COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Uranyl nitrate; $UO_2(NO_3)_2$; [15905-86-9] (2) Water; H_2O; [7732-18-5]	De Conninck, Oe. *Compt. Rend.*, 1900, *131*, 1219 - 1220.
VARIABLES: Temperature: About 287 K	**PREPARED BY:** L. Fuks; S. Siekierski

EXPERIMENTAL VALUES:

The solubility of uranyl nitrate in water is reported to be about one part of the salt per two parts of water. It is an average of determinations at 12.9°C, 13.2°C, 13.7°C, 14°C, and 14.2°C.

The compilers have calculated this solubility as 1.25 mol/kg.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Nothing specified.	Uranyl nitrate, presumably the hexahydrate, $UO_2(NO_3)_2.6H_2O$ (compilers) was exposed for several days to a stream of dry air, and then dried for four hours at 85°C to 90°C. Distilled water was used as the solvent.
	ESTIMATED ERROR: Nothing specified.
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Uranyl nitrate; $UO_2(NO_3)_2$; [15905-86-9] (2) Water; H_2O; [7732-18-5]	Vasil'ev, A. M. *Zh. Russ. Fiz. Khim. Obied.*, 1910, *42*, 570 - 581.
VARIABLES:	PREPARED BY:
Temperature: 271 to 345 K	L. Fuks; S. Siekierski

EXPERIMENTAL VALUES:

Solubility of $UO_2(NO_3)_2$ in H_2O as a function of temperature[a,b]

$t/^oC$	$UO_2(NO_3)_2.6H_2O$	$UO_2(NO_3)_2$		Solid[c] Phase
	mass %	mass %	mol/kg	
-1.6	13.80	10.83	0.3082	A
-2.1	15.59	12.23	0.3536	A
-2.9	21.90	17.18	0.5264	A
-4.4	29.96	23.51	0.7800	A
-6.0	33.38	26.19	0.9005	A
-7.9	41.44	32.52	1.223	A
-11.2	47.45	37.23	1.505	A
-18.1	54.90	43.08	1.921	B
-12.1	58.00	45.51	2.119	B
-2.2	62.13	48.75	2.414	B
0	63.01	49.44	2.482	B
12.3	67.36	52.86	2.846	B
25.6	72.83	57.15	3.385	B
36.7	78.05	61.25	4.011	B
45.2	82.96	65.10	4.734	B
71.8[d]	86.32	67.74	5.329	B

[a] Temperature and solubility values were taken by the compilers from Ref. (1).

[b] Mass % of $UO_2(NO_3)_2$ and molalities calculated by the compilers.

[c] Solid phases: A = ice; B = $UO_2(NO_3)_2.6H_2O$.

[d] Probably a typographical error in Ref. (1). According to Ref. (2), the temperature is 51.8°C.

The eutectic temperature is -18.1°C and the congruent melting points of the hexa-, tri- and dihydrate are 60.2, 121.5, and 179.3°C, respectively.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Nothing specified in Ref. (1).	$UO_2(NO_3)_2.6H_2O$ with a m.p. of 60.2°C was used.
	ESTIMATED ERROR: Nothing specified.
	REFERENCES: 1. Vasil'ev, A. *Chem. Zentr.* 1910, *81*, 1527. 2. Guempel, O. *Bull. Soc. Chim. Belg.* 1929, *38*, 443.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Uranyl nitrate; $UO_2(NO_3)_2$; [15905-86-9] (2) Water; H_2O; [7732-18-5]	Guempel, O. *Bull. Soc. Chim. Belg.* 1929, *38*, 443 - 477.
VARIABLES:	**PREPARED BY:**
Temperature: 273 to 362 K	L. Fuks; S. Siekierski

EXPERIMENTAL VALUES:

