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.

By employing this preliminary concentration 100 lb. of zinc oxide could be put through the distillation process in four or five runs using a 12-liter Pyrex flask, whereas before this method was used it required 25 to 30 runs; also, the quantity of material from that process which had to be worked over for gallium was correspondingly decreased.

CONTRIBUTION FROM THE
CHEMICAL LABORATORY OF THE
UNIVERSITY OF NEW HAMPSHIRE
DURHAM, NEW HAMPSHIRE
C. JAMES
H. C. FOGG

RECEIVED JANUARY 9, 1929
PUBLISHED MAY 6, 1929

Determination of Ethylene by Absorption in a Solution of Silver Nitrate.—During the course of a study of the catalytic hydrogenation of acetylene[1] the author observed that a solution of silver nitrate is capable of absorbing ethylene. A preliminary test at that time tended to indicate that the reaction might be used for the quantitative determination of the latter gas.

A search of the literature revealed that reactions between ethylene and silver salts have been previously observed by Ross and Trumbull,[2] Gluud and Schneider[3] and Lommel and Engelhardt.[4] The feasibility of using a solution of a silver salt alone as an absorbing medium in the determination of ethylene has apparently never been investigated.

Reactions between ethylene and salts of a few other metals have also been observed. In this connection, attention may be directed to the suggestion[5] for the use of a solution of mercuric nitrate over mercury as a quantitative absorbing agent for this gas.

The apparatus used during a brief investigation of the usefulness of a solution of silver nitrate as an absorbent in the determination of ethylene has been described previously by the author.[6] In its use the absorbing solution is passed slowly over and around the gaseous sample and is removed continuously at the bottom. Such an apparatus is particularly advantageous in cases where, as appeared to be probable in this case, there is a tendency toward an equilibrium condition involving incomplete absorption.

The table below records the results of a comparison of the absorption of ethylene from a mixture consisting essentially of nitrogen and ethylene by solutions of silver nitrate of various concentrations. The volumes of

[1] Morris and Reyerson, *J. Phys. Chem.*, **31**, 1332 (1927).

[2] Ross and Trumbull, THIS JOURNAL, **41**, 1180 (1919).

[3] Gluud and Schneider, *Ber.*, **57B**, 254 (1924).

[4] Lommel and Engelhardt, *ibid.*, **57B**, 848 (1924).

[5] See Treadwell–Hall, "Quantitative Analysis," 7th ed., John Wiley and Sons, Inc., New York, p. 698.

[6] Morris, THIS JOURNAL, **49**, 979 (1927).