were then refluxed with 30% hydrogen peroxide, with the result that the oxidation values were much higher. These results were reproducible as is shown in the following table.

TABLE I

RESULTS OF EXPERIMENTS

Selenium dioxide, g.	0.2019	0.2000	0.2029
Hydrogen peroxide, 30%, cc.	10	10	10
Time of refluxing, hours	2	2	2
Oxidation, %	89.5	90.7	91.9

A quantity of selenic acid was prepared, adhering to the conditions shown in Table I. The small amount of selenious acid was reduced to selenium, filtered off and the filtrate concentrated, following the procedure of Cameron and Macallan.[2] In this manner selenic acid of high purity with a concentration of 84% was readily prepared.

Since hydrogen peroxide proved so effective in oxidizing selenious acid, it seemed desirable to try its use for the oxidation of selenites to selenates. Copper selenite was prepared by treating copper carbonate with selenious acid. The green, insoluble copper selenite remained. This salt was covered with 30% hydrogen peroxide and refluxed for three hours, during which time it was oxidized to the blue, soluble selenate. A small amount of the insoluble selenite was filtered off, leaving a clear blue filtrate from which copper selenate crystals formed, identical in appearance to those of copper sulfate. Using the same procedure selenates of nickel, cobalt, aluminum and magnesium were prepared. All of these salts were obtained in a well defined, crystalline condition, similar to the corresponding sulfates.

CONTRIBUTION FROM THE
DEPARTMENT OF CHEMISTRY
SYRACUSE UNIVERSITY
SYRACUSE, NEW YORK

ERNEST R. HUFF
C. R. MCCROSKY

RECEIVED NOVEMBER 23, 1928
PUBLISHED MAY 6, 1929

Use of Cresol Red in Acid Solutions.—As has been pointed out by Clark[1] and Cohen,[2] the sulfonephthalein indicator dyes undergo two distinct color changes at different points on the *P*H scale. However, of this series only thymol blue and meta cresol purple have been applied as indicators in both acid and alkaline solutions and the fact that the sulfonic acid dissociation of cresol red is sufficiently repressed so that it can be used in acid solutions has not been emphasized. This indicator is really

[2] Cameron and Macallan, *Chem. News*, **59**, 219 (1899).

[1] Clark, "The Determination of Hydrogen Ions," Williams and Wilkins Co., Baltimore, Md., **1922**, p. 93.

[2] Cohen, "U. S. Public Health Reports," **41**, 3051–3074 (1926).

quite valuable in certain cases. The color change is from red at P_H 0.2 to yellow at P_H 1.8, the half transformation point occurring at a hydrogen-ion concentration of approximately 1.0×10^{-1}, or P_H 1.0. The virage resembles those of thymol blue and meta cresol purple over their acid ranges.

Cresol red can be used to advantage in testing for free mineral acids in solutions of weak acids, such as citric or acetic, or hydrolyzable salts of an acidic nature, such as ferric chloride or sulfate. It can also be employed in adjusting solutions in qualitative analysis, so as to separate the sulfides of the second and third groups. Cresol red is superior to methyl violet in that it is quite stable in solution and also gives stable, reproducible colors.

Contribution from the
Research Laboratory
LaMotte Chemical Products Co.
Baltimore, Maryland

F. R. McCrumb
W. R. Kenny

Received January 7, 1929
Published May 6, 1929

The Rapid Concentration of Germanium and Gallium Contained in Zinc Oxide Carrying Them.—The method usually given for the extraction of germanium and gallium from zinc oxide carrying a small percentage of these elements, calls for solution in hydrochloric acid and the subjection of the whole solution to distillation, after oxidizing the arsenic with potassium chlorate or other suitable oxidizing agent. It has been found in the Laboratories of the University of New Hampshire that the two elements can be rapidly concentrated as follows.

The zinc oxide was dissolved in an excess of commercial hydrochloric acid, allowed to stand for a short time and the precipitate of lead chloride removed by filtration. The hot solution, while being thoroughly stirred, was then rendered basic by the slow addition of some of the original zinc oxide. After continuing the stirring for some time to make certain of the precipitation of all the germanium and gallium, the precipitate carrying them was filtered off, dissolved in hydrochloric acid, distilled and treated in the usual manner to obtain the two elements.

In order to ascertain the completeness of their precipitation by the treatment with zinc oxide, large portions of the filtrates from several different runs were strongly acidified with hydrochloric acid, the arsenic was oxidized with potassium chlorate, a portion distilled off and hydrogen sulfide passed into the distillate. The absence of any germanium sulfide was considered evidence that all but negligible quantities at least of that element had been removed. The liquid remaining in the flask after distillation was examined by means of the spark spectrum for gallium after any traces of it had been concentrated by neutralizing with ammonum hydroxide and rendering basic with metallic zinc, etc. The violet lines characteristic of it were not visible.