = 101.325 kPa

T/K = 298.15				T/K = 313.15	
x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹
0.0432	99	0.9249	97	0.0673	151
0.0843	179	0.9518	64	0.1322	248
0.1312	254			0.1959	330
0.1776	322			0.2550	391
0.2353	377			0.3170	435
0.2491	388			0.3773	459
0.3080	429			0.4389	460
0.3569	441			0.4965	451
0.4007	450			0.5591	427
0.4341	452			0.6119	400
0.4764	448			0.6721	363
0.5348	434			0.7261	320
0.5837	409			0.7819	264
0.6251	386			0.8348	212
0.6652	354			0.8622	182
0.7463	292			0.9474	85
0.7901	254				
0.8505	187				
0.8888	142				



SMOOTHING EQUATION

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

Coefficients a_i in the smoothing equation, standard deviation σ_d, and maximum deviation δ_m determined by least-squares analysis.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	10 ⁻⁹ m ³ ·mol ⁻¹						
298.15	1768.6 (3.5)	-537.5 (7.0)	156.1 (15.5)			2.2	4.1
313.15	1816.1 (6.9)	-481.3 (18.3)				5.2	10.9

The standard deviations σ(a_i) of the coefficients a_i are given in parentheses
δ_m = max |V^E_{calc} - V^E|; σ_d = [Σ(V^E_{calc} - V^E)² / (N - n)]^{1/2}
N, number of direct experimental values; n, number of coefficients a_i
All direct experimental values equally weighted

AUXILIARY INFORMATION

Apparatus: The density was determined by an Anton Paar Model DMA-58 vibrating-tube digital densimeter with a precision of ±0.02 kg·m⁻³. The temperature was controlled to ±0.01 K with a Heto ultrathermostat.

Procedure: The procedure was described in ref. 2. Mixtures were prepared by weighing in hermetically sealed 2.5 cm³ glass vials. The apparatus was calibrated with doubly distilled and degassed water and nonane.

Materials: 1. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4030, n(D, 313.15 K) = 1.3970, ρ(298.15 K)/kg·m⁻³ = 879.45, ρ(313.15 K)/kg·m⁻³ = 865.10.
2. Fluka AG (Buchs, St. Gallen, Switzerland), "purum" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.3955, n(D, 313.15 K) = 1.3885, ρ(298.15 K)/kg·m⁻³ = 698.59, ρ(313.15 K)/kg·m⁻³ = 686.17.

Errors: |δT|/K = 0.02; |δx₁| = 0.0005; |δV^E|/10⁻⁹·m³·mol⁻¹ < 6.

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 3b*, 1994, 22(1).
2. Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jiménez, E. *J. Chem. Thermodyn.*, 1985, 17, 1127.

Components: 1. Methyl heptanoate, C₈H₁₆O₂ [106-73-0]
2. Octane, C₈H₁₈ [111-65-9]
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: Ortega, J. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, 35071 Las Palmas de Gran Canaria, Canary Islands, Spain)
Edited by: Skrzecz, A.; Mączyński, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)

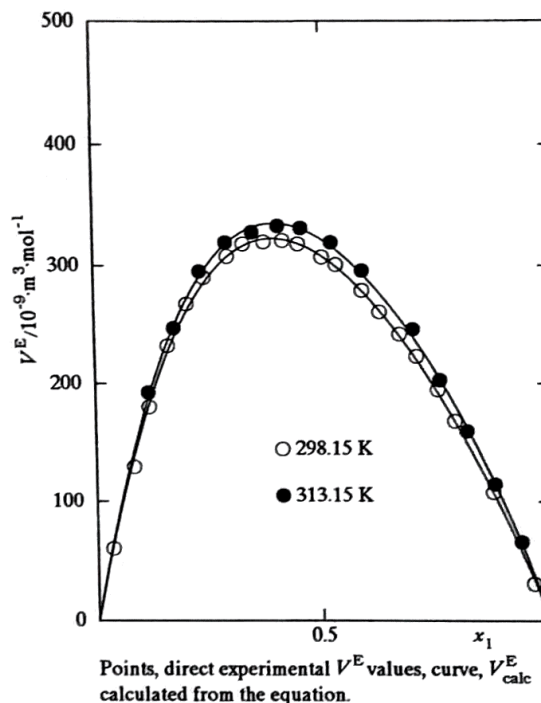
SOURCE OF DATA

Ortega, J.; Sabater, G.; Dieppa, R.; Navas, A.; Marrero, E.; Espiau, F. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P = 101.325 kPa

T/K = 298.15				T/K = 313.15	
x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹
0.0341	60	0.8765	108	0.1166	193
0.0831	130	0.9638	31	0.1760	247
0.1191	181			0.2337	295
0.1622	232			0.2921	319
0.2041	268			0.3502	328
0.2437	290			0.4078	333
0.2959	308			0.4588	331
0.3313	318			0.5240	319
0.3775	320			0.5928	296
0.4181	321			0.7030	246
0.4530	318			0.7618	203
0.5052	307			0.8205	160
0.5361	301			0.8799	115
0.5926	279			0.9375	66
0.6308	261				
0.6737	242				
0.7114	223				
0.7564	195				
0.7944	169				



SMOOTHING EQUATION

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

Coefficients a_i in the smoothing equation, standard deviation σ_d, and maximum deviation δ_m determined by least-squares analysis.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	10 ⁻⁹ m ³ ·mol ⁻¹						
298.15	1239.6 (4.9)	-491.2 (10.2)	239 (24)			3.2	8.3
313.15	1294.1 (6.6)	-471.5 (12.8)	294 (30)			3.5	5.6

The standard deviations σ(a_i) of the coefficients a_i are given in parentheses
δ_m = max |V^E_{calc} - V^E|; σ_d = [Σ(V^E_{calc} - V^E)² / (N - n)]^{1/2}
N, number of direct experimental values; n, number of coefficients a_i
All direct experimental values equally weighted

AUXILIARY INFORMATION

Apparatus: The density was determined by an Anton Paar Model DMA-58 vibrating-tube digital densimeter with a precision of ±0.02 kg·m⁻³. The temperature was controlled to ±0.01 K with a Heto ultrathermostat.

