

LXXXI.—*The Chemical Inactivity of Röntgen Rays.*

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THE authors have investigated the effect of X rays on some chemical actions, but the results have hitherto been negative. The source of the rays in most cases was a bulb of the form devised by Mr. Herbert Jackson. The bulb and coil were enclosed in a metal box, connected to earth, with an aluminium window just above the bulb. The substances were enclosed in thin glass bulbs, provided with aluminium windows when the nature of the substance allowed the use of this metal. When aluminium would have been attacked by the substance used, the containing vessels were bulbs so thin that they gave only a faint annular shadow on a screen of potassium platinocyanide.

The exposure was usually half an hour, the efficiency of the bulb being tested at frequent intervals with the fluorescent screen.

The effect was tried on mixtures of (1) carbon monoxide and oxygen (dried and moist); (2) hydrogen and oxygen; (3) carbon monoxide and chlorine; (4) hydrogen and chlorine; (5) hydrogen sulphide and sulphur dioxide (dried).

No combination, either explosive or gradual, occurred between the gases exposed. In the case of the dried mixture of carbon monoxide and oxygen, sparks were passed through the mixture while it was exposed to the Röntgen rays. Each spark produced slight combination in its path, but no difference could be detected in its action when the rays were falling on the mixture and when they were not.

The combination of chlorine with carbon monoxide and with hydrogen is effected by light. The rate of combination in both cases depends on the intensity of the light. It is easy to measure accurately the rate of combination of these gases when combining slowly; and then, on allowing the Röntgen rays to fall upon the mixtures, to observe any alteration in the rate of union. Dr. A. Harden, who is investigating the union of carbon monoxide and chlorine, was good enough to measure the rate of combination in the presence and absence of the Röntgen rays. No difference could be detected. For the combination of chlorine and hydrogen, an apparatus somewhat similar to that used by Bunsen and Roscoe was employed. Not only did the Röntgen rays have no effect on hydrogen and chlorine in the dark, but they did not alter the rate of combination due to the action of light. The effect discovered by Pringsheim—a sudden expansion and slow return of the gases to their original volume under the influence of the light from a bright spark—was also examined, in presence and absence of Röntgen rays. No difference could be

detected. The Röntgen bulb in these cases seemed to act merely like a warm body would do in its place.\*

A solution of sodium sulphite exposed to the rays showed no greater absorption of oxygen than a similar solution which was protected. Hydrogen peroxide was apparently unaffected. The glowing of two pieces of phosphorus, one of which was exposed to the rays, and the other shielded by a thick piece of platinum, showed no perceptible difference.

It was thought that, since the rays cause electric discharge from metallic bodies, they might show some effect on electrolysis. A cell with an aluminium bottom was filled with distilled water, and connected with a battery and a delicate Thomson galvanometer. The latter was placed at some distance from the box containing the coil and bulb, and was shielded by a thick, earth-connected iron screen. No effect was observable when the rays were passed through the cell, and when, by the addition of a small quantity of sulphuric acid, the liquid became a conductor, the rays produced no sensible increase or decrease in the conductivity of the liquid. Though the experiments described all gave negative results, it is probable that the rays may exert some direct influence on chemical action, only this result may be too small to be measured.

In the action on a photographic plate, which is believed to be chemical in its nature, it must be remembered that a very small force will produce a result which is very apparent. The action of the X rays on a sensitive plate is probably caused either directly, or by the fluorescence of the film. That it is not due to the fluorescence of the glass behind the film is shown by examining a section of the film with the microscope, when the deposit of silver is found to be entirely on the side of the film directly exposed to the rays.

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