Solubility of $UO_2(NO_3)_2$ in H_2O as a function of temperature[a]

t/°C	$UO_2(NO_3)_2$		Method	Solid Phase[c]
	mass %	mol/kg		
-0.3	7.87	0.217	Cryoscopic	A
-2.9	17.33	0.5320	"	A
-5.4	24.85	0.8392	"	A
-7.3	29.60	1.067	"	A
-18.0	43.04	1.918	"	A
-11.5	46.25	2.182	Synthetic	B
-5.5	48.47	2.387	"	B
-4.2	45.27[b]	2.099	"	B
5.5	50.55[b]	2.594	"	B
7.6	51.27	2.702	"	B
15.0	52.80	2.839	"	B
20.0	54.40[b]	3.028	Analytical	B
21.1	55.58[b]	3.175	"	B
25.0	55.90	3.217	"	B
36.1	60.28	3.851	"	B
43.6	64.20	4.551	"	B
54.5	70.25	5.993	"	B
56.1	71.95	6.510	"	B
57.4	72.76	6.779	"	B
58.2	74.13	7.272	"	B
58.6	75.65	7.884	"	B+C
62.0	76.83	8.415	"	C
72.4	78.50	9.266	"	C
80.9	80.20	10.28	"	C
88.5	81.13	10.91	"	C

[a] Molalities calculated by compilers.

[b] Data points erroneously ascribed to Vasil'ev (1).

[c] Solid phases: A = ice, B = $UO_2(NO_3)_2.6H_2O$, C = $UO_2(NO_3)_2.xH_2O$, $x<6$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The uranyl nitrate concentrations were determined gravimetrically as U_3O_8.	Nothing specified.
	ESTIMATED ERROR:
	Nothing specified.
	REFERENCES:
	1. Vasil'ev, A. *Chem. Zentr.* 1910, *81*, 1527.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Uranyl nitrate; $UO_2(NO_3)_2$; [15905-86-9] (2) Water; H_2O; [7732-18-5]	Benrath, A. *Z. Anorg. Allg. Chem.*, 1942, *249*, 245 - 250.
VARIABLES:	**PREPARED BY:**
Temperature: 353 to 460 K	A. Sozanski; S. Siekierski

EXPERIMENTAL VALUES:

Solubility of $UO_2(NO_3)_2$ in H_2O as a function of temperature[a]

$t/^oC$	$UO_2(NO_3)_2$	
	mass %	mol/kg
80	79	9.5
94	80.6	10.5
108	82.9	12.3
115	84.6	13.9
116	85.8	15.3
138	86.7	16.5
156	87.9	18.4
175	90.5	24.2
187	91.6	27.7

[a]Molalities calculated by the compilers.

COMMENTS AND/OR ADDITIONAL DATA:

The hexa ---> trihydrate transition point is at 58.6°C.

Decomposition of uranyl nitrate was observed at 180°C.

In the source paper, the solubility vs. temperature diagram is given.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF CHEMICALS:
The synthetic method was used. The temperature of crystallization was determined visually. Details were given in Ref. (1).	Nothing specified.
	ESTIMATED ERROR:
	Nothing specified.
	REFERENCES:
	1. Benrath, A.; Gjedebo, F.; Schiffers, B.; Wunderlich, H. *Z. Anorg. Allg. Chem.* 1937, *231*, 285.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Uranyl nitrate; $UO_2(NO_3)_2$; [15905-86-9] (2) Water; H_2O; [7732-18-5]	Lane, J. A. Plutonium Project Handbook, Rev. Ed., CL-697, Chapt. 2, "Physical and Chemical Properties",May 1945.
VARIABLES:	**PREPARED BY:**
Temperature: 333 to 417 K	L. Fuks; S. Siekierski

EXPERIMENTAL VALUES:

Solubility of $UO_2(NO_3)_2$ in H_2O as a function of temperature[a]

$t/^oC$	$UO_2(NO_3)_2$		Solid Phase[b]
	mass %	mol/kg	
60	79.0	9.57	A
64.5	79.5	9.87	A
71.9	79.2	9.68	A
78.9	80.6	10.5	A
80.5	82.0	11.6	A
92.2	82.8	12.2	A
101.1	85.6	15.1	A
105.5	86.0	15.6	A
144.2	89.3	21.2	B

[a]Numerical data were taken by the compilers from Ref. (1) which contained the phase diagram. In the phase diagram, some of the data points reported by Lane and by Guempel (2) have been interchanged (compilers).

