COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Copper(II) oxide; CuO; [1317-38-0] (2) Water; H_2O; [7732-18-5]	Remy, H.; Kuhlmann, A. *Z. Anal. Chem.* 1924, *65*, 161-81.
VARIABLES: Method of measuring solubility of CuO in water.	**PREPARED BY:** T. P. Dirkse

EXPERIMENTAL VALUES:

Solubility of CuO in water.

Method	C_{CuO}/mg dm^{-3}	C_{CuO}/mol dm^{-3}
conductimetric titration	5.46	6.86×10^{-5}
specific conductance	5.39	6.77×10^{-5}

One of the purposes of this work was to devise a method to correct the measured specific conductance for the presence of CO_2. A Table was constructed to give these corrections for various conditions. The specific conductance was measured at 19.2°C, but was corrected to 18°C to calculate the solubility of CuO. Because of these corrections, the solubility determined from specific conductance measurements must be considered the less accurate of these two values.

The solubility value determined from a conductimetric titration has the disadvantage that small volumes and dilute solutions were used. There is at least a 1% uncertainty in these values.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Hot CuO was added to conductivity water. The mixture was shaken, and after shaking for about 3 hours the electrical conductivity became constant. The specific conductance was measured, corrected for the presence of CO_2, and the solubility of CuO was calculated from this value and the accepted literature values for individual ionic conductances. The above saturated solution was filtered and subjected to a conductimetric titration. The solution was first titrated with dilute H_2SO_4 and then back titrated with dilute KOH. From these values, the OH^- ion content and the solubility of CuO were calculated.

SOURCE AND PURITY OF MATERIALS:

Conductivity water was used. The CuO was prepared by dissolving recrystallized pure $Cu(NO_3)_2$ in conductivity water, adding NH_4OH, carefully washing the precipitate, and then heating the precipitate.

ESTIMATED ERROR:

No details are given. The temperature varied from 19.0 to 21.3°C during the measurements.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Copper(II) oxide; CuO; [1317-38-0] (2) Baltic Sea water.	Ragg, M. *Farbe u. Lack* 1950, *56*, 435-41.
VARIABLES:	**PREPARED BY:**
None.	T. P. Dirkse

EXPERIMENTAL VALUES:

The solubility of CuO in Baltic Sea water is 0.08 mg dm^{-3}, i.e., 1.3×10^{-6} mol dm^{-3}[a]. The weight is that of copper and not of the oxide.

The article also gives solubility values for other compounds that are used in marine anti-fouling paints. The solubilities of these compounds is expressed as the weight of the metal dm^{-3}. For some of these other determinations the pH of the Baltic Sea water was 8.1, for some the temperature was 15°C, for others it was 18°C. Nothing specific is said about the temperature and the pH of the Baltic Sea water in which the solubility of CuO was measured.

[a] Calculated by the compiler.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
One-half gram of CuO was added to filtered Baltic Sea water and the mixture was shaken for several hours until equilibrium was attained. After filtration, the copper content of the filtrate was determined, but the analytical method is not described. The temperature was probably either 15 or 18°C.	No indication is given.
	ESTIMATED ERROR: No details are given.
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Copper(II) oxide; CuO; [1317-38-0] (2) Water; H_2O; [7732-18-5]	Pocock, F. J.; Stewart, J. F. *J. Eng. Power* 1963, *85*, 33-45.
VARIABLES: Temperature and pressure of the steam.	**PREPARED BY:** T. P. Dirkse

EXPERIMENTAL VALUES: Solubility of CuO in supercritical steam, pH = 7.5

Pressure/psig	temp/°F[a]	C_{Cu}/ppb
4500	1090	2.4
4500	994	5.8
1850	907	0.5
1850	931	-0.4[b]
2700	1006	2.9
3200	1053	2.9
4500	1153	18.4
4500	1143	15.2
1850	911	0.9
4500	1035	6.2
4500	1068	6.3
4500	1005	8.2
4500	976	11.5
4500	1152	12.3
3900	1136	11.3
4500	963	11.8
4500	1150	15.6
2700	1134	3.3

[a] Average temperature during the entire procedure.

[b] The authors suspect the blank correction was too large.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Samples of CuO were placed in a stainless steel autoclave and the superheated steam was passed through the autoclave at the desired pressure. Sampling was continued until 3 liters of condensate had passed through the sample. This required 2.5 to 3 hours. Blank runs were made to measure the amount of copper extracted from the metal in the apparatus under the test conditions. The method used to determine copper content is not mentioned. Additional runs were made to ensure that equilibrium conditions had been attained.

SOURCE AND PURITY OF MATERIALS:

CuO was a reagent grade material that was washed with deionized water to free it of fines. The feedwater was demineralized and deaerated. Some NH_4OH was added to raise the pH.

ESTIMATED ERROR:

No details are given

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Copper(II) oxide; CuO, [1317-38-0] (2) Water; H_2O; [7732-18-5]	Pocock, F. J.; Stewart, J. F. *J. Eng. Power* 1963, *85*, 33-45.

