

COMPONENTS: 1. Deuterium sulfide; D ₂ S; [13536-94-2] 2. Water - d ₂ ; D ₂ O; [7789-20-0]	EVALUATOR: Peter G.T. Fogg, Department of Applied Chemistry and Life Sciences, Polytechnic of North London, Holloway, London N7 8DB, U.K. July 1987
CRITICAL EVALUATION: The solubility of deuterium sulfide in water-d ₂ (D ₂ O) has been measured by Clarke and Glew (1) over the temperature range 278 to 323 K and a total pressure range of 0.437 to 1.044 bar. These measurements are consistent with each other and appear to be reliable. No other data are available for this system and these data should therefore be accepted on a tentative basis. The evaluator has calculated mole fraction solubilities for a partial pressure of 1.013 bar from the data which has been published. These mole fraction solubilities fit the following equation: $\ln x_{D_2S} = - 54.487 + 5727.1/(T/K) + 3.6052 \ln(T/K) + 0.028224 T/K$ Standard deviation for $x_{D_2S} = \pm 4.0 \times 10^{-6}$ This equation is based upon measurements from 278 to 323 K. The mole fraction solubilities for a partial pressure of 1.013 bar in this temperature range lie close to mole fraction solubilities of hydrogen sulfide in water (H ₂ O). The evaluator has also derived a similar smoothing equation for solubilities of hydrogen sulfide in water at a partial pressure of 1.013 bar. All the corresponding values for deuterium sulfide in D ₂ O lie within the standard deviation for this smoothing equation for hydrogen sulfide. <u>References</u> 1. Clarke, E.C.W.; Glew, D.N. <i>Can. J. Chem.</i> <u>1971</u> , <i>49</i> , 691-698.	

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1. Deuterium sulfide; D ₂ S; [13536-94-2]			Clarke, E.C.W.; Glew, D.N.		
2. Water - d ₂ ; D ₂ O; [7789-20-0]			Can. J. Chem. <u>1971</u> , <i>49</i> , 691-698.		
VARIABLES:			PREPARED BY:		
Temperature, pressure			C.L. Young.		
EXPERIMENTAL VALUES:					
T/K	Total pressure		D ₂ S in gas	Mole fractions	
	P/atm	P/kPa	y _{D₂S}	D ₂ S in liquid 10 ³ x _{D₂S}	DS ⁻ in liquid* 10 ⁶ x _{DS-}
278.104	0.46205	46.818	0.98441	1.4489	0.56
278.103	0.53869	54.583	0.98659	1.6916	0.61
278.104	0.65058	65.921	0.98886	2.0451	0.67
278.103	0.83037	84.138	0.99122	2.6113	0.76
278.119	0.48660	49.305	0.98514	1.5266	0.58
278.119	0.56686	57.438	0.98721	1.7806	0.63
278.121	0.68365	69.272	0.98935	2.1493	0.69
278.120	0.87050	88.204	0.99159	2.7373	0.78
283.162	0.49623	50.281	0.97917	1.3152	0.59
283.161	0.58177	58.948	0.98219	1.5453	0.64
283.161	0.70846	71.785	0.98531	1.8853	0.71
283.161	0.91626	92.840	0.98857	2.4409	0.81
283.166	0.49103	49.754	0.97895	1.3017	0.59
283.167	0.57614	58.378	0.98201	1.5308	0.64
283.167	0.70225	71.156	0.98519	1.8694	0.71
283.165	0.90982	92.188	0.98849	2.4248	0.80
288.146	0.49292	49.946	0.97051	1.1202	0.60
288.145	0.58044	58.814	0.97489	1.3239	0.65
288.144	0.71133	72.076	0.97943	1.6278	0.72
288.142	0.92970	94.203	0.98416	2.1331	0.83
288.148	0.50118	50.783	0.97098	1.1375	0.60
288.149	0.58946	59.728	0.97526	1.3425	0.66
288.148	0.72127	73.083	0.97970	1.6480	0.73
288.147	0.94014	95.261	0.98433	2.1535	0.83
293.165	0.47451	48.080	0.95748	0.9288	0.59
AUXILIARY INFORMATION					
METHOD/APPARATUS/PROCEDURE:			SOURCE AND PURITY OF MATERIALS:		
Static equilibrium cell described in source. Vapor pressure over a saturated aqueous solution were measured with a fused quartz precision Bourdon gauge. Great care was taken to make the necessary correction for water in the vapor phase.			1. Prepared by the action of D ₂ O on aluminium sulfide (pure grade K and K lab).		
			2. Contained 0.25 weight % protium oxide (water). Supplied by Atomic Energy of Canada.		
			ESTIMATED ERROR: $\delta T/K = \pm 0.0015$; $\delta P/P = \pm 0.0002$; $\delta x_{D_2S}/x_{D_2S} = \pm 0.002$.		
			REFERENCES:		

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EXPERIMENTAL VALUES:					
T/K	Total Pressure		D ₂ S in gas y _{D₂S}	Mole fractions	
	P/atm	P/kPa		D ₂ S in liquid 10 ³ x _{D₂S}	DS ⁻ in liquid* 10 ⁶ x _{DS⁻}
293.167	0.56008	56.751	0.96388	1.1027	0.65
293.168	0.68930	69.844	0.97054	1.3647	0.72
293.167	0.90742	91.945	0.97748	1.8056	0.83
298.152	0.53870	54.584	0.94869	0.9207	0.64
298.151	0.65900	66.774	0.95792	1.1360	0.71
298.150	0.85875	87.014	0.96752	1.4924	0.82
298.153	0.55844	56.584	0.95048	0.9577	0.65
298.153	0.68292	69.198	0.95936	1.1807	0.73
298.153	0.88929	90.108	0.96861	1.5494	0.83
298.154	0.46306	46.920	0.94042	0.7867	0.59
298.155	0.54848	55.575	0.94958	0.9401	0.65
298.156	0.67873	68.773	0.95911	1.1736	0.72
298.155	0.90170	91.366	0.96902	1.5721	0.84
303.141	0.55882	56.623	0.93309	0.8361	0.66
303.141	0.69356	70.276	0.94589	1.0506	0.74
303.141	0.92605	93.833	0.95922	1.4196	0.86
303.148	0.62235	63.060	0.93982	0.9373	0.70
303.147	0.77226	78.250	0.95130	1.1757	0.78
303.146	1.03080	104.447	0.96326	1.5853	0.91
313.134	0.43164	43.736	0.84752	0.4797	0.57
313.132	0.51421	52.103	0.87173	0.5874	0.63
313.133	0.64240	65.092	0.89699	0.7543	0.71
313.133	0.86778	87.929	0.92331	1.0469	0.84
323.141	0.54232	54.951	0.79389	0.4746	0.64
323.141	0.68071	68.974	0.83525	0.6260	0.73
323.140	0.92773	94.003	0.87840	0.8956	0.87
*Values of x _{DS⁻} were calculated from the equation					
$\log_{10} K_{D_2S} = 54.50 - 3760 (T/K) - 20 \log (T/K)$					