

<p>COMPONENTS:</p> <p>(1) Methane; CH₄; [74-82-8]</p> <p>(2) Arenes Benzene Methylbenzene Dimethylbenzenes 1,1'-Methylenebisbenzene 1-Methylnaphthalene Decahydronaphthalene</p>	<p>EVALUATOR:</p> <p>H. Lawrence Clever Chemistry Department Emory University Atlanta, GA 30322 USA</p> <p>1984, January</p>
<p>CRITICAL EVALUATION:</p> <p style="text-align: center;">The Solubility of Methane in Arenes at Partial Pressures up to 200 kPa (ca. 2 atm).</p> <p>The solubility of methane in arenes at methane partial pressures up to 200 kPa is reported in nine papers. With one exception all of the solubilities were measured by volumetric methods at a total pressure near 101 kPa (ca. 1 atm). The exception (ref. 5) used a GLC system to analyze the saturated solution.</p> <p>The partial molal enthalpy change on solution is less exothermic for the arenes than for the alkanes. For the methane + benzene it is -1.23 kJ mol⁻¹ while for the other methyl substituted benzenes it ranges from -2.6 to -4.3 kJ mol⁻¹. Most of the methyl substituted enthalpy change values are intermediate between the benzene and alkane values. Enthalpy changes based on the temperature coefficient of solubility are probably not reliable enough to base any far reaching conclusions on when they show as little difference as do these values.</p> <p style="text-align: center;">Methane + Benzene; C₆H₆; [71-43-2]</p> <p>McDaniel (ref. 1) reports four solubility values between 295.25 and 323.05 K; Horiuti (ref. 2) reports four values between 286.25 and 333.15 K, Lannung and Gjaldbaek (ref. 3) report six values between 291.15 and 310.15 K and Hayduk and Buckley (ref. 4) report one value at 298.15 K.</p> <p>The smoothed McDaniel data are smaller by 9 percent at 293 K and 35 percent at 323 K than the data in (ref. 2,3). McDaniel's data are rejected.</p> <p>The smoothed data of Horiuti and of Lannung and Gjaldbaek agree within 0.5 to 1.5 percent between 288 and 308 K with the Lannung and Gjaldbaek solubility values the larger. Hayduk and Buckley's single value at 298.15 K is between 1 and 2 percent smaller than the values from the other two papers.</p> <p>The data of Horiuti, Lannung and Gjaldbaek, and Hayduk and Buckley were combined in a linear regression to obtain the equation</p> $\ln x_1 = -6.66791 + 1.47786/(T/100 \text{ K})$ <p>with a standard error about the regression line of 1.7×10^{-5}.</p> <p>The temperature independent thermodynamic changes calculated from the constants of the equation are</p> $\Delta \bar{H}_1^\circ / \text{kJ mol}^{-1} = -1.23 \quad \text{and} \quad \Delta \bar{S}_1^\circ / \text{J K}^{-1} \text{ mol}^{-1} = -55.4$ <p>Smoothed values of the mole fraction solubility and partial molal Gibbs energy of solution are given in Table 1.</p>	

Table 1. Solubility of methane in benzene. Tentative mole fraction solubility at 101.325 (1 atm) methane partial pressure and partial Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction	$\Delta\bar{G}_1^\circ/\text{kJ mol}^{-1}$
	$10^3 x_1$	
283.15	2.14	14.469
293.15	2.10	15.023
298.15	2.05	15.300
303.15	2.07	15.578
313.15	2.04	16.132
323.15	2.01	16.686
333.15	1.98	17.241

Methane + Methylbenzene; C_7H_8 ; [108-88-3]

McDaniel (ref. 1) reports four values of the solubility of methane in methylbenzene between 303.15 and 333.15 K and Field, Wilhelm and Battino (ref. 7) report three values of temperatures between 284.28 and 313.17 K.

The McDaniel data are 10 percent smaller than the Field *et al.* data over the temperature interval of common measurement. Although both data sets are classed as tentative the data of Field, Wilhelm and Battino are preferred and the tentative values below are based on their data.

A linear regression of the data of Field *et al.* gives the equation

$$\ln x_1 = -7.79695 + 5.22144/(T/100 \text{ K})$$

with a standard error about the regression line of 1.66×10^{-4} .

The thermodynamic changes for the transfer of one mole of gas from the gas phase to the infinitely dilute solution are

$$\Delta H_1^\circ/\text{kJ mol}^{-1} = -4.34 \quad \text{and} \quad \Delta S_1^\circ/\text{J K}^{-1} \text{ mol}^{-1} = -64.8$$

We are concerned that this is larger by about 25 percent than any of the other enthalpies of solution in benzene and methyl substituted benzenes.

