(K^+); but this is not true in any case where other positive ions are present, for example in mixtures with another sulphate, or in mixtures with no common ion like those above considered. Making the assumption that equations of the first form hold for potassium and sodium sulphates (in place of equations (12) and (13)) and that the other equations (6) to (11) hold true as before, the composition and conductance of Mixture No. 3 was calculated with the following result:

Concentrations in milli-equivalents per liter.								Spec. cond. × 1000.		
NaCl.	KCl.	Na_2SO_4.	K_2SO_4.	Na^+.	K^+.	Cl^-.	SO_4^{--}.	Calc.	Obs.	% Diff.
9.70	8.40	12.40	10.91	77.9	80.7	81.9	76.7	19.22	17.52	9.6

It is seen that the conductance calculated under this assumption deviates very greatly (9.6 per cent. from the observed value).

BOSTON, April 10, 1910.

THE SOLID HYDRATES OF AMMONIA. II.

BY FRANK F. RUPERT.

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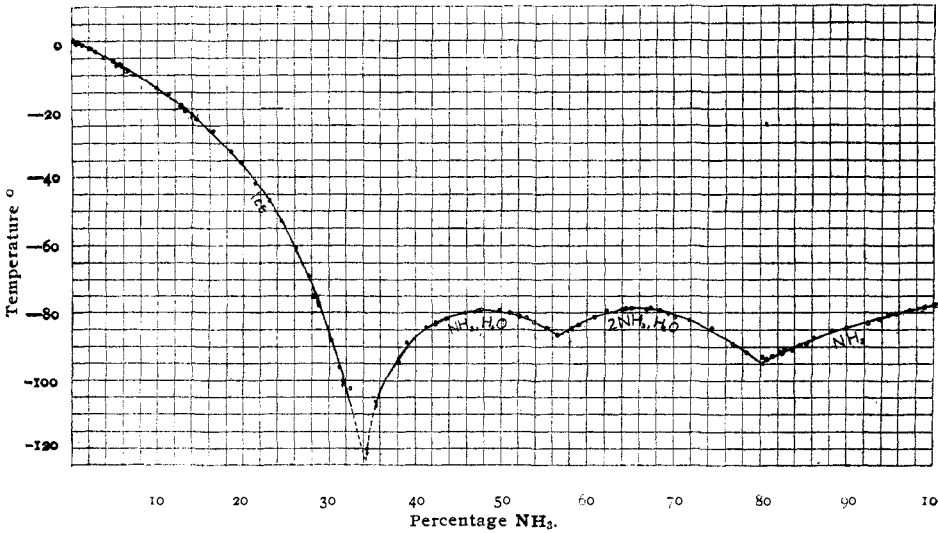
In a previous paper[1] the author gave the freezing-point curve for the system ammonia-water, showing the existence of two hydrates. Since then the work has been repeated, making a larger number of freezing-point determinations, and using better aids to accuracy.

The method used was substantially that described in the previous paper. Corrections were made for the weight of the ice inevitably collecting on the tube containing the solution, while being inserted in the vacuum tube. This amounted to 0.05 gram, with a possible error of 0.02 gram, in a total of 10 to 20 grams.



[1] THIS JOURNAL, 31, 866 (1909).

Temperatures above —100° were determined by using a standardized toluene thermometer, and are probably correct to within 0.5°; below that temperature by a thermo-couple standardized by comparison with the thermometer and with liquid air, but on account of the high viscosity of the solution, and consequent supercooling, the results for the latter determinations are unsatisfactory.

The table of freezing points follows:

Per cent. NH_3.	Freezing point.	Per cent. NH_3.	Freezing point.	Per cent. NH_3.	Freezing point.
0.6	—0.6	30.2	—87.9	65.1	—79.0
0.7	—0.5	31.1	—96.0	66.9	—79.1
1.2	—1.0	31.7 Below	—100.1	67.4	—78.6
2.1	—2.2	32.9	—102.5	68.4	—79.4
2.2	—2.2	34.5 Below	—120.0	69.3	—80.2
2.9	—3.7	35.5 Below	—101.5	70.1	—81.0
3.8	—5.0	38.0	—94.5	71.9	—82.0
4.0	—4.6	39.0	—88.8	74.3	—84.6
4.9	—5.9	41.4	—84.5	76.9	—88.8
5.1	—7.1	42.4	—84.2	78.6	—92.0
5.5	—7.0	42.4	—83.9	80.3	—92.9
5.7	—7.3	43.7	—82.0	80.8	—93.4
6.5	—8.5	45.9	—80.0	81.3	—92.8
6.7	—8.5	47.1	—79.6	82.3	—91.9
9.9	—13.4	47.7	—79.3	82.5	—92.4
11.1	—15.5	49.8	—79.3	82.8	—90.4
12.6	—19.0	51.1	—80.0	83.7	—90.6
13.2	—20.2	52.0	—80.6	84.9	—89.6
14.7	—22.9	52.2	—81.0	85.2	—88.8
16.4	—26.8	53.1	—81.8	86.1	—87.1
18.3	—32.6	53.9	—82.8	88.2	—85.3
19.6	—35.3	55.3	—84.2	90.0	—84.2
21.4	—41.9	56.7	—86.2	92.4	—82.9
23.0	—46.8	58.1	—84.9	93.6	—81.7
24.5	—52.6	58.9	—83.6	94.8	—81.0
26.1	—60.7	60.9	—81.2	95.7	—80.3
27.6	—68.5	62.2	—79.5	97.4	—79.4
28.5	—75.0	64.0	—79.4	98.9	—78.6
28.7	—77.8	64.6	—79.0	100.0	—78.0

The accompanying curve clearly shows two maxima, which do not differ from the theoretical compositions of NH_4OH and $(NH_4)_2O$, 48.6 and 65.4 per cent. ammonia respectively, by more than the experimental error. The eutectic points are: H_2O — NH_4OH, not determined; NH_4OH — $(NH_4)_2O$, —87°, 56.5 per cent. NH_3; $(NH_4)_2O$ — NH_3, —94°, 80.3 per cent. NH_3. Both ammonium hydroxide and ammonium oxide form fine white crystalline masses.

This work confirms the conclusion of the previous paper, namely, that ammonia forms two, and only two solid hydrates.

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