

<p>COMPONENTS:</p> <ol style="list-style-type: none"> <li>1. Hydrogen sulfide; H<sub>2</sub>S; [7783-06-4]</li> <li>2. Strong electrolytes</li> </ol>	<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>Several workers have reported the solubilities of hydrogen sulfide in solutions of salts and of acids and, as part of the same work, the solubility of the gas in pure water. If such measurements using pure water are in accord with values given by other workers then measurements of solubilities in the presence of electrolytes which have been carried out as part of the same research are likely to be reliable.</p> <p>The published solubilities indicate that addition of an acid to water usually increases the solubility of hydrogen sulfide whereas addition of a salt often has the opposite effect. Experimental values for low electrolyte concentrations sometimes approximately obey empirical equations based upon the Sechenov relation (1). i.e.</p> $s = s' \exp(-kc)$ <p>where <math>s</math> is the solubility of the gas in solution, <math>s'</math> the solubility in pure water, <math>c</math> the concentration of the electrolyte and <math>k</math> an empirical constant specific for the electrolyte. Concentrations may be expressed as molarities, molalities or mole fractions. When the equation is expressed in a form such as:</p> $\ln(s/\text{mol dm}^{-3}) = \ln(s'/\text{mol dm}^{-3}) - kc$ <p>the effects of different electrolytes are approximately additive i.e.</p> $\ln(s/\text{mol dm}^{-3}) = \ln(s'/\text{mol dm}^{-3}) - (k_1c_1 + k_2c_2 + \dots)$ <p>where <math>k_1, k_2</math> etc. are appropriate constants for electrolyte 1,2, etc. at concentrations <math>c_1, c_2</math>, etc. Better agreement with experimental data is obtained if additional terms depending on concentrations raised to a higher power, are introduced.</p> <p>Solubilities in hydrochloric acid solutions at 298.15 K and a partial pressure of 1.013 bar have been reported by Kendall &amp; Andrews (2), Kapustinsky &amp; Anvaer (3) and by Gamsjäger &amp; Schindler (4). Solubilities in pure water at the same temperature and pressure, which were reported by each group, are within 1% of the recommended value.</p> <p>Gamsjäger &amp; Schindler investigated the solubilities in the concentration range of hydrochloric acid of 0 to 3 mol dm<sup>-3</sup>. Values are within about 2% of solubilities reported by Kendall &amp; Andrews who made measurements at acid concentrations to 4.9 mol dm<sup>-3</sup>. Kapustinsky &amp; Anvaer measured solubilities in hydrochloric acid of concentrations from 5 to 11.4 mol dm<sup>-3</sup>. Extrapolation of these measurements to lower concentrations of hydrochloric acid confirms that Gamsjäger's experimental measurements are likely to be reliable. However the empirical equation for the ratio of solubility in acid to that in pure water as a function of acid concentration, reported by Gamsjäger, does not appear to be applicable to the acid concentration range investigated by Kapustinsky.</p> <p>Measurements reported by Gamsjäger &amp; Schindler (4) for solutions containing sodium chloride are self-consistent. The solubility at 298.15 K for a partial pressure of 1.013 bar in sodium chloride of concentration 3.0 mol dm<sup>-3</sup> is 0.062 mol dm<sup>-3</sup> which is greater than the value of 0.0548 reported by Kapustinsky &amp; Anvaer (3). The evaluator considers that data given by Gamsjäger &amp; Schindler are likely to be the more reliable and these should be accepted on a tentative basis.</p> <p>Kapustinsky and Anvaer (3) also reported the solubility at 298.15K and 1.013 bar in a solution of potassium chloride (1.0 mol dm<sup>-3</sup>) to be 0.0877 mol dm<sup>-3</sup> which is close to the value of the value of 0.089 estimated from measurements by McLaughlin (5). In view of the uncertainty over the solubility in sodium chloride solution this value for potassium chloride solutions can only be accepted on a tentative basis.</p> <p>Kozintseva (6) measured solubilities in solutions of sodium chloride, calcium chloride and sodium sulfate at temperatures of 475 K and 535 K. These solubilities appear to be reliable and may be accepted as tentative values.</p>	

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<p>CRITICAL EVALUATION:</p> <p>Comparison with measurements by other workers at lower temperatures is not possible.</p> <p>Measurements by Gamsjäger and Schindler (4) of solubilities in solutions containing both hydrochloric acid and sodium chloride are consistent with their measurements on solutions containing either one or other of these two compounds.</p> <p>Solubilities in solutions of hydrochloric acid and zinc chloride and in solutions of hydrochloric acid and ferrous chloride were investigated by Kapustinsky and Anvaer. Their results show that, over the concentration ranges studied, addition of hydrochloric acid and of zinc chloride increased the solubility of hydrogen sulfide but addition of ferrous chloride decreased solubility. Further work on these systems is required before quantitative relationships can be reliably established.</p> <p>Dede &amp; Becker (7) measured solubilities, in solutions of calcium chloride, of sodium perchlorate and of sodium sulfate at 293.15 K and a total pressure equal to barometric. The value of the solubility in pure water, measured as part of the same research, is about 7% less than the recommended value based upon more modern measurements. There is a linear variation of log(concentration of H<sub>2</sub>S in solution) with concentration of sodium perchlorate over the concentration range studied (0 to 4 mol dm<sup>-3</sup>) showing that a Sechenov equation is applicable over this range. The other two salts deviate from linearity over the range 0 to 2 mol dm<sup>-3</sup>.</p> <p>Solubilities in sodium perchlorate solutions, perchloric acid solutions and in mixtures of the two have been reported by Gamsjäger, Rainer &amp; Schindler (8) at 298.15 K and a partial pressure of 1.013 bar. The measurements are self consistent. An empirical equation relating solubility of hydrogen sulfide to concentration of sodium perchlorate and of perchloric acid was derived for total concentrations of perchlorates to 3 mol dm<sup>-3</sup>. In the absence of acid the variation of solubility with concentration of sodium perchlorate found by Gamjager at 298.15 K is consistent with the similar behaviour at 293.15 K found by Dede &amp; Becker (7).</p> <p>Pollitzer (9) measured the solubility of hydrogen sulfide at 298.15 K and a total pressure of 1.013 bar in solutions of hydrogen iodide of concentrations 1.01 to 9.21 mol dm<sup>-3</sup>. His value for the solubility in pure water corresponds to a mole fraction solubility at a partial pressure of 1.013 bar of <math>1.864 \times 10^{-3}</math> compared with the recommended value of <math>(1.830 \pm 0.014) \times 10^{-3}</math> based upon more modern determinations (see Critical Evaluation - pure water). The solubilities over the hydrogen iodide concentration range follow a Sechenov relation fairly closely and can be fitted to the equation:</p> $\log_{10}(\text{concn. H}_2\text{S/mol dm}^{-3}) = -0.9979 + 0.04494 (\text{concn. HI/mol dm}^{-3})$ <p>Standard deviation of <math>\log_{10}(\text{concn. of H}_2\text{S/mol dm}^{-3}) = \pm 0.0122</math></p> <p>Aleksandrova and Yaroshchuk (10) measured the solubility in pure water, in dilute sulfuric acid and in concentrated sulfuric acid at 323.15 K, each at a different partial pressure of H<sub>2</sub>S in the range 0.02 to 0.05 bar. Measurements indicate that, if the pressure were kept constant, solubility would increase with concentration of acid. The value of the solubility in pure water is about double the value expected on the assumption that the variation of mole fraction solubility would vary linearly with pressure to 1.013 bar. The solubilities reported for sulfuric acid are therefore of uncertain reliability.</p> <p>Litvinenko (11) investigated the reversible equilibria between hydrogen sulfide gas and solutions of potassium carbonate and of sodium carbonate at temperatures from 298.15 K to 333.15 K. Values of the ratio:</p> $\frac{[\text{HCO}_3^-] [\text{HS}^-]}{[\text{CO}_3^{2-}] P_{\text{H}_2\text{S}}}$ <p>depend upon the concentration of alkali metal ions and change with temperature. Measurements made by Dryden (12) for the the equilibrium involving potassium salts indicate that the ratio increases with decrease in concentration of</p>	

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1. Hydrogen sulfide; H<sub>2</sub>S; [7783-06-4]
2. Strong electrolytes

## EVALUATOR:

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July 1987

## CRITICAL EVALUATION:

potassium ions. Litvinenko made measurements at a concentration of potassium ions of about 2 mol dm<sup>-3</sup> and obtained values of the ratio about 20% lower than values presented by Dryden. In the opinion of the evaluator, the data presented by Dryden are the more reliable.