Smoothed values of the mole fraction solubility and partial molal Gibbs energy of solution are in Table 2.

Table 2. Solubility of methane in methylbenzene. Tentative values of the mole fraction solubility at 101.325 kPa methane partial pressure and partial molal Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction	$\Delta\bar{G}_1^\circ/\text{kJ mol}^{-1}$
	$10^3 x_1$	
283.15	2.60	14.014
293.15	2.44	14.663
298.15	2.37	14.987
303.15	2.30	15.311
313.15	2.18	15.959

<p>COMPONENTS:</p> <p>(1) Methane; CH₄; [74-82-8]</p> <p>(2) Arenes Benzene Methylbenzene Dimethylbenzenes 1,1'-Methylenebisbenzene 1-Methylnaphthalene Decahydronaphthalene</p>	<p>EVALUATOR:</p> <p>H. Lawrence Clever Chemistry Department Emory University Atlanta, GA 30322 USA</p> <p>1984, January</p>																
<p>CRITICAL EVALUATION:</p> <p>Methane + 1,2-Dimethylbenzene; C₈H₁₀; [95-47-6]</p> <p>Methane + 1,3-Dimethylbenzene; C₈H₁₀; [108-38-3]</p> <p>Methane + 1,4-Dimethylbenzene; C₈H₁₀; [106-42-3]</p> <p>Byrne, Battino and Wilhelm (ref. 9) report between 5 and 7 solubility values each for these systems over the 283 to 313 K temperature interval. McDaniel reports four solubility values for the methane + 1,3-dimethylbenzene system at temperatures between 294.25 and 333.15 K.</p> <p>All of the data are classed as tentative. For the methane + 1,3-dimethylbenzene system McDaniel's smoothed data are 5.2 to 5.4 percent smaller than the smoothed results of Byrne, Battino and Wilhelm. The agreement is within the experimental error. However, the Byrne <i>et al.</i> data are preferred and their data are the basis of all the smoothed data presented here. The data were fitted to the following equations by a linear regression.</p> <p>Methane + 1,2-dimethylbenzene</p> $\ln x_1 = -7.03873 + 3.13979/(T/100 \text{ K})$ <p>Methane + 1,3-dimethylbenzene</p> $\ln x_1 = -7.06540 + 3.44764/(T/100 \text{ K})$ <p>Methane + 1,4-dimethylbenzene</p> $\ln x_1 = -7.20727 + 4.01581/(T/100 \text{ K})$ <p>with standard errors about the regression lines of 7.9×10^{-6}, 9.7×10^{-6}, and 18.2×10^{-6}, respectively.</p> <p>The temperature independent thermodynamic changes for the transfer of one mole of methane from the gas phase to the infinitely dilute solution are given in Table 3.</p> <p>Table 3. Thermodynamic values for the transfer of methane from the gas to the infinitely dilute solution in dimethylbenzenes.</p>																	
<table border="1"> <thead> <tr> <th>Solvent</th> <th>$\Delta\bar{H}_1^\circ/\text{kJ mol}^{-1}$</th> <th>$\Delta\bar{S}_1^\circ/\text{J K}^{-1} \text{ mol}^{-1}$</th> <th>$\Delta\bar{G}_1^\circ/\text{kJ mol}^{-1}$</th> </tr> </thead> <tbody> <tr> <td>1,2-Dimethylbenzene</td> <td>-2.61</td> <td>-58.5</td> <td>14.838^a</td> </tr> <tr> <td>1,3-Dimethylbenzene</td> <td>-2.87</td> <td>-58.7</td> <td>14.648^a</td> </tr> <tr> <td>1,4-Dimethylbenzene</td> <td>-3.34</td> <td>-59.9</td> <td>14.527^a</td> </tr> </tbody> </table>		Solvent	$\Delta\bar{H}_1^\circ/\text{kJ mol}^{-1}$	$\Delta\bar{S}_1^\circ/\text{J K}^{-1} \text{ mol}^{-1}$	$\Delta\bar{G}_1^\circ/\text{kJ mol}^{-1}$	1,2-Dimethylbenzene	-2.61	-58.5	14.838 ^a	1,3-Dimethylbenzene	-2.87	-58.7	14.648 ^a	1,4-Dimethylbenzene	-3.34	-59.9	14.527 ^a
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<p>^a The partial molar Gibbs energy values are for a temperature of 298.15 K. The smoothed solubility values are given in Table 4.</p>																	

Table 4. Tentative values of the solubility of methane in the dimethylbenzenes. Mole fraction solubility at 101.325 kPa partial pressure methane as a function of temperature.

