

<b>COMPONENTS:</b> (1) Silver(I) oxide; $\text{Ag}_2\text{O}$ ; [20667-12-3] (2) Sodium hydroxide; $\text{NaOH}$ ; [1310-73-2] (3) Silver nitrate; $\text{AgNO}_3$ ; [7761-88-8] (4) Water; $\text{H}_2\text{O}$ ; [7732-18-5]		<b>ORIGINAL MEASUREMENTS:</b> Britton, H. T. S. <i>J. Chem. Soc.</i> <u>1925</u> , 127, 2956-70.		
<b>VARIABLES:</b> Concentration of $\text{NaOH}$ at $20^\circ\text{C}$		<b>PREPARED BY:</b> T. P. Dirkse		
<b>EXPERIMENTAL VALUES:</b>				
Solubility product constant of $\text{AgOH}$ at $20^\circ\text{C}$ . <sup>a</sup>				
$v/\text{ml}^b$	e.m.f./V	$10^7 C_{\text{Ag}^+}/\text{mol dm}^{-3}$	$10^4 C_{\text{OH}^-}/\text{mol dm}^{-3}$	$10^8 (C_{\text{Ag}^+} \cdot C_{\text{OH}^-})$
27.62	0.263	24.0	59.4	1.43
30.0	0.269	18.9	76.9	1.45
35.0	0.279	12.7	111	1.41
40.1	0.285	9.98	143	1.43
50.1	0.293	7.46	200	1.49
60.0	0.300	5.51	250	1.38
71.1	0.303	4.89	289 <sup>c</sup>	1.46
80.0	0.303	4.89	333	1.63 <sup>d</sup>
90.0	0.3045	4.60	368	1.70 <sup>d</sup>
100.0	0.306	4.35	400	1.74
<p><sup>a</sup> Measurements were made only after all colloidal material had disappeared.</p> <p><sup>b</sup> Volume of <math>0.1 \text{ mol NaOH dm}^{-3}</math> solution added to <math>100 \text{ ml}</math> of <math>0.2 \text{ mol AgNO}_3 \text{ dm}^{-3}</math>.</p> <p><sup>c</sup> Compiler's note; this should be 299.</p> <p><sup>d</sup> Compiler's note; this should be 1.69.</p> <p>The average value of <math>K_{\text{so}}</math> in the above table is <math>1.51 \times 10^{-8} \text{ mol}^2 \text{ dm}^{-6}</math>. This is a concentration product. The assumption that the degree of ionization of the <math>\text{AgNO}_3</math> in the reference electrode was 81.4% is significantly larger than the activity coefficient of 0.75 calculated from the extended Debye-Huckel equation (1). Recalculating the above values using this activity coefficient gives an average <math>K_{\text{so}}</math> of <math>1.42 \times 10^{-8} \text{ mol}^2 \text{ dm}^{-6}</math>.</p>				
<b>AUXILIARY INFORMATION</b>				
<b>METHOD/APPARATUS/PROCEDURE:</b> A solution of $\text{AgNO}_3$ containing $0.02 \text{ mol dm}^{-3}$ was titrated with a $\text{NaOH}$ solution containing $0.1 \text{ mol dm}^{-3}$ . During the titration the e.m.f. was measured between a silver electrode immersed in this solution and a silver electrode immersed in a solution containing $0.1 \text{ mol AgNO}_3 \text{ dm}^{-3}$ . A saturated solution of $\text{KNO}_3$ served as a bridge between these 2 electrode systems. The concentration of silver ion was calculated from the equation: $E_{\text{cell}} = -0.063 - 0.058 \log [\text{Ag}^+]$ . The $\text{OH}^-$ ion concentration was assumed to be equal to the concentration of the excess alkali that had been added.		<b>SOURCE AND PURITY OF MATERIALS:</b> No details are given.		
		<b>ESTIMATED ERROR:</b> No information is given.		
		<b>REFERENCES:</b> 1. Kielland, J. J. <i>Am. Chem. Soc.</i> <u>1937</u> , 59, 1675.		