Equilibria in the system hydrogen sulfide-carbon dioxide-potassium carbonate-water were also investigated by Dryden (12) and by Litvinenko (11). Both workers presented values of the the ratio:

$$\frac{[\text{KHCO}_3] P_{\text{H}_2\text{S}}}{[\text{KHS}] P_{\text{CO}_2}}$$

Dryden's measurements indicate that the ratio changes with total concentration of potassium ions. Dryden made measurements at 293.2 K and 323.2 K. A value of about 2.5 for a concentration of potassium ions of 2 mol dm<sup>-3</sup> at 298.2 K may be obtained from these measurements by interpolation. This is close to the average value of 2.6 under these conditions from Litvinenko's measurements. If Dryden's measurements are extrapolated to give the ratio at 333.2 K for this concentration of potassium ions a value of about 1.0 is obtained. The average of the values for 333.2 K obtained by Litvinenko is 1.5 so there is poor agreement in this case.

The corresponding system containing sodium ions instead of potassium ions was investigated by Berl & Rittener (13). They gave values of the ratio

$$\frac{(\text{molar concentration of carbonate} + \text{bicarbonate}) P_{\text{H}_2\text{S}}}{(\text{molar concentration of sulfide} + \text{bisulfide}) P_{\text{CO}_2}}$$

Under the conditions of the experiments the concentrations of carbonate and sulfide ions are small compared with the concentrations of bicarbonate and bisulfide ions and the ratio is equivalent to

$$\frac{[\text{NaHCO}_3] P_{\text{H}_2\text{S}}}{[\text{NaHS}] P_{\text{CO}_2}}$$

Values of this ratio for a concentration of sodium ions of about 0.5 mol dm<sup>-3</sup> are very close to values reported by Dryden for the similar ratio for the potassium compounds at this concentration. This is shown in the table below :

	T/K	[M <sup>+</sup> ]/mol dm <sup>-3</sup>	Ratio
Berl & Rittener (13)	291.2	0.544	2.01
	291.2	0.544	1.97
	328.2	0.532	0.90
Dryden (12)	293.2	0.49	1.9
	323.2	0.50	0.93

On the basis of the evidence which is available, the general relationships for the two systems which have been presented by Dryden and by Berl & Rittener, appear to be reliable.

References

1. Sechenov, *Z. physik. Chem.* **1889**, *4*, 121.
2. Kendall, J.; Andrews, J.C. *J. Amer. Chem. Soc.* **1921**, *43*, 1545-1560.

<b>COMPONENTS:</b>  1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4]  2. Strong electrolytes	<b>EVALUATOR:</b>  Peter G.T. Fogg, Department of Applied Chemistry and Life Sciences, Polytechnic of North London, Holloway, London N7 8DB, U.K.  July 1987
<b>CRITICAL EVALUATION:</b>  3. Kapustinsky, A.F.; Anvaer, B.I. <i>Compt. Rend. Acad. Sci. URSS</i> <u>1941</u> , 30, 625-628.  4. Gamsjäger, H.; Schindler, P. <i>Helv. Chim. Acta</i> <u>1969</u> , 52, 1395-1402.  5. McLaughlin, W.H. <i>Z. physik. Chem.</i> <u>1903</u> , 44, 600-633.  6. Kozintseva, T.N. <i>Geokhim. Issled. v Obl. Povyshennykh Davlenii i Temperatur.</i> , Akad. Nauk SSSR, <i>Inst. Geokhim. i Analit. Khim.</i> , Sb. Statei <u>1965</u> , 121-134.  7. Dede, L.; Becker, Th. <i>Z. anorg. allgem. Chem.</i> <u>1926</u> , 152, 185-196.  8. Gamsjäger, H.; Rainer, W.; Schindler, P. <i>Monatsh. Chem.</i> <u>1967</u> , 98, 1782-1802.  9. Pollitzer, F. <i>Z. anorg. Chem.</i> <u>1909</u> , 64, 121-148.  10. Aleksandrova, M.V.; Yaroshchuk, E.G. <i>Zh. Prikl. Khim. (Leningrad)</i> <u>1978</u> , 51, 1273-1276. <i>J. Applied Chem. (USSR)</i> <u>1978</u> , 51, 1221-1223.  11. Litvinenko, M.S. <i>Zh. Prikl. Khim.</i> <u>1952</u> , 25, 516-532. <i>J. Applied Chem. (USSR)</i> <u>1952</u> , 25, 579-595.  12. Dryden, I.G.C. <i>J. Soc. Chem. Ind.</i> <u>1947</u> , 66, 59-64.  13. Berl, A.; Rittener, A. <i>Z. angew. Chem.</i> <u>1907</u> , 20, 1637-1642.	

<b>COMPONENTS:</b> 1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Water; H <sub>2</sub> O; [7732-18-5] 3. Hydrogen chloride, HCl; [7647-01-0]	<b>ORIGINAL MEASUREMENTS:</b> Kendall, J.; Andrews, J.C.  <i>J. Amer. Chem. Soc.</i> <u>1921</u> , 43, 1545-1560.	
<b>VARIABLES:</b>  Concentration of HCl	<b>PREPARED BY:</b>  P.G.T. Fogg	
<b>EXPERIMENTAL VALUES:</b>		
Concentration of HCl /mol dm <sup>-3</sup>	Absorption* coefficient	Concentration of H <sub>2</sub> S /mol dm <sup>-3</sup> ( <i>P</i> <sub>H<sub>2</sub>S</sub> = 1.013 bar)
0.0	2.266	0.1023
0.1348	2.253	0.1018
0.2828	2.247	0.1015
0.6308	2.250	0.1016
1.180	2.260	0.1020
1.848	2.272	0.1026
2.498	2.281	0.1030
3.040	2.291	0.1034
3.308	2.301	0.1039
4.410	2.384	0.1076
4.874	2.413	0.1090
T/K = 298.15		
Mole fraction solubility in pure water, <i>x</i> <sub>H<sub>2</sub>S</sub> ( <i>P</i> <sub>H<sub>2</sub>S</sub> = 1.013 bar) = 0.001845		
This has been estimated by the compiler assuming no change of volume on dissolution of gas.		
* Volume of gas, measured at 273.15 K and 1.013 bar, absorbed by one volume of solution at the temperature specified, when <i>P</i> <sub>H<sub>2</sub>S</sub> = 1.013 bar.		
<b>AUXILIARY INFORMATION</b>		
<b>METHOD/APPARATUS/PROCEDURE:</b> Hydrogen sulfide, produced from aqueous ammonium sulfide and concentrated hydrochloric acid, was washed with dilute sulfuric acid and with concentrated sodium sulfide solution. It then passed through hydrochloric acid at the same concentration as the solution in which solubility was to be determined. The gas then passed into standardised hydrochloric acid in a calibrated absorption burette held in a thermostat controlled to ± 0.01 K. Absorption was complete in 2-3 h. Hydrogen sulfide in the solution was estimated by iodimetry. Corrections were made for the barometric pressure, the vapor pressure of the solution and the head of liquid over the solution.	<b>SOURCE AND PURITY OF MATERIALS:</b>  1. from ammonium sulfide solution and concentrated hydrochloric acid.	
	<b>ESTIMATED ERROR:</b>  δT/K = ± 0.01 (authors)	
	<b>REFERENCES:</b>	