T/K	Mole Fraction, $10^3 x_1$		
	1,2-Dimethylbenzene	1,3-Dimethylbenzene	1,4-Dimethylbenzene
283.15	2.66	2.89	3.06
293.15	2.56	2.77	2.91
298.15	2.51	2.71	2.85
303.15	2.47	2.66	2.79
313.15	2.39	2.57	2.67

Methane + 1,1'-Methylenebisbenzene; $C_{13}H_{12}$; [101-81-5]

Cukor and Prausnitz (ref. 6) report Henry's constant values at 25 degree intervals from 300 to 475 K. The solubility values were converted to mole fraction values at a 101.325 kPa methane partial pressure assuming ideal gas behavior and Henry's law to be obeyed. The results are classed as tentative.

The solubility shows a minimum in the temperature range. The values were fitted to a three constant equation by a linear regression to obtain

$$\ln x_1 = -12.53866 + 10.12809/(T/100 \text{ K}) + 2.59305 \ln(T/100 \text{ K})$$

with a standard error about the regression line of 1.26×10^{-5} .

Values of the thermodynamic changes for the transfer of methane from the gas phase at 101.325 kPa to the infinitely dilute solution at several temperatures are as follows:

T/K	$\Delta \bar{H}_1^\circ / \text{kJ mol}^{-1}$	$\Delta \bar{S}_1^\circ / \text{J K}^{-1} \text{ mol}^{-1}$	$\Delta \bar{C}_{P1}^\circ / \text{J K}^{-1} \text{ mol}^{-1}$
298.15	-1.99	-59.1	21.6
323.15	-1.45	-57.4	21.6
373.15	-0.38	-54.3	21.6
423.15	+0.70	-51.6	21.6
473.15	1.78	-49.2	21.6

Smoothed values of the solubility of methane and the partial molal Gibbs energy as a function of temperature are given in Table 5. The temperature of minimum solubility is 391 K.

Table 5. Tentative values of the solubility of methane in 1-methylnaphthalene. Mole fraction solubility of 101.325 kPa (1 atm) methane partial pressure and partial molal Gibbs energy as a function of temperature.

T/K	Mol Fraction $10^3 x_1$	$\Delta \bar{G}_1^\circ / \text{kJ mol}^{-1}$
298.15	1.58	15.988
323.15	1.47	17.531
348.15	1.40	19.018
373.15	1.37	20.453
391	1.36	21.621
398.15	1.36	21.839
423.15	1.38	23.181
448.15	1.40	24.479
473.15	1.44	25.737

COMPONENTS: (1) Methane; CH ₄ ; [74-82-8] (2) Arenes Benzene Methylbenzene Dimethylbenzenes 1,1'-Methylenebisbenzene 1-Methylnaphthalene Decahydronaphthalene	EVALUATOR: H. Lawrence Clever Chemistry Department Emory University Atlanta, GA 30322 USA 1984, January
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CRITICAL EVALUATION:

Methane + Decahydronaphthalene; C₁₀H₁₈; [91-17-8]

Lenoir, Renault, and Renon (ref. 5) report solubility values at two temperatures of 298.2 and 323.2 K. The values are classed as tentative, but there is some concern regarding the results because of the large magnitude of the enthalpy of solution relative to similar solvents.

The solubility data are reproduced by the equation

$$\ln x_1 = -8.7721 + 8.7034/(T/100 \text{ K})$$

which gives temperature independent thermodynamic changes for the transfer of methane from the gas at 101.325 kPa to the infinitely dilute solution of

$$\bar{H}_1^\circ/\text{kJ mol}^{-1} = -7.24 \quad \text{and} \quad \bar{S}_1^\circ/\text{J K}^{-1} \text{ mol}^{-1} = -72.9$$

The values are of larger magnitude than normally observed for either alkane or arene solvents.

Smoothed values of solubility and partial molal Gibbs energy of solution are given in Table 6.

Table 6. Tentative values of the solubility of methane in decahydronaphthalene or decalin. Mole fraction solubility at 101.325 kPa methane partial pressure and partial molal Gibbs energy of solution as a function of temperature.

T/K	Mol Fraction 10 ³ x ₁	ΔG ₁ ^o /kJ mol ⁻¹
298.15	2.87	14.513
303.15	2.74	14.877
313.15	2.50	15.607
323.15	2.29	16.336

References

- McDaniel, A. S. *J. Phys. Chem.* 1911, *15*, 587.
- Horiuti, J. *Sci. Pap. Inst. Phys. Chem. Res. (JPN)*, 1931/32, *17*, 125.
- Lannung, A.; Gjaldbaek, J. C. *Acta Chem. Scand.* 1960, *14*, 1124.
- Hayduk, W.; Buckley, W. D. *Can. J. Chem. Eng.* 1971, *49*, 667.
- Lenoir, J-Y.; Renault, P.; Renon, H. *J. Chem. Eng. Data*, 1971, *16*, 340.
- Cukor, P. M.; Prausnitz, J. M. *J. Phys. Chem.* 1972, *76*, 598.
- Field, L. R.; Wilhelm, E.; Battino, R. *J. Chem. Thermodyn.* 1974, *6*, 237.
- Chappelow, C. C.; Prausnitz, J. M. *Am. Inst. Chem. Engrs. J.* 1974, *20*, 1097.
- Byrne, J. E.; Battino, R.; Wilhelm, E. *J. Chem. Thermodyn.* 1975, *7*, 515.

