

## DISCUSSION.

**Mr. W. R. Bousfield, K.C., M.P.** (*communicated*): I do not think we deserve to have our knuckles rapped quite so sharply. Professor Walker has not set out enough of my observations to show the point to which they were directed. The paragraph introducing the quotation given by him runs as follows:—

“It was pointed out by Dr. Lowry and myself (*Proc. R. S.* 1902, lxxi. 8), that the viscosity temperature co-efficients and the conductivity temperature co-efficients for ‘water’ were practically identical, and this at first seem to support the view that the H and OH ions are anhydrous,

Wiedemann's *Annalen*, 53, 209; *Zeitschrift für physika Chem.*, 14, 317.

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identity of the co-efficients would be consistent with the view that of the conducting ions did not change with temperature. But consideration displaces this view."

It follows the quotation given by Professor Walker.

Reference to the original will show that I used the term "water" in inverted commas throughout. Professor Walker says:—

Kohlrausch emphasises the fact that he is not dealing with even approximately pure water, by putting 'wasser' within inverted commas."

It is curious that Professor Walker fails to note that my inverted commas had precisely the same meaning as those of Kohlrausch, and that I did not profess to be dealing with *pure* water. My point was to show that the coincidence of the viscosity and temperature co-efficients for "water" did not support the view of anhydrous H and OH ions, since these were not the ions upon which the conductivity of "water" depended.

The passage quoted from my observations is therefore perfectly correct as applied to the matter with which I was dealing.

Further on I made the observation that "it is *doubtful* whether water possesses any autolytic conductivity whatever," which may have led Dr. Lowry and Professor Walker to think that the preceding passage had reference to pure water. This scepticism as to the conductivity of pure water I have hitherto shared with some physicists of undoubted eminence. But I now agree that this doubt must be considered to be finally removed by the present Paper. There was already strong evidence leading to the view that pure water had a genuine conductivity due to H and OH ions. But that this evidence was not considered to be quite conclusive, may, I think, be gathered from the way in which Professor Walker himself refers to the matter in his "Introduction to Physical Chemistry" (ed. 1903, p. 289). He says, referring to the conductivity which Kohlrausch had obtained for the conductivity of his purest water:—

"This conductivity must be accepted as the specific conductivity of pure water, for it is in close accordance with the numbers calculated from the chemical and electrical behaviour of the substance. If the *conductivity is not due to dissolved impurity*, the ions with which the electricity travels must come from the water itself. Since water contains only hydrogen and oxygen the ions we should expect are hydron and hydroxion. This *assumption* accounts very well for the chemical and electro-chemical behaviour of water and affords the desired basis of a numerical comparison between the results of the different investigations." (The italics are mine.)

The hypothetical mode of statement which Professor Walker adopts in the above passage is in conformity with the view that the evidence then available was not convincing. A perusal of Kohlrausch and Heydweil shows how that it did not clearly bring out the identity of the theoretical temperature co-efficients. It may no doubt be investigated, but it is concealed by the form of expression. When my observations criticised, I gave the theoretical expression of pure water as derived from that of the H and OH ions

$$\kappa = m \times (1 + 0.0163 T - 0.0000 T^2)$$

Professor Walker has adopted this form, and his variation of  $m$  in a similar form, has clearly observed temperature co-efficients of pure water. This demonstration clearly shows that the view upon the H and OH ions. I think the "

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Professor Walker guarded himself in the above quoted passage and dispensed with.

I may add that, before we knew of Professor Walker's Paper, Dr. Bousfield and I had discussed the applicability of the above equation to pure water in connection with the Paper of Kohlrausch and Heydweiller, and had observed that in order to apply this equation to pure water, the effect of rise of temperature in increasing the ionisation of the water would have to be brought into account. This consideration does not apply to "water."

**Professor Walker** (*communicated reply*) : I regret to have misunderstood Mr. Bousfield. It was, I think, only natural for Dr. Lowry and myself to suppose that Mr. Bousfield, in the passage which I have quoted, was under the impression that the "water" he referred to was *pure* water, since it is surely quite unnecessary to consider the temperature co-efficients of the hydrogen and hydroxide ions in connection with *impure* water, the conductivity of which cannot possibly be due to these ions.