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THE ATOM

ELECTRICAL CONSTITUTION OF MATTER

LECTURE BY PROF. KERR GRANT.

The first of a series of extension lectures on "Matter, Ether, and Electricity" was given by Professor Kerr Grant in the Prince of Wales lecture room at the University on Tuesday night, in the presence of a moderate attendance. The speaker said:—

The problem on which physicists were mainly concentrating their attack, both by theory and experiment, was that of the electrical constitution of matter—in what manner the different kinds of material atoms which exist are built up of positive and negative units of electricity.

The existence of atoms was no longer a hypothesis, it was a fact more securely established by various lines of evidence than the existence of the stars. Over 80 different elements or atomic species are known to chemists. Several more are known to exist in extremely minute quantities on the basis of radioactive evidence, a total of 87. It would be shown that between hydrogen the largest atom known, and uranium, the heaviest, there are 90 other chemical species making a total of 92. Of these 92, therefore, five remain to be discovered.

Until recently the classification of the atoms was based mainly upon their relative weights determined by chemical analysis. John Walton (1803) was the first to show that the laws of chemical combination could be simply explained on the assumption that all elementary atoms of the same species were identical in all their properties including weight. The hypothesis put forward by Prout a few years later that all atoms were built up of hydrogen was not confirmed by more exact determinations of the relative atomic weights and abandones only to be revived recently on other grounds.

The Russian chemist Mendeleif in 1869 put forward the "Periodic" classification of the elements, the most important generalisation of modern chemistry.

The main features of this system were discussed by the lecturer, stress being laid on the properties of chemical valency, relative abundance, magnetic character, and radioactivity.

The discovery of this latter property of atoms opened up entirely new and unsuspected fields of theoretical and experimental investigation.

The dogma of the eternal existence of the atom was completely shattered. The discovery of "isotopic" species which had different atomic weights but identical chemical properties was very disturbing to chemists and led to enquiry after a new basis of classification. Such a basis was found in the concept of "atomic number," i.e., the ordinal number of an element when all were arranged in order according to their properties. Later an independent method of determining this number was found in the nature of its X-ray spectrum which led to its identification with the positive electric charges carried by the nucleus. This conception found strong support also in the laws of radioactive changes.

The method of determining atomic weights by "Positive-ray" analysis inaugurated by Sir Joseph Thomson and perfected recently by his pupil [illegible]ston has led to the discovery of numerous isotopic species among the commoner elements of lower atomic number. The chlorine has two isotopic forms of atomic weights, 35 and 37 exactly. The mixture of these gives an average atomic weight of 35.47.

Aston has investigated by this method the atomic weights of about 30 elements and found that in every case except for hydrogen and possibly tin the atomic weight is an exact integer, oxygen 16 being taken as the standard. Thus, Prout's hypothesis has at last found vindication.

The atomic nature of electricity has also been firmly established by the work of J. J. Thomson, Millikan, and others, and the electron or atom of negative electricity found to be a universal constituent of material atoms.

While the electrical nature of atoms is established beyond doubt by the facts of radioactivity and vacuum-tube phenomena further confirmation is given by the phenomenon of ionisation or the conversion by suitable agencies of neutral gaseous atoms and molecules into ions bearing an electric charge.

Lantern views were shown of the remarkable photographs by means of which the track of a single A or B ray could be followed. The chemical properties of ionised atoms are completely different from those of the parent neutral atoms. Ozone is thus produced, for example, by ionisation of the oxygen of the air caused by electrical discharge.

The next lecture will deal with the problem of the structure of atoms from positive and negative electrons.

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Mr. G. M. Eimer, who until recently has been assistant to Professor Kerr Grant in the Department of Physics at the Adelaide University, has resigned that appointment, and accepted an engagement with the Hospital Electrical & Radium Ltd., in connection with their X-ray department.

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SYDNEY CONSERVATORIUM.

NEW DIRECTOR APPOINTED.

SYDNEY, August 2.

The New South Wales Cabinet has approved of the appointment of Mr. W. A. Orchard as Director of the Conservatorium. The salary is £1,250 a year. In musical circles it was believed that Mr. Alfred Hill would be chosen. Out of the applications recently received the names of Mr. Orchard and Mr. Hill were selected. Enquiries were made by cable to London whether the increased salary was likely to attract applications from London or America. The reply was in the negative.