Procedure: The procedure was described in ref. 2. Mixtures were prepared by weighing in hermetically sealed 2.5 cm³ glass vials. The apparatus was calibrated with doubly distilled and degassed water and nonane.

Materials: 1. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4094, n(D, 313.15 K) = 1.4035, ρ(298.15 K)/kg·m⁻³ = 875.43, ρ(313.15 K)/kg·m⁻³ = 861.93.
2. Fluka AG (Buchs, St. Gallen, Switzerland), "purum" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.3955, n(D, 313.15 K) = 1.3885, ρ(298.15 K)/kg·m⁻³ = 698.59, ρ(313.15 K)/kg·m⁻³ = 686.17.

Errors: |δT|/K = 0.02; |δx₁| = 0.0005; |δV^E|/10⁻⁹·m³·mol⁻¹ < 4.

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 3b*, 1994, 22(1).
2. Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jiménez, E. *J. Chem. Thermodyn.*, 1985, 17, 1127.

SELECTED DATA ON MIXTURES
International Data Series*

2c. EXCESS VOLUME

National Institute of Standards and Technology, Boulder, CO 80305-3328

Compiled by Thermodynamics Research Center

Components: 1. Octane, C₈H₁₈ [111-65-9]
2. Methyl octanoate, C₉H₁₈O₂ [111-11-5]
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: Ortega, J. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, 35071 Las Palmas de Gran Canaria, Canary Islands, Spain)
Edited by: Skrzecz, A.; Mączynski, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)

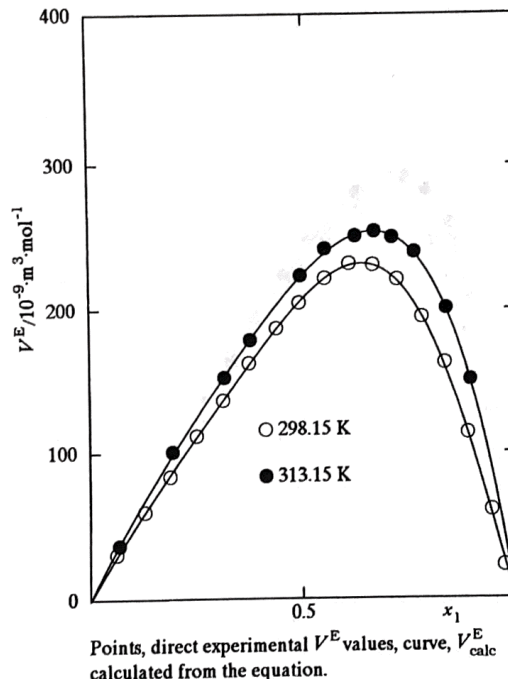
SOURCE OF DATA

Ortega, J.; Sabater, G.; Dieppa, R.; Navas, A.; Marrero, E.; Espiau, F. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P = 101.325 kPa

T/K = 298.15		T/K = 313.15			
x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹		
0.0620	31	0.0675	37		
0.1271	60	0.1936	101		
0.1875	84	0.3172	153		
0.2503	112	0.3792	179		
0.3137	137	0.4969	224		
0.3747	163	0.5537	242		
0.4398	187	0.6244	251		
0.4934	205	0.6692	254		
0.5532	222	0.7111	250		
0.6109	232	0.7638	240		
0.6654	231	0.8385	201		
0.7230	221	0.8950	151		
0.7809	195				
0.8349	163				
0.8885	114				
0.9443	61				
0.9743	23				



SMOOTHING EQUATION

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

Coefficients a_i in the smoothing equation, standard deviation σ_d, and maximum deviation δ_m determined by least-squares analysis.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	10 ⁻⁹ m ³ ·mol ⁻¹						
298.15	831.1 (3.4)	622.5 (11.3)	174.5 (35.3)	-362 (29)	-244 (59)	1.7	3.8
313.15	897.4 (2.8)	632.0 (5.9)	337.6 (13.9)			1.4	2.5

The standard deviations σ(a_i) of the coefficients a_i are given in parentheses
δ_m = max |V^E_{calc} - V^E|; σ_d = [Σ(V^E_{calc} - V^E)² / (N - n)]^{1/2}
N, number of direct experimental values; n, number of coefficients a_i
All direct experimental values equally weighted

AUXILIARY INFORMATION

Apparatus: The density was determined by an Anton Paar Model DMA-58 vibrating-tube digital densimeter with a precision of ±0.02 kg·m⁻³. The temperature was controlled to ±0.01 K with a Heto ultrathermostat.

Procedure: The procedure was described in ref. 2. Mixtures were prepared by weighing in hermetically sealed 2.5 cm³ glass vials. The apparatus was calibrated with doubly distilled and degassed water and nonane.

Materials: 1. Fluka AG (Buchs, St. Gallen, Switzerland), "purum" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.3955, n(D, 313.15 K) = 1.3885, ρ(298.15 K)/kg·m⁻³ = 698.59, ρ(313.15 K)/kg·m⁻³ = 686.17.
2. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4150, n(D, 313.15 K) = 1.4090, ρ(298.15 K)/kg·m⁻³ = 872.31, ρ(313.15 K)/kg·m⁻³ = 859.28.

