

n = concentration; Q = energy (negative) required in bringing two active molecules together from a great distance; μ = a constant determined by the maximum distance apart at which one active molecule prevents radiation by the other. This expression represents the experimental results better than that derived on the assumption of random distribution. For large values of n the expression takes the form

$$F = F_0 e^{-\mu(n-n_0)},$$

which was given by Wawilow as best representing his results. The corresponding expression for the observed fluorescence in the case of a solid is also derived and is found to agree with the experimental results. The complicating effects of dissociation and the possible causes of the inhibiting action are discussed.

X-ray diffraction determinations of electron distributions in atoms: ARTHUR H. COMPTON. Work by Darwin, the author, the Braggs, Duane and others has made it possible to estimate from measurements of the intensity of X-ray diffraction by crystals the distribution of the electrons in the atoms of which the crystals are composed. Similar analysis now shows that the density of distribution of the electrons as a function of the distance from the center of an atom may be expressed as a Fourier integral, which can be evaluated from the observed intensities of the X-rays diffracted by amorphous substances. The theory, which is based on classical electrodynamics, is identical with the results of the quantum mechanics, except for a small correction which is to be applied when dealing with the diffraction of short waves at large angles. A comparison of the results obtained from the diffraction by gases with those calculated from the diffraction by crystals shows a close agreement in the general form of the electron distribution curves. The data from the gases show, however, a stronger concentration of the electrons near the center of the atom, a result which is doubtless due to the thermal agitation of the atoms in the crystal lattice, which gives to these atoms an apparent diffuseness. In fact, we are thus afforded an interference method of determining the amplitude of the atomic motions in a crystal lattice. The results are in qualitative accord with those to be expected from the usual kinetic theory.

Absorption spectra and the problem of the pyrones: R. C. GIBBS, J. R. JOHNSON and E. C. HUGHES (introduced by Ernest Merritt). Organic compounds that contain a pyrone ring exhibit certain unusual properties. Strictly chemical evidence as well as that of absorption spectra has led to conflicting suggestions regarding the structural formulas for the pyrones and their acid salts. Arguments have been advanced for the free substance chiefly in favor of either the ketonic structure with a quinoid-like nucleus or an inner salt formula, the nucleus of which is benzenoid. In forming an acid salt, the acid radical has been considered to be attached to either of the two oxygen atoms or to the carbon atom involved in the ketonic linkage thus producing either an oxonium or a carbonium salt. In seeking to secure crucial data that might serve to clarify the problem, the absorption

spectra of gamma-pyrone, dimethyl pyrone, benzopyrone and xanthone in absolute alcohol and alcoholic HCl were carefully examined. Sulphuric acid solutions of two of these compounds were also examined. Whenever dissociation might conceivably occur and thus possibly modify the results, ether or dimethyl sulphate solutions were also measured. The absorption for the neutral solutions of gamma-pyrone and dimethyl pyrone is characteristic of that found for compounds known to have a ketonic linkage which, in these cases, involves a quinoid-like nucleus. Although the absorption in the case of neutral benzopyrone and xanthone is more complex due to the presence of benzene rings, the ketonic type of absorption also appears to be present in these compounds. The absorption curve for the acid solution of each of these four compounds resembles that for the corresponding neutral solution. It is therefore concluded that in forming an acid salt of these pyrones, the ketonic linkage is not broken and that an oxonium salt is produced through addition to the ketonic oxygen atom. The formation of a carbonium salt would have necessitated a rupturing of the ketonic linkage, thus producing a marked change in the nature of the absorption spectra. Furthermore the resemblance between the absorption of the free pyrones and that of their acid salts gives fairly conclusive evidence that these salts do not have an oxonium benzenoid structure, for such a structure would have yielded widely modified absorption spectra. Additional confirmation of these conclusions is obtained by comparing the absorption of 4-methoxy lutidine, a compound in which only the benzenoid structure is possible, with that of its ketonic isomer, N-methyl lutidone. The absorption spectrum of lutidone bears a close resemblance to that of pyrone, but that of lutidine is radically different, being similar in character to those for benzene and toluene.

BOOKS RECEIVED

- BAKER, ROBERT H. *Astronomy. An Introduction.* Pp. xix + 521. 27 tables. 283 figures. Van Nostrand. \$3.75.
- DEMING, HORACE G. *In the Realm of Carbon: The Story of Organic Chemistry.* Pp. x + 365. Illustrated. Wiley. \$3.00.
- DICKSON, LEONARD E. *Studies in the Theory of Numbers.* Pp. x + 230. University of Chicago Press. \$4.00.
- FISHER, R. A. *The Genetical Theory of Natural Selection.* Pp. xiv + 272. 2 colored plates. 12 tables. 11 figures. Oxford University Press. \$6.00.
- HADDON, KATHLEEN. *Artists in String. String Figures: Their Regional Distribution and Social Significance.* Pp. x + 174. 41 figures. Dutton. \$2.20.
- HOLMES, HARRY N. *General Chemistry.* Revised edition. Pp. x + 654. 167 figures. Macmillan. \$3.50.
- Medical Education and Related Problems in Europe.* Pp. 200. Commission on Medical Education, American Medical Association.
- PITT, ERNEST R., Editor. *Catalogue of the Scientific and Technical Periodicals in the Libraries of Australia.* Pp. xxiv + 1208. Council for Scientific and Industrial Research, Melbourne.
- WALTER, HERBERT E. *Genetics: An Introduction to the Study of Heredity.* Third edition. Pp. xxi + 359. 92 figures. Macmillan. \$2.50.