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<p>^aBunsen coefficient, α/cm^3 (STP) $cm^{-3}\ atm^{-1}$.</p> <p>^bListed as absorption coefficient in the original paper. Interpreted to be equivalent to Ostwald coefficient by compiler.</p> <p>^cOstwald coefficient (absorption coefficient) estimated as 298.15 K value by author.</p> <p>^dMole fraction and Bunsen coefficient values calculated by compiler assuming ideal gas behavior.</p>																																				
<p>EVALUATOR'S COMMENT: McDaniel's data should be used with caution. His values are often 20 percent or more too small when compared with more reliable data.</p>																																				
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METHOD/APPARATUS/PROCEDURE: The apparatus is all glass. It consists of a gas buret connected to a contacting vessel. The solvent is degassed by boiling under reduced pressure. Gas pressure or volume is adjusted using mercury displacement. Equilibration is achieved at atm pressure by hand shaking, and incrementally adding gas to the contacting chamber. Solubility measured by obtaining total uptake of gas by known volume of the solvent.	SOURCE AND PURITY OF MATERIALS: (1) Methane. Prepared by reaction of methyl iodide with zinc-copper. Passed through water and sulfuric acid. (2) Benzene. Source not given.																																			
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EXPERIMENTAL VALUES: <table border="1" data-bbox="216 479 1064 653"> <thead> <tr> <th>T/K</th> <th>Mol Fraction 10³x₁</th> <th>Bunsen Coefficient α/cm³ (STP) cm⁻³ atm⁻¹</th> <th>Ostwald Coefficient L/cm³ cm⁻³</th> </tr> </thead> <tbody> <tr> <td>286.25</td> <td>2.130</td> <td>0.5427</td> <td>0.5687</td> </tr> <tr> <td>293.15</td> <td>2.094</td> <td>0.5292</td> <td>0.5680</td> </tr> <tr> <td>303.15</td> <td>2.056</td> <td>0.5133</td> <td>0.5697</td> </tr> <tr> <td>333.15</td> <td>1.972</td> <td>0.4745</td> <td>0.5787</td> </tr> </tbody> </table> <p data-bbox="142 661 1240 711">The mole fraction and Bunsen coefficient values were calculated by the compiler with the assumption the gas is ideal and that Henry's law is obeyed.</p> <p data-bbox="142 719 900 745">Smoothed Data: For use between 286.25 and 333.15 K.</p> $\ln x_1 = -6.6908 + 1.5351/(T/100K)$ <p data-bbox="259 792 1133 818">The standard error about the regression line is 6.44 x 10⁻⁶.</p> <table border="1" data-bbox="477 828 828 1010"> <thead> <tr> <th>T/K</th> <th>Mol Fraction 10³x₁</th> </tr> </thead> <tbody> <tr> <td>288.15</td> <td>2.116</td> </tr> <tr> <td>298.15</td> <td>2.079</td> </tr> <tr> <td>308.15</td> <td>2.044</td> </tr> <tr> <td>318.15</td> <td>2.013</td> </tr> <tr> <td>328.15</td> <td>1.983</td> </tr> </tbody> </table>		T/K	Mol Fraction 10 ³ x ₁	Bunsen Coefficient α/cm ³ (STP) cm ⁻³ atm ⁻¹	Ostwald Coefficient L/cm ³ cm ⁻³	286.25	2.130	0.5427	0.5687	293.15	2.094	0.5292	0.5680	303.15	2.056	0.5133	0.5697	333.15	1.972	0.4745	0.5787	T/K	Mol Fraction 10 ³ x ₁	288.15	2.116	298.15	2.079	308.15	2.044	318.15	2.013	328.15	1.983
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METHOD/APPARATUS/PROCEDURE: <p data-bbox="137 1294 691 1463">The apparatus consists of a gas buret, a solvent reservoir, and an absorption pipet. The volume of the pipet is determined at various meniscus heights by weighing a quantity of water. The meniscus height is read with a cathetometer.</p> <p data-bbox="137 1487 683 1749">The dry gas is introduced into the degassed solvent. The gas and solvent are mixed with a magnetic stirrer until saturation. Care is taken to prevent solvent vapor from mixing with the solute gas in the gas buret. The volume of gas is determined from the gas buret readings, the volume of solvent is determined from the meniscus height in the absorption pipet.</p>	SOURCE AND PURITY OF MATERIALS: (1) Methane. Aluminum carbide was prepared from aluminum and soot carbon. The aluminum carbide was treated with hot water. The gas evolved was scrubbed to remove impurities, dried and fractionated. Final product had a density, ρ/g dm ⁻³ = 0.7168±0.0003 at normal conditions. (2) Benzene. Merck. Extra pure and free of sulfur. Refluxed with sodium amalgam, distilled. Boiling point(760 mmHg) 80.18°C.																																
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<p>Smoothed Data: For use between 291.15 and 310.15 K.</p> $\ln x_1 = -6.5770 + 1.2198/(T/100 \text{ K})$ <p>The standard error about the regression line is 1.37×10^{-5}.</p>																													
<table border="1"> <thead> <tr> <th>T/K</th> <th>Mol Fraction $10^3 x_1$</th> </tr> </thead> <tbody> <tr><td>298.15</td><td>2.095</td></tr> <tr><td>308.15</td><td>2.07</td></tr> </tbody> </table>		T/K	Mol Fraction $10^3 x_1$	298.15	2.095	308.15	2.07																						
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METHOD/APPARATUS/PROCEDURE: A calibrated all-glass combined manometer and bulb containing degassed solvent and the gas was placed in an air thermostat and shaken until equilibrium (1). The absorbed volume of gas is calculated from the initial and final amounts, both saturated with solvent vapor. The amount of solvent is determined by the weight of displaced mercury. The values are at 101.325 kPa (1 atm) pressure assuming Henry's law is obeyed.	SOURCE AND PURITY OF MATERIALS: (1) Methane. Generated from magnesium methyl iodide. Purified by fractional distillation. Specific gravity corresponds with mol wt 16.08. (2) Benzene. Kahlbaum. "Zur molekulargewichtsbestimmung." M.p./°C = 5.48. ESTIMATED ERROR: $\delta T/K = \pm 0.05$ $\delta x_1/x_1 = \pm 0.015$																												
REFERENCES: 1. Lannung, A. <i>J. Am. Chem. Soc.</i> <u>1930</u> , <i>52</i> , 68.																													

