

	Experiment.			Theory.
	I.	II.	III.	
Carbon.....	35·03 ....	34·54 ....	35 09 ....	34·82
Hydrogen .....	3·41 ....	3·35 ....	3·35 ....	3·16
Nitrogen .....	3·70 ....	„ ....	„ ....	3·70
Chlorine.....	„ ....	„ ....	27·4 ....	28·09
Platinum.....	26·09 ....	26·8 ....	26·9 ....	26·0

The Specimen I was the pulverulent yellowish chloroplatinate, simply precipitated and dried in the vacuum. The others had been dissolved in boiling water, and were thereby slightly altered, as the excess of platinum proves. When quinoline is heated with an equivalent quantity of ethylene chlorhydrine without adding water, a dark purple-reddish mass is obtained. Extracted with ether, dried and treated with absolute alcohol, this mass gives a dark violet solution, which, if ether is poured on it, deposits an almost black mass, which finally crystallises. The crystals, pressed between sheets of paper, are sensibly less coloured than the mother-liquor, which imparts to the paper a dark violet colour.

I have not yet concluded the analysis of this product, and I propose to continue these researches in various directions.

#### IV. "On the Movement of Gas in 'Vacuum Discharges.'" By WILLIAM SPOTTISWOODE, P.R.S., and J. FLETCHER MOULTON, F.R.S. Received March 25, 1882.

In the preparation of tubes for our experiments it was often noticed that, after the exhaustion had been carried to a certain degree, the passage of a strong current had the effect of increasing the pressure. This appeared to be due to an expulsion of gas from the terminals themselves by the passage of the discharge. And accordingly the use of such currents from time to time during the process of exhaustion was adopted for making the vacuum more perfect and more permanent than otherwise would have been the case. On the other hand, it was also noticed, that after the tube had been taken off the pump and sealed in the usual way, the passage of a strong current had in some instances the effect of decreasing the pressure. We thus met with two effects, apparently due to the same cause, but diametrically opposite in character.

The fact of the tube being on the pump or off it did not appear to be at all material to the question, because the first effect could be obtained when the tube was temporarily shut off by a stopcock. Nor indeed did either the first or the second effect depend upon the absolute

pressure, although neither was observed except when the pressure was such as to approach the stage when Crookes' phosphorescence was produced.

These phenomena also reproduced themselves in another way. Some tubes, after having been completed and taken off the pump, showed a decreased pressure after a prolonged passage of a strong current, others an increased pressure, but among both classes tubes were not unfrequently found which recovered their original pressure after a period of rest or cessation of discharge.

Matters remained in this rather confused state until we observed with more care than before a tube of which the exhaustion was near the phosphorescent state, and of which both terminals were metallic cones, and consequently presented large surfaces for any action which might take place upon them.

In what may be considered to have been its normal condition, this tube showed three or four large white striæ with a dark space of considerable size round the negative terminal. On passing the discharge through the tube for some minutes the dark space increased, the striæ became fewer and feebler in illumination, the green phosphorescence began to show itself, and the discharge showed the usual signs of reduced pressure. On suddenly reversing the current the striæ became again more numerous and more brightly illuminated, precisely as they would be by an increase of pressure, while the other features of the discharge in a great measure resumed their original character; and not only so, but by a comparatively slow process, occupying many seconds in duration, the indications of increasing pressure continued still further, until they implied a pressure even beyond that at which the tube stood when the experiments began, after which the appearance slowly changed as before in a manner indicating reduced pressure. This reversal of the discharge was repeated many times with the same result in every case. The amount of change in pressure indicated by the appearance on each reversal was found to depend within wide limits upon the duration of the previous discharge, or, what is the same thing, upon the amount of depression below the normal pressure indicated by the previous discharge.

The most probable explanation of these phenomena appears to be this, that the effect of the discharge is actually to alter the pressure in the tube, not by any modification in the chemical composition of the gas, still less by anything that could be represented as a destruction of matter, but simply by driving occluded gas out of one terminal, and by drawing it in, or occluding it, at the other. On reversing the discharge, the operation is reversed, and the occluded contents of one terminal are thrown along the tube to be occluded at the other. This view of the mechanism whereby the observed phenomena are produced is supported by the absence of these appearances when the terminals are compara-

tively small and the pressure is such that the occluded contents of the metallic mass forming one terminal would form only a small fraction of the total mass of gas in the tube; for in that case the pressure, and consequently the appearance of the discharge, would be affected only in an inappreciable degree by the injection of the contents of the terminal. It should also be added that, when the terminals are of unequal size, the effects are unequal, as might have been expected.

The phenomenon in question appears to have so important a bearing on the mechanism of the discharge itself, that it becomes a question of great interest to determine whether the missing gas is to be found in either of the terminals; and if so, whether the ejection takes place at the positive, and the occlusion at the negative, terminal, or *vice versâ*. For this purpose I have devised a tube with three terminals, but have not yet had time to complete its construction or to make the experiment.

*Presents, March 2, 1882.*

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