[b]Solid phase: A = $UO_2(NO_3)_2.3H_2O$, B = $UO_2(NO_3)_2.2H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Nothing specified.	Nothing specified.
	ESTIMATED ERROR:
	Nothing specified.
	REFERENCES:

1. Marshall, W. L.; Gill, J. S.; Secoy, C. H.
J. Am. Chem. Soc. 1951, 73, 1867.

2. Guempel, O.
Bull. Soc. Chim. Belg. 1929, 30, 443.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Uranyl nitrate; $UO_2(NO_3)_2$; [15905-86-9] (2) Water; H_2O; [7732-18-5]	Marshall, W. L.; Gill, J. S. Report 1949, ORNL-607, Oak Ridge National Laboratory, 38 - 44.
VARIABLES: Temperature: 343 to 457 K	**PREPARED BY:** A. Sozanski; S. Siekierski

EXPERIMENTAL VALUES:

Solubility of $UO_2(NO_3)_2$ in H_2O as a function of temperature[a]

$t/^oC$	$UO_2(NO_3)_2$		Solid Phase[b]
	mass %	mol/kg	
70	77.25	8.617	A
77.2	78.49	9.260	A[c]
85	79.92	10.10	A
90.5	80.98	10.81	A[d]
92	81.37	11.08	A
100	82.57	12.02	A
110	84.14	13.46	A
113	84.67	14.02	A+B
120	85.25	14.67	B
130	86.16	15.80	B
133	86.54	16.32	B
137	87.07	17.09	B
141.2	87.02	17.01	B[e]
147	87.75	18.18	B
154.5	88.23	19.02	B
159	88.74	20.00	B
160	88.94	20.41	B
166.5	89.22	21.00	B
172	89.92	22.64	B
180	90.78	24.99	B
181	91.01	25.69	B
184	91.63	27.78	B[f]

[a] Molalities calculated by the compilers.

[b] Solid phases: A = $UO_2(NO_3)_2.3H_2O$, B = $UO_2(NO_3)_2.2H_2O$.

[c] 87.08% $UO_2(NO_3)_2$ (theor. 87.95%). [d] 87.05% $UO_2(NO_3)_2$ (theor. 87.95%).

[e] 90.58% $UO_2(NO_3)_2$ (theor. 91.63%). [f] True dihydrate melting point.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method used. Solubility runs made in a long-necked 200 cm^3 flask complete with a side arm. The flask was connected to a standard taper joint unit having gas analysis and vacuum line takeoff. Sample was withdrawn with pipets through the side arm. A partial vacuum was placed on molten uranyl nitrate hydrate at the working temperature to remove water, and the liquid was vigorously stirred until crystals formed. After 40 to 45 min. of further stirring, samples of clear solution were taken. Analysis of uranium was made by straight oxidation at 900°C to U_3O_8, or by precipitation of ammonium diuranate followed by oxidation to U_3O_8. Values have been obtained both going up and down the temperature scale. The system appears thermally stable up to 184°C, above the dihydrate decomposition to UO_3 and NO_2.

SOURCE AND PURITY OF MATERIALS:

1. $UO_2(NO_3)_2.6H_2O$, chemically pure.
2. $UO_2(NO_3)_2.2H_2O$ obtained by dehydration of hexahydrate.

ESTIMATED ERROR:

Solubility: less than 0.2%.

Temperature: Precision ±0.1K.

REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Uranyl nitrate; $UO_2(NO_3)_2$; [15905-86-9] (2) Water; H_2O; [7732-18-5]	De Keyser, W. L.; Cypres, R.; Herrmann, M. Bull. Centre Phys. Nucl. Univ. Libre de Bruxelles No. 17, 1950.
VARIABLES:	**PREPARED BY:**
Temperature: 293 K	A. Sozanski; S. Siekierski

EXPERIMENTAL VALUES:

The solubility of $UO_2(NO_3)_2.6H_2O$ in water is reported to be 54.09 g of anhydrous salt per 100 g of solution, at 20°C. The corresponding molality value calculated by the compilers is 2.990 mol/kg.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used. An excess of uranyl nitrate hexahydrate was placed in 20 cm^3 of water and mixed for 30 minutes at 30 to 40°C. The liquid with crystals was then transferred to a thermostat where it was stirred for another 30 min. After the solution had settled (15 min), a 10 cm^3 aliquot was pipetted for weighing. The sample was dried at 120°C and calcined at 900°C in a platinum crucible to constant weight as the oxide, U_3O_8.	Nothing specified for the solid uranyl nitrate hexahydrate. The amount of crystallization water was 21.30% (theor. 21.52%).
	ESTIMATED ERROR: Soly: the reported solubility is mean of two values which differ by 0.003 mol/kg Temp: nothing specified
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Uranyl nitrate; $UO_2(NO_3)_2$; [15905-86-9] (2) Water; H_2O; [7732-18-5]	Marshall, W. L.; Gill, J. S.; Secoy, C. H. *J. Am. Chem. Soc.*, 1951, *73*, 1867 - 1869.
VARIABLES: Temperature: 343 to 457 K	**PREPARED BY:** L. Fuks; S. Siekierski

