XC.—*Some Physical Properties of the Chlorides of Gold.*

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Melting Point of Gold Trichloride.—In the course of the work described in the previous paper, it was found that gold trichloride could be readily fused if heated in a sealed tube, or under a pressure of two atmospheres of chlorine; the liquid was quite black and did not wet glass; some effervescence occurs as the chloride melts. The melting point was determined by heating about a gram of pure, dry volatilised gold trichloride in a sealed tube in sulphuric acid; three determinations were made, each of which gave the melting point as 288° , a mercury thermometer containing nitrogen being used. The freezing point was not so easy to determine, but solidification appeared to begin at about 287° . A mixture containing about 4 mols. of the trichloride, AuCl_3 , to one of the monochloride, AuCl , melted at 287° , and another mixture, probably of about the same composition, melted at 286° under a pressure of 1.81 atmospheres of chlorine. The presence of the monochloride, therefore, does not much affect the melting point of gold trichloride. After being fused, no metallic gold remains in the mixture, even if it had been originally present.

Specific Gravity of the Chlorides of Gold.—The densities were taken by means of a specific gravity bottle, sulphuric acid being used as the liquid with which to fill the bottle. Neither gold monochloride nor gold trichloride appears to be attacked by sulphuric acid, but the acid was left in contact with a mixture of the two chlorides for 24 hours before being used. In each experiment, some of the chloride was shaken into the bottle, and at the end of the operation it was separated and analysed. Pickering's determinations of the density of sulphuric acid at different temperatures were employed. The gold monochloride was prepared by digesting a fused mixture of the chlorides of gold with ether, and drying the residue at 100° ; on analysis, it proved to contain 14.85 per cent. of chlorine, as against 15.2 per cent. according to theory. The weight used was 1.248 grams. The fused mixture of the two chlorides used for the density determination contained 1.9341 grams of gold trichloride and 1.0793 grams of the monochloride. The volatilised trichloride consisted of 0.22 gram of fine, needle-like crystals.

The determinations were made in each case at slightly different temperatures. The results were as follows.

	Mean.
Density of AuCl.	$\left\{ \begin{array}{l} 7.35 \\ 7.39 \\ 7.42 \end{array} \right\}$ 7.4
Density of fused mixture of AuCl ₃ and AuCl	$\left\{ \begin{array}{l} 5.13 \\ 5.12 \\ 5.09 \end{array} \right\}$ 5.1
Density of fused AuCl ₃ (calculated)	4.3
Density of volatilised AuCl ₃	3.9

The last result, being made only at one temperature and on a very small quantity of material, is less trustworthy than the others.

The molecular volumes are therefore—

AuCl 32 AuCl₃ (fused).. 70

This gives about 20 as the atomic volume of chlorine when in combination with gold, and the agreement with Schröder's theory (*Lehrbuch von allg. Chem.*, 1, 851) is not satisfactory. If, in accordance with this theory, the atomic volume of gold in combination is 10.2 and that of chlorine 15.3, the densities should be

AuCl 9.1 AuCl₃ 5.4

On the other hand, if the atom of chlorine is taken as occupying the space of four "steren" instead of only three when in combination with gold, the observed densities and corresponding molecular volumes agree fairly well with the theoretical amounts.

Crystals of Gold Trichloride, AuCl₃.—I am kindly allowed by Mr. W. J. Pope to add the following communication from him regarding some volatilised crystals of gold trichloride which he examined.

"The crystals mostly consist of small, brilliant prisms, which, when crushed, transmit light of a deep claret-red colour, but show no pleochroism; one or two thin, six-sided plates adhering to the sides of the tube showed an indistinct extinction parallel to one edge of the crystal. The crushed fragments of the massive crystals do not extinguish, even the thinnest remaining bright between crossed nicols; no trace of an interference figure was ever observed, so that the crystals afford an instance of aggregate polarisation. No examination in monochromatic sodium light was possible, as the crystals have a very great absorptive power for light of this colour."

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