<b>COMPONENTS:</b> (1) Silver(I) oxide; Ag <sub>2</sub> O; [20667-12-3] (2) Sodium hydroxide; NaOH; [1310-73-2] (3) Sodium perchlorate; NaClO <sub>4</sub> ; [7601-89-0] (4) Water; H <sub>2</sub> O; [7732-18-5]	<b>ORIGINAL MEASUREMENTS:</b> Antikainen, P. J.; Dyrssen, D. <i>Acta Chem. Scand.</i> <u>1960</u> , <i>14</i> , 86-94.																								
<b>VARIABLES:</b> Concentration of NaOH at 25°C.	<b>PREPARED BY:</b> T. P. Dirkse																								
<b>EXPERIMENTAL VALUES:</b> Solubility of Ag <sub>2</sub> O in NaOH solutions at 25°C. <sup>a</sup> <table data-bbox="230 576 943 828" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;"><u>log C<sub>OH<sup>-</sup></sub>/mol dm<sup>-3</sup></u></th> <th style="text-align: center;"><u>log C<sub>Ag</sub>/mol dm<sup>-3</sup></u></th> <th style="text-align: center;"><u>log C<sub>Ag</sub>/C<sub>OH<sup>-</sup></sub><sup>b</sup></u></th> </tr> </thead> <tbody> <tr><td style="text-align: center;">-1.42</td><td style="text-align: center;">-5.08</td><td style="text-align: center;">(-3.66)</td></tr> <tr><td style="text-align: center;">-1.04</td><td style="text-align: center;">-4.76</td><td style="text-align: center;">(-3.72)</td></tr> <tr><td style="text-align: center;">-0.883</td><td style="text-align: center;">-4.65</td><td style="text-align: center;">-3.77</td></tr> <tr><td style="text-align: center;">-0.827</td><td style="text-align: center;">-4.60</td><td style="text-align: center;">-3.77</td></tr> <tr><td style="text-align: center;">-0.578</td><td style="text-align: center;">-4.50</td><td style="text-align: center;">-3.92</td></tr> <tr><td style="text-align: center;">-0.461</td><td style="text-align: center;">-4.30</td><td style="text-align: center;">-3.84</td></tr> <tr><td style="text-align: center;">-0.248</td><td style="text-align: center;">-4.06</td><td style="text-align: center;">-3.81</td></tr> </tbody> </table> <p><sup>a</sup> The solutions all had a Na<sup>+</sup> ion concentration of 3 mol dm<sup>-3</sup>.</p> <p><sup>b</sup> The authors assume, on the basis of distribution experiments, that the only solute species are: Ag<sup>+</sup>, AgOH and Ag(OH)<sub>2</sub><sup>-</sup>. With the further<sub>3</sub> assumption that at OH<sup>-</sup> ion concentrations greater than 0.1 mol dm<sup>-3</sup> the main solute species is Ag(OH)<sub>2</sub><sup>-</sup>, the authors arrive at a value of log K<sub>s</sub> = -3.82 ± 0.06 for the following reaction:</p> $\frac{1}{2}\text{Ag}_2\text{O}(\text{s}) + \frac{1}{2}\text{H}_2\text{O} + \text{OH}^- = \text{Ag}(\text{OH})_2^-.$		<u>log C<sub>OH<sup>-</sup></sub>/mol dm<sup>-3</sup></u>	<u>log C<sub>Ag</sub>/mol dm<sup>-3</sup></u>	<u>log C<sub>Ag</sub>/C<sub>OH<sup>-</sup></sub><sup>b</sup></u>	-1.42	-5.08	(-3.66)	-1.04	-4.76	(-3.72)	-0.883	-4.65	-3.77	-0.827	-4.60	-3.77	-0.578	-4.50	-3.92	-0.461	-4.30	-3.84	-0.248	-4.06	-3.81
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<b>METHOD/APPARATUS/PROCEDURE:</b> The Ag <sub>2</sub> O and solvent were mixed and slowly tilted at least 2 days. The Na <sup>+</sup> concentration in the solvent was maintained at 3 mol dm <sup>-3</sup> by the addition of NaOH and NaClO <sub>4</sub> . After equilibration the phases were separated by centrifuging. Silver analysis was done by means of radioactive <sup>110m</sup> Ag. The hydroxide ion concentration was determined with the use of a glass electrode.	<b>SOURCE AND PURITY OF MATERIALS:</b> The NaClO <sub>4</sub> was prepared by the reaction of Na <sub>2</sub> CO <sub>3</sub> with HClO <sub>4</sub> . It was recrystallized twice. Distilled water was used. Nothing is said about the source or purity of the Ag <sub>2</sub> O. The NaOH was a reagent grade material.																								
