XLVII.—*On the Isomorphism of Thallium-Perchlorate with the Potassium and Ammonium-Perchlorates.*

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THE recently ascertained isomorphism of the thallium- and ammonium-sulphates* renders it highly probable that the perchlorates of these metals also exhibit isomorphous relations.

Thallium-perchlorate equals the alkaline-perchlorates in stability. It can be readily prepared either by dissolving metallic thallium in aqueous perchloric acid, or by the double decomposition of thallium-sulphate and barium-perchlorate. From solution the anhydrous salt is easily deposited in colourless rhombic crystals, which are transparent, bright, well-defined, and non-deliquescent. The specific gravity of the crystals is 4.844 at 15°.5 C.; they dissolve in 10 times their weight of water at 15°, and in about $\frac{3}{4}$ ths of their weight of water at 100°; the salt is also slightly soluble in alcohol. Thallium-perchlorate does not lose weight when heated to 200° C., and the temperature may even be raised to within a few degrees of the boiling point of mercury without producing the slightest decomposition of the salt. On the further application of heat a black mass is formed, and the salt finally volatilises as thallium-chloride.

The crystalline form of thallium-perchlorate is that of a right rhombic prism (pp_1), in which the faces of the rhombic octohedron (rr_1) and the basal faces of the prism (c) generally appear, the crystals being lengthened, as is the case with the alkaline-perchlorates sometimes in the direction of the prismatic, and sometimes in the direction of the octohedral faces. A careful measurement

* Lang, Phil. Mag. xxv, 248.

of the crystals gave the mean value of $102^{\circ} 50'$ for the angle pp_1 ; and that of $102^{\circ} 6'$ for the angle rr on c . Hence the relation of the axes is $0.7978 : 1 : 0.6449$.

The angles observed by Mitscherlich (Pogg. Ann. xxv., 301), in the case of potassium and ammonium-perchlorates agree exactly with the above; for the first of these salts, $pp_1 = 103^{\circ} 58'$, rr_1 on $c = 101^{\circ} 19'$; and for the second, $pp_1 = 103^{\circ} 11'$, and rr_1 on $c = 102^{\circ} 4'$, giving the relation of the axes to be (1) $0.7817 : 1 : 0.6408$ and (2) $0.7926 : 1 : 0.6410$. An analysis, made in my laboratory by Mr. T. E. Thorpe, shows that the formula of the salt is $Tl Cl O_4$.

(1.) *Determination of Thallium.*—The crystals were well dried in vacuo over sulphuric acid, and precipitated with platinum-tetrachloride, the passage of the finely divided precipitate through the filter being avoided by evaporating to dryness on the water-bath, and taking up with absolute alcohol. (a) Salt prepared by direct solution of the metal in perchloric acid; 0.1831 salt yielded 0.2476 chloroplatinate. (b) Salt prepared by double decomposition; 0.4502 salt yielded 0.6060 chloroplatinate.

(2.) *Determination of Perchloric Acid.*—A solution of potassium-acetate was added to the thallium-perchlorate, and the whole evaporated to dryness on a water-bath, the acetates of thallium and potassium washed out with absolute alcohol, and the insoluble potassium-perchlorate collected on a weighed filter; 0.4570 thallium-perchlorate yielded 0.2100 potassium-perchlorate. Hence :

		Calculated.	I.	Found.	III.
				II.	
Tl.....	204.0	67.21	67.33 (a)	67.18 (b)	} 32.96
Cl.....	35.5	21.09			
O ₄	64.0	11.70			
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	303.5	100.00			