COMPONENTS:			ORIGINAL MEASUREMENTS:		
1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Water; H <sub>2</sub> O; [7732-18-5] 3. Hydrogen chloride; HCl; [7647-01-0]			Kapustinsky, A.F.; Anvaer, B.I.  <i>Compt.Rend.Acad.Sci.URSS</i> <u>1941</u> , 30, 625-8.		
VARIABLES:			PREPARED BY:		
Concentration of HCl			P.G.T. Fogg		
EXPERIMENTAL VALUES:					
Concentration of HCl in liquid			Conc. of H <sub>2</sub> S in liquid		
Wt%	/mol dm <sup>-3</sup>	/mol kg <sup>-1</sup> of H <sub>2</sub> O	/mol dm <sup>-3</sup> *	/mol kg <sup>-1</sup> *	/mol kg <sup>-1</sup> †
16.8	5.0	5.55	0.1098	0.1227	0.1200
20.2	6.1	7.0	0.1124	0.1291	0.1266
23.7	7.3	8.4	0.1165	0.1375	0.1351
28.1	8.8	10.7	0.1192	0.1462	0.1437
34.9	11.4	14.7	0.1169	0.1542	0.1319
T/K = 298.2					
* correspond to a partial pressure of H <sub>2</sub> S of 760 mmHg (1.013 bar)					
† correspond to a total pressure of 760 mmHg (1.013 bar)					
AUXILIARY INFORMATION					
METHOD/APPARATUS/PROCEDURE:			SOURCE AND PURITY OF MATERIALS:		
Hydrogen sulfide, saturated with vapor from a sample of the solution under test, was bubbled through further solution in a thermostatted absorption vessel for 3 - 4 h. Samples were then withdrawn for analysis by iodimetry. Allowance was made for the vapor pressure of water and hydrogen chloride and for the density of the solutions in the calculation of solubilities.			1. from chemically pure hydrochloric acid and NaHS; CO <sub>2</sub> removed by Ba(OH) <sub>2</sub> .		
			ESTIMATED ERROR:		
			$\delta T/K = \pm 0.1$ (authors)		
			REFERENCES:		

<b>COMPONENTS:</b>  1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Hydrogen iodide; HI; [10034-85-2] 3. Water; H <sub>2</sub> O; [7732-18-5]	<b>ORIGINAL MEASUREMENTS:</b>  Pollitzer, F.  <i>Zeit. anorg. Chem.</i> <u>1909</u> , 64, 121-148.																										
<b>VARIABLES:</b>  Concentration	<b>PREPARED BY:</b>  P.G.T. Fogg																										
<b>EXPERIMENTAL VALUES:</b> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center; width: 50%;">Conc. of HI /mol dm<sup>-3</sup></th> <th style="text-align: center; width: 50%;">Conc. of H<sub>2</sub>S /mol dm<sup>-3</sup></th> </tr> </thead> <tbody> <tr><td style="text-align: center;">0.00</td><td style="text-align: center;">0.1004</td></tr> <tr><td style="text-align: center;">1.01</td><td style="text-align: center;">0.111</td></tr> <tr><td style="text-align: center;">1.51</td><td style="text-align: center;">0.113</td></tr> <tr><td style="text-align: center;">1.93</td><td style="text-align: center;">0.125</td></tr> <tr><td style="text-align: center;">2.45</td><td style="text-align: center;">0.130</td></tr> <tr><td style="text-align: center;">2.64</td><td style="text-align: center;">0.138</td></tr> <tr><td style="text-align: center;">3.42</td><td style="text-align: center;">0.142</td></tr> <tr><td style="text-align: center;">4.38</td><td style="text-align: center;">0.163</td></tr> <tr><td style="text-align: center;">5.005</td><td style="text-align: center;">0.165</td></tr> <tr><td style="text-align: center;">5.695</td><td style="text-align: center;">0.181</td></tr> <tr><td style="text-align: center;">6.935</td><td style="text-align: center;">0.197</td></tr> <tr><td style="text-align: center;">9.21</td><td style="text-align: center;">0.267</td></tr> </tbody> </table> <p style="margin-top: 10px;">T/K = 298.2                      Total pressure = 760 mmHg = 1.01325 bar</p>		Conc. of HI /mol dm <sup>-3</sup>	Conc. of H <sub>2</sub> S /mol dm <sup>-3</sup>	0.00	0.1004	1.01	0.111	1.51	0.113	1.93	0.125	2.45	0.130	2.64	0.138	3.42	0.142	4.38	0.163	5.005	0.165	5.695	0.181	6.935	0.197	9.21	0.267
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<b>METHOD/APPARATUS/PROCEDURE:</b>  H <sub>2</sub> S was passed into solutions of HI which were then analysed iodimetrically.	<b>SOURCE AND PURITY OF MATERIALS:</b>  1. from CaS and dilute HCl.																										
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<b>EXPERIMENTAL VALUES:</b> <table border="1" data-bbox="179 555 1302 866"> <thead> <tr> <th>Solvent</th> <th><math>P_{\text{H}_2\text{S}}/\text{mmHg}</math></th> <th><math>P_{\text{H}_2\text{S}}/\text{bar}^*</math></th> <th>Total pressure ** /mmHg</th> <th>Mole fraction of H<sub>2</sub>S in liquid <math>x_{\text{H}_2\text{S}}</math></th> </tr> </thead> <tbody> <tr> <td>Water</td> <td>16.5</td> <td>0.0220</td> <td>786.0</td> <td>0.000055</td> </tr> <tr> <td>Sulfuric acid 7.25 mol dm<sup>-3</sup></td> <td>5.0</td> <td>0.0067</td> <td>780.5</td> <td>0.00009</td> </tr> <tr> <td>Sulfuric acid (concentrated)</td> <td>36.6</td> <td>0.0488</td> <td>769.0</td> <td>0.00129</td> </tr> </tbody> </table> <p>Temperature = 323.2 K</p> <p>* calculated by compiler</p> <p>** the compiler considers that an inert gas must also have been present to give the reported total pressure although this was not stated by the authors.</p>		Solvent	$P_{\text{H}_2\text{S}}/\text{mmHg}$	$P_{\text{H}_2\text{S}}/\text{bar}^*$	Total pressure ** /mmHg	Mole fraction of H <sub>2</sub> S in liquid $x_{\text{H}_2\text{S}}$	Water	16.5	0.0220	786.0	0.000055	Sulfuric acid 7.25 mol dm <sup>-3</sup>	5.0	0.0067	780.5	0.00009	Sulfuric acid (concentrated)	36.6	0.0488	769.0	0.00129
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<b>AUXILIARY INFORMATION</b>																					
<b>METHOD/APPARATUS/PROCEDURE:</b> <p>A flow method described in ref.(1) was used. A gas mixture was passed into the apparatus for 1 - 1.5 h. Samples of liquid and of gas were then analysed.</p>	<b>SOURCE AND PURITY OF MATERIALS:</b> <p>No information</p> <hr/> <b>ESTIMATED ERROR:</b>  <hr/> <b>REFERENCES:</b> 1. Hals, E.; Pick, J.; Fried, V.; Vilim, O. <i>Vapor-Liquid Equilibrium</i> , Pergamon Press, New York																				

<b>COMPONENTS:</b> 1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Water; H <sub>2</sub> O; [7732-18-5] 3. Sulfuric acid; H <sub>2</sub> SO <sub>4</sub> ; [7664-93-9]	<b>ORIGINAL MEASUREMENTS:</b> Douabul, A.A.; Riley, J.P. <i>Deep-Sea Res.</i> <u>1979</u> , 26A, 259 - 268.																																			
<b>VARIABLES:</b> Temperature	<b>PREPARED BY:</b> P.G.T. Fogg																																			
<b>EXPERIMENTAL VALUES:</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: left;">T/K</th> <th colspan="3" style="text-align: center;">Solubility of H<sub>2</sub>S at a H<sub>2</sub>S fugacity of 1 atm (1.01325 bar).</th> </tr> <tr> <th style="text-align: center;">Unacidified distilled water /mol dm<sup>-3</sup></th> <th style="text-align: center;">mole fraction* x<sub>H<sub>2</sub>S</sub></th> <th style="text-align: center;">Acidified<sup>†</sup> distilled water /mol dm<sup>-3</sup></th> </tr> </thead> <tbody> <tr><td>275.25</td><td>0.1944</td><td>0.003490</td><td>0.1944</td></tr> <tr><td>278.20</td><td>0.1769</td><td>0.003177</td><td>0.1769</td></tr> <tr><td>283.34</td><td>0.1518</td><td>0.002728</td><td>0.1517</td></tr> <tr><td>288.19</td><td>0.1314</td><td>0.002364</td><td>0.1314</td></tr> <tr><td>293.25</td><td>0.1156</td><td>0.002082</td><td>0.1155</td></tr> <tr><td>297.87</td><td>0.1022</td><td>0.001843</td><td>0.1023</td></tr> <tr><td>302.97</td><td>0.0915</td><td>0.001653</td><td>0.0913</td></tr> </tbody> </table> <p>* Calculated by compiler</p> <p>† Dilute sulfuric acid was prepared by adding 4 cm<sup>3</sup> of sulfuric acid (5 mol dm<sup>-3</sup>) to 5 dm<sup>3</sup> of distilled water.</p>		T/K	Solubility of H <sub>2</sub> S at a H <sub>2</sub> S fugacity of 1 atm (1.01325 bar).			Unacidified distilled water /mol dm <sup>-3</sup>	mole fraction* x <sub>H<sub>2</sub>S</sub>	Acidified <sup>†</sup> distilled water /mol dm <sup>-3</sup>	275.25	0.1944	0.003490	0.1944	278.20	0.1769	0.003177	0.1769	283.34	0.1518	0.002728	0.1517	288.19	0.1314	0.002364	0.1314	293.25	0.1156	0.002082	0.1155	297.87	0.1022	0.001843	0.1023	302.97	0.0915	0.001653	0.0913
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<b>AUXILIARY INFORMATION</b>																																				
<b>METHOD/APPARATUS/PROCEDURE:</b> Distilled water or dilute acid was placed in a glass vessel. The liquid under test was deoxygenated by a stream of nitrogen. Hydrogen sulfide was then bubbled through the liquid for about 15 h. with continuous magnetic stirring. Gas flow rate was then reduced and use made of a shorter inlet tube so as to ensure that the pressure of the gas was within 0.5 mmHg of barometric pressure. After a further 2 h a sample of the liquid was analysed by iodimetry.	<b>SOURCE AND PURITY OF MATERIALS:</b> 1. from Air Products Ltd; purity > 99.6% <b>ESTIMATED ERROR:</b> δ(solubility) = ± 0.2%; δP/Pa = ± 70; δT/K = ± 0.02 (authors) <b>REFERENCES:</b>																																			