Errors: |δT|/K = 0.02; |δx₁| = 0.0005; |δV^E|/10⁻⁹·m³·mol⁻¹ < 4.

REFERENCES

- Int. DATA Ser., Ser. A, Guideline 3b, 1994, 22(1).
- Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jiménez, E. *J. Chem. Thermodyn.*, 1985, 17, 1127.

Components: 1. Octane, C₈H₁₈ [111-65-9]
2. Methyl nonanoate, C₁₀H₂₀O₂ [1731-84-6]
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: Ortega, J. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, 35071 Las Palmas de Gran Canaria, Canary Islands, Spain)
Edited by: Skrzecz, A.; Mączynski, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)

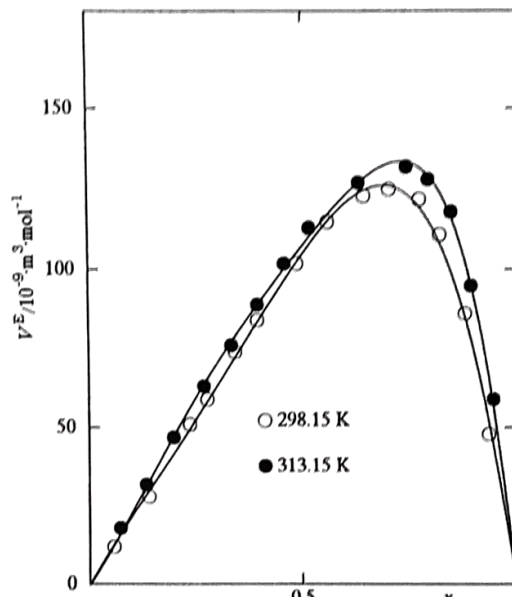
SOURCE OF DATA

Ortega, J.; Sabater, G.; Dieppa, R.; Navas, A.; Marrero, E.; Espiau, F. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P = 101.325 kPa

T/K = 298.15		T/K = 313.15			
x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹		
0.0564	12	0.0721	18		
0.1396	28	0.1331	32		
0.2372	51	0.1991	47		
0.2781	59	0.2706	63		
0.3442	74	0.3359	76		
0.3975	84	0.3974	89		
0.4888	102	0.4607	102		
0.5617	115	0.5185	113		
0.6461	123	0.6342	127		
0.7046	125	0.7448	132		
0.7756	122	0.7958	128		
0.8231	111	0.8487	118		
0.8835	86	0.8976	95		
0.9384	48	0.9494	59		



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

SMOOTHING EQUATION

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

Coefficients a_i in the smoothing equation, standard deviation σ_d, and maximum deviation δ_m determined by least-squares analysis.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	10 ⁻⁹ m ³ ·mol ⁻¹						
298.15	419.3 (4.0)	377.5 (7.5)	198.9 (18.0)			2.0	4.2
313.15	429.7 (3.3)	336.8 (13.0)	340.4 (13.8)	236 (32)		1.7	2.5

The standard deviations σ_{ai} of the coefficients a_i are given in parentheses
δ_m = max |V^E_{calc} - V^E| ; σ_d = [Σ(V^E_{calc} - V^E)² / (N - n)]^{1/2}
N, number of direct experimental values; n, number of coefficients a_i
All direct experimental values equally weighted

AUXILIARY INFORMATION

Apparatus: The density was determined by an Anton Paar Model DMA-58 vibrating-tube digital densimeter with a precision of ±0.02 kg·m⁻³. The temperature was controlled to ±0.01 K with a Heto ultrathermostat.

Procedure: The procedure was described in ref. 2. Mixtures were prepared by weighing in hermetically sealed 2.5 cm³ glass vials. The apparatus was calibrated with doubly distilled and degassed water and nonane.

Materials: 1. Fluka AG (Buchs, St. Gallen, Switzerland), "purum" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.3955, n(D, 313.15 K) = 1.3885, ρ(298.15 K)/kg·m⁻³ = 698.59, ρ(313.15 K)/kg·m⁻³ = 686.17.
2. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4195, n(D, 313.15 K) = 1.4135, ρ(298.15 K)/kg·m⁻³ = 870.15, ρ(313.15 K)/kg·m⁻³ = 857.43.

Errors: |δT|/K = 0.02; |δx₁| = 0.0005; |δV^E|/10⁻⁹·m³·mol⁻¹ < 4.

REFERENCES

- Int. DATA Ser., Ser. A, Guideline 3b, 1994, 22(1).
- Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jiménez, E. *J. Chem. Thermodyn.*, 1985, 17, 1127.

SELECTED DATA ON MIXTURES

International DATA Series*

2c. EXCESS VOLUME

National Institute of Standards and Technology, Boulder, CO 80305-3328

Compiled by Thermodynamics Research Center

Components: 1. Octane, C₈H₁₈ [111-65-9]
2. Methyl decanoate, C₁₁H₂₂O₂ [110-42-9]
State: Binary system, single-phase liquid; pure components, both liquid
Variables: V^E, molar excess volume
x₁, 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 x₁; ref. 1

Author(s) of table: Ortega, J. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, 35071 Las Palmas de Gran Canaria, Canary Islands, Spain)