<b>ESTIMATED ERROR:</b> No information is given except as the results are reported.																									
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<b>COMPONENTS:</b> (1) Silver(I) oxide; Ag <sub>2</sub> O; [20667-12-3] (2) Potassium hydroxide; KOH; [1310-58-3] (3) Zinc oxide; ZnO; [1314-13-2] (4) Water; H <sub>2</sub> O; [7732-18-5]	<b>ORIGINAL MEASUREMENTS:</b> Amle, R. F.; Ruetschi, P. J. <i>Electrochem. Soc.</i> <u>1961</u> , <i>108</i> , 813-9.															
<b>VARIABLES:</b> Solvent composition at room temperature.	<b>PREPARED BY:</b> T. P. Dirkse															
<b>EXPERIMENTAL VALUES:</b> <p style="text-align: center;">Solubility of Ag<sub>2</sub>O in aqueous KOH at room temperature.</p> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;"><math>C_{\text{KOH}}/\text{mol dm}^{-3}</math></th> <th style="text-align: center;"><math>C_{\text{ZnO}}/\text{mol dm}^{-3}</math></th> <th style="text-align: center;"><math>C_{\text{Ag}}/\text{mol dm}^{-3}</math></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">7.0</td> <td style="text-align: center;">1.9</td> <td style="text-align: center;"><math>4.05 \times 10^{-4}</math></td> </tr> <tr> <td style="text-align: center;">7.0</td> <td style="text-align: center;">0</td> <td style="text-align: center;"><math>4.8 \times 10^{-4}</math></td> </tr> <tr> <td style="text-align: center;">5.04</td> <td style="text-align: center;">1.52</td> <td style="text-align: center;"><math>4.3 \times 10^{-4}</math></td> </tr> <tr> <td style="text-align: center;">5.04</td> <td style="text-align: center;">0</td> <td style="text-align: center;"><math>4.7 \times 10^{-4}</math></td> </tr> </tbody> </table> <p>Solubility data for other concentrations are presented graphically. They show that the solubility of Ag<sub>2</sub>O in aqueous KOH reaches a maximum value for C<sub>Ag</sub> of about <math>4.5 \times 10^{-4} \text{ mol dm}^{-3}</math> in 6 mol KOH dm<sup>-3</sup> and then decreases to about <math>3.5 \times 10^{-4} \text{ mol dm}^{-3}</math> in 13 mol KOH dm<sup>-3</sup>.</p>		$C_{\text{KOH}}/\text{mol dm}^{-3}$	$C_{\text{ZnO}}/\text{mol dm}^{-3}$	$C_{\text{Ag}}/\text{mol dm}^{-3}$	7.0	1.9	$4.05 \times 10^{-4}$	7.0	0	$4.8 \times 10^{-4}$	5.04	1.52	$4.3 \times 10^{-4}$	5.04	0	$4.7 \times 10^{-4}$
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<b>AUXILIARY INFORMATION</b>																
<b>METHOD/APPARATUS/PROCEDURE:</b> The mixtures were shaken mechanically for 3 to 4 weeks. After being allowed to stand for 1 or 2 hours, the mixtures were filtered through a Pyrex fritted glass filter. Silver content was determined by a potentiometric titration with KI (1).	<b>SOURCE AND PURITY OF MATERIALS:</b> All materials were of a purified, commercially available grade.															
<b>ESTIMATED ERROR:</b> No details are given.																
<b>REFERENCES:</b> 1. Johnston, H. L.; Cuta, F.; Garrett, A. B. <i>J. Am. Chem. Soc.</i> <u>1933</u> , <i>55</i> , 2311.																