## Hydrogen Sulfide in Aqueous Solvents

<b>COMPONENTS:</b> 1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Water; H <sub>2</sub> O; [7732-18-5] 3. Hydrogen chloride; HCl; [7647-01-0] 4. Iron(II) chloride; FeCl <sub>2</sub> ; [7758-94-3]		<b>ORIGINAL MEASUREMENTS:</b> Kapustinsky, A.F.; Anvaer, B.I. <i>Compt.Rend.Acad.Sci.URSS</i> 1941, 30, 625-8.		
<b>VARIABLES:</b> Concentration		<b>PREPARED BY:</b> P.G.T. Fogg		
<b>EXPERIMENTAL VALUES:</b>				
T/K	Total pressure /mmHg	Conc. of HCl /mol kg <sup>-1</sup> of water	Conc. of FeCl <sub>2</sub> /mol kg <sup>-1</sup> of water	Conc. of H <sub>2</sub> S /mol. kg <sup>-1</sup> of water
298.15	760	1.6	0.9	0.085
		3.4	1.0	0.089
		7.8	1.1	0.108
		10.6	1.2	0.120
		9	saturated	0.101
<b>AUXILIARY INFORMATION</b>				
<b>METHOD/APPARATUS/PROCEDURE:</b> Hydrogen sulfide, saturated with vapor from a sample of the solution under test, was bubbled through further solution in a 300 cm <sup>3</sup> thermostatted absorption vessel for 3 - 4 hours. Samples of this solution were then withdrawn for analysis by iodimetry.		<b>SOURCE AND PURITY OF MATERIALS:</b> 1. from chemically pure hydrochloric acid and NaHS; CO <sub>2</sub> removed by Ba(OH) <sub>2</sub> . 4. from FeS and hydrochloric acid.		
		<b>ESTIMATED ERROR:</b> $\delta T/K = \pm 0.1$ (authors)		
		<b>REFERENCES:</b>		

COMPONENTS:		ORIGINAL MEASUREMENTS:		
1. Hydrogen sulfide; $H_2S$ ; [7783-06-4] 2. Water; $H_2O$ ; [7732-18-5] 3. Hydrogen chloride; $HCl$ ; [7647-01-0] 4. Zinc chloride; $ZnCl_2$ ; [7646-85-7]		Kapustinsky, A.F.; Anvaer, B.I.  <i>Compt.Rend.Acad.Sci.URSS</i> <u>1941, 30, 625-8.</u>		
VARIABLES:		PREPARED BY:		
Concentration		P.G.T. Fogg		
EXPERIMENTAL VALUES:				
T/K	Total pressure /mmHg	Conc. of $HCl$ /mol $kg^{-1}$ of water	Conc. of $ZnCl_2$ /mol $kg^{-1}$ of water	Conc. of $H_2S$ /mol. $kg^{-1}$ of water
298.15	760	3.9	2.1	0.1157
	758	5.0	4.7	0.1501
	755	7.8	1.0	0.1345
	746	9.1	1.5	0.1433
	755	10.6	1.1	0.1495
	750	13.5	0.8	0.1416
AUXILIARY INFORMATION				
METHOD/APPARATUS/PROCEDURE:		SOURCE AND PURITY OF MATERIALS:		
Hydrogen sulfide, saturated with vapor from a sample of the solution under test, was bubbled through further solution in a 300 $cm^3$ thermostatted absorption vessel for 3 - 4 hours. Samples of this solution were then withdrawn for analysis by iodimetry.		1. from chemically pure hydrochloric acid and $NaHS$ ; $CO_2$ removed by $Ba(OH)_2$ . 4. from pure zinc and hydrochloric acid.		
		ESTIMATED ERROR:		
		$\delta T/K = \pm 0.1$ (authors)		
		REFERENCES:		

COMPONENTS:		ORIGINAL MEASUREMENTS:	
1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Water; H <sub>2</sub> O; [7732-18-5] 3. Hydrogen chloride; HCl; [7647-01-0] 4. Sodium chloride; NaCl; [7647-14-5]		Gamsjäger, H.; Schindler, P.  <i>Helv. Chim. Acta</i> <u>1969</u> , 52, 1395-1402.	
VARIABLES:		PREPARED BY:	
Concentrations of HCl and NaCl		P.G.T. Fogg	
EXPERIMENTAL VALUES:			
Ionic strength /mol dm <sup>-3</sup>	Conc. of HCl /mol dm <sup>-3</sup>	Conc. of NaCl <sup>†</sup> /mol dm <sup>-3</sup>	Absorption constant* /mol dm <sup>-3</sup> atm <sup>-1</sup>
0.500	0.000	0.500	0.0925
0.500	0.250	0.250	0.0970
0.500	0.500	0.000	0.1005
1.000	0.000	1.000	0.0856
1.000	0.000	1.000	0.0858
1.000	0.400	0.600	0.0913
1.000	0.780	0.220	0.0976
1.000	1.000	0.000	0.1008
1.500	0.000	1.500	0.0784
1.500	0.500	1.000	0.0856
1.500	0.750	0.750	0.0899
1.500	1.000	0.500	0.0933
1.500	1.400	0.100	0.0997
1.500	1.500	0.000	0.1004
1.500	1.500	0.000	0.1010
T/K = 298.15			
* Mole of gas absorbed by one dm <sup>3</sup> of solution per atm pressure of H <sub>2</sub> S. It was assumed that the following form of Henry's law was applicable: $\text{molar concentration of H}_2\text{S} = \text{constant} \times P_{\text{H}_2\text{S}}$			
† calculated by compiler; ionic strength - conc. of HCl.			
AUXILIARY INFORMATION			
METHOD/APPARATUS/PROCEDURE:		SOURCE AND PURITY OF MATERIALS:	
The method was described in ref.(1). $P_{\text{H}_2\text{S}}$ was taken to be equal to barometric pressure minus $P_{\text{H}_2\text{O}}$ . Allowance was made for vapor pressure lowering resulting from the presence of electrolytes.		1. From Fa. Gerling, Holz & Co. (99.0 ± 0.5%) or Matheson & Co. (99.5 ± 0.5%) 3. Merck p.a. grade. 4. Merck p.a. grade; dried at 150 °C.	
		ESTIMATED ERROR: $\delta(\text{absorption constant}) = \pm 0.5\%$ (authors)	
		REFERENCES: 1. Gamsjäger, H.; Rainer, W.; Schindler, P. <i>Mh. Chem.</i> <u>1967</u> , 98, 1793.	