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

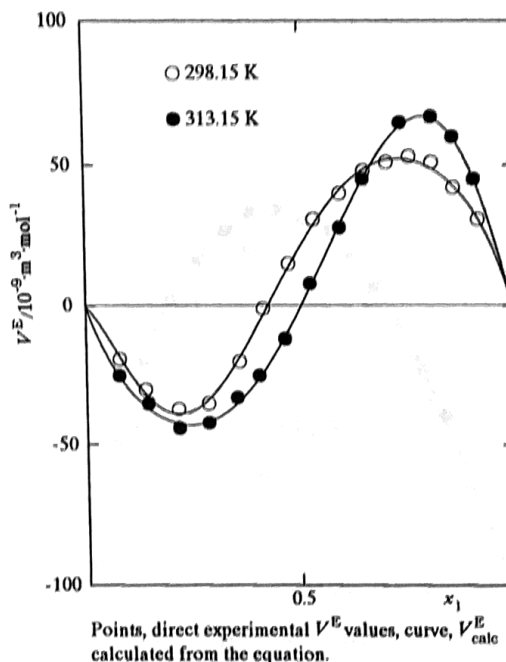
SOURCE OF DATA

Ortega, J.; Sabater, G.; Dieppa, R.; Navas, A.; Marrero, E.; Espiau, F. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P = 101.325 kPa

T/K = 298.15		T/K = 313.15	
x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹
0.0787	-19	0.0775	-25
0.1383	-30	0.1451	-35
0.2153	-37	0.2164	-44
0.2857	-35	0.2857	-42
0.3602	-20	0.3538	-33
0.4175	-1	0.4061	-25
0.4770	15	0.4683	-12
0.5359	31	0.5280	8
0.5962	40	0.5968	28
0.6524	48	0.6510	45
0.7069	51	0.7368	65
0.7582	53	0.8090	67
0.8109	51	0.8581	60
0.8608	42	0.9078	45
0.9179	31		



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

SMOOTHING EQUATION

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

Coefficients a_i in the smoothing equation, standard deviation σ_d, and maximum deviation δ_m determined by least-squares analysis.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	10 ⁻⁹ m ³ ·mol ⁻¹						
298.15	81.9 (3.5)	523.2 (11.5)	-262 (38)	-180 (30)	382 (67)	1.6	2.0
313.15	-6.3 (2.9)	598.0 (9.9)	335 (33)	-90 (25)	-254 (58)	1.3	2.0

The standard deviations σ(a_i) of the coefficients a_i are given in parentheses
δ_m = max |V^E_{calc} - V^E|; σ_d = [Σ(V^E_{calc} - V^E)²/(N - n)]^{1/2}
N, number of direct experimental values; n, number of coefficients a_i
All direct experimental values equally weighted

AUXILIARY INFORMATION

Apparatus: The density was determined by an Anton Paar Model DMA-58 vibrating-tube digital densimeter with a precision of ±0.02 kg·m⁻³. The temperature was controlled to ±0.01 K with a Heto ultrathermostat.

Procedure: The procedure was described in ref. 2. Mixtures were prepared by weighing in hermetically sealed 2.5 cm³ glass vials. The apparatus was calibrated with doubly distilled and degassed water and nonane.

Materials: 1. Fluka AG (Buchs, St. Gallen, Switzerland), "purum" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.3955, n(D, 313.15 K) = 1.3885, ρ(298.15 K)/kg·m⁻³ = 698.59, ρ(313.15 K)/kg·m⁻³ = 686.17.
2. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4233, n(D, 313.15 K) = 1.4181, ρ(298.15 K)/kg·m⁻³ = 868.19, ρ(313.15 K)/kg·m⁻³ = 856.35.

Errors: |δT|/K = 0.02; |δx₁| = 0.0005; |δV^E|/10⁻⁹·m³·mol⁻¹ < 4.

REFERENCES

1. Int. DATA Ser., Ser. A, Guideline 3b, 1994, 22(1).
2. Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jiménez, E. J. Chem. Thermodyn., 1985, 17, 1127.

0147-1503/04/01-7084-00

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Int. DATA Ser., Ser. A, Guideline 3b, 1994, 22(1), 61-75

SELECTED DATA ON MIXTURES

International DATA Series*

2c. EXCESS VOLUME

National Institute of Standards and Technology, Boulder, CO 80305-3328

Compiled by Thermodynamics Research Center

Components: 1. Methyl hexanoate, C₇H₁₄O₂ [106-70-7]
2. Decane, C₁₀H₂₂ [124-18-5]
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: Ortega, J. (Laboratorio de Termodinámica y Físicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, 35071 Las Palmas de Gran Canaria, Canary Islands, Spain)
Edited by: Skrzecz, A.; Mączynski, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)

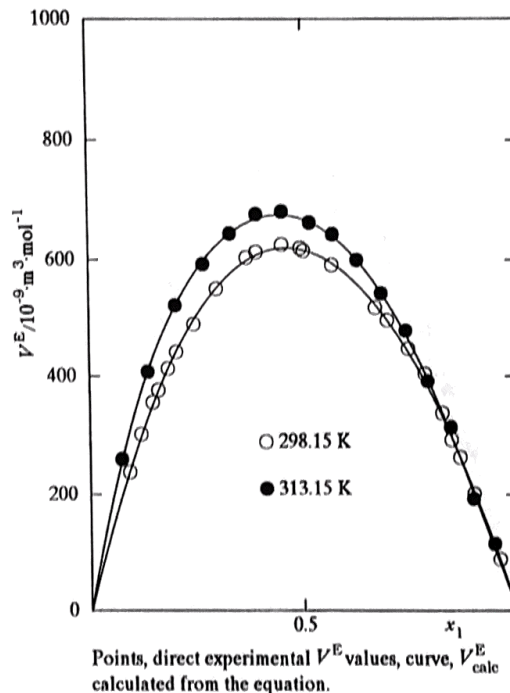
SOURCE OF DATA

Ortega, J.; Sabater, G.; Dieppa, R.; Navas, A.; Marrero, E.; Espiau, F. (Laboratorio de Termodinámica y Físicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P = 101.325 kPa

