

*March 29, 1860.*

Sir BENJAMIN C. BRODIE, Bart., President, in the Chair.

The Right Hon. Lord Belper and Dr. W. Bird Herapath were admitted into the Society.

The following communications were read :—

- I. "On the Volumetric Relations of Ozone and the Action of the Electrical Discharge on Oxygen and other Gases." By THOMAS ANDREWS, M.D., F.R.S., and P. G. TAIT, Esq., M.A. Received February 20, 1860.

(Abstract.)

This paper contains the full details of the authors' experiments on the volumetric changes which occur in the formation of ozone. From three distinct series of experiments, performed by different methods, they show that when ozone is formed from pure oxygen by the action of the electrical discharge, a condensation takes place, as had already been announced in a former Note published in the 'Proceedings.' But the condensation is much greater than the earlier experiments of the authors on the expansion by heat of electrolytic ozone had indicated. It is, in fact, so great, that if the allotropic view of the constitution of ozone be correct, the density of that body, as compared with oxygen, would be represented by a number corresponding to the density of a solid or liquid rather than that of a gaseous substance. This conclusion follows necessarily from the authors' experiments, unless it be assumed that when ozone comes into contact with such substances as iodine, or a solution of iodide of potassium, one portion of it is changed back into common oxygen, while the remainder enters into combination, and that these portions are so related to one another, that the expansion due to the one is exactly equal to the contraction arising from the other. For the details of the experiments and of the methods of investigation employed, reference must be made to the original paper.

The second part of the communication is devoted to the action of the silent discharge and of the electrical spark on other gases.

Hydrogen and nitrogen undergo no change of volume when exposed to the action of either form of discharge. Cyanogen is readily decomposed by the spark, but presents so great a resistance to the passage of electricity, that the action of the silent discharge can scarcely be observed. Protoxide of nitrogen is readily attacked by both forms of discharge, with increase of volume and formation of nitrogen and hyponitric acid. Deutoxide of nitrogen exhibits the remarkable example of a gas which, under the action either of the silent discharge or of the spark, undergoes, like oxygen, a diminution of volume. It also is resolved into nitrogen and hyponitric acid. Carbonic oxide has given results of great interest; but the nature of the reaction has been only partially investigated. The silent discharge decomposes this gas with production of a substance of a bronze colour on the positive wire. The spark acts differently, destroying, as in the case of oxygen, the greater part of the contraction produced by the silent discharge. The authors are engaged in the further prosecution of this inquiry.

II. "On the Equation of Differences for an Equation of any Order, and in particular for the Equations of the Orders Two, Three, Four, and Five." By ARTHUR CAYLEY, Esq., F.R.S. Received March 2, 1860.

(Abstract.)

The term *equation of differences*, denotes the equation for the squared differences of the roots of a given equation; the equation of differences afforded a means of determining the number of real roots, and also limits for the real roots of a given numerical equation, and was upon this account long ago sought for by geometers. In the Philosophical Transactions for 1763, Waring gives, but without demonstration or indication of the mode of obtaining it, the equation of differences for an equation of the fifth order wanting the second term: the result was probably obtained by the method of symmetric functions. This method is employed in the 'Meditationes Algebraicæ' (1782), where the equation of differences is given for the equations of the third and fourth orders wanting the second terms; and in p. 85 the before-mentioned result for the equation of the fifth order wanting the second term, is reproduced. The formulæ for