DOCTOR OF PHILOSOPHY

PH. D. CHEMISTRY

JOHN STANLEY ALLEN

THE ELECTRIC MOMENT IN RELATION TO THE STRUCTURE OF ORGANIC COMPOUNDS.

A complete review of the theory and application of electric moment measurements is given. Fundamental mathematical theory of dipoles and molecular association are discussed. Methods of measurement of the electric moment, apparatus, dielectric cells and the construction and operation of a heterodyne beat apparatus for measurement of dielectric constants are given. Densities and dielectric constants of benzene solutions of glycol monochloroacetate, the ring isomer of glycol monodichloroacetate, propylene oxide, trimethylene oxide and tetrahydropyran are measured. The electric moments are 3.94, 3.35, 1.83, 2.01 and 1.87 $\times$ 10^{-18} e.s.u. respectively. These measurements are used to detect ring-chain isomerism, and to determine the "normal" oxygen valence angle, 90 $\pm$ 5°, the first experimental confirmation, by electric moment measurements, of the same value suggested by Pauling. This value explains the relative stability of furanose and pyranose rings in carbohydrates and polysaccharides, and other discrepancies in literature. New values of the (H—O) and (CH_3—O) moments and a minimum oxygen valence angle are given.

THE NATURE OF POLYMERIZATION AND ITS RELATION TO THE DIELECTRIC CONSTANT.

A method is given for the slow and controlled polymerization of vinyl acetate without catalysts by the use of visible light and heat. The reaction is catalysed by benzoyl peroxide, and mercury, and inhibited by copper and copper acetate. The density and dielectric constant increased with time of exposure and degree of polymerization. One-half of one percent polymerization or less can be detected by dielectric constant measurements. The results support the "normal valence" theory of polymerization.

PH. D. BOTANY

JOHN MAXWELL ARMSTRONG

CYTO-GENETIC STUDIES IN *MATTHIOLA* AND *TRITICUM*.

A detailed comparison of the snowflake race of *Matthiola incana,* distinguished by long first metaphase chromosomes, with normal short chromosome races was made to obtain evidence on the origin and mechanism of meiosis. The higher incidence of irregularities in the long chromosome type accounts for its relatively frequent production of extrachromosome mutations. The chiasma theory of metaphase pairing was confirmed by comparison of two extra chromosome forms, Crenate and Crenatoid. The factor 1, which determines the long chromosome condition is shown to reduce the initial chiasma formation. These observations favour the retardation rather than the precocity theory of meiosis.

In *Triticum vulgare* aberrant forms known as speltoids, occasionally appear. In a speltoid strain of the A series several genetic anomalies were found to be correlated with distinctive cytological conditions. The chromosome aberration hypothesis appears to be the most tenable explanation for the origin and behaviour of speltoids, but its original formulation must be extended on account of the important part now shown to be played by translocations and sectional duplications or deficiencies.

PH. D. CHEMISTRY

JACOB BARSHA

THE STRUCTURE OF SYNTHETIC POLYSACCHARIDES.

The investigation of the chemical constitution of the polysaccharide membranes produced by Bacterium xylinum from glucose, fructose and glycerol, was carried out in order to determine which substances could give rise to polysaccharide formation and to establish the identity or otherwise of the products from these substances (glucose, fructose and glycerol) with one another and with cotton cellulose.

The purified membranes were subjected to acetylation, hydrolysis, methylation and acetolysis reactions and the products compared with those obtained from cotton by similar treatment. The products were found to be identical in each case, thus establishing the similarity of the constitution of the polysaccharides synthesized by Bacterium xylinum from glucose, fructose and glycerol, and their identity with cotton cellulose. X-ray investigation of the purified bacterial celluloses by Dr. George L. Clark and Mr. W. A. Sisson, University of Illinois, yielded X-ray diagrams characteristic of cellulose.