EXPERIMENTAL VALUES:

Solubility of $UO_2(NO_3)_2$ in H_2O as a function of temperature[a]

t/°C	$UO_2(NO_3)_2$		Solid Phase[d]
	mass %	mol/kg (compilers)	
70	77.25	8.617	A
77.2	78.49	9.260	A
85	79.92	10.10	A
90.5	80.98	10.80	A
92	81.37	11.08	A
100	82.57	12.02	A
110	84.14	13.46	A
113[b]	84.67	14.02	A+B
120	85.25	14.67	B
130	86.13	15.76	B
133	86.54	16.32	B
137	87.07	17.09	B
141.2	87.02	17.10	B
147	87.75	18.18	B
154.5	88.23	19.02	B
159	88.74	20.00	B
160	88.94	20.41	B
165.5	89.22	21.00	B
172	89.92	22.64	B
180	90.78	24.99	B
181[c]	91.10	25.98	B
184	91.63	27.78	B

[a]The initial solid phase is $UO_2(NO_3)_2.6H_2O$.

[b]Intersecting point for incongruent melting point of trihydrate.

[c]True melting point of the dihydrate.

[d]Solid phases: A = $UO_2(NO_3)_2.3H_2O$; B = $UO_2(NO_3)_2.2H_2O$.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Uranyl nitrate hexahydrate was placed in the thermostated vacuum-connected flask at the desired temperature, and was stirred until crystallization began. Then dried air was admitted to the system, followed by stirring for an additional 40 to 50 min. Duplicate samples of the clear solution as well as of the solid phase were removed, and the uranium content determined by ignition at 900°C to form the oxide, U_3O_8.	1. $UO_2(NO_3)_2.6H_2O$, Mallinckrodt C.P. 2. Dihydrate prepared by the dehydration of the hexahydrate.
	ESTIMATED ERROR: Soly: Results of 5 separate runs. Temp: Precision ±0.1°C.
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Uranyl nitrate; $UO_2(NO_3)_2$; [15905-86-9] (2) Water; H_2O; [7732-18-5]	Warner, R. K. *Australian J. Appl. Sci.*, 1953, 4, 581-589.
VARIABLES: One temperature: 293 K	**PREPARED BY:** L. Fuks; S. Siekierski

EXPERIMENTAL VALUES:

The solubility of $UO_2(NO_3)_2.6H_2O$ in water at 20°C was reported to be 0.540 g of the anhydrous salt per g of the solution.

The corresponding molality was calculated by the compilers as 2.98 mol/kg.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used. Excess uranyl nitrate hexahydrate was placed with the appropriate amount of pure solvent into a small flask, warmed to between 30°C and 50°C, and agitated for 15 min. Then the flask was placed in a thermostated bath at 20°C, and shaken for 6 to 8 hours. When equilibrium was reached, the solution was decanted, filtered, and sampled for analysis. The analysis consisted of the total uranium concentration determined by evaporation of the weighed aliquots, followed by ignition to U_3O_8.	"AR" grade $UO_2(NO_3)_2.6H_2O$. **ESTIMATED ERROR:** Soly: Repeat determinations of the solubility were made until agreement within 0.2 mass %. Temp: Precision ±0.05 K. **REFERENCES:**

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Uranyl nitrate; $UO_2(NO_3)_2$; [15905-86-9] (2) Water; H_2O; [7732-18-5]	Nethaway, M. O.; Lang, G. P. Report 1958, MCW-1412 (Elliot, B., ed.)
VARIABLES:	**PREPARED BY:**
Temperature: 287 to 457 K	A. Sozanski; S. Siekierski

EXPERIMENTAL VALUES:

Solubility of $UO_2(NO_3)_2$ in H_2O as a function of temperature[a,b]

$t/^oC$	$UO_2(NO_3)_2$	
	mass %	mol/kg
14	32.4	2.94
20.2-20.6	33.1	3.08
23.2	34.2	3.31
31.9	35.94	3.728
57	45.72	7.900
59	46.5	8.50
61	46.7	8.64
60	47.4	9.27
73	49.1	11.0
175-180	55.1	26.3
181-184	55.3	27.3

[a]Molalities calculated by the compilers.