T/K = 298.15				T/K = 313.15	
x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹
0.0930	239	0.8499	294	0.0731	261
0.1201	303	0.8696	264	0.1363	408
0.1477	357	0.9009	203	0.2031	523
0.1608	378	0.9602	89	0.2693	593
0.1840	414			0.3318	644
0.2039	443			0.3942	676
0.2455	491			0.4536	681
0.2998	551			0.5185	663
0.3707	604			0.5729	643
0.3937	613			0.6294	599
0.4532	626			0.6857	543
0.4973	620			0.7427	479
0.5041	616			0.7938	392
0.5711	591			0.8478	315
0.6727	520			0.9007	193
0.7001	498			0.9479	115
0.7485	448				
0.7884	405				
0.8270	339				



SMOOTHING EQUATION

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

Coefficients a_i in the smoothing equation, standard deviation σ_d, and maximum deviation δ_m determined by least-squares analysis.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	10 ⁻⁹ m ³ ·mol ⁻¹						
298.15	2476.0 (7.6)	-324.7 (13.3)	196 (30)			4.8	12.3
313.15	2682.4 (11.3)	-471.1 (43.6)	423 (52)	-588 (112)		6.4	10.4

The standard deviations σ(a_i) of the coefficients a_i are given in parentheses
δ_m = max |V^E_{calc} - V^E_{exp}|; σ_d = [Σ(V^E_{calc} - V^E_{exp})² / (N - n)]^{1/2}
N, number of direct experimental values; n, number of coefficients a_i
All direct experimental values equally weighted

AUXILIARY INFORMATION

Apparatus: The density was determined by an Anton Paar Model DMA-58 vibrating-tube digital densimeter with a precision of ±0.02 kg·m⁻³. The temperature was controlled to ±0.01 K with a Heto ultrathermostat.

Procedures: The procedure was described in ref. 2. Mixtures were prepared by weighing in hermetically sealed 2.5 cm³ glass vials. The apparatus was calibrated with doubly distilled and degassed water and nonane.

Materials: 1. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4030, n(D, 313.15 K) = 1.3970, ρ(298.15 K)/kg·m⁻³ = 879.45, ρ(313.15 K)/kg·m⁻³ = 865.10.
2. Fluka AG (Buchs, St. Gallen, Switzerland), "purum" grade material; purity > 98.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4095, n(D, 313.15 K) = 1.4030, ρ(298.15 K)/kg·m⁻³ = 726.21, ρ(313.15 K)/kg·m⁻³ = 714.75.

Errors: |δT|/K = 0.02; |δx₁| = 0.0005; |δV^E|/10⁻⁹·m³·mol⁻¹ < 8.

REFERENCES

- Int. DATA Ser., Ser. A, Guideline 3b, 1994, 22(1).
- Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jiménez, E. J. Chem. Thermodyn., 1985, 17, 1127.

0147-1503/4/01-71\$4.00

71

Int. DATA Ser., Ser. A, Guideline 3b, 1994, 22(1), 61-75

SELECTED DATA ON MIXTURES

International DATA Series*

2c. EXCESS VOLUME

Compiled by Thermodynamics Research Center

National Institute of Standards and Technology, Boulder, CO 80305-3328

0147-1503/4/01-72\$4.00

Components: 1. Methyl heptanoate, C₈H₁₆O₂ [106-73-0]
2. Decane, C₁₀H₂₂ [124-18-5]
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: Ortega, J. (Laboratorio de Termodinámica y Físicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, 35071 Las Palmas de Gran Canaria, Canary Islands, Spain)

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

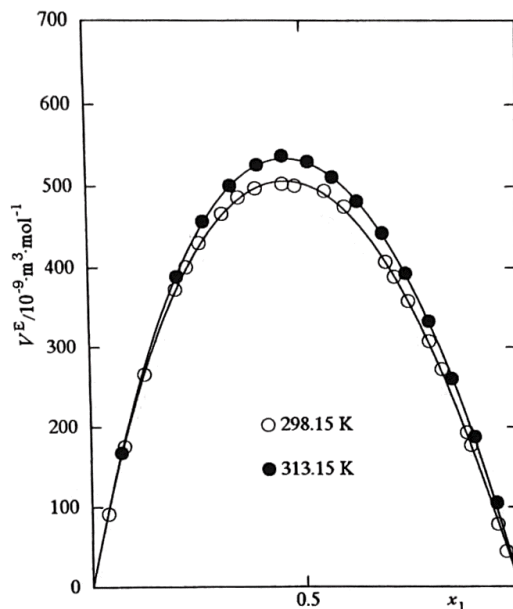
SOURCE OF DATA

Ortega, J.; Sabater, G.; Dieppa, R.; Navas, A.; Marrero, E.; Espiau, F. (Laboratorio de Termodinámica y Físicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P = 101.325 kPa

T/K = 298.15				T/K = 313.15	
x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹
0.0386	92	0.8914	178	0.0704	168
0.0782	176	0.9509	79	0.2059	389
0.1273	267	0.9688	45	0.2696	457
0.2031	373			0.3341	501
0.2286	401			0.3971	527
0.2603	431			0.4550	538
0.3146	467			0.5156	531
0.3524	487			0.5722	512
0.3927	498			0.6297	482
0.4560	504			0.6879	443
0.4847	501			0.7422	393
0.5537	495			0.7953	333
0.6006	476			0.8471	261
0.6947	408			0.8999	188
0.7159	389			0.9485	106
0.7482	359				
0.7949	308				
0.8248	273				
0.8811	194				



