Chemistry. *"The behaviour of the halogens towards each other".* By Prof. H. W. BAKHUIS ROOZEBOOM.

If the phase-doctrine in its first period was concerned mainly with the question whether two or more substances in the solid condition give rise to chemical compounds, or mixed crystals, or remain unchanged in the presence of each other, lately it has commenced to draw conclusions from the form of the melting point lines of the solid mixtures, both for the nature of those solid mixtures and of the liquid mixtures into which they pass, namely whether, and to what extent, compounds occur therein:

Likewise, the same questions may be answered in regard to liquid and vapour from the equilibrium lines for those two phases, namely boiling point lines or vapour pressure lines.

The three systems of the best known halogens having now been investigated their mutual behaviour may be surveyed.

As regards chlorine and iodine, STORTENBEKER had proved in 1888 that no other compounds occur in the solid condition but ICl_3 and ICl. He also showed that it is probable that ICl, on melting, liquefies to a very large extent without dissociation, whilst on the other hand ICl_3 is almost entirely dissociated into $ICl + Cl_2$.

Miss KARSTEN has now added to this research by the determination of the boiling point lines. This showed that the liquid and the vapour line approach each other so closely in the vicinity of the composition ICl [1]), that the conclusion must be drawn that the dissociation of ICl is also exceedingly small in the vapour, it being already known that it is very large in the case of ICl_3.

From the investigation of MEERUM TERWOGT [2]) it has been shown that Br and I form only one compound BrI which in the solid state forms mixed crystals both with Br and I and which on account of the form of the vapour pressure and boiling point lines is largely dissociated in the liquid and gaseous states.

Finally it now appears from an investigation by Miss KARSTEN that Chloriné and Bromine only give mixed crystals on cooling and that in a connected series, whilst, in agreement with this no indication for the existence of the compound in the liquid or vapour could be deduced from the form of the boiling point line.

We, therefore come to the conclusion that ICl_3 is a feeble and ICl a strong compound. IBr is also a feeble compound and no compound exists between Cl and Br. The combining power is, therefore,

1) Still closer than represented in Fig. 7, p. 540. These proceedings [VIII] 1904.
2) These proceedings VI, p. 331.

greatest in the most distant elements and greater in Br + I than in Br + Cl.

From the researches of MOISSAN and others it follows that Fluorine yields the compound IF_5 which is stable even in the vapour-condition. With Bromine, the compound BrF_3 is formed but no compound is formed with Chlorine. This, also, is in harmony with the above result.

As, however, the compounds with Fluorine have not been studied from the standpoint of the phase-doctrine, there does not exist as yet a reasonable certainty as to their number or their stability.

Mathematics. — *"Second communication on the* PLÜCKER *equivalents of a cyclic point of a twisted curve."* By Dr. W. A. VERSLUYS. (Communicated by Prof. P. H. SCHOUTE).

§ 1. If the origin of coordinates is a cyclic point (n, r, m) of a twisted curve C the coordinates of a point of C lying in the vicinity of the origin on a branch passing through the origin can be represented as follows:

$$x = a\,t^n,$$
$$y = b_0\,t^{n+r} + b_1\,t^{n+r+1} + b_2\,t^{n+r+2} + \text{etc.},$$
$$z = c_0\,t^{n+r+m} + c_1\,t^{n+r+m+1} + c_2\,t^{n+r+m+2} + \text{etc.}$$

Let q_1 be the greatest common divisor of n and r, let q_2 be that of r and m, q_3 that of m and $n+r$ and finally q_4 that of n and $r+m$.

If $q_1 = q_2 = q_3 = q_4 = 1$ the PLÜCKER equivalents depend only on n, r and m. In a preceding communication[1]) I gave the PLÜCKER equivalents for this special case[2]).

§ 2. If the 4 G. C. Divisors q are not all unity, the PLÜCKER equivalents of the cyclic point (n, r, m) depend on the values of the coefficients b and c, just as in general for a cyclic point of a plane curve given by the developments:

$$x = t^n,$$
$$y = t^{n+m} + d_1\,t^{n+m+1} + d_2\,t^{n+m+2} + \text{etc.},$$

the vanishing of coefficients d influences the number of nodal points and double tangents equivalent to the cyclic point (n, m)[3]).

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1) Proceedings Royal Acad. Amsterdam, Nov. 1905.

2) The deduction of these equivalents is to be found among others in my treatise: "*Points sing. des courbes gauches données par les équations:* $x = t^n$, $y = t^{n+r}$, $z = t^{n+r+m}$," inserted in "*Archives du Musée Teyler*", série II, t. X, 1906.

3) A. BRILL and M. NOETHER. Die Entwicklung der Theorie der algebraischen Functionen, p. 400. *Jahresbericht der Deutschen Mathematiker-Vereinigung*, III, 1892—93.