

COMPONENTS:		EVALUATOR:			
(1) 2-Methylpropane (isobutane); C ₄ H ₁₀ ; [75-28-5]		Rubin Battino Department of Chemistry Wright State University Dayton, Ohio 45435 U.S.A.			
(2) Water; H ₂ O; [7732-18-5]		November, 1983			
CRITICAL EVALUATION:					
<p>Four papers reported data for this system (1-4). The early work by Lebeau (4) reports an extraordinarily large value and was rejected. McAuliffe's work (3) has proven to be usually significantly low for all of the systems he measured and his single value was also rejected. This left three points from reference (1) and one from reference (2) in the temperature range 278 to 318 K. These four points were smoothed to give the following equation:</p> $\ln x_1 = -129.714 + 183.044/T + 53.4651 \ln T \quad \text{where } T = T/100 \text{ K.}$ <p>The standard deviation of the fit was 0.034 in $\ln x_1$ or about 2.8% in x_1. For this limited range smoothed values at 5 K intervals are given below for the mole fraction solubility at 0.101325 MPa partial pressure of gas (x_1), the Ostwald coefficient (L), and the thermodynamic functions for the transfer of the gas from the vapor phase at 0.101325 MPa partial pressure of gas to the (hypothetical) solution of unit mole fraction. It was found that ΔC_{P1}^0 was constant at 463 J mol⁻¹ K⁻¹.</p>					
T/K	10 ⁵ x ₁	L	$\Delta \bar{G}_1^0 /$ kJ mol ⁻¹	$\Delta \bar{H}_1^0 /$ kJ mol ⁻¹	$\Delta \bar{S}_1^0 /$ J mol ⁻¹ K ⁻¹
278.15	3.589	0.04547	23.67	-30.86	-196.0
283.15	2.859	0.03687	24.63	-28.68	-188.3
288.15	2.333	0.03059	25.55	-26.49	-180.6
293.15	1.947	0.02595	26.44	-24.31	-173.1
298.15	1.659	0.02247	27.28	-22.13	-165.7
303.15	1.443	0.01983	28.09	-19.95	-158.5
308.15	1.278	0.01783	28.87	-17.77	-151.4
313.15	1.151	0.01630	29.61	-15.59	-144.3
318.15	1.055	0.01514	30.31	-13.41	-137.4
<u>References</u>					
1. Wetlaufer, D.B.; Malik, S.K.; Stoller, L.; Coffin, R.L., <i>J. Am. Chem. Soc.</i> 1964 , <i>86</i> , 508-14.					
2. Rudakov, E.S.; Lutsyk, A.I., <i>Zh. Fiz. Khim.</i> 1979 , <i>53</i> , 1298-1300; <i>Russ. J. Phys. Chem.</i> 1979 , <i>53</i> , 731-3.					
3. McAuliffe, C., <i>J. Phys. Chem.</i> 1966 , <i>70</i> , 1267-75; <i>Nature</i> 1963 , <i>200</i> , 1092-3.					
4. Lebeau, P., <i>Bull. Acad. Roy. Belg.</i> 1908 , 300-4.					

COMPONENTS: (1) 2-Methylpropane (isobutane); C_4H_{10} ; [75-28-5] (2) Water; H_2O ; [7732-18-5]		ORIGINAL MEASUREMENTS: Wetlaufer, D.B.; Malik, S.K.; Stoller, L.; Coffin, R.L. <i>J. Am. Chem. Soc.</i> <u>1964</u> , <i>86</i> , 508-514.		
VARIABLES: T/K : 278.15-318.15 P/kPa : 101.325		PREPARED BY: W. Hayduk, C.L. Young		
EXPERIMENTAL VALUES:				
T/K	Solubility ¹ $s/mm\text{ol dm}^{-3}$	Mole Fraction ² $/10^5 x_1$	Ostwald Coefficient ² $L/cm^3 cm^{-3}$	Bunsen Coefficient ² $\alpha/cm^3 (STP) cm^{-3} atm^{-1}$
278.15	1.99	3.59	0.0436	0.0427
298.15	0.94	1.70	0.0223	0.0202
318.15	0.58	1.055	0.0148	0.0125
¹ Original data reported as millimoles per litre at a gas partial pressure of 101.325 kPa. ² Calculated by compilers using a real gas molar volume. ³ No correction was made for the amount of gas retained by the solvent during extraction, estimated by the authors to be 1-1.5 per cent; hence the results are expected to be too low by that amount.				
AUXILIARY INFORMATION				
METHOD/APPARATUS/PROCEDURE: A modified Van Slyke-Neill manometric blood gas apparatus, fitted with a magnetic stirrer was used. The solvent was saturated with gas; then a sample was transferred to the Van Slyke extraction chamber for gas desorption and volume measurement.		SOURCE AND PURITY OF MATERIALS: 1. Matheson Co. Instrument grade. Minimum specified purity 99.5 per cent. 2. Distilled.		
		ESTIMATED ERROR: $\delta T/K = 0.05$ $\delta s/s = 0.02$ (authors) ³		
		REFERENCES:		