EXPERIMENTAL VALUES: Solubility of CuO in supercritical steam, pH ∿ 9.5.

Pressure/psig	temp/°F[a]	C_{Cu}/ppb
1750	904	-1.5[b]
2700	1015	1.1
3200	1033	4.0
2700	1135	4.2
3300	1161	12.9
4500	1164	17.1
4500	1144	15.1
4500	1159	17.0
4500	1007	23.0
4500	1053	21.1
4500	927	14.9
4500	1012	15.9
2700	1158	5.4
4500	1126	17.6
4500	898	18.4
4500	1063	13.0
4500	1089	20.2

[a] Average temperature during the procedure.

[b] This is considered to be due to too large a blank correction.

After the experiments had been concluded, an X-ray diffraction pattern was taken of the solid phase. This indicated that Cu_2O was present, possibly due to reduction of CuO by H_2 formed as a result of corrosion of the stainless steel.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Copper(II) hydroxide; $Cu(OH)_2$; [20427-59-2] (2) Water; H_2O; [7732-18-5]	Jenkins, S. H.; Keight, D. G.; Humphreys, R. E. *Air Water Pollution* 1964, *8*, 537-56.
VARIABLES: Source of the water.	**PREPARED BY:** T. P. Dirkse

EXPERIMENTAL VALUES: Table I. Solubility of $Cu(OH)_2$ in distilled water. [a]

Sample number	1	2	3	4	5	6
C_{Cu}/ppm	0.22	0.19	0.18	0.25	0.13	0.16

[a] No temperature is given. The results are those obtained after four extractions.

Table II. Solubility of $Cu(OH)_2$ in CO_2-free distilled water.[a]

Sample number	1	2	3
pH of solvent	6.20	6.20	6.20
pH of sln	7.20	7.13	7.09
C_{Cu}/ppm	0.23	0.23	0.39
t/°C	18.8	18.8	18.8

[a] These results are for the eighth, and final, extraction.

Table III. Solubility of $Cu(OH)_2$ in Birmingham tap water.[a]

Number of extractions	pH of water	t/°C	Sample 1 pH	Sample 1 C_{Cu}/ppm	Sample 2 pH	Sample 2 C_{Cu}/ppm	Sample 3 pH	Sample 3 C_{Cu}/ppm
10	7.25	22.0	7.88	0.31	7.95	0.27	7.90	0.22
11	7.60	20.0	7.58	0.12	7.68	0.12	7.41	0.25
12	7.41	20.0	8.03	0.25	7.92	0.31	7.82	0.27
13	7.72	17.0	7.53	0.06	7.59	0.04	7.50	0.06
14	7.60	16.5	7.56	0.12	7.62	0.15	7.59	0.15
15	7.20	17.5	7.25	0.19	7.50	0.23	7.18	0.26
16	7.00	19.0	7.25	0.19	7.30	0.15	7.30	0.17
17	7.52	19.5	7.58	0.19	7.51	0.23	7.50	0.19

[a] After several washings the brown cupric hydroxide began to turn black.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

The $Cu(OH)_2$ was washed several times, then added to the water. The mixtures were shaken mechanically, but there is no indication as to how long they were shaken. After some time was allowed for settling, the mixtures were filtered through a Millipore HA filter. Further extractions were made by adding more water and repeating the process for each such extraction. The copper content of the filtrate was determined colorimetrically using the biscyclohexanone oxalyldihydrazone (1).

SOURCE AND PURITY OF MATERIALS:

The $Cu(OH)_2$ was of reagent grade quality. Distilled water and Birmingham (England) tap water were used as solvents.

ESTIMATED ERROR:

No details are given but from the results given in the paper it appears that the average deviation from the mean value was about 15%.

REFERENCES:

1. Williams, T. R.; Morgan, R. R. T. *Chem. & Ind. (Rev.)* 1954, *16*, 461.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Copper(II) oxide; CuO; [1317-38-0] (2) Water; H_2O; [7732-18-5]	Hearn, B.; Hunt, M. R.; Hayward, A. *J. Chem. Eng. Data* 1969, *14*, 442-7.
VARIABLES: Temperature and pressure of the water.	**PREPARED BY:** T. P. Dirkse

EXPERIMENTAL VALUES:

Solubility of CuO in superheated steam.