COMPONENTS: (1) Methane; CH ₄ ; [74-82-8] (2) Benzene; C ₆ H ₆ ; [71-43-2]	ORIGINAL MEASUREMENTS: Hayduk, W.; Buckley, W.D. <i>Can. J. Chem. Eng.</i> <u>1971</u> , <i>49</i> , 667-671.										
VARIABLES: T/K: 298.15 P/kPa: 101.325	PREPARED BY: W. Hayduk										
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<table border="1"> <thead> <tr> <th>T/K</th> <th>Ostwald Coefficient¹ L/cm³ cm⁻³</th> <th>Bunsen Coefficient² α/cm³ (STP) cm⁻³ atm⁻¹</th> <th>Mole Fraction 10⁴ x₁</th> <th>10⁻⁴ΔG°³ /J mol⁻¹</th> </tr> </thead> <tbody> <tr> <td>298.15</td> <td>0.565</td> <td>0.518</td> <td>20.6</td> <td>1.533</td> </tr> </tbody> </table>		T/K	Ostwald Coefficient ¹ L/cm ³ cm ⁻³	Bunsen Coefficient ² α/cm ³ (STP) cm ⁻³ atm ⁻¹	Mole Fraction 10 ⁴ x ₁	10 ⁻⁴ ΔG° ³ /J mol ⁻¹	298.15	0.565	0.518	20.6	1.533
T/K	Ostwald Coefficient ¹ L/cm ³ cm ⁻³	Bunsen Coefficient ² α/cm ³ (STP) cm ⁻³ atm ⁻¹	Mole Fraction 10 ⁴ x ₁	10 ⁻⁴ ΔG° ³ /J mol ⁻¹							
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<p>¹Original data.</p> <p>²Calculated by compiler.</p> <p>³Calculated by compiler from the following equation:</p> $\Delta G^\circ / \text{J mol}^{-1} = -RT \ln x_1$											
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METHOD/APPARATUS/PROCEDURE: A volumetric method using a glass apparatus was employed. Degassed solvent contacted the gas while flowing as a thin film, at a constant rate, through an absorption spiral into a solution buret. A constant solvent flow was obtained by means of a calibrated syringe pump. The solution at the end of the spiral was considered saturated. Dry gas was maintained at atmospheric pressure in a gas buret by mechanically raising the mercury level in the buret at an adjustable rate. The solubility was calculated from the constant slope of volume of gas dissolved and volume of solvent injected. Degassing was accomplished using a two stage vacuum process described by Clever et al. (1).	SOURCE AND PURITY OF MATERIALS: 1. Matheson Co. Specified as ultra high purity grade of 99.97 per cent. 2. Canlab. Chromatoquality grade of specified minimum purity of 99.0 per cent. ESTIMATED ERROR: $\delta T/K = 0.1$ $\delta x_1/x_1 = 0.01$ REFERENCES: 1. Clever, H.L.; Battino, R.; Saylor, J.H.; Gross, P.M. <i>J. Phys. Chem.</i> <u>1971</u> , <i>61</i> , 1078.										