Points, direct experimental V^E values, curve, V^E_{calc}

SMOOTHING EQUATION

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

Coefficients a_i in the smoothing equation, standard deviation σ_d, and maximum deviation δ_m determined by least-squares analysis.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	10 ⁻⁹ m ³ ·mol ⁻¹						
298.15	2021.4 (6.0)	-287.0 (21.9)	188 (26)	-171 (56)		3.7	8.7
313.15	2132.1 (4.1)	-288.3 (8.8)	247 (21)			2.3	4.8

The standard deviations σ_{a_i} of the coefficients a_i are given in parentheses
δ_m = max |V^E_{calc} - V^E|; σ_d = [Σ(V^E_{calc} - V^E)² / (N - n)]^{1/2}
N, number of direct experimental values; n, number of coefficients a_i
All direct experimental values equally weighted

AUXILIARY INFORMATION

Apparatus: The density was determined by an Anton Paar Model DMA-58 vibrating-tube digital densimeter with a precision of ±0.02 kg·m⁻³. The temperature was controlled to ±0.01 K with a Heto ultrathermostat.

Procedure: The procedure was described in ref. 2. Mixtures were prepared by weighing in hermetically sealed 2.5 cm³ glass vials. The apparatus was calibrated with doubly distilled and degassed water and nonane.

Materials: 1. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4094, n(D, 313.15 K) = 1.4035, ρ(298.15 K)/kg·m⁻³ = 875.43, ρ(313.15 K)/kg·m⁻³ = 861.93.
2. Fluka AG (Buchs, St. Gallen, Switzerland), "purum" grade material; purity > 98.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4095, n(D, 313.15 K) = 1.4030, ρ(298.15 K)/kg·m⁻³ = 726.21, ρ(313.15 K)/kg·m⁻³ = 714.75.

Errors: |δT|/K = 0.02; |δx₁| = 0.0005; |δV^E|/10⁻⁹·m³·mol⁻¹ < 4.

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 3b*, 1994, 22(1).
2. Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jiménez, E. *J. Chem. Thermodyn.*, 1985, 17, 1127.

SELECTED DATA ON MIXTURES

International DATA Series*

2c. EXCESS VOLUME

National Institute of Standards and Technology, Boulder, CO 80305-3328

Compiled by Thermodynamics Research Center

Components: 1. Methyl octanoate, $C_9H_{18}O_2$ [111-11-5]
2. Decane, $C_{10}H_{22}$ [124-18-5]
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: Ortega, J. (Laboratorio de Termodinámica y Físicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, 35071 Las Palmas de Gran Canaria, Canary Islands, Spain)
Edited by: Skrzecz, A.; Mączynski, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)

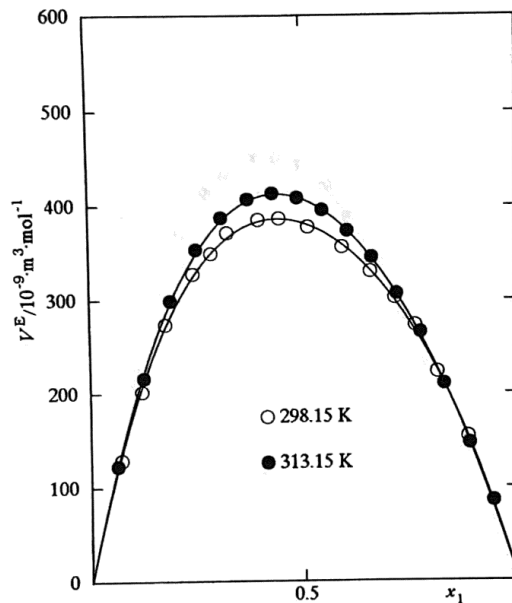
SOURCE OF DATA

Ortega, J.; Sabater, G.; Dieppa, R.; Navas, A.; Marrero, E.; Espiau, F. (Laboratorio de Termodinámica y Físicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: $P = 101.325$ kPa

$T/K = 298.15$		$T/K = 313.15$					
x_1	$V^E/10^{-9}$ $m^3 \cdot mol^{-1}$	x_1	$V^E/10^{-9}$ $m^3 \cdot mol^{-1}$				
0.0707	129	0.0622	123				
0.1196	202	0.1250	216				
0.1765	274	0.1898	299				
0.2433	328	0.2515	354				
0.2857	350	0.3115	388				
0.3240	372	0.3731	408				
0.3989	386	0.4317	414				
0.4473	387	0.4909	409				
0.5159	378	0.5485	396				
0.5954	357	0.6079	374				
0.6613	331	0.6652	346				
0.7189	303	0.7224	307				
0.7663	273	0.7786	266				
0.8168	223	0.8328	210				
0.8880	154	0.8903	147				
		0.9440	86				



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

SMOOTHING EQUATION

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

Coefficients a_i in the smoothing equation, standard deviation σ_d , and maximum deviation δ_m determined by least-squares analysis.

T/K	a_1	a_2	a_3	a_4	a_5	σ_d	δ_m
	$10^{-9} m^3 \cdot mol^{-1}$						
298.15	1534.8 (6.5)	-272.3 (12.2)	370 (30)			3.5	5.3
313.15	1636.4 (4.9)	-337.5 (9.8)	246 (22)			2.8	5.8

The standard deviations $\sigma(a_i)$ of the coefficients 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 , number of direct experimental values; n , number of coefficients a_i
All direct experimental values equally weighted

AUXILIARY INFORMATION

Apparatus: The density was determined by an Anton Paar Model DMA-58 vibrating-tube digital densimeter with a precision of ± 0.02 kg m^{-3} . The temperature was controlled to ± 0.01 K with a Heto ultrathermostat.