COMPONENTS:		ORIGINAL MEASUREMENTS:	
1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Water; H <sub>2</sub> O; [7732-18-5] 3. Hydrogen chloride; HCl; [7647-01-0] 4. Sodium chloride; NaCl; [7647-14-5]		Gamsjäger, H.; Schindler, P. <i>Helv. Chim. Acta</i> <u>1969</u> , 52, 1395-1402.	
EXPERIMENTAL VALUES:			
Ionic strength /mol dm <sup>-3</sup>	Conc. of HCl /mol dm <sup>-3</sup>	Conc. of NaCl <sup>†</sup> /mol dm <sup>-3</sup>	Absorption constant* /mol dm <sup>-3</sup> atm <sup>-1</sup>
2.000	0.000	2.000	0.0724
2.000	0.000	2.000	0.0727
2.000	0.200	1.800	0.0753
2.000	0.500	1.500	0.0794
2.000	1.000	1.000	0.0867
2.000	1.500	0.500	0.0940
2.000	1.800	0.200	0.0989
2.000	2.000	0.000	0.1014
2.500	0.000	2.500	0.0668
2.500	0.250	2.250	0.0705
2.500	0.600	1.900	0.0749
2.500	1.250	1.250	0.0839
2.500	1.875	0.625	0.0933
2.520	2.270	0.250	0.0983
2.500	2.500	0.000	0.1018
3.000	0.000	3.000	0.0619
3.000	0.000	3.000	0.0621
3.000	0.300	2.700	0.0660
3.000	0.750	2.250	0.0712
3.000	1.600	1.400	0.0824
3.000	1.600	1.400	0.0825
3.000	2.250	0.750	0.0919
3.000	2.700	0.300	0.0986
3.000	2.900	0.100	0.1010
3.000	3.000	0.000	0.1031
T/K = 298.15			
* Mole of gas absorbed by one dm <sup>3</sup> of solution per atm pressure of H <sub>2</sub> S. It was assumed that the following form of Henry's law was applicable:			
molar concentration of H <sub>2</sub> S = constant × P <sub>H<sub>2</sub>S</sub>			
† calculated by compiler; ionic strength - conc. of HCl.			

<b>COMPONENTS:</b> 1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Water; H <sub>2</sub> O; [7732-18-5] 3. Perchloric acid; HClO <sub>4</sub> ; [7601-90-3] 4. Sodium perchlorate; NaClO <sub>4</sub> ; [7601-89-0]			<b>ORIGINAL MEASUREMENTS:</b> Gamsjäger, H.; Rainer, W.; Schindler, P. <i>Monatsh. Chem.</i> <u>1967</u> , <i>98</i> , 1782-1802.		
<b>VARIABLES:</b> Concentrations of 3 & 4			<b>PREPARED BY:</b> P.G.T. Fogg		
<b>EXPERIMENTAL VALUES:</b>					
Concn. of solution / mol dm <sup>-3</sup>			Concn. of solution / mol dm <sup>-3</sup>		
NaClO <sub>4</sub>	HClO <sub>4</sub>	H <sub>2</sub> S	NaClO <sub>4</sub>	HClO <sub>4</sub>	H <sub>2</sub> S
0	0.000	0.1021	1.20	0.800	0.0881
0	0.100	0.1022	0.80	1.200	0.0936
0	0.200	0.1022	0.40	1.600	0.0994
0	0.400	0.1028	3.00	0.000	0.0677
0	0.601	0.1031	2.996	0.004	0.0678
0	1.000	0.1040	2.99	0.010	0.0678
0	2.015	0.1055	2.90	0.100	0.0685
0	2.300	0.1058	2.80	0.200	0.0699
0	2.714	0.1059	2.70	0.300	0.0710
0	3.021	0.1059	2.60	0.400	0.0724
1.00	0.000	0.0895	2.50	0.500	0.0735
0.90	0.100	0.0902	2.40	0.600	0.0743
0.80	0.200	0.0915	2.80	1.200	0.0818
0.50	0.500	0.0959	1.20	1.800	0.0898
0.20	0.800	0.1004	1.76	2.240	0.0952
2.00	0.000	0.0777	1.60	2.400	0.0971
1.80	0.200	0.0798	1.40	2.600	0.1001
1.60	0.400	0.0826	1.20	2.800	0.1031
Partial pressure of H <sub>2</sub> S / bar = 1.013;			Temperature/K = 298.2		
<b>AUXILIARY INFORMATION</b>					
<b>METHOD/APPARATUS/PROCEDURE</b> Hydrogen sulfide was passed into the perchlorate solution until the concentration of H <sub>2</sub> S, as estimated by iodimetry, was constant. Allowance was made for the partial vapor pressure of water over the solution in the calculation of the solubility for a partial pressure of H <sub>2</sub> S of 1.013 bar.			<b>SOURCE AND PURITY OF MATERIALS</b> 1. from Fa. Gerling & Holz, Hanau; 98.5 - 99.5 % pure. 2. & 3. prepared as in ref.(1)		
			<b>ESTIMATED ERROR</b> $\delta T/K = \pm 0.1$ ; concentrations accurate to $\pm 1\%$ (authors)		
			<b>REFERENCES</b> 1. Gämsjäger, H.; Kraft, W.; Rainer, W. <i>Monatsh. Chem.</i> <u>1966</u> , <i>97</i> , 833.		



COMPONENTS:		ORIGINAL MEASUREMENTS:	
1. Hydrogen sulfide; H <sub>2</sub> S [7783-06-4] 2. Water; H <sub>2</sub> O; [7732-18-5] 3. Salts		Dede, L; Becker, Th.  <i>Z. anorg. allgem. Chem.</i> <u>1926</u> , 152, 185-196.	
VARIABLES:		PREPARED BY:	
Concentration of salt.		P.G.T. Fogg	
EXPERIMENTAL VALUES:			
Salt	Concn. of salt / normality	Concn. of salt* / mol dm <sup>-3</sup>	Concn. of H <sub>2</sub> S /g per 100 g of solution
Calcium chloride; CaCl <sub>2</sub> ; [10043-52-4]	0 1 2 4	0 0.5 1 2	0.392 0.350 0.313 0.270
Sodium perchlorate; NaClO <sub>4</sub> ; [7601-89-0]	1 2 4	1 2 4	0.340 0.293 0.220
Sodium sulfate; Na <sub>2</sub> SO <sub>4</sub> ; [7757-82-6]	1 2 4	0.5 1 2	0.348 0.306 0.257
Temperature = 293.2 K      Pressure = barometric (unspecified)			
* the compiler has assumed that the equivalent of CaCl <sub>2</sub> and of Na <sub>2</sub> SO <sub>4</sub> is half a mole in each case.			
AUXILIARY INFORMATION			
METHOD/APPARATUS/PROCEDURE:		SOURCE AND PURITY OF MATERIALS:	
Hydrogen sulfide from a Kipp's apparatus was washed with water and passed through the solution under test for about 15 min. Passing the gas for a longer period did not increase the amount dissolved. The temperature was controlled by a thermostat.		No information.	
		ESTIMATED ERROR:	
		REFERENCES:	

COMPONENTS:		ORIGINAL MEASUREMENTS:		
1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Water; H <sub>2</sub> O; [7732-18-5] 3. Alkali chlorides		Kapustinsky, A.F.; Anvaer, B.I. <i>Compt. Rend. Acad. Sci. URSS</i> <u>1941</u> , 30, 625-8.		
VARIABLES:		PREPARED BY:		
		P.G.T. Fogg		
EXPERIMENTAL VALUES:				
Halide solution	T/K	P <sub>H<sub>2</sub>S</sub> /mmHg	conc. of halide /mol dm <sup>-3</sup>	conc. of H <sub>2</sub> S in liquid /mol dm <sup>-3</sup>
Sodium chloride; NaCl; [7647-14-5]	298.2	760	3.0	0.0548
Potassium chloride; KCl; [7447-40-7]	298.2	760	1.0	0.0877
AUXILIARY INFORMATION				
METHOD/APPARATUS/PROCEDURE:		SOURCE AND PURITY OF MATERIALS:		
Hydrogen sulfide, saturated with water vapor, was bubbled through a 300 cm <sup>3</sup> thermostatted absorption vessel for 3 - 4 hours. Samples of solution were then withdrawn for analysis by iodimetry. Allowance was made for the vapor pressure of water.		1. from chemically pure hydrochloric acid and NaHS; CO <sub>2</sub> removed by Ba(OH) <sub>2</sub> .		
		ESTIMATED ERROR:		
		$\delta T/K = \pm 0.1$ (authors)		
		REFERENCES:		



