

rament with the planes of the two CR'R" groups at 90°. Hence after a molecule has absorbed ultraviolet light, its two parts should undergo a spontaneous rotation with respect to each other, which can carry it from *cis* to *trans* or *vice versa*. Olson has already discussed possibilities somewhat similar to this [*Trans. Faraday Soc.*, **27**, 69 (1931)]. Details will be given in an article in the *Physical Review*.

The present quantum theory of the double bond is similar to that of Hückel [*Z. Physik*, **60**, 423 (1930)] but goes farther. As compared with the theory of Pauling and Slater [THIS JOURNAL, **53**, 1367 (1931), and *Phys. Rev.*, **37**, 481 (1931)] it appears to make closer contact with chemical and photochemical facts.

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REACTIONS BETWEEN HYDRIODIC ACID AND HIGHLY INSOLUBLE COMPOUNDS

Sir:

Recently the writer published an account of the action of concentrated hydriodic acid on stannic oxide [THIS JOURNAL, **54**, 3240 (1932)]. Experiments made subsequent to the observations recorded in this paper have demonstrated that this acid reacts readily with numerous other compounds of very low solubility, including many of those not attacked by hydrochloric acid, nitric acid or aqua regia. A number of these reactions are apparently new. Some illustrative examples follow.

The alkaline earth sulfates are attacked and reduced by hot concentrated hydriodic acid with the evolution of hydrogen sulfide, sulfur dioxide or both, and the liberation of iodine, resulting in a solution of the corresponding iodides. Likewise anhydrous chromium sulfate is reduced and dissolved by this acid. Sublimed chromic chloride and bromide are rapidly dissolved by the warm concentrated acid. Lead sulfate and fused lead chromate readily dissolve in the cold concentrated acid. The first is transposed into lead iodide, which then dissolves in the excess acid to form a complex which appears to be iodoplumbous acid. In the case of the chromate the same reaction occurs accompanied by the reduction of the chromium to the trivalent state. The insoluble halides of silver are also transposed and dissolved by the cold concentrated acid, the complex forming in this case being an iodoargentic acid. Certain more complex insoluble compounds such as copper ferrocyanide are readily attacked and dissolved in a series of complicated reactions.

Many of these reactions are not only of interest in themselves but they

hold some promise of useful analytical application in the separation and identification of members of the group of highly insoluble compounds. The writer hopes to have the privilege of publishing a more detailed account of these reactions at some future date.

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GERMICIDAL ACTIVITY OF ALKYL SULFUR ETHERS

Sir:

A problem interesting various investigators during recent years in the field of antiseptics has been the effect on the activity of phenol germicides of variations in substituting groups. Johnson and Lane [THIS JOURNAL, **43**, 348 (1921)], and Dohme, Cox and Miller [*ibid.*, **48**, 1688 (1926)] pointed out that alkyl resorcinols become progressively more active as the length of an alkyl side chain increases. Hilbert and Johnson [THIS JOURNAL, **51**, 1534 (1929)] showed that the activity of the three hydroxy diphenyl sulfides increased in the order: ortho, meta, para. The authors [*ibid.*, **54**, 1195 (1932)] discussed the effect of alkyl chains substituted into the phenol nucleus, stating that position isomerism is of slight importance but that variations in the chain are of greatest importance.

It seemed of interest to compare certain sulfur containing phenols with those previously studied. Methyl, ethyl, *n*-propyl, *n*-butyl, *n*-amyl, *n*-hexyl, isopropyl, isobutyl, isoamyl and benzyl thio ethers of phenol of the general formula RSC_6H_4OH have been prepared.

As in the case of the alkylresorcinols, alkyl phenols and alkyl ethers of hydroquinone [Ref. 4 and Klarmann, Gatyas and Shternov, THIS JOURNAL, **54**, 298 (1932)], the germicidal activity of these alkyl sulfur ethers increases with increase in the size of the alkyl group. They show, however, a higher activity for a given alkyl group and reach the maximum with the amyl derivative. An increase in the temperature at which the bacteriological examination is made raises this maximum to higher members of the series. The iso-alkyl ethers have lower phenol coefficients than the corresponding normal alkyl derivatives.

The O-ethers of thiophenol are probably much less active than the corresponding S-ethers of phenol.

A complete report of this work will be published in the near future.

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