that may be attributed to the destruction by the soda of the ice-molecules present in the water. In the formula

$$\rho_t = \rho_0 + \alpha t + \beta t^2 + \gamma t^3,$$

which represents the influence of temperature on the density of water and aqueous solutions of soda, the coefficient of t^3 vanishes when a concentration of 12 per cent. NaOH is reached, whilst the coefficient of t^2 vanishes at 42 per cent. NaOH; at the latter concentration there is a simple linear relationship between density and temperature.

(7) The molecular volume of sodium hydroxide in dilute aqueous solution has a large negative value, a litre of water dissolving 140 grammes of sodium hydroxide at 0°, 100 grammes at 18°, or 60 grammes at 50°, without increasing in volume. It is noteworthy that the molecular volume does not increase continuously as the temperature rises, but reaches a maximum value at about 70° C. In a 50-per-cent. solution, however, the temperature has little effect on the molecular volume, the extreme variation being only about 10 per cent.

"The Refractive Indices of the Elements." By CLIVE CUTHBERTSON. Communicated by Professor F. T. TROUTON, F.R.S. Received October 18,—Read November 24, 1904.

(Abstract.)

In a letter addressed to 'Nature,' in October, 1902, attention was drawn to the fact that the refractivities of the five inert gases of the atmosphere, He, Ne, A, Kr, and X, as determined by Ramsay and Travers, were, within narrow limits of accuracy, in the proportion of 1, 2, 8, 12 and 20; or, more simply, of $\frac{1}{4}$, $\frac{1}{2}$, 2, 3, and 5.

In a second letter it was shown that the refractivities of the halogens, Cl, Br, and I, stand also in the relation of 2, 3, and 5 to the same degree of accuracy; but it was pointed out that the figures for P, As, and S, as measured by M. Le Roux in 1861, did not show any similar relation; and it was observed that a redetermination of them would be interesting.

With a Jamin's refractometer, adapted for use with high temperatures, results have now been obtained for Hg, P, and S, which differ widely from those of M. Le Roux. The index of mercury, calculated for a molecule containing two atoms, is placed at 1·001857, a number which agrees closely with the value given by the refractive equivalent of Gladstone. The index of P_2 is found to be 1·001197 and that of S_2 is 1·001101.

In all three cases it is estimated that the margin of error does not

exceed $1\frac{1}{2}$ per cent. Comparing these values for P_2 and S_2 with those of N_2 and O_2, it is shown that the simple relations found in the case of the inert gases and the halogens also hold in the case of nitrogen and phosphorus, oxygen and sulphur; and that an atom of phosphorus retards light four times as much as an atom of nitrogen, an atom of sulphur four times as much as an atom of oxygen.

Efforts have also been made to measure the index of fluorine in the gaseous state, but, owing to the experimental difficulties, success has not yet been attained.

It appears then, that, out of fourteen elements whose index of refraction has been measured in the gaseous state, twelve conform to the rule that in each chemical group the refractivities of the elements are in the ratios of small integers. The other two, Hg and H, have no allied elements with which they can be compared.

It is pointed out that N, O, and Ne are each followed, in their respective families, by an element whose refractivity is four times as great, and that, consequently, there are reasons for believing that the elements composing the series N, O, F, and Ne, and P, S, Cl, and A are, in some sense, homologous. Comparing the refractivities of the latter series we see that the power to retard light appears to be closely connected with the valency, increasing as it increases, in spite of the decrease in atomic weight, as shown in the following table:—

	Element.			
	P.	S.	Cl.	A.
Atomic weight	31	32	35·5	40
Refractivity	299×4	275×4	192×4	141×4

The series Ne, O, N, show the same relation, and it is probable that the refractivity of C is even higher than that of N.

The refractivity of B, estimated from BCl_3 and BBr_3, is certainly very great; but whether it exceeds that of C there is not sufficient evidence to determine.