<b>COMPONENTS:</b> (1) Silver(I) oxide; $\text{Ag}_2\text{O}$ ; [20667-12-3] (2) Sodium hydroxide; $\text{NaOH}$ ; [1310-73-2] (3) Perchloric acid; $\text{HClO}_4$ ; [7601-90-3] (4) Water, $\text{H}_2\text{O}$ ; [7732-18-5]	<b>ORIGINAL MEASUREMENTS:</b> Gubeli, A. O.; Ste-Marie, J. <i>Can. J. Chem.</i> 1967, 45, 827-32.																																				
<b>VARIABLES:</b> pH of the solutions at 25°C.	<b>PREPARED BY:</b> T. P. Dirkse																																				
<b>EXPERIMENTAL VALUES:</b> Solubility of $\text{AgOH}$ as a function of pH at 25°C. <table border="1" data-bbox="343 538 713 808"> <thead> <tr> <th>pH</th> <th>pAg</th> <th>pH</th> <th>pAg</th> </tr> </thead> <tbody> <tr><td>10.28</td><td>4.36</td><td>11.90</td><td>4.89</td></tr> <tr><td>10.60</td><td>4.63</td><td>11.96</td><td>4.89</td></tr> <tr><td>10.78</td><td>4.80</td><td>11.98</td><td>4.97</td></tr> <tr><td>11.04</td><td>4.93</td><td>12.20</td><td>4.79</td></tr> <tr><td>11.36</td><td>4.95</td><td>12.66</td><td>4.59</td></tr> <tr><td>11.42</td><td>5.01</td><td>13.24</td><td>4.23</td></tr> <tr><td>11.60</td><td>5.01</td><td>13.32</td><td>4.14</td></tr> <tr><td>11.76</td><td>4.93</td><td>13.44</td><td>4.03</td></tr> </tbody> </table> <p>Using <math>K_p = [\text{Ag}^+] \cdot [\text{OH}^-]</math> and <math>\phi_x = [\text{Ag}(\text{OH})_x^{1-x}]/[\text{Ag}^+] \cdot [\text{OH}^-]^x</math>            the authors arrive at an expression for total concentration of silver.</p> $[\text{Ag}_{\text{tot}}] = \frac{K_p}{[\text{OH}^-]} (1 + \phi_1[\text{OH}^-] + \phi_2[\text{OH}^-]^2)$ <p>Writing this equation for 3 experimental points the authors write 3 equations which, when solved simultaneously, give the following values:</p> $pK_p = 8.17 \pm 0.01; \quad p\phi_1 = -3.02 \pm 0.01; \quad p\phi_2 = -4.69 \pm 0.02.$		pH	pAg	pH	pAg	10.28	4.36	11.90	4.89	10.60	4.63	11.96	4.89	10.78	4.80	11.98	4.97	11.04	4.93	12.20	4.79	11.36	4.95	12.66	4.59	11.42	5.01	13.24	4.23	11.60	5.01	13.32	4.14	11.76	4.93	13.44	4.03
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<b>AUXILIARY INFORMATION</b>																																					
<b>METHOD/APPARATUS/PROCEDURE:</b> It is not precisely clear how the solutions were prepared. It appears that $\text{NaOH}$ was added to solutions of $\text{AgClO}_4$ to precipitate $\text{Ag}_2\text{O}$ and then the pH of the solution was adjusted by adding $\text{HClO}_4$ or $\text{NaOH}$ . The mixtures were stirred continuously for 5 to 6 days in a constant temperature bath at 25°C and then allowed to settle. The silver content was determined by counting the radioactivity of $^{110}\text{Ag}$ . The pH of the solution was measured with a glass electrode. $\text{CO}_2$ and $\text{O}_2$ were excluded from the mixtures. The total ionic strength of each solution was 1 mol $\text{dm}^{-3}$ .	<b>SOURCE AND PURITY OF MATERIALS:</b> Nothing is stated except that pure water was used.																																				
<b>ESTIMATED ERROR:</b> This is given for each value that is reported.																																					
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<b>COMPONENTS:</b> (1) Silver(I) oxide; $\text{Ag}_2\text{O}$ ; [20667-12-3] (2) Potassium nitrate; $\text{KNO}_3$ [7757-79-1] (3) Ammonium hydroxide; $\text{NH}_4\text{OH}$ ; [1336-21-6] (4) Water; $\text{H}_2\text{O}$ ; [7732-18-5]	<b>ORIGINAL MEASUREMENTS:</b> Kozłowska-Kolodziej, B.; Bartecki, A. <i>Rocz. Chem.</i> <u>1973</u> , <i>47</i> , 1841-8.																
<b>VARIABLES:</b> Temperature of 343 to 403 K and concentration of $\text{NH}_4\text{OH}$ .	<b>PREPARED BY:</b> T. P. Dirkse																
<b>EXPERIMENTAL VALUES:</b> <p style="text-align: center;">Table I. Solubility of <math>\text{Ag}_2\text{O}</math> in 1 mol <math>\text{KNO}_3</math> <math>\text{dm}^{-3}</math></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;"><math>T/\text{K}</math></th> <th style="text-align: center;"><math>10^4 C_{\text{Ag}^+}/\text{mol dm}^{-3}</math></th> </tr> </thead> <tbody> <tr><td style="text-align: center;">343</td><td style="text-align: center;">8.1</td></tr> <tr><td style="text-align: center;">353</td><td style="text-align: center;">9.7</td></tr> <tr><td style="text-align: center;">363</td><td style="text-align: center;">11.3</td></tr> <tr><td style="text-align: center;">373</td><td style="text-align: center;">12.7</td></tr> <tr><td style="text-align: center;">383</td><td style="text-align: center;">14.5</td></tr> <tr><td style="text-align: center;">393</td><td style="text-align: center;">16.1</td></tr> <tr><td style="text-align: center;">403</td><td style="text-align: center;">18.1</td></tr> </tbody> </table>		$T/\text{K}$	$10^4 C_{\text{Ag}^+}/\text{mol dm}^{-3}$	343	8.1	353	9.7	363	11.3	373	12.7	383	14.5	393	16.1	403	18.1
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<b>AUXILIARY INFORMATION</b>																	
<b>METHOD/APPARATUS/PROCEDURE:</b> Mixtures of solid $\text{Ag}_2\text{O}$ and aqueous $\text{NH}_3$ solutions containing 1 mol $\text{KNO}_3$ $\text{dm}^{-3}$ were placed in an autoclave supplied with a mechanical stirrer. The mixtures were stirred until the silver content of the liquid phase became constant (this required about 6 hours). The temperature was controlled to within 0.1 K. The pressure was read on a manometer but the values are not given. The pH of the solutions was read, but these values are not supplied in the article. Silver concentration was determined by a potentiometric titration. No further details are given.	<b>SOURCE AND PURITY OF MATERIALS:</b> The water was redistilled and was $\text{CO}_2$ -free. $\text{Ag}_2\text{O}$ was synthesized according to directions of others (1). No other information is given.																
<b>ESTIMATED ERROR:</b> Probably less than 1%.																	
<b>REFERENCES:</b> 1. Brauer, J. <i>Handbuch der Preparativen Anorganischen Chemie</i> , Bd. II, Stuttgart, <u>1960</u> .																	

