

substance itself is oxidized by chromic acid. This reaction, however, takes place slowly in the relatively dilute solution of chromic acid left by the previous oxidation, as is shown by the measurements of Table II.

TABLE II

Phthalonic acid Gram	Bichromate cc	Sulphuric acid cc	t minutes	Bi cc
0.1230	70	5	40	8.2
0.1230	70	5	80	13.2
0.0615	70	5	40	2.7
0.0615	70	5	80	4.4
0.1230	35	5	40	6.0
0.1230	35	5	80	8.0
0.1230	70	2.5	40	9.3
0.1230	70	2.5	80	7.0

The weights of anhydrous phthalonic acid taken are entered under *Phthalonic acid*, the volumes of the bichromate solution and of the acid page 123 under *Bichromate* and *Sulphuric acid* respectively, the duration of the oxidation under *t*, and the bichromate reduced under *Bi*. The great effect of the concentrations of the reagents on the rate is sufficiently obvious. From a graph of the results it appears that the rate is proportional to the concentrations of the sulphuric acid and of the bichromate respectively, and to the square of that of the phthalonic acid; but for the purposes of this paper it was not necessary to undertake special measurement to establish this relation rigorously.

Far the greater part of the phthalonic acid formed in my experiments would thus escape further oxidation, and, in fact, the presence of that substance in each of the solutions at the expiration of *t* minutes was established by the test with potassium permanganate described in my paper on "Analytical Methods."¹ This test was carried out as follows. First, the chromic acid remaining was reduced with ferrous sulphate. The phthalonic acid