

<p>COMPONENTS:</p> <ol style="list-style-type: none"> 1. Hydrogen sulfide; H₂S; [7783-06-4] 2. Aqueous solutions of weak or non-electrolytes 	<p>EVALUATOR:</p> <p>Peter G.T. Fogg, Department of Applied Chemistry and Life Sciences, Polytechnic of North London, Holloway, London N7 8DB, U.K.</p> <p>July 1987</p>
<p>CRITICAL EVALUATION:</p> <p>Carbon dioxide; CO₂; [124-38-9] Phenol; C₆H₆O; [108-95-2] 1,2,3-Propanetriol, (<i>glycerol</i>); C₃H₈O₃; [56-81-5] Ethanol; C₂H₆O; [64-17-5] Urea; CH₄N₂O; [57-13-6]</p> <p>The solubility of hydrogen sulfide in water containing carbon dioxide was measured by Golutvin, Malysheva & Skorobogatova (1). It was part of a study of the ratios of concentrations of H₂S/CO₂ in the gas phase to that in the liquid phase, in the presence of aqueous solutions. Water at 293.2 K was saturated with various mixtures of hydrogen sulfide and carbon dioxide. The total pressure of gas (CO₂ + H₂S + H₂O) was equal to barometric pressure. Within the limits of the experimental error the molar concentration of hydrogen sulfide in the saturated solution was proportional to the partial pressure of the hydrogen sulfide. The varying partial pressure of carbon dioxide did not cause any deviation from this linear relationship between solubility and partial pressure of hydrogen sulfide. Extrapolation of the solubility to a partial pressure of 1.013 bar gives a solubility of 0.098 mol dm⁻³ at 293.2 K. This may be compared with the solubility of 0.112 mol dm⁻³ calculated from the recommended value of the mole fraction solubility for H₂S in pure water (see Critical Evaluation - pure water).</p> <p>In addition, Golutvin <i>et al.</i> (1) measured solubilities of mixtures of carbon dioxide and hydrogen sulfide in aqueous solutions of ammonia and of ammonia and phenol. There is no obvious inconsistency between these measurements of solubility in ammonia solutions and measurements made by other workers (see Critical Evaluation - aqueous solutions of ammonia). No other measurements of solubilities in the presence of phenol are available for comparison.</p> <p>Kiss, Lajtai & Thury (2) measured solubilities of hydrogen sulfide in pure water and aqueous solutions of ethanol, glycerol and of urea in the temperature range 273.2 K to 298.15 K. The total pressure was barometric but the reported solubilities were corrected to a partial pressure of hydrogen sulfide of 1.013 bar. Solubilities in pure water are within a standard deviation of the recommended solubilities (see Critical Evaluation - pure water) and are therefore consistent with measurements by other workers.</p> <p>Concentrations of ethanol ranged from 2 mol dm⁻³ to 16 mol dm⁻³. Concentrations of glycerol and of urea ranged from 2 mol dm⁻³ to 8 mol dm⁻³. The solubilities in ethanol solutions show a self-consistent variation with temperature and concentration of ethanol. They may be extrapolated to give estimated solubilities in pure ethanol. i.e, ethanol at a concentration of approximately 17.6 mol dm⁻³. The extrapolated value for 273.2 K is about 6% lower than the solubility calculated from direct measurements of the solubility in pure ethanol made by Gerrard (3). The extrapolated solubility for 285.5 K is about 40% greater and the extrapolated value for 298.15 K about 100% greater than solubilities estimated from Gerrard's data.</p> <p>Solubility measurements for aqueous solutions of glycerol are self-consistent but, in this case, the concentrations of glycerol do not extend high enough to enable extrapolation to pure glycerol (approx. 13.7 mol dm⁻³). Comparison with other systems is not possible for this system or for the urea-water-hydrogen sulfide system.</p> <p><u>References</u></p> <ol style="list-style-type: none"> 1. Golutvin, Yu. M.; Malysheva, T.V.; Skorobogatova, V.I. <i>Izvest. Sibir. Otdel. Akad. Nauk. SSSR</i> 1958, No.8, 83-87. 2. Kiss, A.; Lajtai, I.; Thury, G. <i>Z. anorg. allgem. Chem.</i> 1937, 233, 346-352. 3. Gerrard, W. J. <i>Appl. Chem. Biotechnol.</i> 1972, 22, 623-650. 	