COMPONENTS: (1) Methane; CH ₄ ; [74-82-8] (2) Methylbenzene or toluene; C ₇ H ₈ ; [108-88-3]	ORIGINAL MEASUREMENTS: McDaniel, A. S. <i>J. Phys. Chem.</i> <u>1911</u> , <i>15</i> , 587-610.																																			
VARIABLES: $T/K = 298.15 - 333.15$ $p_1/kPa = 101.3 (1 \text{ atm})$	PREPARED BY: H. L. Clever																																			
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VARIABLES: <i>T</i> /K: 284.28 - 313.17 <i>P</i> /kPa: 101.325 (1 atm)	PREPARED BY: H. L. Clever																												
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COMPONENTS: (1) Methane; CH ₄ ; [74-82-8] (2) 1,2-Dimethylbenzene or <i>o</i> -xylene; C ₈ H ₁₀ ; [95-47-6]	ORIGINAL MEASUREMENTS: Byrne, J. E.; Battino, R.; Wilhelm, E. <i>J. Chem. Thermodyn.</i> <u>1975</u> , <i>7</i> , 515-522.																																				
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VARIABLES: T/K : 283.13 - 313.21 p_1/kPa : 101.325 (1 atm)	PREPARED BY: H. L. Clever A. L. Cramer

EXPERIMENTAL VALUES:

T/K	Mol Fraction $10^3 x_1$	Bunsen Coefficient $\alpha/cm^3 (STP) cm^{-3} atm^{-1}$	Ostwald Coefficient $L/cm^3 cm^{-3}$
283.13	2.885	0.5330	0.5525
283.21	2.891	0.5341	0.5538
298.09	2.709	0.4928	0.5378
298.17	2.713	0.4935	0.5387
313.14	2.556	0.4581	0.5252
313.14	2.584	0.4631	0.5309
313.21	2.569	0.4603	0.5278

The Bunsen coefficients were calculated by the compiler. The solubility values were adjusted to a methane partial pressure of 101.325 kPa (1 atm) by Henry's law.

Smoothed Data: For use between 283.15 and 313.21 K.

$$\ln x_1 = -7.0654 + 3.4476/(T/100 \text{ K})$$

The standard error about the regression line is 9.72×10^{-6} .

T/K	Mol Fraction $10^3 x_1$
283.15	2.886
293.15	2.769
298.15	2.715
303.15	2.663
313.15	2.568

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE: The solubility apparatus is based on the design of Morrison and Billett (1) and the version used is described by Battino, Evans, and Danforth (2). The degassing apparatus is that described by Battino, Banzhof, Bogan, and Wilhelm (3). Degassing. Up to 500 cm ³ of solvent is placed in a flask of such size that the liquid is about 4 cm deep. The liquid is rapidly stirred, and vacuum is applied intermittently through a liquid N ₂ trap until the permanent gas residual pressure drops to 5 microns. Solubility Determination. The degassed solvent is passed in a thin film down a glass helical tube containing solute gas plus the solvent vapor at a total pressure of one atm. The volume of gas absorbed is found by difference between the initial and final volumes in the buret system. The solvent is collected in a tared flask and weighed.	SOURCE AND PURITY OF MATERIALS: (1) Methane. Either Air Products & Chemicals, Inc., or Matheson Co., Inc. 99 mol per cent or better. (2) 1,3-Dimethylbenzene. Phillips Petroleum Co. Pure grade.
	ESTIMATED ERROR: $\delta T/K = 0.03$ $\delta P/mmHg = 0.5$ $\delta x_1/x_1 = 0.005$
	REFERENCES: 1. Morrison, T. J.; Billett, F. <i>J. Chem. Soc.</i> <u>1948</u> , 2033. 2. Battino, R.; Evans, F. D.; Danforth, W. F. <i>J. Am. Oil Chem. Soc.</i> <u>1968</u> , <i>45</i> , 830. 3. Battino, R.; Banzhof, M.; Bogan, M.; Wilhelm, E. <i>Anal. Chem.</i> <u>1971</u> , <i>43</i> , 806.

