If the Lorenz expression for S, namely, $\frac{\mu^2-1}{\mu^2+2} \cdot \frac{1}{d}$, be preferred to $\mu-1/d$, it may be substituted in either of the above formulæ.

In either case the actual numbers will, of course, be changed more or less, but the relation above pointed out will still hold good. The discrepancies will, however, be somewhat exaggerated by the change.

This is suggested as a first approximation to a new law. It may be useful in both chemical and physical science. It holds good, however, only for the metallic elements.

"Selective Absorption of Röntgen Rays." By J. A. M'Clelland, M.A., Fellow of the Royal University of Ireland. Communicated by Professor J. J. Thomson, F.R.S. Received June 11,—Read June 18, 1896.

(From the Cavendish Laboratory.)

The experiments described in this paper were made to determine whether or not the Röntgen rays given off by a vacuum bulb were of a homogeneous nature, by examining the manner in which they are absorbed by different substances. The induction coil and vacuum bulb for producing the rays were enclosed in a wooden box thickly lined with metal, with a small hole in the top, directly beneath which and close up to it the vacuum bulb was placed. Over the hole a well-insulated metal disk was placed and connected to one pair of quadrants of an electrometer. The two pairs of quadrants are first connected together and with one terminal of a battery of small storage cells, the other terminal being connected to earth.

The quadrants of the electrometer are then separated from each other and from the storage cells, and the induction coil turned on. The Röntgen rays passing through the hole in the box and falling on the charged disk discharges it, and the intensity of the radiation is measured by the rate at which the spot of light from the electrometer needle moves across the scale. The metal lining of the box is connected to earth, and the small hole covered with a single sheet of tinfoil to screen the electrometer from direct electrical disturbances.

The substance whose absorptive power is to be examined is placed over the hole so that the rays traverse it before falling on the charged disk.

Evidences of selective absorption were sought for in the following manner. The rate of leakage was accurately determined when the rays were passing through one of the substances used, say a plate of glass. Sheets of tinfoil were then substituted for the glass and the

number—n, say—taken such that the leakage from the charged disk was approximately the same as when the glass was used. The rate of leak was then measured accurately. The ratio of the rate of leak with the glass to that with the n sheets of tinfoil gives a measure of their relative transparency to Röntgen rays.

A number of tinfoil sheets is now placed over the hole; the glass plate is placed on the top, and the rate of leak measured. The glass is removed and the same n sheets of tinfoil as were formerly used put in its place, and the leakage measured. The ratio of the rate of leak in the latter two cases is a measure of the relative transparency of the glass and the n tinfoil sheets to the Röntgen rays after they have been already screened by passing through several layers of tinfoil.

The two ratios thus obtained should be equal if the Röntgen rays are all of one kind, but if the glass is relatively less transparent in the second case it can only be explained by assuming that the Röntgen rays are not homogeneous, and that some of them are more readily absorbed by the glass and others by the tinfoil.

Various substances were tested against tinfoil in the manner described. With some there was no selective absorption, with others it was very marked. Glass gave none, with mica and paraffin the effect was small, with fuchsine, eosine, fluorescine, aesculin, and barium sulphide the effect was very marked. With several fluorescent screens the effect was also marked. Pure water also gave a distinct though smaller effect.

The table below sets forth the results obtained with these substances.

Column B gives the quotient of the rate of leak through the substance in column A to that through a number of tinfoil layers which gave approximately the same leak. Column C gives the quotient of the rate of leak through the substance to that through the same tinfoil layers after the rays have already passed through four layers of tinfoil.

A.	B.	C.	Difference.
Calcium tungstate	1·07	0·85	0·22
Calcium platinocyanide	1·30	0·86	0·44
Luminous paint	1·0	0·71	0·29
Potassium platinocyanide	1·10	0·87	0·23
Fuchsine	1·15	0·77	0·38
Eosine	1·31	1·00	0·31
Aesculin	1·33	0·90	0·43
Fluorescine	1·32	1·08	0·24
Barium sulphide	1·30	0·97	0·33

Of the substances used, the above showed the effect best, but with wood, paraffin, and water, although small, it could always be detected. We conclude from the above results that the Röntgen rays are of different kinds, and that the substances given in the table differ very much from tinfoil in their selective absorption. After the rays have been screened by passing through some tinfoil layers additional layers are much less absorbent, while the absorption produced by other substances is not so much diminished.

Of the substances tried, those which are fluorescent gave the most marked difference as compared with tinfoil.

The above results were all obtained with one vacuum tube, which was working extremely well. It produced a very rapid leak from the charged disk, and the pressure of its residual air was very small. In fact, after working for a time it became too strong for the coil that was being used to work it. Another vacuum tube, in which the pressure of the residual air was greater and which was not so efficient in producing leakages, was then used, and several of the substances used before were again tested, but in no case was any evidence of selective absorption obtained. As far as the test was efficient, the radiation from this bulb was homogeneous.

A third tube was then used, more efficient than the last in producing leakage, but not so good as the first used. With this tube experiments made in the same way as before gave evidence of selective absorption, but not so marked as with the first tube.

It seems therefore that as a tube becomes more efficient the character of the rays given off becomes less homogeneous.

"On the Structure of Metals, its Origin and Changes." By F. Osmond and W. C. Roberts-Austen, F.R.S., Professor of Metallurgy, Royal College of Science. Received June 10, —Read June 18, 1896.

(Abstract.)

The authors begin their paper by stating that it has been shown by Herbert Tomlinson that the atomic volume of metals is intimately connected with their thermal capacity* and with Young's modulus.† He considers, in view of the work of Wertheim,‡ of Maxwell,§ and of Heen,|| and as the result of his own experiments, that the value of

* 'Roy. Soc. Proc.,' vol. 38 (1884–85), p. 488.

† 'Phil. Trans.,' Part I, 1883, p. 32.

‡ 'Ann. de Chim. et de Phys.,' vol. 12, 1844.

§ 'Phil. Trans.,' vol. 156, 1866, p. 249.

|| 'Bull. de l'Acad. Roy. de Belgique,' vol. 4 (1882).