COMONENTS:		ORIGINAL MEASUREMENTS:		
1. Hydrogen sulfide; H ₂ S; [7783-06-4] 2. Carbon dioxide; CO ₂ ; [124-38-9] 3. Water; H ₂ O; [7732-18-5]		Golutvin, Yu. M.; Malysheva, T.V.; Skorobogatova, V.I. <i>Izvest. Sibir. Otdel. Akad. Nauk.</i> <i>S.S.S.R. 1958, No.8, 83-7.</i>		
VARIABLES:		PREPARED BY:		
Concentration of ammonia		P.G.T. Fogg		
EXPERIMENTAL VALUES:				
Liquid phase		Gas phase		
Conc. of H ₂ S /mol dm ⁻³	Conc. of CO ₂ /mol dm ⁻³	P_{H_2S} / P_{CO_2}	P_{H_2S}/bar^*	P_{CO_2}/bar^*
0.000000	0.030170	0.0000	0.0000	0.9899
0.001425	0.025979	0.0338	0.0324	0.9575
0.003377	0.020680	0.0378	0.0361	0.9538
0.011310	0.018775	0.1263	0.1110	0.8789
0.012310	0.018070	0.2208	0.1790	0.8109
0.015380	0.021050	0.1927	0.1599	0.8300
0.017690	0.019175	0.3044	0.2310	0.7589
0.018500	0.017340	0.4000	0.2828	0.7071
0.020400	0.017342	0.3871	0.2762	0.7137
0.021100	0.019970	0.3973	0.2815	0.7084
0.038720	0.014550	0.7084	0.4105	0.5794
0.040200	0.014540	0.6881	0.4035	0.5864
0.043380	0.011980	0.8133	0.4440	0.5459
0.048630	0.011810	0.7740	0.4319	0.5580
0.052400	0.006827	1.6650	0.6184	0.3715
0.056920	0.010088	1.2220	0.5444	0.4455
0.072746	0.004295	3.7350	0.7808	0.2091
0.082180	0.002274	3.9930	0.7916	0.1983
0.091180	0.001491	16.4510	0.9331	0.0568
T/K = 293.2; * calculated by the compiler on the assumption that the sum of the partial pressure of H ₂ S, CO ₂ & H ₂ O is 1.013 bar. Concentrations of H ₂ S and of CO ₂ include all ionic species derived from these compounds.				
AUXILIARY INFORMATION				
METHOD/APPARATUS/PROCEDURE:		SOURCE AND PURITY OF MATERIALS:		
Premixed hydrogen sulfide and carbon dioxide were bubbled through water in a thermostatted saturator for 4.5 to 5 hrs. The gas and the liquid phases were analysed by chemical methods. The solubility of H ₂ S, in the absence of CO ₂ , was measured by the authors but there is clearly a mistake in the figures which were published.		1. from a Kipp's apparatus. 2. by action of hydrochloric acid on marble chips.		
		ESTIMATED ERROR:		
		$\delta T/K = \pm 0.1$ (authors)		
		REFERENCES:		

COMPONENTS:				ORIGINAL MEASUREMENTS:		
1. Hydrogen sulfide; H ₂ S; [7783-06-4] 2. Water; H ₂ O; [7732-18-5] 3. Urea; CH ₄ N ₂ O; [57-13-6]				Kiss, A. v.; Lajtai, I.; Thury, G. <i>Zeit. anorg. allgem. Chem.</i> 1937, 233, 346-352.		
VARIABLES:				PREPARED BY:		
Temperature, concentration of urea.				P.G.T. Fogg		
EXPERIMENTAL VALUES:						
Conc. of urea /mol dm ⁻³	Conc. of H ₂ S in liquid /mol dm ⁻³			Ostwald coefficient, L		
	273.20 K	285.65 K	298.15 K	273.20 K	285.65 K	298.15 K
0	0.2079	0.1410	0.1014	4.662	3.307	2.482
2	0.2095	0.1445	0.1055	4.698	3.389	2.582
4	0.2110	0.1462	0.1081	4.732	3.424	2.646
6	0.2129	0.1487	0.1103	4.774	3.487	2.698
8		0.1497	0.1117		3.511	2.734
$P_{\text{H}_2\text{S}} = 1.013 \text{ bar}$						
AUXILIARY INFORMATION						
METHOD / APPARATUS / PROCEDURE:				SOURCE AND PURITY OF MATERIALS:		
H ₂ S was bubbled through about 100 cm ³ of water & urea in an absorption vessel at barometric pressure for 1 to 1.5 h. Dissolved H ₂ S was estimated iodometrically. Allowance was made for the partial pressure of water and the head of liquid in the absorption vessel in the calculation of the partial pressure of H ₂ S. Solubilities were corrected to a partial pressure of 1.013 bar by use of Henry's law.				1. From iron sulfide (ex Merck) and dilute H ₂ SO ₄ ; washed with H ₂ O and solvent mixture. 2. Distilled. 3. <i>p.a.</i> or <i>puriss.</i> from Merck or Kahlbaum-Schering;		
				ESTIMATED ERROR:		
				Quoted values are averages from several measurements with a maximum deviation from the mean of ± 0.2% (authors)		
				REFERENCES:		