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THE LEAGUE OF NATIONS.

To the Editor

Sir—On this, the ninth anniversary of our country's entry into the most terrible war in history, it is fitting that we recall to memory the purpose we set out to achieve, and for which more than 50,000 of the fittest and best of Australia's manhood laid down their lives. The great commonwealth of nations in whose name the British Government speaks and acts, comprises many millions of people actuated by every possible kind of motive and sentiment, but we believe that it was the high and noble purpose enunciated by the British Prime Minister in August, 1914, and not in the lust of conquest or territory or other material advantage that was the dominating motive of the British people. The conviction, expressed in varying terms, but with increasing emphasis as the war dragged on, that this was in truth a war to end war, was the sustaining thought of the nation, and inspired all classes of citizens to heights of disinterested sacrifice such as our country had never before experienced. The sacrifices of the war made possible what hitherto has been regarded as an impracticable dream—the coming together of the nations, great and small, in regular conferences for mutual discussion and co-operation, and the establishment of effective machinery for settling international differences by recourse to law in place of the method of wholesale slaughter. The League of Nations, embracing to-day 52 nations or three-quarters of the whole globe, has already in the three years of its existence accomplished tremendous tasks in the restoration of Europe. When all other expedients had failed, it found a peaceful solution of the Sweden-Finland rupture, which otherwise must have involved those countries in war: it has restored the tottering and starving Austria, whose finances a year ago were scarcely less desperate than Germany's to-day; it has succeeded in setting up a Court of International Justice with a permanent judiciary and wide and effective powers, free from the blemishes which have rendered futile all previous attempts in that direction. In many other ways, it has succeeded far beyond the most sanguine hopes of its founders. The imminent peril in which we now stand of a general European collapse, which would bring ruin and death to millions of the white race, can only be averted by utilising again the machinery of the League. The unhappy differences existing between England and France, to which it would be hypocrisy to shut our eyes, involved the fourfold problem of reparations, inter-Allied debts, limitation of armaments and security of frontiers, and no other solution seems practicable but entrusting the settlement to the League of Nations, with the help, if possible, of Germany and the United States. The British Government and Parliament, supported by the great mass of public opinion in the mother country, seems resolved in any case to find a peaceful way out of the Ruhr along the path of co-operation. Australia will be faithless to the memory of her dead if she fails to give loyal and wholehearted support to every effort made in this direction.—On behalf of the Australian League of Nations' Union, we are, &c.,

WM. MITCHELL, President;
J. HOWARD VAUGHAN, Chairman of Executive;
MARGARET DARNLEY NAYLOR, Hon. Secretary.

ADVANCEMENT OF SCIENCE CONGRESS.

The President of the Australasian Association for the Advancement of Science (Sir George Knibbs) has received letters from Sir William H. Bragg (Quain Professor of Physics in the University of London), and from Professor Archibald Liversidge (Emeritus Professor of Chemistry at the University of Sydney), stating that they will be glad to act as representatives of the Australasian Association for the Advancement of Science at the meeting in Liverpool on September 12-19. Australia is fortunate in having secured two men so eminent in the course of science, as its representatives. Sir William Bragg rendered excellent service as a member of the Australasian Association. In the University of Adelaide he laid the foundations of that work which has made his name famous throughout the world—namely, his study of the nature of the different rays in radio active substances, work which has culminated in his researches as to the mode in which atoms all build up into crystals. Professor Liversidge was really the founder of the Australasian Science Association, and was indefatigable in its service. Apart from his university labours, he was a tremendous worker in the Royal Society of New South Wales, and it was through his influence that that society was able to build up the magnificent scientific library which it possesses and which is well-known to every genuine research student in that State and, in fact, even in wider fields. Both Sir William Bragg and Professor Liversidge are Fellows of the Royal Society of England, and have expressed the most cordial appreciation of their nomination as representatives of the Australasian Association.

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ELDER CONSERVATORIUM.

ENSEMBLE CLASSES CONCERT.

