CCCCII.—*The Conductivity of Phosphoric Acid Solutions at* 0°.

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Although the conductivities of phosphoric acid solutions at 18° have been determined by Kohlrausch (Landolt-Börnstein, " Physikalisch-chemische Tabellen," 1912, p. 1100), those at 0° have not hitherto been investigated. It is stated by Partington (Taylor's " Treatise on Physical Chemistry," I, p. 538) that the conductivity of phosphoric acid solution has a negative temperature coefficient, but a very considerable decrease of conductivity from 18° to 0° has now been observed; presumably the statement of Partington refers, therefore, to higher temperatures.

All the usual precautions were taken, including calibration of the bridge, and the water used in making up the solutions was thrice distilled: (*a*) from potassium permanganate, (*b*) from baryta, (*c*) through a block-tin condenser. Water of this high degree of purity, however, was not strictly necessary in view of the high conductivity of the solutions. The phosphoric acid used was

B.D.H. "Analytical Reagent" (*d* 1·75); it contained 85·49% H_3PO_4, and was without reducing action on permanganate. The concentrations of the solutions were estimated volumetrically by Thomson's method (Sutton, "Volumetric Analysis," 1904, p. 113). An ordinary medical coil was used as the source of current. The values given were the means of several determinations in each case, and were reproducible within 1 mm. on a metre bridge.

In the table, p is the weight of anhydrous phosphoric acid per 100 g. of solution, n is the number of g.-mols. of phosphoric acid per 1000 g. of water, and κ is the specific conductivity. If the values for concentration and conductivity are plotted, the maximum conductivity is obtained as 1408×10^{-4} mho, occurring at 45·16% H_3PO_4 (n = 8·4).

p.	n.	$10^4 \kappa_0$ in mhos.	$\frac{1}{\kappa_0} \cdot \left(\frac{d\kappa}{dt}\right)_9$.	p.	n.	$10^4 \kappa_0$ in mhos.	$\frac{1}{\kappa_0} \cdot \left(\frac{d\kappa}{dt}\right)_9$.
8·93	1	441	—	43·81	7·95	1400	0·0268
16·40	2	731	0·0150	45·47	8·51	1408	0·0270
22·73	3	929	0·0210	47·14	9·10	1392	0·0283
28·18	4	1124	0·0214	48·76	9·71	1376	0·0289
32·91	5	1238	0·0241	49·49	10	1368	0·0291
37·04	6	1357	0·0234	51·66	11	1342	0·0289
40·70	7	1374	0·0264	54·06	12	1314	0·0290
41·77	7·32	1396	0·0251				

The values of $1/\kappa_0 \cdot (d\kappa/dt)_9$ are obtained from Kohlrausch's series at 18° and the author's at 0°. It will be observed that they are much larger than Kohlrausch's values for $1/\kappa_{18} \cdot (d\kappa/dt)_{22}$ at corresponding concentrations. The temperature coefficient is therefore decreasing with increase of temperature and will eventually become negative in accordance with the statement of Partington (*loc. cit.*).

Summary.

1. The specific conductivities of phosphoric acid solutions at 0° have been determined over a wide range of concentrations, and the maximum conductivity has been evaluated.

2. The temperature coefficients are calculated and it is shown that these will eventually become negative.

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