[b]Nature of solid phase not specified.

COMMENTS AND/OR ADDITIONAL DATA:

Uranyl nitrate solutions exhibit a very marked ability to supercool. For this reason, it is somewhat difficult to accurately determine a precise temperature of physical change. The best freezing point values were obtained by repeated determinations at close to equilibrium conditions. The results are presented also in the form of a temperature vs. composition (mass % or uranium) plot.

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF CHEMICALS:
The synthetic method was used. An oil bath was used as a heat transfer medium to provide slow and uniform temperature change. No other information is given.	Mallinckrodt $UO_2(NO_3)_2.6H_2O$ was (purified). Uraynyl nitrate dihydrate obtained by drying hexahydrate and storing under vacuum. Analysis of these materials showed a ratio to within 0.5 to 1% of the stoichiometry.
	ESTIMATED ERROR: Nothing specified.
	REFERENCES:

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Thorium nitrate; $Th(NO_3)_4$; [13823-29-5] (2) Water; H_2O; [7732-18-5]	Misciattelli, P. *Gazz. Chim. Ital.* 1930, *60*, 833-838.
VARIABLES: T/K = 229 - 293	**PREPARED BY:** L. Fuks; S. Siekierski

EXPERIMENTAL VALUES:

Solubility of $Th(NO_3)_4$ in water[a]

	$Th(NO_3)_4$				$Th(NO_3)_4$		
$t/^oC$	mass %	mol/kg	Solid Phase	$t/^oC$	mass %	mol/kg	Solid Phase
-0.2	1.0	0.021	ice	-13.5	46.2	1.80	A
-0.5	2.0	0.040	"	-15.0	47.7	1.90	A
-1.0	5.2	0.110	"	-16.6	49.8	2.07	A
-1.5	9.0	0.210	"	-19.1	51.0	2.17	A
-2.1	13.0	0.311	"	-23.3	53.1	2.36	A
-2.9	16.0	0.397	"	-25.0	55.7	2.62	A
-4.0	20.0	0.521	"	-28.6	58.0	2.88	A
-4.6	23.5	0.640	"	-31.3	59.2	3.02	A
-5.4	26.4	0.747	"	-35.0	60.6	3.20	A
-5.6	27.3	0.782	"	-40.6	62.0	3.40	A
-6.0	33.0	1.030	"				
-6.6	37.0	1.220	"	-43.5	64.0[b]	3.70	B
-9.0	41.0	1.450	"	-22.0	64.2[b]	3.73	B
-11.2	43.0	1.570	"	0.0	65.0[b]	3.87	B
-12.2	44.5	1.670	"	10.0	65.2[b]	3.90	B
				20.0	65.6[b]	3.97	B

[a]Molalities, mol/kg, calculated by the compilers.

[b]Isothermal method.

[c]Solid phase: A = ice; B = $Th(NO_3)_4.6H_2O$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
Synthetic and isothermal methods were used. Thorium nitrate hexahydrate was analyzed using procedure described by Fuhse (1) and Jacoby (2).	Merck thorium nitrate tetrahydrate used. This contained 47% of ThO_2, which corresponded to a mixture of the penta-and tetrahydrates.
	ESTIMATED ERROR: Nothing specified.
	REFERENCES: 1. Fuhse, O. *Z. angew. Chem.* 1897, *10*, 116. 2. Jacoby, R. Dissertat. No. 77, Berlin 1901.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Thorium nitrate; $Th(NO_3)_4$; [13823-29-5] (2) Water; H_2O; [7732-18-5]	Templeton, C. C. Atomic Energy Commission Document, AECU-1721, 1950.
VARIABLES:	**PREPARED BY:**
T/K = 302 - 431	A. Sozanski; S. Siekierski

EXPERIMENTAL VALUES:

Composition of Saturated Solutions[a]

	$Th(NO_3)_4$		
t/°C	mass %	mol/kg	Solid Phase[b]
29.8	66.2	4.08	A or B
40.1	67.5	4.33	A or B
50.0	69.1	4.66	A or B
58.8	70.2	4.91	A or B
60.5	70.6	5.00	A or B
77.6	73.5	5.78	A or B
82.4	74.6	6.12	A or B
99.2	77.3	7.09	A or B
109.4	79.5	8.08	A or B
121.5	81.6	9.24	A or B
142.0	83.9	10.9	C
158.0	85.5	12.3	C

[a]Molalities, mol/kg, calculated by the compilers.