COMPONENTS:			ORIGINAL MEASUREMENTS:			
1. Hydrogen sulfide; H ₂ S; [7783-06-4] 2. Water; H ₂ O; [7732-18-5] 3. Ethanol; C ₂ H ₆ O; [64-17-5]			Kiss, A. v.; Lajtai, I.; Thury, G. <i>Zeit. anorg. allgem. Chem.</i> 1937, 233, 346-352.			
VARIABLES:			PREPARED BY:			
Temperature, concentration of ethanol.			P.G.T. Fogg			
EXPERIMENTAL VALUES:						
Conc. of ethanol /mol dm ⁻³	Conc. of H ₂ S in liquid /mol dm ⁻³			Ostwald coefficient, L		
	273.20 K	285.65 K	298.15 K	273.20 K	285.65 K	298.15 K
0	0.2079	0.1410	0.1014	4.662	3.307	2.482
2	0.1881	0.1320	0.0994	4.218	3.096	2.433
4	0.1680	0.1276	0.1034	3.767	2.988	2.531
5	0.1590	0.1285	0.1074	3.566	3.013	2.629
6	0.1632	0.1345	0.1155	3.660	3.154	2.827
7	0.1761	0.1513	0.1324	3.949	3.631	3.240
8	0.2030	0.1709	0.1470	4.552	3.989	3.598
10	0.2832	0.2350	0.1970	6.351	5.500	4.281
12	0.3982	0.3182	0.2621	8.029	7.462	6.415
14	0.5435	0.4255	0.3431	12.19	9.978	8.397
16	0.7115	0.5650	0.4469	15.95	13.25	10.94
<i>P</i> _{H₂S} = 1.013 bar						
AUXILIARY INFORMATION						
METHOD APPARATUS/PROCEDURE:			SOURCE AND PURITY OF MATERIALS:			
H ₂ S was bubbled through about 100 cm ³ of water & ethanol in an absorption vessel at barometric pressure for 1 to 1.5 h. Dissolved H ₂ S was estimated iodimetrically. Allowances were made for the partial pressure of water, the partial pressure of ethanol and the head of liquid in the absorption vessel when the partial pressure of H ₂ S was calculated. Solubilities were corrected to 1.013 bar by use of Henry's law.			1. From iron sulfide (ex Merck) and dilute H ₂ SO ₄ ; washed with H ₂ O and solvent mixture. 2. Distilled. 3. <i>p.a.</i> or <i>puriss.</i> from Merck or Kahlbaum-Schering; distilled			
			ESTIMATED ERROR: Quoted values are averages from several measurements with a maximum deviation from the mean of ± 0.2% (authors)			
			REFERENCES:			

COMPONENTS: 1. Hydrogen sulfide; H ₂ S; [7783-06-4] 2. Water; H ₂ O; [7732-18-5] 3. 1,2,3-Propanetriol (<i>glycerol</i>); C ₃ H ₈ O ₃ ; [56-81-5]		ORIGINAL MEASUREMENTS: Kiss, A. v.; Lajtai, I.; Thury, G. <i>Zeit. anorg. allgem. Chem.</i> 1937, 233, 346-352.				
VARIABLES: Temperature, concentration of glycerol		PREPARED BY: P.G.T. Fogg				
EXPERIMENTAL VALUES:						
Conc. of glycerol /mol dm ⁻³	Conc. of H ₂ S in liquid /mol dm ⁻³			Ostwald coefficient, <i>L</i>		
	273.20 K	285.65 K	298.15 K	273.20 K	285.65 K	298.15 K
0	0.2079	0.1410	0.1014	4.662	3.307	2.482
2	0.1752	0.1180	0.0930	3.929	2.768	2.276
4	0.1514	0.1066	0.0850	3.396	2.500	2.080
6	0.1311	0.0967	0.0793	2.940	2.267	1.938
8	0.1165	0.0913	0.0770	2.613	2.140	1.885
$P_{\text{H}_2\text{S}} = 1.013 \text{ bar}$						
AUXILIARY INFORMATION						
METHOD/APPARATUS/PROCEDURE: H ₂ S was bubbled through about 100 cm ³ of water & glycerol in an absorption vessel at barometric pressure for 1 to 1.5 h. Dissolved H ₂ S was estimated iodimetrically. Allowance was made for the partial pressure of water and the head of liquid in the absorption vessel in the calculation of the partial pressure of H ₂ S. Solubilities were corrected to a partial pressure of 1.013 bar by use of Henry's law.				SOURCE AND PURITY OF MATERIALS: 1. From iron sulfide (ex Merck) and dilute H ₂ SO ₄ ; washed with H ₂ O and solvent mixture. 2. Distilled. 3. <i>p.a.</i> or <i>puriss.</i> from Merck or Kahlbaum-Schering; distilled.		
				ESTIMATED ERROR: Quoted values are averages from several measurements with a maximum deviation from the mean of ± 0.2% (authors)		
				REFERENCES:		