Procedure: The procedure was described in ref. 2. Mixtures were prepared by weighing in hermetically sealed 2.5 cm^3 glass vials. The apparatus was calibrated with doubly distilled and degassed water and nonane.

Materials: 1. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; $n(D, 298.15 K) = 1.4150$, $n(D, 313.15 K) = 1.4090$, $\rho(298.15 K)/kg \cdot m^{-3} = 872.31$, $\rho(313.15 K)/kg \cdot m^{-3} = 859.28$.
2. Fluka AG (Buchs, St. Gallen, Switzerland), "purum" grade material; purity > 98.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; $n(D, 298.15 K) = 1.4095$, $n(D, 313.15 K) = 1.4030$, $\rho(298.15 K)/kg \cdot m^{-3} = 726.21$, $\rho(313.15 K)/kg \cdot m^{-3} = 714.75$.

Errors: $|\delta T|/K = 0.02$; $|\delta x_1| = 0.0005$; $|\delta V^E|/10^{-9} m^3 \cdot mol^{-1} < 4$.

REFERENCES

1. *Int. DATA Ser., Ser. A, Guideline 3b*, 1994, 22(1).
2. Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jiménez, E. *J. Chem. Thermodyn.*, 1985, 17, 1127.

0147-1503/04/01-7354-00

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Int. DATA Ser., Sel. Data Mixtures, Ser. A 2004, 32 (1), 61-75

Compiled by Thermodynamics Research Center

Components: 1. Methyl octanoate, C₉H₁₈O₂ [111-11-5]
2. Decane, C₁₀H₂₂ [124-18-5]
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: Ortega, J. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, 35071 Las Palmas de Gran Canaria, Canary Islands, Spain)
Edited by: Skrzecz, A.; Mączynski, A. (Instytut Chemii Fizycznej, Polska Akademia Nauk, ul. Kasprzaka 44/52, 01-224 Warszawa, Poland)

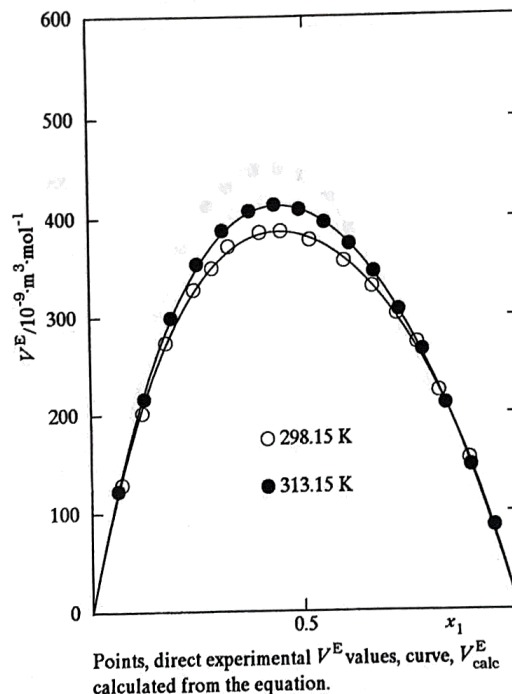
SOURCE OF DATA

Ortega, J.; Sabater, G.; Dieppa, R.; Navas, A.; Marrero, E.; Espiau, F. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P = 101.325 kPa

T/K = 298.15		T/K = 313.15	
x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹
0.0707	129	0.0622	123
0.1196	202	0.1250	216
0.1765	274	0.1898	299
0.2433	328	0.2515	354
0.2857	350	0.3115	388
0.3240	372	0.3731	408
0.3989	386	0.4317	414
0.4473	387	0.4909	409
0.5159	378	0.5485	396
0.5954	357	0.6079	374
0.6613	331	0.6652	346
0.7189	303	0.7224	307
0.7663	273	0.7786	266
0.8168	223	0.8328	210
0.8880	154	0.8903	147
		0.9440	86



SMOOTHING EQUATION

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

Coefficients a_i in the smoothing equation, standard deviation σ_d, and maximum deviation δ_m determined by least-squares analysis.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	10 ⁻⁹ m ³ ·mol ⁻¹						
298.15	1534.8 (6.5)	-272.3 (12.2)	370 (30)			3.5	5.3
313.15	1636.4 (4.9)	-337.5 (9.8)	246 (22)			2.8	5.8

The standard deviations σ(a_i) of the coefficients a_i are given in parentheses
δ_m = max |V^E_{calc} - V^E|; σ_d = [Σ(V^E_{calc} - V^E)²/(N - n)]^{1/2}
N, number of direct experimental values; n, number of coefficients a_i
All direct experimental values equally weighted

AUXILIARY INFORMATION

Apparatus: The density was determined by an Anton Paar Model DMA-58 vibrating-tube digital densimeter with a precision of ±0.02 kg·m⁻³. The temperature was controlled to ±0.01 K with a Heto ultrathermostat.

Procedure: The procedure was described in ref. 2. Mixtures were prepared by weighing in hermetically sealed 2.5 cm³ glass vials. The apparatus was calibrated with doubly distilled and degassed water and nonane.

Materials: 1. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4150, n(D, 313.15 K) = 1.4090, ρ(298.15 K)/kg·m⁻³ = 872.31, ρ(313.15 K)/kg·m⁻³ = 859.28.
2. Fluka AG (Buchs, St. Gallen, Switzerland), "purum" grade material; purity > 98.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4095, n(D, 313.15 K) = 1.4030, ρ(298.15 K)/kg·m⁻³ = 726.21, ρ(313.15 K)/kg·m⁻³ = 714.75.