[b]Solid phases: A = $Th(NO_3)_4.6H_2O$, B = $Th(NO_3)_4.5.5H_2O$, C = $Th(NO_3)_4.4H_2O$.

(continued on the next page)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Synthetic and analytical methods were used (1). Solutions were placed in a constant temperature bath, and gently agitated for at least two days. For temperatures between 30°C and 60°C, measurements were made by the analytical method. Thorium was determined by ignition of a solution sample to thoria, ThO_2, and the hydrated water determined by the Karl Fischer method. Above 70°C, the synthetic method was used. Samples of known composition were weighed, mixed and sealed in glass tubes. The temperature of disappearance of the last speck of solid matter was determined by slowly raising the bath temperature while agitating the sample. The sample was agitated at least 2 hours between temperature increases.

SOURCE AND PURITY OF MATERIALS:

$Th(NO_3)_4.5H_2O$, General Chemical Baker & Adamson Reagent Grade. As usual, the solid corresponded to about 4.3 molecules of hydrated water.

ESTIMATED ERROR:

Solubility: Nothing specified. Over three-fourths of the points are the average of two or more replicates.

Temperature: Precision ±0.2K for the analytical method, and ±0.5K for the synthetic method.

REFERENCES:

1. Marshall, W. L.

Pure Appl. Chem. 1985, *57*, 283-301.

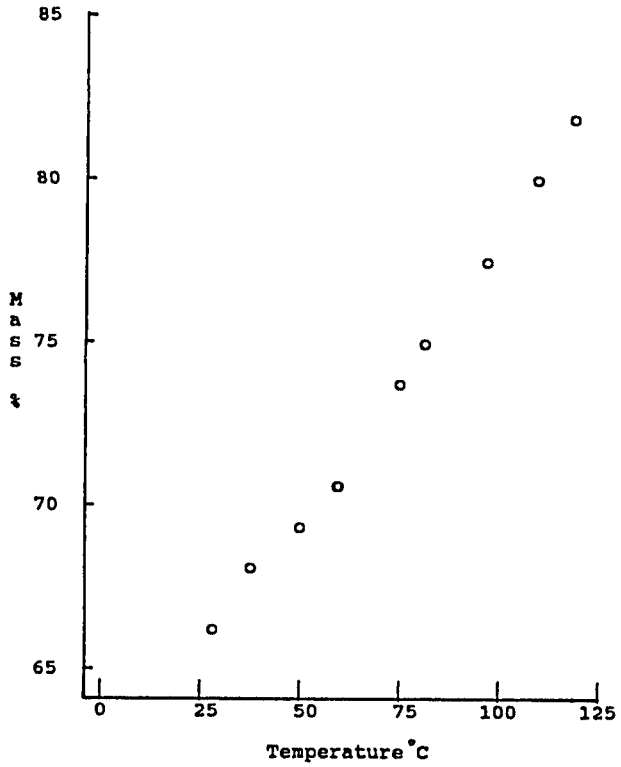
COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Thorium nitrate; $Th(NO_3)_4$; [13823-29-5] (2) Water; H_2O; [7732-18-5]	Templeton, C. C. Atomic Energy Commission Document, AECU-1721, 1950.

EXPERIMENTAL VALUES: (Continued)

COMMENTS AND/OR ADDITIONAL DATA:

In the Compiler's opinion, the Author's data are more consistent with $Th(NO_3)_4.5.5H_2O$, than with the formula $Th(NO_3)_4.6H_2O$:

Formula	CAS No.	ThO_2 %	H_2O %
$Th(NO_3)_4.6H_2O$	[23739-44-8]	44.9	18.38
$Th(NO_3)_4.5.5H_2O$	[61443-54-7]	45.6	17.11
Author's data	---	45.7±0.1	17.5±0.1
$Th(NO_3)_4.5H_2O$	[14767-04-5]	46.32	15.8