COMPONENTS:		ORIGINAL MEASUREMENTS:		
(1) 2-Methylpropane (isobutane); C ₄ H ₁₀ ; [75-28-5] (2) Water; H ₂ O; [7732-18-5]		McAuliffe, C. <i>J. Phys. Chem.</i> <u>1966</u> , <i>70</i> , 1267-1275. <i>Nature</i> , <u>1963</u> , <i>200</i> , 1092-1093.		
VARIABLES:		PREPARED BY:		
T/K: 298.15 P/kPa: 101.325		W. Hayduk		
EXPERIMENTAL VALUES:				
T/K	Solubility ¹ s/g(10 ⁶ g water) ⁻¹	Mole Fraction ² /10 ⁵ x ₁	Ostwald Coefficient ² L/cm ³ cm ⁻³	Bunsen Coefficient ² α/cm ³ (STP)cm ⁻³ atm ⁻¹
298.15	48.9	1.52	0.0199	0.0181
¹ Original data at 1 atm total pressure.				
² Calculated by compiler correcting for vapor pressure of water.				
The same data appear in both sources.				
AUXILIARY INFORMATION				
METHOD/APPARATUS/PROCEDURE:		SOURCE AND PURITY OF MATERIALS:		
The equipment consisted of a gas reservoir, contacting bottle, stripping column and a gas chromatographic analyzer. A rubber balloon maintained at essentially atmospheric pressure served as the gas reservoir which was connected to a bottle partially filled with the water solvent. Equilibrium was established by hand shaking for 5 to 10 min after which the mixture was allowed to stand for phase separation. The solubility was determined by injection of the gas-saturated water solution into a stripping column supplied with helium. The quantity of gas was determined by a gas chromatograph equipped with a hydrogen-flame ionization detector.		1. Phillips Petroleum Co. of minimum specified purity 99.0%. 2. Distilled.		
		ESTIMATED ERROR: δT/K = 1.5 δs/s = 0.04 (author)		
		REFERENCES:		

COMPONENTS:		ORIGINAL MEASUREMENTS:		
(1) 2-Methylpropane (isobutane); C ₄ H ₁₀ ; [75-28-5] (2) Water; H ₂ O; [7732-18-5]		Rudakov, E.S.; Lutsyk, A.I. <i>Zh. Fiz. Khim.</i> , <u>1979</u> , <i>53</i> , 1298-1300. <i>Russ. J. Phys. Chem.</i> , <u>1979</u> , <i>53</i> , 731-733.		
VARIABLES:		PREPARED BY:		
T/K = 298.15		E.S. Rudakov W. Hayduk		
EXPERIMENTAL VALUES:				
T/K	Partition coefficient ¹ k/cm ₂ ³ cm ₁ ⁻³	Ostwald coefficient ² L/cm ³ cm ⁻³	Bunsen coefficient ² α/cm ³ (STP)cm ⁻³ atm ⁻¹	Mole fraction ² 10 ⁵ x ₁
298.15	47	0.0213	0.0193	1.62
¹ Original data. ² Ostwald and Bunsen coefficients and mole fraction for 101.325 kPa calculated by compilers on basis that partition coefficient is equivalent to the inverse of the Ostwald coefficient and assuming that Henry's law applies.				
AUXILIARY INFORMATION				
METHOD/APPARATUS/PROCEDURE:		SOURCE AND PURITY OF MATERIALS:		
<p>Gas chromatographic method used to evaluate partition coefficients. Reactor containing gas and water mechanically shaken. After phase separation a measured volume of gas introduced into carrier gas for analysis. An equal volume of solution placed into a gas stripping cell for complete stripping of the isobutane by the carrier gas. The ratio of areas under the isobutane peaks used to determine the solubility. Actual equilibrium pressure not specified.</p>		Sources and purities not specified.		
		ESTIMATED ERROR:		
		$\delta k/k = 0.10$ (authors)		
		REFERENCES:		

COMPONENTS: (1) 2-Methylpropane or isobutane; C_4H_{10} ; [75-28-5] (2) Water; H_2O ; [7732-18-5] Ethanol; C_2H_6O ; [64-17-5] Diethylether; $C_4H_{10}O$; [60-29-7] Chloroform; $CHCl_3$; [67-66-3]	ORIGINAL MEASUREMENTS: Lebeau, P. <i>Bull. Acad. Roy. Belg.</i> <u>1908</u> , 300-4.																																								
VARIABLES: $T/K = 290, 291$ $p/kPa = 102.9 - 104.8$	PREPARED BY: H. L. Clever																																								
EXPERIMENTAL VALUES: <table border="1" data-bbox="294 521 1200 997"> <thead> <tr> <th colspan="2">Temperature</th> <th>Pressure^a</th> <th>Solubility</th> </tr> <tr> <th>$t/^\circ C$</th> <th>T/K</th> <th>$p/mmHg$</th> <th>Volume Isobutane/Volume Solvent</th> </tr> </thead> <tbody> <tr> <td colspan="4">Water</td> </tr> <tr> <td>17</td> <td>290</td> <td>772</td> <td>0.13</td> </tr> <tr> <td colspan="4">Ethanol</td> </tr> <tr> <td>17</td> <td>290</td> <td>775</td> <td>13.2</td> </tr> <tr> <td colspan="4">Diethylether or 1,1'-oxybisethane</td> </tr> <tr> <td>18</td> <td>291</td> <td>773</td> <td>27.9</td> </tr> <tr> <td colspan="4">Chloroform or trichloromethane</td> </tr> <tr> <td>17</td> <td>290</td> <td>786</td> <td>39.5</td> </tr> </tbody> </table> <p>^a Not clear whether this is total pressure or isobutane partial pressure. It is probably the total pressure.</p>		Temperature		Pressure ^a	Solubility	$t/^\circ C$	T/K	$p/mmHg$	Volume Isobutane/Volume Solvent	Water				17	290	772	0.13	Ethanol				17	290	775	13.2	Diethylether or 1,1'-oxybisethane				18	291	773	27.9	Chloroform or trichloromethane				17	290	786	39.5
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METHOD/APPARATUS/PROCEDURE: Details not given.	SOURCE AND PURITY OF MATERIALS: (1) Isobutane. Prepared by the author by the reaction of sodium or calcium in liquid ammonia on isobutyl chloride. The normal boiling point is $-10.5^\circ C$ and the critical temperature is $134-5^\circ C$. (2) Solvents. No information.																																								
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