COMPONENTS:			ORIGINAL MEASUREMENTS:			
1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Water; H <sub>2</sub> O; [7732-18-5] 3. Sodium Sulfate; Na <sub>2</sub> SO <sub>4</sub> ; [7757-82-6]			Kozintseva, T. N.  <i>Geokhim. Issled. v Obl. Povyshennykh Davlenii i Temperatur., Akad. Nauk SSSR, Inst. Geokhim. i Analit. Khim., Sb. Statei 1965, 121-134</i>			
VARIABLES:			PREPARED BY:			
Temperature, concentration of salt			P.G.T. Fogg			
EXPERIMENTAL VALUES:						
T/K	Conc. of Na <sub>2</sub> SO <sub>4</sub> /mol. dm <sup>-3</sup>	P <sub>H<sub>2</sub>S</sub> /atm	P <sub>H<sub>2</sub>S</sub> /bar <sup>†</sup>	Distribution ratio, A*	Henry's constant /atm	
475.2	0.24	1.00	1.01	0.0086	2050	
475.2	0.26	0.71	0.72	0.0086	2050	
475.2	0.50	0.86	0.87	0.0075	2355	
475.2	0.52	1.13	1.14	0.0076	2330	
<sup>†</sup> calculated by the compiler. * A = mole ratio H <sub>2</sub> S to H <sub>2</sub> O in liquid phase / corresponding mole ratio in the gas phase.  The definition of Henry's constant was not stated clearly. Kozintseva compared values with those published by Ellis & Golding for CO <sub>2</sub> -salt-H <sub>2</sub> O systems (1). The compiler has assumed that Henry's constants given by Kozintseva were calculated in an analogous way to those given by Ellis & Golding.  i.e. Henry's constant = $P_{H_2S} / x$ $x = \frac{\text{number of moles of H}_2\text{S in the liquid phase}}{\text{number of moles of H}_2\text{S} + \text{H}_2\text{O in the liquid phase}}$						
AUXILIARY INFORMATION						
METHOD/APPARATUS/PROCEDURE:			SOURCE AND PURITY OF MATERIALS:			
A special bomb, from which samples of either gas phase or liquid phase could be withdrawn, was used. The bomb was flushed with oxygen-free nitrogen, solution of salt (50cm <sup>3</sup> ) added and the apparatus saturated with H <sub>2</sub> S (pressure not stated). The bomb and contents were heated and agitated for 25 - 50 hrs. A sample of the liquid phase was analysed iodimetrically to determine the H <sub>2</sub> S content. The sulfate content was determined as barium sulfate. A sample of the gas phase was passed through traps to collect the condensed water and through iodine solution. The H <sub>2</sub> S in the gas phase was determined iodimetrically and the water content found from the weight of condensate.			No information			
			ESTIMATED ERROR:			
			$\delta T/K = \pm 2$			
			REFERENCES:			
			1. Ellis, A.J.; Golding, R.M. <i>Amer. J. Sci.</i> <u>1963</u> , 261, 47.			

<b>COMPONENTS:</b> 1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Water; H <sub>2</sub> O; [7732-18-5] 3. Calcium Chloride; CaCl <sub>2</sub> ; [10043-52-4]	<b>ORIGINAL MEASUREMENTS:</b> Kozintseva, T. N. <i>Geokhim. Issled. v Obl. Povyshennykh Davlenii i Temperatur., Akad. Nauk SSSR, Inst. Geokhim. i Analit. Khim., Sb. Statei 1965, 121-134</i>																								
<b>VARIABLES:</b> Temperature, concentration of salt	<b>PREPARED BY:</b> P.G.T. Fogg																								
<b>EXPERIMENTAL VALUES:</b> <table border="1" data-bbox="170 533 1293 737"> <thead> <tr> <th>T/K</th> <th>Conc. of CaCl<sub>2</sub> /mol. dm<sup>-3</sup></th> <th>P<sub>H<sub>2</sub>S</sub>/atm</th> <th>P<sub>H<sub>2</sub>S</sub>/bar<sup>†</sup></th> <th>Distribution ratio, A*</th> <th>Henry's constant /atm</th> </tr> </thead> <tbody> <tr> <td>475.2</td> <td>0.23</td> <td>1.07</td> <td>1.08</td> <td>0.0083</td> <td>2130</td> </tr> <tr> <td>475.2</td> <td>0.57</td> <td>1.06</td> <td>1.07</td> <td>0.0070</td> <td>2530</td> </tr> <tr> <td>475.2</td> <td>0.54</td> <td>0.99</td> <td>1.00</td> <td>0.0071</td> <td>2496</td> </tr> </tbody> </table> <p data-bbox="189 752 610 784">† calculated by the compiler.</p> <p data-bbox="189 799 1211 860">* A = mole ratio H<sub>2</sub>S to H<sub>2</sub>O in liquid phase / corresponding mole ratio in the gas phase.</p> <p data-bbox="189 901 1243 1024">The definition of Henry's constant was not stated clearly. Kozintseva compared values with those published by Ellis &amp; Golding for CO<sub>2</sub>-salt-H<sub>2</sub>O systems (1). The compiler has assumed that Henry's constants given by Kozintseva were calculated in an analogous way to those given by Ellis &amp; Golding.</p> <p data-bbox="278 1044 893 1077">i.e. Henry's constant = <math>P_{H_2S} / x</math></p> <p data-bbox="305 1091 1126 1152"> <math display="block">x = \frac{\text{number of moles of H}_2\text{S in the liquid phase}}{\text{number of moles of H}_2\text{S} + \text{H}_2\text{O in the liquid phase}}</math> </p>		T/K	Conc. of CaCl <sub>2</sub> /mol. dm <sup>-3</sup>	P <sub>H<sub>2</sub>S</sub> /atm	P <sub>H<sub>2</sub>S</sub> /bar <sup>†</sup>	Distribution ratio, A*	Henry's constant /atm	475.2	0.23	1.07	1.08	0.0083	2130	475.2	0.57	1.06	1.07	0.0070	2530	475.2	0.54	0.99	1.00	0.0071	2496
T/K	Conc. of CaCl <sub>2</sub> /mol. dm <sup>-3</sup>	P <sub>H<sub>2</sub>S</sub> /atm	P <sub>H<sub>2</sub>S</sub> /bar <sup>†</sup>	Distribution ratio, A*	Henry's constant /atm																				
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475.2	0.54	0.99	1.00	0.0071	2496																				
<b>AUXILIARY INFORMATION</b>																									
<b>METHOD/APPARATUS/PROCEDURE:</b> A special bomb, from which samples of either gas phase or liquid phase could be withdrawn, was used. The bomb was flushed with oxygen-free nitrogen, solution of salt (50cm <sup>3</sup> ) added and the apparatus saturated with H <sub>2</sub> S (pressure not stated). The bomb and contents were heated and agitated for 25 - 50 hrs. A sample of the liquid phase was analysed iodimetrically to determine the H <sub>2</sub> S content and titrated with oxalate to determine CaCl <sub>2</sub> . A sample of the hot gas phase was passed through traps to collect the condensed water and through iodine solution. The H <sub>2</sub> S in the gas phase was determined iodimetrically and the water content found from the weight of condensate.	<b>SOURCE AND PURITY OF MATERIALS:</b> No information																								
<b>ESTIMATED ERROR:</b> $\delta T/K = \pm 2$																									
<b>REFERENCES:</b> 1. Ellis, A.J.; Golding, R.M. <i>Amer. J. Sci.</i> 1963, 261, 47.																									