Plot of the tabulated data for the temperature range 29.8 to 121.5°C.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Thorium nitrate; $Th(NO_3)_4$; [13823-29-5] (2) Water; H_2O; [7732-18-5]	Marshall, W. L.; Gill, J. S.; Secoy, C. H. *J. Am. Chem. Soc.* 1951, *73*, 4991-4992.
VARIABLES:	**PREPARED BY:**
T/K = 310 - 484	L. Fuks; S. Siekierski

EXPERIMENTAL VALUES:

Composition of Saturated Solutions[a]

	$Th(NO_3)_4$			
t/°C	mass %	mol/kg	Solid Phase[d]	Method of Determination
37.3	67.07	4.243	A	analytical
54.5	69.78	4.810	A	"
72.0	73.39	5.745	A	"
90.2	76.39	6.740	A	"
99.7	78.56	7.633	A	"
110.4	81.11	8.944	A	"
110.9	81.50	9.177	A	"
111.0[b]	--	--	A+B	---
120.6	82.01	9.496	B	analytical
128.0	82.41	9.759	B	synthetic
130.5	82.85	10.06	B	analytical
139.5	84.27	11.16	B	"
146.0	85.30	12.09	B	"
149.0	85.81	12.60	B	"
151.0[c]	--	--	B+C	
159.0	87.41	14.46	C	synthetic
211.0	91.82	23.38	C	"

(continued on the next page)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Synthetic (1) and analytical methods used. Analytical method: Thorium nitrate solutions were stirred in the presence of excess solid for 40 min. After the solid had settled, duplicate samples of clear solution were taken and analyzed. Synthetic method: $Th(NO_3)_4$ - water mixtures of known compositions were slowly heated until complete dissolution. The temperature was probably determined visually (compilers). Samples of the solid phase, as well as those of the saturated solution, were ignited at 900°C and weighed as ThO_2 (1).

SOURCE AND PURITY OF MATERIALS:

CP grade thorium nitrate tetrahydrate from Maywood Company used.

ESTIMATED ERROR:

Temperature control for analytical method was ±0.05°C, and for the synthetic method, ±1°C. Maximum deviation for ThO_2 duplicates was ±0.15%.

REFERENCES:

1. Secoy, C. H.

J. Am. Chem. Soc. 1950, *72*, 3343.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Thorium nitrate; $Th(NO_3)_4$; [13823-29-5]	Marshall, W. L.; Gill, J. S.; Secoy, C. H.
(2) Water; H_2O; [7732-18-5]	*J. Am. Chem. Soc.* 1951, 73, 4991 - 4992.

EXPERIMENTAL VALUES: (Continued)

[a]Molalities calculated by the compilers.

[b]Intersection temperature for the incongruent melting point of the hexahydrate is 111.3 ± 0.4 °C.

[c]Intersection temperature for the incongruent melting point of the tetrahydrate.

[d]Solid phases: A = $Th(NO_3)_4.6H_2O$, B = $Th(NO_3)_4.4H_2O$,

C = $Th(NO_3)_4.xH_2O$.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Thorium nitrate; $Th(NO_3)_4$; [13823-29-5] (2) Water; H_2O; [7732-18-5]	Marshall, W. L.; Gill, J. S.; Secoy, C. H. Oak Ridge National Laboratory Report ORNL-925, 1951, p. 279 - 290.
VARIABLES: T/K = 310 - 484	**PREPARED BY:** A. Sozanski; S. Siekierski

EXPERIMENTAL VALUES:

The Solubility of Thorium Nitrate in Water Versus Temperature[a]

	$Th(NO_3)_4$		Density	
t/°C	mass %	mol/kg	g/cm^3	Solid Phase[b]
37.3	67.07	4.243	2.09	A[c]
54.5	69.78	4.810	2.17	A[d]
72.0	73.39	5.745	2.23	A
90.2	76.39	6.740	2.37	A
99.7	78.56	7.633	2.41	A
110.4	81.11	8.944	2.44	A+B
110.9	81.50	9.177	2.45	B
120.2	---	---	2.57	B
120.6	82.01	9.496	2.54	B
128.0	82.41	9.759	--	B
129.5	---	---	2.59	B[e]
130.5	82.85	10.06	2.53	B
139.5	84.27	11.16	2.70	B
159.0	87.41	14.46	2.75	B
211.0	91.82	23.38	2.86	?

