A plot of the data is shown in Fig. 1. The line marked "limiting tangent" is the Debye and Hückel limiting law. The potassium chloride, magnesium chloride and magnesium sulfate curves fuse fairly well into the limiting tangent but the potassium sulfate curve shows the characteristic "hump" obtained by La Mer and Goldman for lanthanum and thallous iodates. This salt also increases the solubility of the iodate more than the others. The general deviation from the theoretical lies somewhere between the deviations of the uni- and trivalent iodates mentioned.

Summary

The activity coefficients of copper iodate have been measured by the solubility method in aqueous solutions of the chlorides and sulfates of potassium and magnesium. The solubility of copper iodate is 0.003693 mole per liter at 25°.

CEDAR RAPIDS, IOWA

NOTES

The Detection of Cobalt as Cesium Cobaltinitrites.—The oxidation of cobaltous ion in acid solution by a concentrated solution of potassium nitrite and its precipitation as the yellow cobaltinitrite are well known in the conventional scheme of analysis. The potassium salt, however, has an appreciable solubility and for low concentrations of cobaltous ion has the undesirable property of precipitating slowly. The corresponding cesium salt, on the other hand, is more insoluble and precipitates and settles much more rapidly. At 17° one cubic centimeter of saturated solution contains approximately 0.05 mg. of the cesium salt.[1] In terms of cobaltous ion the concentration is considerably less and hence serves as a very delicate test for this ion.

Procedure.—The mixture of cobalt and nickel sulfides, from the usual procedure, is dissolved in aqua regia and evaporated just to dryness. The residue is dissolved in one or two cc. of 6 *M* acetic acid. To this solution 2 cc. of 6 *M* sodium nitrite and 0.5 cc. of 0.5 *M* cesium nitrate (or 0.25 *M* cesium sulfate suggested as a reagent for aluminum)[2] are added and the yellow $Cs_2NaCo(NO_2)_6$ precipitates.

The following table illustrates the delicacy and rapidity of the test

Concn. of cobaltous ion, mg. per cc.....	0.5 and greater	0.2–0.5	0.05
Time for precipitation, min.....	Instantaneous	0.5	2

The sensitivity of the test may be increased by substituting potassium nitrite for the corresponding sodium salt in the previously described pro-

[1] Rosenbladt, *Ber.*, **19**, 2531 (1886).

[2] Yagoda and Partridge, THIS JOURNAL, **52**, 3579 (1930).

cedure. If this is done, a solution of cobaltous ion containing 0.01 mg. per cc. will yield a yellow precipitate (probably $Cs_2KCo(NO_2)_6$) in about three minutes.[3]

Considerable quantities of iron, manganese or nickel do not interfere with the cobaltinitrite precipitation.

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Inorganic Lubricants. IV. Lubricants for Temperatures Above and Below Normal. A. For Temperatures Above Normal.—Aqueous metaphosphate and metaphosphoric acid solutions yield clear, viscous lubricants capable of operating up to 120° and by selection to 160°, the operating range of temperature (Op. r.) over which any particular solution has satisfactory lubricating properties depending upon the temperature at which boiling of that solution is stopped (T. b.) Typical examples are listed in Table I.

TABLE I

BOILING TEMPERATURES AND APPROXIMATE OPERATING TEMPERATURE RANGES FOR VARIOUS METAPHOSPHATE SOLUTIONS

A. Aqueous solutions of metaphosphoric acid containing approximately 20% of added orthophosphoric acid

T. b., °C.	140	150	165	185	205
Op. r., °C.	25–30	40–60	45–70	55–75	65–80
T. b.. °C.	230	260	300	350	
Op. r., °C.	70–85	80–95	105–120	Fumes	

B. Solutions of sodium metaphosphate

T. b., °C.	107	*a*	110	*a*	115	120
Op. r., °C.	25+		50–65		60–85	65–90

C. Solutions of sodium metaphosphate containing approximately 20% of borax and 10% of added orthophosphoric acid

T. b, °C.	110	115	122	*a*	118	125
Op. r., °C.	25+	60–80	70–90		50–80	90–160

a The solution was then diluted and again boiled down to avoid crystallization at the operating temperature range.

These lubricants in their respective operating ranges have properties quite similar to those of the phosphoric acid and metaphosphate lubricants

[3] *Cf.* Noyes and Bray, "A System of Qualitative Analysis for the Rare Elements." The Macmillan Company, New York, **1927**, p. 202.