SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 21.—"Helium and Argon. Part III. Experiments which show the Inactivity of these Elements." By Prof. William Ramsay, F.R.S., and Dr. J. Norman Collie.

To chronicle a list of failures is not an agreeable task; and yet it is sometimes necessary, in order that the record of the behaviour of newly-discovered substances may be a complete one. It is with this object that we place on record an account of a number of experiments made to test the possibility of forming compounds of helium and argon.

It will be remembered that in their memoir on Argon (*Phil. Trans.*, vol. clxxxvi., A), Lord Rayleigh and Prof. Ramsay described numerous experiments, made in the hope of inducing argon to combine, all of which yielded negative results. Two further experiments have been since made—again without success.

(1) The electric arc was maintained for several hours in an atmosphere of argon. A slow expansion took place. The resulting gas was treated with caustic soda and with a solution of ammoniacal cuprous chloride, and, on transference to a vacuum-tube, it showed the spectrum of argon along with a spectrum resembling that of hydrocarbons. Having to leave off work at this stage, a short note was sent to the *Chemical News* on "A Possible Compound of Argon." On resuming work after the holidays, the gas was again investigated, and, on sparking with oxygen, carbon dioxide was produced. But it was thought right again to treat the gas with cuprous chloride in presence of ammonia, and it now appeared that when left for a sufficient time in contact with a strong solution, considerable contraction took place, carbonic oxide being removed. There can, therefore, be no doubt that, although apparently all gas had been removed from the carbon electrodes before admitting argon, some carbon dioxide must have been still occluded, probably in the upper part of the electrodes, and that the prolonged heating due to the arc had expelled this gas and converted it into monoxide. It appears, therefore, certain that argon and carbon do not combine, even at the high temperature of the arc, where any product would have a chance of escaping decomposition by removing itself from the source of heat. It is hardly necessary to point out that such a process lends itself to the formation of endothermic compounds such as acetylene, and it was to be supposed that if argon is capable of combination at all, the resulting compound must be produced by an endothermic reaction.

(2) A product rich in barium cyanide was made by the action of producer gas on a mixture of barium carbonate and carbon at the intense temperature of the arc. This product was treated by Dumas' process so as to recover all nitrogen; and, as argon might also have entered into combination, the nitrogen was absorbed by sparking. All the nitrogen entered into combination with oxygen and soda, leaving no residue. Hence it may be concluded that no argon enters into combination.

(3) A mixture of argon with the vapour of carbon tetrachloride was exposed for several hours to a silent discharge from a very powerful induction coil. The apparatus was connected with a gauge which registered the pressure of the vapour of the tetrachloride and of the argon of which it was mixed. Careful measurement of the pressure was made before commencing the experiment, and after its completion. Although a considerable amount of other chlorides of carbon was produced, no alteration of pressure was noticeable; the liberated chlorine having been absorbed by the mercury present. Here again the argon did not enter into the reaction, but it was recovered without loss of volume.

The remaining experiments relate to attempts to produce compounds of helium. The plan of operation was to circulate helium over the reagent at a bright red heat, and to observe whether any alteration in volume occurred—an absorption of a few c.c. could have been observed—or whether any marked change was produced in the reagent employed. As a rule, after the reagent had been allowed to cool in the gas, all helium was removed with the pump, and the reagent was again heated to redness, so as, if a compound had been formed, to decompose it and expel the helium. Every experiment gave negative results; in no case was there any reason to suspect that helium had entered into combination.

A short catalogue of the substances tried may be given, none of which gave any signs of combination.

(4) Sodium.	(13) Thorium.
(5) Silicon.	(14) Tin.
(6) Beryllium.	(15) Lead.
(7) Zinc.	(16) Phosphorus.
(8) Cadmium.	(17) Arsenic.
(9) Boron.	(18) Antimony.
(10) Yttrium.	(19) Bismuth.
(11) Thallium.	(20) Sulphur.
(12) Titanium.	(21) Selenium.

(22) Uranium oxide, mixed with magnesium dust, was heated to bright redness in helium. No change, except the reduction of the oxide, took place. The mixture was allowed to cool slowly in the current, and the helium was removed with the pump till a phosphorescent vacuum was produced in a vacuum tube communicating with the circuit. The mixture was reheated, and no helium was evolved, not even enough to show a spectrum. The vacuum remained unimpaired.

It had been hoped that elements with high atomic weight, such as thallium, lead, bismuth, thorium, and uranium might have effected combination, but the hope was vain.

(23) A mixture of helium with its own volume of chlorine was exposed to a silent discharge for several hours. The chlorine was contained in a reservoir, sealed on to the little apparatus which had the form of an ozone apparatus. No change in level of the sulphuric acid confining the chlorine was detected after the temperature, raised by the discharge, had again become the same as that of the room. Hence helium and chlorine do not combine.