COMPONENTS: (1) Methane; CH ₄ ; [74-82-8] (2) 1,4-Dimethylbenzene or <i>p</i> -xylene; C ₈ H ₁₀ ; [106-42-3]	ORIGINAL MEASUREMENTS: Byrne, J. E.; Battino, R.; Wilhelm, E. <i>J. Chem. Thermodyn.</i> <u>1975</u> , <i>7</i> , 515-522.																																						
VARIABLES: T/K : 287.94 - 313.18 p_1/kPa : 101.325 (1 atm)	PREPARED BY: H. L. Clever																																						
EXPERIMENTAL VALUES: <table border="1" data-bbox="246 483 1111 756"> <thead> <tr> <th>T/K</th> <th>Mol Fraction $10^3 x_1$</th> <th>Bunsen Coefficient $\alpha/cm^3 (STP) cm^{-3} atm^{-1}$</th> <th>Ostwald Coefficient $L/cm^3 cm^{-3}$</th> </tr> </thead> <tbody> <tr><td>287.94</td><td>2.995</td><td>0.5490</td><td>0.5787</td></tr> <tr><td>288.18</td><td>2.976</td><td>0.5454</td><td>0.5754</td></tr> <tr><td>298.12</td><td>2.831</td><td>0.5134</td><td>0.5603</td></tr> <tr><td>298.14</td><td>2.878</td><td>0.5219</td><td>0.5697</td></tr> <tr><td>313.14</td><td>2.675</td><td>0.4778</td><td>0.5477</td></tr> <tr><td>313.18</td><td>2.666</td><td>0.4761</td><td>0.5459</td></tr> </tbody> </table> <p data-bbox="137 766 1207 836">The Bunsen coefficients were calculated by the compiler. The solubility values were adjusted to a methane partial pressure of 101.325 kPa (1 atm) by Henry's law.</p> <p data-bbox="137 846 891 876">Smoothed Data: For use between 287.94 and 313.18 K.</p> $\ln x_1 = -7.2073 + 4.0158/(T/100 \text{ K})$ <p data-bbox="260 917 1138 947">The standard error about the regression line is 1.82×10^{-5}.</p> <table border="1" data-bbox="480 957 823 1159"> <thead> <tr> <th>T/K</th> <th>Mol Fraction $10^3 x_1$</th> </tr> </thead> <tbody> <tr><td>293.15</td><td>2.916</td></tr> <tr><td>298.15</td><td>2.850</td></tr> <tr><td>303.15</td><td>2.788</td></tr> <tr><td>313.15</td><td>2.672</td></tr> </tbody> </table>		T/K	Mol Fraction $10^3 x_1$	Bunsen Coefficient $\alpha/cm^3 (STP) cm^{-3} atm^{-1}$	Ostwald Coefficient $L/cm^3 cm^{-3}$	287.94	2.995	0.5490	0.5787	288.18	2.976	0.5454	0.5754	298.12	2.831	0.5134	0.5603	298.14	2.878	0.5219	0.5697	313.14	2.675	0.4778	0.5477	313.18	2.666	0.4761	0.5459	T/K	Mol Fraction $10^3 x_1$	293.15	2.916	298.15	2.850	303.15	2.788	313.15	2.672
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COMPONENTS:		ORIGINAL MEASUREMENTS:	
1. Methane; CH ₄ ; [74-82-8] 2. 1-Methylnaphthalene; C ₁₁ H ₁₀ ; [1321-94-4]		Chappelow, C.C.; Prausnitz, J.M. <i>Am. Inst. Chem. Engrs. J.</i> <u>1974</u> , 20, 1097-1104.	
VARIABLES:		PREPARED BY:	
Temperature		C.L. Young	
EXPERIMENTAL VALUES:			
T/K	Henry's Constant ^a /atm	Mole fraction ^b of methane at 1 atm. partial pressure, x_{CH_4}	
300	644	0.00155	
325	676	0.00148	
350	705	0.00142	
375	728	0.00137	
400	740	0.00135	
425	738	0.00136	
450	719	0.00139	
475	680	0.00147	
a. Authors stated measurements were made at several pressures and values of solubility used were all within the Henry's Law region.			
b. Calculated by compiler assuming linear relationship between mole fraction and pressure.			
AUXILIARY INFORMATION			
METHOD/APPARATUS/PROCEDURE:		SOURCE AND PURITY OF MATERIALS:	
Volumetric apparatus similar to that described by Dymond and Hildebrand (1). Pressure measured with a null detector and precision gauge. Details in ref. (2).		Solvent degassed, no other details given.	
		ESTIMATED ERROR:	
		$\delta T/K = \pm 0.1$; $\delta x_{CH_4} = \pm 1\%$	
		REFERENCES:	
		1. Dumond, J.; Hildebrand, J.H. <i>Ind. Eng. Chem. Fundam.</i> <u>1967</u> , <i>6</i> , 130. 2. Cukor, P.M.; Prausnitz, J.M. <i>Ind. Eng. Chem. Fundam.</i> <u>1971</u> , <i>10</i> , 638.	

