

That these oscillations must exist will be evident, when it is considered that the gyroscope, with the weight attached and the disc not spinning, becomes an ordinary pendulum: the effect of the spinning being to disturb its oscillations, and to lessen their extent to an unlimited amount, whenever the spinning of the disc is sufficiently rapid.

The preceding investigations, as well as the experiments, show that whenever a force is applied to the axis of a revolving disc, more or less of the momentum due to this force is converted into a momentum of rotation parallel to a plane which is perpendicular to that in which the force acts.

*April 2, 1857.*

The LORD WROTTESELEY, President, in the Chair.

The following communications were read:—

- I. "Researches on Silica." By Colonel PHILIP YORKE, F.R.S.  
Received March 25, 1857.

(Abstract.)

This communication is principally devoted to an attempt to determine the formula of silica, and to the relation of some remarkable results obtained in this research. After giving some account of the grounds on which the three different formulas now in use among chemists (viz.  $\text{SiO}_3$ ,  $\text{SiO}_2$ , and  $\text{SiO}$ ) had been advocated, the author proceeds to state, that it appeared to him that the direct method which had been followed by Rose deserved the preference. This method consists in determining the quantity of carbonic acid which is displaced from excess of an alkaline carbonate in fusion, by a given

weight of silica. The number 22 being the equivalent for carbonic acid on the hydrogen scale, the equivalent of silicic acid is obtained by the proportion  $x = \frac{22 \times \text{weight of silica used}}{\text{weight of carbonic acid expelled}}$ .

Four experiments are detailed, made with carbonate of potash, which give as a mean result the number 30.7 for the equivalent of silica. This agrees with the formula  $\text{SiO}_2$ , and nearly with the previous results of H. Rose. Then follow seven experiments made in a like manner with carbonate of soda, which give as a mean result the number 21.3 as the equivalent of silicic acid—a number agreeing nearly with half that represented by the formula  $\text{SiO}_3$ , or  $\frac{45.2}{2}$ .

Some experiments are then related, which go to show that the increased loss resulting with carbonate of soda could not be caused by the action of heat alone.—The author had next recourse to carbonate of lithia, and obtained as the mean result of four experiments with this substance, agreeing well together, the number 14.99—a number which accords very closely with the formula  $\text{SiO}$ . These different numbers, obtained with silica, led the author to inquire whether any other body acting as an acid produces similar results with the fused carbonates of potash and soda. With this view, experiments were made with dry sulphate of magnesia, as a substitute for sulphuric acid, with bi-borate of soda, for boracic acid, with alumina and sesquioxide of iron. Of these bodies only boracic acid gave results similar to those obtained with silicic acid. The other substances all gave the equivalent numbers usually assigned to them, equally with the carbonates of potash and soda.

Directing his attention then to determine whether the equivalent of silicic acid could be found in other volatile acids than the carbonic, the author relates some experiments made with the hydrates of potash and soda, but he explains that there are circumstances which render it much more difficult to obtain accordant numbers with these bodies than with the carbonates.

Six experiments made with hydrate of potash gave as mean result the same number as that obtained with the carbonate, viz. 30.8. But with hydrate of soda the mean of three experiments gave the number 17.2 as the equivalent of silicic acid,—a result approaching that previously obtained with carbonate of lithia.

A silicate of soda was formed by fusing together silica and carbonate of soda, in proportions indicated by the previous experiments—*i. e.* 23 silica to 54 carbonate of soda = 31 soda. The fused mass was crystallized. It was dissolved in water, and the solution evaporated *in vacuo* yielded a crystallized salt, which contained about 5 per cent. of carbonate of soda; when this, calculated as the ordinary 10-hydrated salt, was subtracted, the silicate agreed nearly with the formula  $\text{NaO} \cdot \text{SiO}_2 + 7\text{HO}$ . A crystallized salt of like composition was obtained when hydrated silica was dissolved in a solution of caustic soda, the silica and soda being in the same proportions, *i. e.* 31 : 23. In these experiments it appears, therefore, that in the process of solution and crystallization a portion of soda is extruded. When exposed to a temperature of about 300° F., nearly all the water was driven off from these salts, less than 1 per cent. remaining.

The fused silicate of lithia in like manner, when treated with water, appeared to split up into different compounds.

After guarding himself from drawing any decided inference from the experiments recorded, the author concludes by observing that at present he can see no alternative but to admit of more than one equivalent for silicic acid (that is to say of more than one acid), the value of which is determined by circumstances,—such as the presence of water and the nature of the base to which it is presented. The existence of such different silicic acids has been already suggested by chemists on different grounds, particularly by Ebelman and Laurent, and lately by M. Fremy.

II. Appendix to the Paper of Mr. W. H. BARLOW, “On an Element of Strength in Beams subjected to Transverse Strain,” &c. By PETER BARLOW, Esq., F.R.S. Received March 25, 1857.

A notice of this communication is given in the abstract of the paper to which it refers (see *antea*, p. 432).