(24) Metallic cobalt in powder does not absorb helium at a red heat.

(25) Platinum black does not occlude it.

(26) It is not caused to combine by passage over a mixture of soda-lime and potassium nitrate heated to bright redness. This was hardly to be expected, for it resists the action of oxygen in presence of caustic soda, even when heated by the sparks which traverse it.

(27) A mixture of soda-lime and sulphur consisting of polysulphides causes no change of volume in a current of helium passed over it at a bright red heat.

(28) Induction sparks in an ozone apparatus passed through a mixture of helium with benzene vapour in presence of liquid benzene for many hours, gave no change of volume. The benzene was, of course, altered, but the sum of the pressures of the helium and the benzene-vapour remained as at first. Had helium been removed, contraction would have occurred.

This ends the catalogue of negative experiments. Any compound of helium capable of existence would probably be endothermic, and the two methods of producing endothermic compounds, where no simultaneous exothermic reaction is possible, are exposure to a high temperature, at which endothermic compounds show greater stability, and the influence of the silent electric discharge. These methods have been tried, so far in vain. There is, therefore, every reason to believe that the elements, helium and argon, are non-valent, that is, are incapable of forming compounds.

Chemical Society, May 21.—Mr. A. G. Vernon Harcourt, President, in the chair.—The following papers were read. The diphenylbenzenes, I. Metadiphenylbenzene, by F. D. Chattaway and R. C. T. Evans. Metadiphenylbenzene may be prepared by the action of melted sodium on a boiling xylene solution of metadichlorobenzene and chlorobenzene; it melts at 84°.—Derivatives of camphoric acid, by F. S. Kipping. A lactonic monocarboxylic acid, $C_{10}H_{14}O_4$, which the author terms trans-π-camphanic acid, is obtained by boiling sodium π-bromocamphorate with water; its cis-isomeride can only be prepared as a salt. On oxidising trans-π-camphanic acid, transcamphotricarboxylic acid $C_{10}H_{14}O_6$ is obtained; on fusion with potash it yields the isomeric ciscamphotricarboxylic acid.—On some substances which exhibit rotatory power both in the liquid and crystalline states, by W. J. Pope. Cis-π-camphanic acid and transcamphotricarboxylic acid possess the power of circularly polarising light, both in the dissolved and crystalline state; in the former case the circular polarisation in the crystalline state is a specific property of the crystalline structure, but in the latter it is due to complicated twinning of the crystals.—Dimethoxydiphenylmethane and some of its homologues, by J. E. Mackenzie. Dimethoxydiphenylmethane, and the corresponding diethoxy- and dibenzoxy-compounds, may be prepared by the interaction of benzophenone chloride and the sodio-derivative of methylic, ethylic or benzylic alcohol respectively.

Zoological Society, June 2.—F. DuCane Godman, F.R.S., Vice-President, in the chair.—Mr. Sclater exhibited the skin of an African Monkey of the genus *Cercopithecus*, originally received alive from Mombasa, which he believed to be referable to Stairs's Monkey (*C. stairsi*).—Mr. Sclater also exhibited a series of water-colour drawings of African antelopes by Mr. Caldwell, and a photograph of the gorilla now living in the Society's Gardens, by Mr. Henry Scherren.—A communication was read from Mr. Henry J. Elwes and Mr. Edwards, containing a revision of the European and Asiatic butterflies of the family Hesperiidæ. The species treated of in this paper were about 450 in number and were divided into about 100 genera.—Mr. Charles Davies Sherborn gave an explanation of the plan he had adopted in his "Index Generum et Specierum Animalium." Mr. Sherborn stated that the absence of any trustworthy lists of the species of particular genera had led him to commence the compilation of an "Index Generum et Specierum Animalium" in 1890. Since that time 130,000 generic and specific names had been recorded in a manuscript which was stored at the British Museum (Natural History). Mr. Sherborn explained in detail the method and plan adopted for the compilation of the work.—Mr. G. A. Boulenger, F.R.S., read a paper on the dentition of snakes, and added remarks on the evolution of the poison-fangs in this order of reptiles.

PARIS.