Errors: |δT|/K = 0.02; |δx₁| = 0.0005; |δV^E|/10⁻⁹·m³·mol⁻¹ < 4.

REFERENCES

- Int. DATA Ser., Ser. A, Guideline 3b, 1994, 22(1).
- Ortega, J.; Matos, J. S.; Paz-Andrade, M. I.; Jiménez, E. J. Chem. Thermodyn., 1985, 17, 1127.

SELECTED DATA ON MIXTURES
International DATA Series*

2c. EXCESS VOLUME

National Institute of Standards and Technology, Boulder, CO 80305-3328

Compiled by Thermodynamics Research Center

Components: 1. Decane, C₁₀H₂₂ [124-18-5]
2. Methyl decanoate, C₁₁H₂₂O₂ [110-42-9]
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: Ortega, J. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, 35071 Las Palmas de Gran Canaria, Canary Islands, Spain)

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

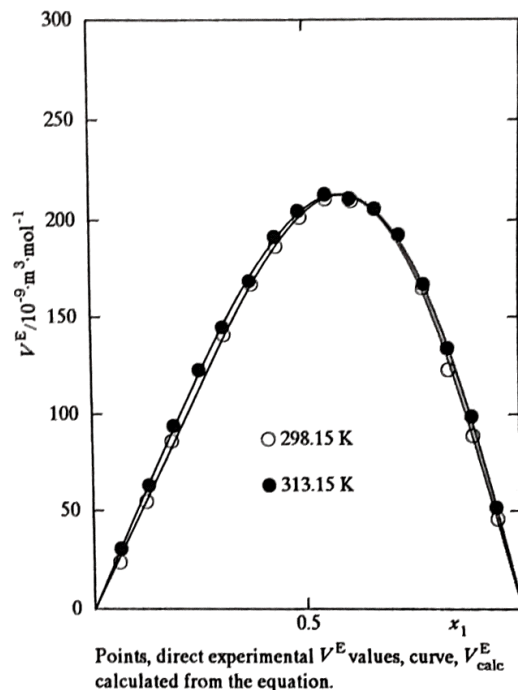
SOURCE OF DATA

Ortega, J.; Sabater, G.; Dieppa, R.; Navas, A.; Marrero, E.; Espiau, F. (Laboratorio de Termodinámica y Fisicoquímica, Escuela Superior de Ingenieros Industriales, Universidad de Las Palmas de Gran Canaria, Canary Islands, Spain); FIRST PUBLISHED RESULTS

DIRECT EXPERIMENTAL VALUES

Notes: P = 101.325 kPa

T/K = 298.15		T/K = 313.15					
x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹	x ₁	V ^E /10 ⁻⁹ m ³ ·mol ⁻¹				
0.0605	24	0.0636	31				
0.1243	55	0.1311	63				
0.1867	86	0.1904	94				
0.3122	141	0.2521	123				
0.3786	167	0.3094	145				
0.4363	187	0.3739	169				
0.4941	202	0.4345	192				
0.5535	211	0.4898	205				
0.6139	210	0.5525	213				
0.6682	206	0.6088	211				
0.7235	193	0.6671	206				
0.7787	165	0.7225	193				
0.8370	123	0.7801	167				
0.8922	89	0.8361	134				
0.9459	46	0.8895	99				
		0.9427	52				



SMOOTHING EQUATION

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

Coefficients a_i in the smoothing equation, standard deviation σ_d, and maximum deviation δ_m determined by least-squares analysis.

T/K	a ₁	a ₂	a ₃	a ₄	a ₅	σ _d	δ _m
	10 ⁻⁹ m ³ ·mol ⁻¹						
298.15	816.1 (4.8)	402.2 (19.5)	-172.8 (22.3)	-219 (48)		2.7	5.5
313.15	823.8 (2.8)	352.0 (10.8)	-84.7 (12.8)	-116 (28)		1.6	2.2

The standard deviations σ_{a_i} of the coefficients a_i are given in parentheses
δ_m = max |V^E_{calc} - V^E|; σ_d = [Σ(V^E_{calc} - V^E)² / (N - n)]^{1/2}
N, number of direct experimental values; n, number of coefficients a_i
All direct experimental values equally weighted

AUXILIARY INFORMATION

Apparatus: The density was determined by an Anton Paar Model DMA-58 vibrating-tube digital densimeter with a precision of ±0.02 kg·m⁻³. The temperature was controlled to ±0.01 K with a Heto ultrathermostat.

Procedure: The procedure was described in ref. 2. Mixtures were prepared by weighing in hermetically sealed 2.5 cm³ glass vials. The apparatus was calibrated with doubly distilled and degassed water and nonane.

Materials: 1. Fluka AG (Buchs, St. Gallen, Switzerland), "puriss" grade material; purity > 99.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4233, n(D, 313.15 K) = 1.4181, ρ(298.15 K)/kg·m⁻³ = 868.19, ρ(313.15 K)/kg·m⁻³ = 856.35.
2. Fluka AG (Buchs, St. Gallen, Switzerland), "purum" grade material; purity > 98.0 mole % by glc; degassed ultrasonically, dried over molecular sieves 3A; n(D, 298.15 K) = 1.4095, n(D, 313.15 K) = 1.4030, ρ(298.15 K)/kg·m⁻³ = 726.21, ρ(313.15 K)/kg·m⁻³ = 714.75.

Errors: |δT|/K = 0.02; |δx₁| = 0.0005; |δV^E|/10⁻⁹·m³·mol⁻¹ < 4.

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