It says much for the interest aroused by the Conservatorium concerts that, in spite of important musical counter-attractions, there was quite a good-sized audience at the Elder Hall on Monday evening—not quite so large as usual, perhaps, but most enthusiastic. The ninth concert of the 1923 session was no exception to the rule of well-chosen programmes and work of a distinctly gratifying quality. The level of performance seems to be steadily advancing, not only in a technical direction, but in the recognition of the something more that makes the difference between a mere presentation and a thoughtful and sympathetic interpretation. At first, of course, the mind of the learner is occupied much with the means of expression, the technical side; but if real music is to be produced the soul and meaning of the writing must be felt for, something more than brilliance—a soul. This comes in its fullness only with the deepening of understanding and intuition, but, if even early in the work it is not the main object towards which the young musician is striving, there is little chance of any real achievement. It is one of the most happy signs of the value of these concerts that, as time goes on, this attitude towards their music on the part of the students is more and more plainly recognised. On Monday evening especially, the music was a real pleasure to listen to, each composition being given with a just appreciation of its character.

At the opening Dr. Davies drew attention to the alteration of the date of the next concert from Monday, August 13, to Tuesday, August 14.

The first number was a trio sonata, for piano, two violins, and 'cello (Boyce), by Misses Gwen Morris, Mary Lamphee, and Eileen Cushman, and Mr. Val Robertson. There was a decided feeling for rhythm in the rendering of both the introduction and the allegro. There followed the last movement of the "Sonata in C minor for piano and violin" (Greig), by Misses Muriel Prince and Helen Magarey, and the character of the writing was well emphasized. "Trio in B flat for piano, violin, and 'cello" (Mozart), by Misses Gladys Jeffery and Annie Oliver, and Master Melville Williams, was also pleasingly presented. Other successful numbers were the "Quartet in C minor for piano, violin, viola, and 'cello" (Mozart), by Misses Marjorie Adamson and Annie Oliver, and Messrs. Edward Black and Melville Williams, and the "Trio in G major" (Haydn), by Misses Margaret Salter and Louise Hackendorf, and Mr. Val Robertson, which was given with the right restraint and delicacy. The programme was concluded with a "Quintet for two violins, viola, and 'cello" (Schuman), the three movements "Allegro brilliante," "Schertzo," and "Allegro ma non troppo," being rendered by the following:—Piano, Misses Doris Kentish, Jean Renou, and Jean Finley; violin, Misses Lilian Pether, Aila Zevern, A.M.U.A., Doreen Stoneman, A.M.U.A., and Mrs. T. Wiles; viola, Mr. Edward Black; and 'cello, Mr. Harold Parsons. Miss Pether was also heard to advantage in a duet for piano and violin, with Miss Alice Meegan, A.M.U.A. There were only two vocal numbers. Miss Hilda Milton won thoroughly well deserved applause for her singing of the recitative "Sposa Euridice," and the air "Che faro," from Gluck's "Orpheus," her voice having unusually fine tone quality, and her rendition being sympathetic and expressive. Miss Lois Lathlean sang "Prelude" (Cyril Scott), with considerable feeling. Misses Alice Meegan, A.M.U.A., and Muriel Prince acted as accompanists.

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THE ATOMIC THEORY.

UNIVERSITY EXTENSION LECTURE.

The second of a series of three extension lectures on the subject of "Matter, Ether, and Electricity," was delivered by Professor Kerr Grant at the Prince of Wales Theatre, Adelaide University, last night. The lecturer said he must assume that his audience possessed a knowledge of the following fundamental fact concerning electricity:—1. That there were two kinds of electricity, termed positive and negative respectively. 2. That no matter how electricity was generated, these two were always produced in exactly equal amounts. 3. That positive and negative electricity might be conceived to exist together in all non-electrical matter in exactly equal amounts. 4. That static ary electric charges exerted mutual forces of repulsion or attraction according as they were of the same or opposite kinds; and that, moving electric charges exerted mutual magnetic force.

The atomic theory of electricity was first clearly stated by Helmholtz in 1881, who based it on the fact that, in electrolysis, each atom of matter liberated carried a definite positive or negative charge, which was invariably a multiple of a definite unit quantity. Later investigations in the domain of electrical discharge through gases, of optics, and of radio-activity, had completely confirmed the atomic hypothesis, and had further led to the discovery of the electron, which was an atom of negative electricity, which could exist entirely apart from matter, though present in all material atoms. In the last years of the nineteenth century, theories of an electrically constituted atom, built up of electrons and positive electricity, were advanced by Sir Joseph J. Thomson and others. In 1911, Rutherford put forward his theory of a nuclear or planetary atom, which successfully explained the scattering