COMPONENTS: 1. Methane; CH ₄ ; [74-82-8] 2. 1,1'-Methylenebisbenzene, (Diphenylmethane); C ₁₃ H ₁₂ ; [101-81-5]	ORIGINAL MEASUREMENTS: Cukor, P.M.; Prausnitz, J.M. <i>J. Phys. Chem.</i> <u>1972</u> , <i>76</i> , 598-601																											
VARIABLES: Temperature	PREPARED BY: C.L. Young																											
EXPERIMENTAL VALUES: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">T/K</th> <th style="text-align: center;">Henry's Constant^a /atm</th> <th style="text-align: center;">Mole fraction of methane^b in liquid, x_{CH_4}</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">300</td><td style="text-align: center;">555</td><td style="text-align: center;">0.00180</td></tr> <tr><td style="text-align: center;">325</td><td style="text-align: center;">579</td><td style="text-align: center;">0.00173</td></tr> <tr><td style="text-align: center;">350</td><td style="text-align: center;">597</td><td style="text-align: center;">0.00168</td></tr> <tr><td style="text-align: center;">375</td><td style="text-align: center;">608</td><td style="text-align: center;">0.00164</td></tr> <tr><td style="text-align: center;">400</td><td style="text-align: center;">611</td><td style="text-align: center;">0.00164</td></tr> <tr><td style="text-align: center;">425</td><td style="text-align: center;">608</td><td style="text-align: center;">0.00164</td></tr> <tr><td style="text-align: center;">450</td><td style="text-align: center;">597</td><td style="text-align: center;">0.00168</td></tr> <tr><td style="text-align: center;">475</td><td style="text-align: center;">579</td><td style="text-align: center;">0.00173</td></tr> </tbody> </table> <p>a. Quoted in supplementary material for original paper b. Calculated by compiler for a partial pressure of 1 atmosphere</p>		T/K	Henry's Constant ^a /atm	Mole fraction of methane ^b in liquid, x_{CH_4}	300	555	0.00180	325	579	0.00173	350	597	0.00168	375	608	0.00164	400	611	0.00164	425	608	0.00164	450	597	0.00168	475	579	0.00173
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COMPONENTS: 1. Methane; CH ₄ ; [74-82-8] 2. Decahydronaphthalene, (Decalin); C ₁₀ H ₁₈ ; [91-17-8]	ORIGINAL MEASUREMENTS: Lenoir, J-Y.; Renault, P.; Renon, H. <i>J. Chem. Eng. Data</i> , <u>1971</u> , <i>16</i> , 340-2.									
VARIABLES: Temperature	PREPARED BY: C. L. Young									
EXPERIMENTAL VALUES: <table border="1" data-bbox="274 572 1179 735"> <thead> <tr> <th>T/K</th> <th>Henry's constant H_{CH_4}/atm</th> <th>Mole fraction at 1 atm* x_{CH_4}</th> </tr> </thead> <tbody> <tr> <td>298.2</td> <td>348</td> <td>0.00287</td> </tr> <tr> <td>323.2</td> <td>437</td> <td>0.00229</td> </tr> </tbody> </table> <p>* Calculated by compiler assuming a linear function of P_{CH_4} vs x_{CH_4}, i.e., $x_{\text{CH}_4}(1 \text{ atm}) = 1/H_{\text{CH}_4}$.</p>		T/K	Henry's constant H_{CH_4} /atm	Mole fraction at 1 atm* x_{CH_4}	298.2	348	0.00287	323.2	437	0.00229
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AUXILIARY INFORMATION										
METHOD/APPARATUS/PROCEDURE: A conventional gas-liquid chromatographic unit fitted with a thermal conductivity detector was used. The carrier gas was helium. The value of Henry's law constant was calculated from the retention time. The value applies to very low partial pressures of gas and there may be a substantial difference from that measured at 1 atm. pressure. There is also considerable uncertainty in the value of Henry's constant since surface adsorption was not allowed for although its possible existence was noted.	SOURCE AND PURITY OF MATERIALS: (1) L'Air Liquide sample, minimum purity 99.9 mole per cent. (2) Touzart and Matignon or Serlabo sample, purity 99 mole per cent. ESTIMATED ERROR: $\delta T/K = \pm 0.1$; $\delta H/\text{atm} = \pm 6\%$ (estimated by compiler). REFERENCES:									