graphical research can only be referred to the brochure itself, the seventy pages of which contain much useful and instructive data. Included will be found a number of photographs illustrating various stations, and diagrams showing the method of taking observations. In addition there are four relief maps of the north-eastern portion of Italy (Venice and the adjacent provinces), indicating the scope of operations and their localisation. There is an interesting description of the construction of an experimental tank at Stra.

POSITIVE RAYS OF ELECTRICITY.[1]

THE first part of the paper contains a discussion of the evidence afforded by the positive rays as to the nature of the ionisation of the gases in a discharge tube and the properties of atoms. The positive rays consist of:—

(1) Atoms with one positive charge.
(2) Molecules with one positive charge.
(3) Multiply charged atoms.
(4) Atoms with one negative charge.
(5) Molecules with one negative charge.

All the diatomic gaseous elements which have been examined furnish both atoms and molecules with single charges. The proportion of atoms to molecules varies very largely with the conditions of the electric discharge, and evidence is given that the charged atoms and molecules are produced by different processes. It is suggested that the ionisation which gives rise to molecules is due to kathode rays, while the charged atoms are produced by the impact of charged atoms and molecules.

All the elements examined, with the significant exceptions of hydrogen and a substance of atomic weight 3 (X_3), furnish, under certain conditions, atoms with more than one charge. The power of acquiring multiple charges seems to be connected with the atomic weight rather than with the valency or other chemical property of the atom. Thus the atom of mercury, the heaviest atom investigated, can have as many as eight changes, crypton five, argon three, while the lighter atoms, as a rule, have only two. No undoubted case of a doubly-charged *molecule* of an element or compound has yet been discovered.

The negative charge is found on the atoms of some elements, *e.g.* hydrogen, oxygen, carbon, sulphur, chlorine, but not on the atoms of nitrogen, helium, neon, argon, or mercury. It may be regarded as an indication of the chemical activity of the atom, in so far as this depends upon the intensity of the electric field outside the atom. No negatively electrified molecules of compounds have been observed; the only cases of negatively electrified molecules of elements are those of oxygen and carbon, and these only occur when the elements are liberated from special types of compounds.

The second part of the paper deals with the use of these rays as a method of chemical analysis. Several applications of the method are considered. The first of these is to the detection of rare gases in the atmosphere. It is shown that while none of the heavier gases in the atmosphere occurring in quantities comparable with that of xenon have escaped detection, this is not the case with the lighter gases.

"Neon," it is shown, is not a simple gas, but a mixture of two gases, containing a large quantity of a gas of atomic weight about 20, and a much smaller quantity of one with an atomic weight about 22. The "22" gas was first observed in samples of residues of liquid air supplied by Sir James Dewar, and has since been found in every specimen of neon examined, including a specimen supplied by M. Claud, of Paris, and a very carefully purified sample of neon prepared by Mr. Watson. The sample from M. Claud contained a small quantity of a substance with atomic weight 3, the properties of which are discussed later on.

Another application of this method was to the analysis of the gas in a small glass tube in which 30 mg. of radium bromide had been sealed for more than ten years; in addition to helium, the gas contained considerable quantities of "neon" or some element with very nearly the same atomic weight; there was also a trace of argon in the gas, a little more than would have been expected from the volume of air in the tube, although the difference was not very great.

The other application of the method is to the investigation of the properties of a substance for which $m/e=3$, X_3. This gas is given off by most solids when they are bombarded by kathode rays. Reasons are given for concluding that the substance is not the carbon alone with four charges.

The gas has the following properties:—

It can pass through tubes containing red-hot copper oxide, and then over potash without being absorbed.

It is not changed when sparked for a long time with an excess of oxygen, the oxygen being subsequently removed by phosphorus.

It can pass over metallic sodium without being absorbed, nor does it disappear when heated along with sodium vapour.

It is absorbed by charcoal cooled with liquid air, but it can circulate through a glass spiral immersed in liquid air without being condensed.

It combines with mercury vapour when an electric discharge is sent through the mixture; it also combines to some extent with red-hot copper when passed slowly over it. If stored over mercury vapour it seems to diminish, though very slowly. The gas has been detected after it has been stored for several weeks.

The study of the positive-ray photograph indicates that the substance is monatomic, and generally it seems to be similar in its behaviour to the inert gases, although its chemical properties are apparently a little more energetic.

[1] Summary of the Bakerian lecture delivered before the Royal Society on May 22 by Sir J. J. Thomson, O.M., F.R.S.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Dr. Shipley, master of Christ's College, has been reappointed representative of the University on the council of the Marine Biological Association.

On June 3 the Rev. S. A. Donaldson, master of Magdalene College, was re-elected Vice-Chancellor of the University for a second year.

It is proposed to confer the degree of Doctor of Letters, *honoris causâ*, upon Commendatore Giacomo Boni, director of the excavations on the Forum and the Palatine.

The registrary reports that the matriculation this term brings the number of new students for the academic year 1912–13 up to 1200. In the last academic year the numbers were 1156.

Mr. R. Assheton, of Trinity College, and Mr. L. Doncaster, of King's College, have been approved by the general board of studies for the degree of Doctor of Science.

OXFORD.—A summer course in advanced practical organic chemistry, with demonstrations, will be held at Queen's College, on August 1–30, by Mr. F. D.