COMPONENTS:		ORIGINAL MEASUREMENTS:			
1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Water; H <sub>2</sub> O; [7732-18-5] 3. Sodium carbonate; Na <sub>2</sub> CO <sub>3</sub> ; [497-19-8]		Litvinenko, M.S.; <i>Zh. Prikl. Khim.</i> 1952, 25, 516-532. <i>J. Appl. Chem. (USSR)</i> 1952, 25, 579-595.			
VARIABLES:		PREPARED BY:			
Temperature, pressure		P.G.T. Fogg			
EXPERIMENTAL VALUES:					
Conc. of Na <sub>2</sub> CO <sub>3</sub> * before addition of H <sub>2</sub> S/mol dm <sup>-3</sup>	T/K	Conc. of NaHS in liquid /mol dm <sup>-3</sup>	Conc. of H <sub>2</sub> S in gas /g m <sup>-3</sup>	P <sub>H<sub>2</sub>S</sub> /mmHg	Equilib. constant K /mol dm <sup>-3</sup> mmHg <sup>-1</sup>
0.491	293.2	0.170	3.5	1.7	0.0529
0.491		0.223	7.9	3.8	0.0488
0.491		0.261	13.0	6.3	0.0470
0.491		0.294	18.5	9.0	0.0487
0.491		0.319	24.0	11.6	0.0510
0.491		0.340	28.6	13.9	0.0552
0.492	333.2	0.135	4.6	1.8	0.0284
0.496		0.185	8.5	3.6	0.0306
0.496		0.242	19.5	8.0	0.0288
0.496		0.281	28.0	11.8	0.0311
* stated in the version in <i>J. Appl. Chem. (USSR)</i> to be the concentration of sodium in the solution. This statement is inconsistent with calculations carried out by the author and appears to be erroneous. (compiler)					
The author evaluated the constants for the equilibrium:					
$\text{Na}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{S}(\text{gas}) \rightleftharpoons \text{NaHCO}_3(\text{aq}) + \text{NaHS}(\text{aq})$					
i.e. $K = \frac{[\text{NaHCO}_3] [\text{NaHS}]}{[\text{Na}_2\text{CO}_3] P_{\text{H}_2\text{S}}}$					
Values of K for individual pressures of H <sub>2</sub> S are given in the final column of the table.					
AUXILIARY INFORMATION					
METHOD/APPARATUS/PROCEDURE			SOURCE AND PURITY OF MATERIALS:		
'Coke oven gas', freed from oxygen and acidic constituents, was mixed with H <sub>2</sub> S, monitored by a flowmeter. The mixed gases were saturated with water vapor and then bubbled through sodium carbonate solution which had first been charged with H <sub>2</sub> S. Samples of liquid were withdrawn every 30 min until two or three consecutive samples had identical sulfide content. The temperature of the absorption vessel was thermostatically controlled. Whether the initial sulfide was above or below the equilibrium value did not affect the consistency of the results.			No information		
			ESTIMATED ERROR:		
			REFERENCES:		

<b>COMPONENTS:</b> 1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Water; H <sub>2</sub> O; [7732-18-5] 3. Potassium carbonate; K <sub>2</sub> CO <sub>3</sub> ; [584-08-7]	<b>ORIGINAL MEASUREMENTS:</b> Dryden, I.G.C <i>J.Soc. Chem. Ind.</i> <u>1947</u> , 66. 59-64.
<b>VARIABLES:</b> Temperature	<b>PREPARED BY:</b> P.G.T. Fogg
<b>EXPERIMENTAL VALUES</b>	
T/K	K <sub>2</sub> / mol dm <sup>-3</sup> mmHg <sup>-1</sup>
273.7	0.147 ± 0.004
283.1	0.120 ± 0.001
293.9	0.098 ± 0.0015
302.7	0.086 ± 0.0015
312.7	0.073 ± 0.002
322.8	0.0635 ± 0.0015
332.8	0.057 ± 0.003
Concentration of potassium ions = 2 mol dm <sup>-3</sup>	
$K_2 = \frac{[\text{KHCO}_3][\text{KHS}]}{[\text{K}_2\text{CO}_3] P_{\text{H}_2\text{S}}}$	
The authors stated that the value of K <sub>2</sub> , extrapolated to zero concentration, at 298.2 K was 0.15 mol dm <sup>-3</sup> mmHg <sup>-1</sup> .	
<b>AUXILIARY INFORMATION</b>	
<b>METHOD/APPARATUS/PROCEDURE:</b> Nitrogen, purified by passage through soda-lime, was bubbled through solutions of potassium carbonate and bicarbonate previously saturated with H <sub>2</sub> S and contained in a series of three Drechsel bottles in a thermostat. The proportion of H <sub>2</sub> S in the emergent gas stream, and hence the partial pressure of H <sub>2</sub> S, was determined by iodimetry. The concentration of KHS in solutions under test was also found by iodimetry.	<b>SOURCE AND PURITY OF MATERIALS:</b> 1. by warming a suspension of MgHS in water. <b>ESTIMATED ERROR:</b> Average standard error is ± 2% (author). <b>REFERENCES:</b>

COMPONENTS:		ORIGINAL MEASUREMENTS:			
1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Water; H <sub>2</sub> O; [7732-18-5] 3. Potassium carbonate; K <sub>2</sub> CO <sub>3</sub> ; [584-08-7]		Litvinenko, M.S.; <i>Zh. Prikl. Khim.</i> 1952, 25, 516-532. <i>J. Appl. Chem. (USSR)</i> 1952, 25, 579-595.			
VARIABLES:		PREPARED BY:			
Temperature, pressure		P.G.T. Fogg			
EXPERIMENTAL VALUES:					
Conc. of K <sub>2</sub> CO <sub>3</sub> * before addition of H <sub>2</sub> S/mol dm <sup>-3</sup>	T/K	Conc. of KHS in liquid /mol dm <sup>-3</sup>	Conc. of H <sub>2</sub> S in gas <sup>†</sup> /g m <sup>-3</sup>	P <sub>H<sub>2</sub>S</sub> /mmHg	Equilib. constant K /mol dm <sup>-3</sup> mmHg <sup>-1</sup>
1.032	298.2	0.356	4.9	2.4	0.0780
1.032		0.466	11.6	5.2	0.0710
1.046		0.587	21.5	10.1	0.0734
1.046		0.685	36.0	17.2	0.0756
1.046		0.670	37.0	17.4	0.0690
1.082	313.2	0.330	6.3	2.8	0.0517
1.082		0.457	14.3	6.5	0.0514
1.040		0.553	22.8	10.4	0.0609
1.113		0.606	27.7	12.8	0.0578
1.046		0.622	35.5	16.0	0.0572
1.032		0.618	36.0	16.3	0.0566
1.110	333.2	0.352	9.3	3.7	0.0447
1.113		0.470	20.42	8.2	0.0418
1.085		0.468	21.20	8.3	0.0427
1.113		0.564	32.71	12.9	0.0456
* stated in the version in <i>J. Appl. Chem. (USSR)</i> to be the concentration of potassium in the solution. † stated in the translated paper to be the concentration in solution. These statements are inconsistent with calculations carried out by the author and appear to be errors. (compiler).					
The author evaluated the constants for the equilibrium: $\text{K}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{S}(\text{gas}) \rightleftharpoons \text{KHCO}_3(\text{aq}) + \text{KHS}(\text{aq})$ i.e $K = \frac{[\text{KHCO}_3] [\text{KHS}]}{[\text{K}_2\text{CO}_3] P_{\text{H}_2\text{S}}}$					
Values of K for individual pressures of H <sub>2</sub> S are given above.					
AUXILIARY INFORMATION					
METHOD/APPARATUS/PROCEDURE 'Coke oven gas', freed from oxygen and acidic constituents, was mixed with H <sub>2</sub> S, monitored by a flowmeter. The mixed gases were saturated with water vapor and then bubbled through potassium carbonate solution which had first been charged with H <sub>2</sub> S. Samples of liquid were withdrawn every 30 min until two or three consecutive samples had identical sulfide content. The temperature of the absorption vessel was thermostatically controlled. Whether the initial sulfide was above or below the equilibrium value did not affect the consistency of the results.			SOURCE AND PURITY OF MATERIALS:		
			No information		
			ESTIMATED ERROR:		
			REFERENCES:		

COMPONENTS:				ORIGINAL MEASUREMENTS:		
1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Carbon dioxide; CO <sub>2</sub> ; [124-38-9] 3. Water; H <sub>2</sub> O; [7732-18-5] 4. Sodium carbonate, bicarbonate or sulfide				Berl, A.; Rittener, A.  <i>Z. angew. Chem.</i> <u>1907</u> , 20, 1637-42.		
VARIABLES:				PREPARED BY:		
				P.G.T. Fogg		
EXPERIMENTAL VALUES:						
T/K	Salt	[salt] <sup>*</sup> /g dm <sup>-3</sup>	[Na <sup>+</sup> ] <sup>†</sup> /mol dm <sup>-3</sup>	Equilib. <sup>§</sup> [CO <sub>2</sub> ]/[H <sub>2</sub> S]	Equilib. $P_{CO_2}/P_{H_2S}$	k
287.2	NaHCO <sub>3</sub> [144-55-8]	34.3	0.408	4.82	2.23	2.16
291.2	NaHCO <sub>3</sub>	45.74	0.544	3.99	1.98	2.01
291.2	Na <sub>2</sub> CO <sub>3</sub> [497-19-8]	29.8	0.562	0.712	0.362	1.97
291.2	Na <sub>2</sub> S [1313-82-2]	35.5	0.910	1.61	0.864	1.86
291.2	Na <sub>2</sub> S	29.1	0.746	1.76	0.889	1.98
328.2	Na <sub>2</sub> CO <sub>3</sub>	28.2	0.532	0.774	0.856	0.90
333.2	Na <sub>2</sub> S	28.5	0.730	1.354	1.493	0.90
363.2	Na <sub>2</sub> S	29.5	0.756	1.01	1.790	0.56
$k = \frac{[CO_2] P_{H_2S}}{[H_2S] P_{CO_2}}$						
* Initial concentration of salt before addition of CO <sub>2</sub> and H <sub>2</sub> S						
† Calculated by the compiler						
§ [CO <sub>2</sub> ] is taken to be the sum of the concentrations of carbonate and bicarbonate ions in solution at equilibrium. [H <sub>2</sub> S] is the corresponding sum of concentrations of sulfide and hydrosulfide ions.						
AUXILIARY INFORMATION						
METHOD/APPARATUS/PROCEDURE:				SOURCE AND PURITY OF MATERIALS:		
The solution under test was shaken under either pure CO <sub>2</sub> or pure H <sub>2</sub> S at barometric pressure. When equilibrium had been reached the gas phase was analysed for H <sub>2</sub> S by iodimetry. The composition of the liquid phase was found by treating it with excess hydrochloric acid and analysing the mixture of CO <sub>2</sub> and H <sub>2</sub> S evolved.						
				ESTIMATED ERROR:		
				REFERENCES:		