t/°C	p/psig	$C_{Cu}/10^{-6}$ g kg^{-1}
57 ± 1	1730 ± 25	12.4 ± 0.3
69 ± 2	1200 ± 100	16 ± 2
81 ± 2	1100 ± 100	23 ± 2
87 ± 2	3830 ± 25	23.5 ± 1
88 ± 1	3850 ± 15	21.5 ± 1
89 ± 1	3950 ± 75	17 ± 1
110 ± 2	3300 ± 80	23.5 ± 1
117 ± 2	3700 ± 45	29 ± 1
121 ± 2	3520 ± 40	38 ± 1
122 ± 3	3450 ± 65	23 ± 1
133 ± 2	1200 ± 100	26 ± 1
154 ± 2	1200 ± 100	52 ± 2
181 ± 2	2640 ± 35	198 ± 5
187 ± 1	2005 ± 20	143 ± 3
207 ± 3	1900 ± 100	212 ± 2
232 ± 1	3025 ± 30	281 ± 5
234 ± 2	3870 ± 45	289 ± 6
249 ± 2	2900 ± 100	360 ± 4
252 ± 1	3020 ± 35	391 ± 5
260 ± 1	3780 ± 55	393 ± 7
260 ± 1	3900 ± 115	378 ± 8
260 ± 2	4135 ± 30	395 ± 5
273 ± 2	3200 ± 50	444 ± 10

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

About 500 g of CuO was placed in the equilibrator, which was then flushed with cold water to remove fine particles of CuO. Steam at the prescribed temperature and pressure was passed through the equilibrator After it had passed through the equilibrator the steam was condensed and about 450 ml was taken for analysis, which was done colorimetrically, using CCl_4 and dibenzyldithiocarbamate (1).

SOURCE AND PURITY OF MATERIALS:

The water was deionized, distilled and deaerated. No information is given about the CuO.

ESTIMATED ERROR:

The copper analysis had a standard deviation of 0.15 to 0.7 μg of Cu kg^{-1}.

REFERENCES:

1. Wilson, A. L. *Analyst* 1962, *87*, 884.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Copper(II) oxide; CuO; [1317-38-0] (2) Water; H_2O; [7732-18-5]	Hearn, B.; Hunt, M. R.; Hayward, A. *J. Chem. Eng. Data* 1969, *14*, 442-7.

EXPERIMENTAL VALUES, contd.

t/°C	p/psig	$C_{Cu}/10^{-6}$ g kg^{-1}
291 ± 1	4055 ± 20	503 ± 5
298 ± 2	3225 ± 50	516 ± 6
307 ± 2	4200 ± 100	547 ± 10
322 ± 3	3270 ± 40	610 ± 32
331 ± 2	4200 ± 35	600 ± 6
350 ± 1	4000 ± 65	462 ± 10
350 ± 1	6000 ± 65	570 ± 10
374 ± 4	3500 ± 65	234 ± 10
379 ± 2	3950 ± 100	137 ± 6
376 ± 2	4000 ± 100	194 ± 6
389 ± 1	4055 ± 15	233 ± 8
389 ± 1	3995 ± 20	227 ± 8
381 ± 2	4000 ± 65	331 ± 10
378 ± 2	4500 ± 65	337 ± 10
381 ± 2	5000 ± 65	320 ± 10
381 ± 2	5500 ± 65	350 ± 10
382 ± 2	6000 ± 65	486 ± 10
386 ± 2	4050 ± 100	89 ± 6
388 ± 2	4600 ± 100	151 ± 6
401 ± 1	4305 ± 20	117 ± 1
408 ± 2	4925 ± 40	129 ± 1
401 ± 3	5100 ± 100	170 ± 1
401 ± 2	5000 ± 65	182 ± 1
405 ± 1	5375 ± 30	214 ± 1
405 ± 1	6070 ± 25	406 ± 6
420 ± 2	3840 ± 60	46 ± 1
422 ± 1	4035 ± 50	90 ± 1
421 ± 2	4435 ± 50	64 ± 1
440 ± 2	4970 ± 65	92 ± 1
430 ± 1	5060 ± 45	100 ± 1
431 ± 2	5500 ± 65	153 ± 2
434 ± 2	6000 ± 130	315 ± 5
440 ± 1	3455 ± 30	77 ± 1
448 ± 2	5990 ± 105	299 ± 2
460 ± 2	3500 ± 80	56 ± 1
460 ± 1	3500 ± 65	81 ± 1
455 ± 2	4010 ± 75	101 ± 1
469 ± 2	4520 ± 65	80 ± 1
468 ± 2	5060 ± 45	108 ± 2
463 ± 2	5490 ± 75	139 ± 4
462 ± 2	6000 ± 115	126 ± 4
461 ± 2	6050 ± 70	184 ± 6
497 ± 1	3465 ± 50	113 ± 1
497 ± 1	4065 ± 25	121 ± 1
502 ± 1	4465 ± 40	145 ± 1
501 ± 2	5045 ± 30	148 ± 1
500 ± 2	5425 ± 40	138 ± 2
503 ± 2	5980 ± 95	178 ± 2
550 ± 1	3530 ± 45	115 ± 1
550 ± 1	4050 ± 35	100 ± 1
551 ± 2	4575 ± 35	133 ± 1
551 ± 1	5050 ± 40	165 ± 1
550 ± 1	5510 ± 35	172 ± 2
550 ± 1	5980 ± 40	159 ± 2