Academy of Sciences, June 1.—M. A. Cornu in the chair.—The President announced the loss sustained by the Academy by the death of M. Paul Daubrée, Member of the Section of Mineralogy. A letter from M. Des Cloizeaux, giving a brief account of M. Daubrée's contributions to science, was read by the Secretary.—Note on the observed passages of Mercury across the disc of the sun, and on the question of the existence of inequalities of long period in the mean longitude of the moon, of which the cause is still unknown, and in the rotation of the earth upon its axis, by M. S. Newcomb.—On the laws of induction. Reply to the note of M. Marcel Deprez, by M. A. Potier.—Action of acetylene upon iron, nickel, and cobalt reduced by hydrogen, by MM. H. Moissan and Ch. Moureu. If acetylene, which has been allowed to suddenly impinge upon pyrophoric iron which has been reduced by hydrogen at the lowest possible temperature, the gas is decomposed with incandescence into its constituents. At the same time, owing to the high temperature, condensation takes place, and a liquid hydrocarbon, rich in benzene, is produced. The same phenomenon is produced by pyrophoric nickel and cobalt, and also by platinum black. No compound containing metal can be isolated, and the decomposition appears to be due to physical causes.—Respiratory exchanges, in the case of muscular contractions provoked electrically in animals either fasting, or fed with a diet rich in carbohydrates, by MM. A. Chauveau and F. Laulanie. The experimental results with dogs and rabbits were identical with those already obtained with men.—New experiments on the distribution of velocities in tubes, by M. Bazin. No single expression can be given which will accurately represent the velocity of an air current at any point between the centre and circumference of the tube, the law being very complicated. At a distance from the centre equal to three-fourths of the radius of the tube the velocity was equal to the mean for the whole tube.—On a musical register, by M. A. Rivoire. Description of an instrument for automatically recording the notes struck on a piano.—Density of variable stars of the Algol type, by M. Mériau. Starting with the hypothesis that the variations in the brightness of stars of the Algol type are due to eclipses produced by dark satellites, a formula is developed giving the density in terms of constants that can be experimentally determined.—On entire functions, by M. Hadamard.—On systems in involution of equations of the second order, by M. E. Goursat.—On a differential equation of the first order, by M. Michel Petrovitch.—On the rotation of a variable body, by M. L. Picart.—On the anomaly in the acceleration of gravity at Bordeaux, by M. J. Collet.—On the theory of turbines, pumps, and centrifugal fans, by M. A. Rateau.—On molybdenite and the preparation of molybdenum, by M. M. Guichard. Metallic molybdenum free from sulphur can be obtained by subjecting the mineral molybdenite in a carbon tube to the electric furnace (900 amperes, at 50 volts) for five minutes. The ingot contained about 92 per cent. of molybdenum, 2 per cent. of iron, and 7 per cent. of carbon.—On the methylamines, by M. Delépine. As a means of distinguishing the three methylamines rapidly and with certainty, the formation of the picrates is recommended, the salts from mono-, di-, and trimethylamine melting respectively at 207°, 156°, and 216°, and differing also in colour and solubility.—On the reaction between aldehydes and phenylhydrazine, by M. H. Causse. Compounds are obtained with acetaldehyde and benzaldehyde which appear to contain one molecule of aldehyde to two of phenylhydrazine, and to be formed without any condensation.—On a new building material from glass refuse, by M. Garchey.—On the influence of certain pathological agents on the bactericidal properties of the blood, by M. E. S. London.—On the slowness of the normal coagulation of the blood in birds, by M. C. Delezenne. Contrary to the generally accepted view, if the blood of birds is taken under experimental conditions similar to those in general use for mammals, the coagulation always takes place with extreme slowness, frequently not commencing until four to six hours after its removal from the artery.—On a new audiometer, and on the general relation between the intensity of the sound and the successive degrees of sensation, by M. Charles Henry.

BOOKS RECEIVED.

BOOKS.—Crystallography for Beginners: C. J. Woodward (Simpkin).—Crystals and Apparatus for use with ditto (Simpkin).—Chemistry in Daily Life: Dr. Lassar-Cohn, translated by M. M. P. Muir (Grevel).—The Spas and Mineral Waters of Europe: Dr. H. and F. P. Weber (Smith, Elder).—The Antichrist Legend: W. Bousset, translated by A. H. Keane (Hutchinson).—Lloyd's Natural History. British Birds: R. B. Sharpe, Part 1 (Lloyd).—Théorie Nouvelle de la Vie: Dr. F. Le Dantec (Paris, Alcan).—Stuttering and how to cure it: L. Klindworth (Glasgow, Bauermeister).—A Manual of Botany: Prof. J. R. Green, Vol. 2 (Churchill).—The Pathology of the Contracted Granular Kidney: Sir G. Johnson (Churchill).—Animals at Work and Play: C. J. Cornish (Seeley).—Physikalisch-Chemische Propaedeutik, Zweite Hälfte, 1 Liefg. (Leipzig, Engelmann).—Lehrbuch der Vergleichenden Mikroskopischen Anatomie der Wirbeltiere: Dr. A. Oppel. 1 Teil. Der Magen (Jena, Fischer).—Geological Sketch Map of South Africa, and Notes on the Geological Formation of South Africa and its Mineral Resources: F. P. T. Struben (Stanford).

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