<b>COMPONENTS:</b> 1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Carbon dioxide; CO <sub>2</sub> ; [124-38-9] 3. Water; H <sub>2</sub> O; [7732-18-5] 4. Potassium carbonate; K <sub>2</sub> CO <sub>3</sub> ; [584-08-7]	<b>ORIGINAL MEASUREMENTS:</b> Dryden, I.G.C. <i>J.Soc. Chem. Ind.</i> <u>1947</u> , 66, 59-64.																																		
<b>VARIABLES:</b> Temperature	<b>PREPARED BY:</b> P.G.T. Fogg																																		
<b>EXPERIMENTAL VALUES:</b> <table data-bbox="196 500 923 715"> <thead> <tr> <th>T/K</th> <th>Concentration of K<sup>+</sup> / mol dm<sup>-3</sup></th> <th>K<sub>3</sub></th> </tr> </thead> <tbody> <tr> <td>293.2</td> <td>0.49</td> <td>1.9 ± 0.07</td> </tr> <tr> <td>293.2</td> <td>0.98</td> <td>2.05 ± 0.07</td> </tr> <tr> <td>293.2</td> <td>1.92</td> <td>2.9 ± 0.15</td> </tr> <tr> <td>323.2</td> <td>0.50</td> <td>0.93 ± 0.03</td> </tr> <tr> <td>323.2</td> <td>1.93</td> <td>1.35 ± 0.07</td> </tr> </tbody> </table> $K_3 = \frac{[\text{KHCO}_3] P_{\text{H}_2\text{S}}}{[\text{KHS}] P_{\text{CO}_2}}$ <p>The authors also determined the following values of the equilibrium constant K<sub>1</sub> given by :</p> $K_1 = \frac{[\text{KHCO}_3]^2}{[\text{K}_2\text{CO}_3] P_{\text{CO}_2}}$ <p>The total concentration of potassium ion was 2 mol dm<sup>-3</sup></p> <table data-bbox="224 1042 812 1277"> <thead> <tr> <th>T/K</th> <th>K<sub>1</sub> / mol dm<sup>-3</sup> mmHg<sup>-1</sup></th> </tr> </thead> <tbody> <tr> <td>273.2</td> <td>0.70 ± 0.01</td> </tr> <tr> <td>283.2</td> <td>0.44 ± 0.01</td> </tr> <tr> <td>293.2</td> <td>0.282 ± 0.004</td> </tr> <tr> <td>303.2</td> <td>0.182 ± 0.002</td> </tr> <tr> <td>313.2</td> <td>0.132 ± 0.002</td> </tr> <tr> <td>323.2</td> <td>0.093 ± 0.0015</td> </tr> <tr> <td>333.6</td> <td>0.072 ± 0.0015</td> </tr> </tbody> </table>		T/K	Concentration of K <sup>+</sup> / mol dm <sup>-3</sup>	K <sub>3</sub>	293.2	0.49	1.9 ± 0.07	293.2	0.98	2.05 ± 0.07	293.2	1.92	2.9 ± 0.15	323.2	0.50	0.93 ± 0.03	323.2	1.93	1.35 ± 0.07	T/K	K <sub>1</sub> / mol dm <sup>-3</sup> mmHg <sup>-1</sup>	273.2	0.70 ± 0.01	283.2	0.44 ± 0.01	293.2	0.282 ± 0.004	303.2	0.182 ± 0.002	313.2	0.132 ± 0.002	323.2	0.093 ± 0.0015	333.6	0.072 ± 0.0015
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<b>AUXILIARY INFORMATION</b>																																			
<b>METHOD/APPARATUS/PROCEDURE:</b> A Winchester quart bottle, fitted with a rubber stopper and stopcock, was three times evacuated and filled with CO <sub>2</sub> . It was then immersed in a warm water bath, excess pressure released and cooled to room temperature. Solutions were prepared by saturating solutions of KHCO <sub>3</sub> + K <sub>2</sub> CO <sub>3</sub> with H <sub>2</sub> S and introduced into the bottle without access of air. For measurements at 293.2 K the bottle was left overnight, shaken for 3 h and immersed in a thermostat for 1 h with frequent shaking. For measurements at 323.2 K, the vessel was rotated in a thermostat. Solutions were then analysed and compositions of the gas phase found by material balance.	<b>SOURCE AND PURITY OF MATERIALS:</b> 1. from a Kipp's apparatus. <b>ESTIMATED ERROR:</b> Average value of δK <sub>3</sub> = ± 4% (author) <b>REFERENCES:</b>																																		

<b>COMPONENTS:</b> 1. Hydrogen sulfide; H <sub>2</sub> S; [7783-06-4] 2. Carbon dioxide; CO <sub>2</sub> ; [124-38-9] 3. Water; H <sub>2</sub> O; [7732-18-5] 4. Potassium carbonate; K <sub>2</sub> CO <sub>3</sub> ; [584-08-7]		<b>ORIGINAL MEASUREMENTS:</b> Litvinenko, M.S.; <i>Zh. Prikl. Khim.</i> 1952, 25, 516-532. <i>(J. Appl. Chem. (USSR) 1952, 25, 579-595)</i>			
<b>VARIABLES:</b> Temperature, pressure		<b>PREPARED BY:</b> P.G.T. Fogg			
<b>EXPERIMENTAL VALUES:</b>					
T/K	Conc. of H <sub>2</sub> S in gas phase /mol m <sup>-3</sup>	Conc. of CO <sub>2</sub> in gas phase /mol m <sup>-3</sup>	Conc. of KHS in solution /mol dm <sup>-3</sup>	Conc. of KHCO <sub>3</sub> in solution /mol dm <sup>-3</sup>	Equilib. const. K
298.2	0.990	0.615	0.558	0.863	2.48
	1.310	0.669	0.610	0.865	2.78
	1.370	0.669	0.612	0.764	2.56
	0.680	0.464	0.473	0.784	2.46
333.2	0.870	0.803	0.500	0.572	1.24
	1.240	0.853	0.542	0.662	1.76
	1.094	0.781	0.567	0.638	1.58
The concentration of potassium carbonate before adsorption of gases was 1.0 mol dm <sup>-3</sup> .					
The equilibrium constant was defined as: $K = \frac{[\text{KHCO}_3] P_{\text{H}_2\text{S}}}{[\text{KHS}] P_{\text{CO}_2}}$					
<b>AUXILIARY INFORMATION</b>					
<b>METHOD/APPARATUS/PROCEDURE:</b> 'Coke oven gas', freed from oxygen and acidic constituents, was mixed with H <sub>2</sub> S & CO <sub>2</sub> , monitored by a flowmeter. The mixed gases were saturated with water vapor and then bubbled through potassium carbonate solution. Samples of liquid were withdrawn every 30 min until two or three consecutive samples had identical sulfide content. The temperature of the adsorption vessel was thermostatically controlled. Whether the initial sulfide was above or below the equilibrium value did not affect the consistency of the results.			<b>SOURCE AND PURITY OF MATERIALS:</b> No information		
			<b>ESTIMATED ERROR:</b>		
			<b>REFERENCES:</b>		