LXXXII.—*Note on the Influence of Liquid Water in promoting the Interaction of Hydrogen Chloride and Oxygen on Exposure to Light.*

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THE experiments described by Dr. Richardson appear to establish the fact that hydrogen chloride is not oxidised by ordinary oxygen on exposure to sunlight unless water be present; and thus one more is added to the now numerous instances showing that interactions which are commonly assumed to occur between *two* substances more frequently than not are possible only in presence of a third substance—of a *catalyst* as I have elsewhere termed it.

Dr. Richardson states that no chlorine is liberated if only one of the gases be saturated, and that it is necessary to saturate *both* gases with water; on hearing of his results at the recent British Association

meeting, I was much struck and also puzzled by this statement. The explanation which he has now given in the foregoing paper that *liquid* water must be present, however, appears to me to be satisfactory, and it is on this point that I venture to offer the following remarks in the hope that I am thereby contributing to the appreciation of the importance of observations of the character of those which he has recorded.

The interaction in question is a parallel case to that of the oxidation of sulphur dioxide so carefully worked out by Professor H. B. Dixon, and which I have already discussed in my paper on "Electrolytic Conduction, &c." (*Proc. Roy. Soc.*, 1886, 288). In gaseous mixtures chemical change appears to take place only when a comparatively high electromotive force—or its equivalent—is employed, one sufficient to produce disruptive discharge being usually required: regarding the interaction as a case of electrolysis, a gaseous mixture of HCl , O_2 and OH_2 might therefore be expected to prove insensitive to light. But an aqueous solution of hydrogen chloride is one of the best of liquid conductors, and it is easy therefore to understand that a relatively small electromotive force should suffice to electrolyse a *liquid* system of the same three elements.

From this it should follow that a moist mixture of HCl and O_2 which is affected at ordinary temperatures would prove to be insensitive to light if the temperature be raised sufficiently to gasify the water. It is also probable that a *gaseous* mixture of chlorine and water will be found insensitive to light, provided that the temperature be high enough to destroy all *molecular aggregates* of the two substances: this proviso appears to me to be necessary as I imagine it is possible that in a molecule which includes both chlorine and water the direct absorption of light energy may induce a rearrangement ending in the formation of hydrogen chloride and oxygen.

The study of the effect of light on mixtures of H_2 , Cl_2 and water at temperatures high enough to gasify the water would be of interest from this point of view; probably it will be very difficult to entirely hinder the formation of surface layers of liquid and thus prevent any action taking place, but Professor Dixon's observations on the influence of the amount of gaseous water on the rate of propagation of explosive waves encourage us to hope that the required information may be gained in such a case by studying the rate of change at various temperatures.

It may be pointed out that Dr. Richardson's observation on a mixture of dry hydrogen iodide and oxygen is inconclusive owing to his having allowed phosphoric oxide to be present with the gases: this substance appears almost invariably to contain either phosphorus or lower oxides.