

Highways Association; John H. Delaney, commissioner, New York State Department of Efficiency and Economy; A. W. Dow, chemical and consulting paving engineer; H. W. Durham, chief engineer of highways, Borough of Manhattan, New York City; C. N. Forrest, chief chemist, New York Testing Laboratory; Walter H. Fulweiler, chief chemist, United Gas Improvement Company; Frank B. Gilbreth, consulting engineer; George P. Hemstreet, superintendent, The Hastings Pavement Company; Samuel Hill, president, American Road Builders' Association; D. L. Hough, president, the United Engineering and Contracting Company; J. W. Howard, consulting engineer; Arthur N. Johnson, state highway engineer of Illinois; William H. Kershaw, manager, Paving and Roads Division, the Texas Company; Nelson P. Lewis, chief engineer, Board of Estimate and Apportionment, New York City; Harold Parker, first vice-president, Hassam Paving Company; Paul D. Sargent, chief engineer, Maine State Highway Commission; Philip P. Sharples, chief chemist, Barrett Manufacturing Company; Francis P. Smith, chemical and consulting paving engineer; Albert Sommer, consulting chemist; George W. Tillson, consulting engineer to the president of the Borough of Brooklyn.

DR. O. W. RICHARDSON, F.R.S., professor of physics in Princeton University, has been appointed to the Wheatstone chair of physics at King's College, London, in succession to Professor C. G. Barkla, F.R.S.

DR. KARL BOEHM, of Heidelberg, has been appointed professor of mathematics in the University of Königsberg as successor to Professor G. Faber.

#### DISCUSSION AND CORRESPONDENCE

##### ATOMIC IONIZATION AND ATOMIC CHARGES

IN a discussion of "The Rutherford Atom" in *SCIENCE* for August 22 Mr. Fulcher gives Kleeman's table of the relative ionization of different elements by the  $\beta$  and  $\gamma$  radiation and concludes that "atomic ionization seems to depend primarily upon the atomic weight,

which is probably proportional to the number of electrons in the atom."

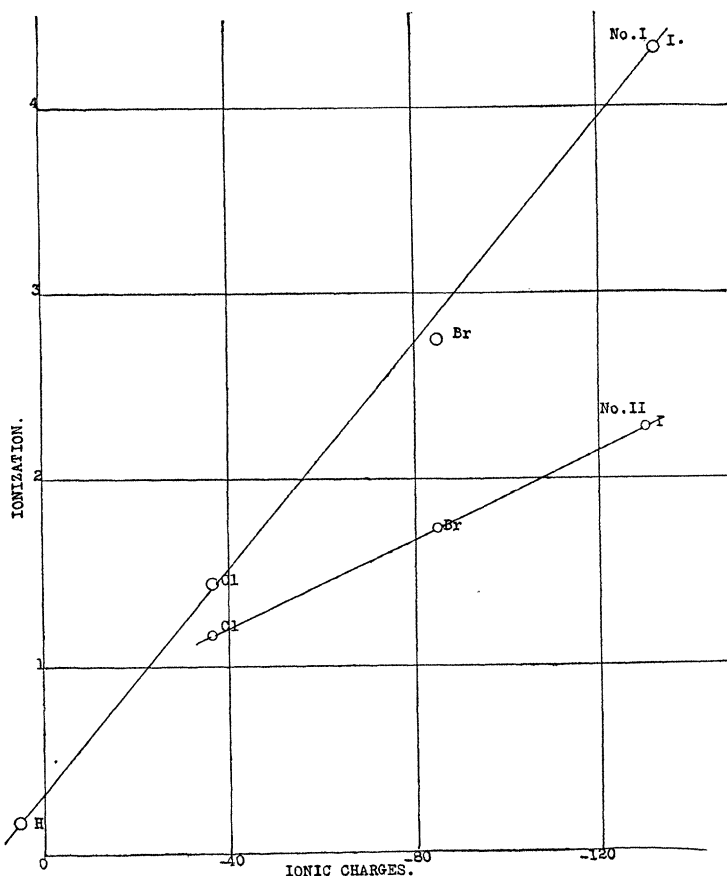
Whatever theory of atomic structure we may adopt, it seems certain that electrons are held to their atoms by electrical forces in which the mass of the atom can play no part. If a relation exists between the mass of an atom and its electrical charge, then a corresponding relation should exist between its mass and its attraction for electrons. Since the ionization investigated by Kleeman consisted in the separation of electrons from their atoms by the discharge of  $\alpha$ ,  $\beta$  and  $\gamma$  radiation through the substance, it seems probable that the weaker the hold of the atoms upon their electrons the greater would be their ionization.

Elsewhere I have tried to show that it is possible to calculate the electrical charges of a number of free atoms from their atomic mass and their velocity in electrolysis. If the above reasoning is correct, the charges calculated in this way should bear a definite relation to the ionization in Kleeman's investigation.

Unfortunately, the atomic charges can be calculated in this way for only four of the elements in Kleeman's table, but the indications given by these four seem so conclusive that I have thought it worth while to present them here. The four elements referred to are hydrogen, chlorine, bromine and iodine. Their relative ionization by the different rays and their charges as electrolytic ions are given in the table below.

Element	Ionization			Charge
	$\alpha$ Rays	$\beta$ Rays	$\gamma$ Rays	
H.....	.175	.18	.18	+ 5
Cl.....	1.16	1.44	1.44	— 36.5
Br.....	1.72	2.76	2.81	— 84.9
I.....	2.26	4.10	4.50	—132.5

It will be seen that while the ionization produced by the  $\beta$  and  $\gamma$  rays is practically the same, that produced by the  $\alpha$  rays is much less. In either case, however, there is a constant relation between the ionic charges and the amount of ionization, showing that the greater the negative charge of the atom the



greater the ionization. This relation is shown graphically in the following curves, where No. I. shows the mean ionization produced by the  $\beta$  and  $\gamma$  rays as compared with the ionic charges and No. II. shows the same relation for the  $\alpha$  radiation.

FERNANDO SANFORD

STANFORD UNIVERSITY,  
September 30, 1913

#### SCIENTIFIC BOOKS

##### THE MARYLAND DEVONIAN BOOKS

THE fine series of volumes issued by the Maryland Geological Survey (Professor Wm. Bullock Clark, state geologist) has recently

<sup>1</sup> Maryland Geological Survey: Lower Devonian. Text, 560 p.; Middle and Upper Devonian. Text, 719 p.; Plates (Lower Devonian, 1-98; Middle Devonian, 7-44; Upper Devonian, 45-73). Baltimore, The Johns Hopkins Press, 1913.

been substantially supplemented in number and enhanced in worth by the publication of what may, for brevity, be styled the "Maryland Devonian Books."<sup>1</sup>

Following the tasteful pattern and admirable mechanical execution of the previous members of the series, the Devonian books constitute a graceful and enduring monument to the scientific vigor of the State of Maryland in which His Excellency, The Honorable Phillips Lee Goldsborough, and his distinguished colleagues of the Geological Survey Commission may take a just and satisfying pride. These books are three stout volumes and the golden device of the state which they carry on their covers declares that good men have done this work at the command of the presiding genius of Maryland. The accomplishment of this undertaking is the fulfilment