(continued on the next page)

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:

Isothermal method used up to 125°C. Thorium nitrate solutions were stirred in the presence of excess salt for about 40 min. in a round-bottom flask set in the thermostat. Preliminary sampling had shown that 10 to 15 min. was sufficient for equilibrium. Then stirring was stopped, the solid phase was allowed to settle, and duplicate samples of clear solutions were removed. These samples were weighed, evaporated to dryness, and ignited to ThO_2 (900°C). Solid phase samples were obtained by direct sampling of the solid, drying between filter papers, and igniting to ThO_2. Solubility data above 125°C were obtained by the synthetic method in quartz tubing.

SOURCE AND PURITY OF MATERIALS:

$Th(NO_3)_4 \cdot 4H_2O$, CP grade from the Maywood Company was used.

ESTIMATED ERROR:

Solubility: Duplicate samples deviated approximately by about ±0.015%.

Temperature: Nothing specified.

REFERENCES:

None.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Thorium nitrate; $Th(NO_3)_4$; [13823-29-5]	Marshall, W. L.; Gill, J. S.; Secoy, C. H.
(2) Water; H_2O; [7732-18-5]	Oak Ridge National Laboratory Report, ORNL-925, 1951, 279 - 290.

EXPERIMENTAL VALUES: (Continued)

[a]Molalities calculated by the compilers.

[b]Solid phases: A = $Th(NO_3)_4.6H_2O$, B = $Th(NO_3)_4.4H_2O$.

[c]81.18 mass % $Th(NO_3)_4$ in the solid phase. Theoretical value for $Th(NO_3)_4.6H_2O$ is 81.62 mass %.

[d]80.82 mass % $Th(NO_3)_4$ in the solid phase.

[e]85.84 mass % $Th(NO_3)_4$ in the solid phase. Theoretical value for $Th(NO_3)_4.4H_2O$ is 86.97 mass %.

COMMENTS AND/OR ADDITIONAL DATA

An initial hydrolytic decomposition temperature was determined between 115°C and 130°C; above this temperature nitrogen oxides are liberated and basic thorium oxide is precipitated. However, in a closed system, the vapor phase appears to equilibrate with the liquid phase, and the system in this form does not show precipitation up to an experimentally determined curve, at which a solid phase appears even in the closed system. The rates of decomposition precipitation at elevated temperatures were found to be relatively slow compared to the rates for attainment of solubility equilibrium.

COMPONENTS:	ORIGINAL MEASUREMENTS:
(1) Thorium nitrate; $Th(NO_3)_4$; [13823-29-5] (2) Water; H_2O; [7732-18-5]	Apelblat, A.; Azoulay, D.; Sahar, A. *J. Chem. Soc. Faraday Trans. I* 1973, *69*, 1618 - 1623.
VARIABLES:	**PREPARED BY:**
T/K = 278 - 333	A. Sozanski; S. Siekierski

EXPERIMENTAL VALUES:

The solubility, c, increases linearly with temperature, °C, according to the equation,

$$c,\ mol/dm^3 = 2.615 + 0.010\ (\ t - 25\ )$$

The following table of solubilities was calculated by the compilers from this equation:

	$Th(NO_3)_4$		Density
t/°C	mol/dm^3	mol/kg	g/cm^3
5	2.415	---	---
25	2.615	3.74	1.955
35	2.715	4.35	1.928
45	2.815	4.68	1.953
60	2.965	5.47	1.965

The densities d(t), were calculated by the compilers from equations given in the source paper.

$$d(25^\circ C) = 0.9973 + 0.3877c - 0.0082c^2$$

$$d(35^\circ C) = 0.9941 + 0.3953c - 0.0189c^2$$

$$d(45^\circ C) = 0.9903 + 0.3992c - 0.0203c^2$$

$$d(60^\circ C) = 0.9832 + 0.3972c - 0.0223c^2$$

AUXILIARY INFORMATION

METHOD/APPARATUS/PROCEDURE:	SOURCE AND PURITY OF MATERIALS:
The isothermal method was used. The concentration of thorium was determined by complexometric titration with EDTA, using xylenol orange as the indicator (1). Some samples were analyzed gravimetrically. Results by both methods were consistent with each other. The authors did not report their measured solubilities, but instead reported smoothed data in the form of the above equations.	$Th(NO_3)_4.5H_2O$ supplied by Merck was used without further purification. **ESTIMATED ERROR:** Nothing specified.

REFERENCES:

1. E. Y. Welcher

The Analytical Uses of EDTA, Van Nostrand, N.Y. (1958).