## COMPONENTS:

- (1) Silver(I) oxide;  $\text{Ag}_2\text{O}$ ; [20667-12-3]  
 (2) Potassium nitrate;  $\text{KNO}_3$ ; [7757-79-1]  
 (3) Ammonium hydroxide;  $\text{NH}_4\text{OH}$ ; [1336-21-6]  
 (4) Water;  $\text{H}_2\text{O}$ ; [7732-18-5]

## ORIGINAL MEASUREMENTS:

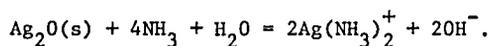
Kozłowska-Kolodziej, B.; Bartecki, A. *Rocz. Chem.* 1973, *47*, 1841-8.

## EXPERIMENTAL VALUES, contd:

Table II. Solubility of  $\text{Ag}_2\text{O}$  in aqueous  $\text{NH}_3$  containing 1 mol  $\text{KNO}_3 \text{ dm}^{-3}$ .

T/K	$C_{\text{NH}_3} / \text{mol dm}^{-3}$	$C_{\text{Ag}^+} / \text{mol dm}^{-3}$	log K <sup>a</sup>
343	0.0380	0.00979	1.39
"	0.0256	0.00690	1.38
"	0.0202	0.00571	1.33
"	0.0128	0.00423	1.34
353	0.0376	0.00932	1.59
"	0.0252	0.00658	1.58
"	0.0199	0.00548	1.54
"	0.0124	0.00378	1.54
363	0.0371	0.00886	1.78
"	0.0245	0.00626	1.79
"	0.0196	0.00523	1.78
"	0.0122	0.00365	1.82
373	0.0364	0.00835	1.99
"	0.0240	0.00591	2.01
"	0.0193	0.00494	2.02
"	0.0120	0.00350	2.05
383	0.0235	0.00544	2.29
"	0.0190	0.00472	2.32
"	0.0118	0.00344	2.39
393	0.0228	0.00521	2.55
"	0.0187	0.00452	2.58
"	0.0114	0.00341	2.55
403	0.0224	0.00496	2.83
"	0.0179	0.00343	2.80
"	0.0109	0.00335	2.82

<sup>a</sup> These values are for the reaction:



In deriving these values the following assumptions were made:

1-  $[\text{Ag}(\text{NH}_3)_2^+] = [\text{OH}^-] = C_{\text{Ag}^+}$  in Table II.

2-  $[\text{NH}_3] = [\text{NH}_3]^0 - 2[\text{Ag}(\text{NH}_3)_2^+]$  where  $[\text{NH}_3]^0$  is  $C_{\text{NH}_3}$  of Table II.

The following equation was developed for the above data:

$$\log K = 1977.2 - 760.2 \log T - 64313/T + 0.3973 T.$$