that the late Mr. W. M. Rice, who was for many years a resident in Houston, left a large sum of money, which after reduction by litigation still reached 2,000,000*l.*, to endow and equip the institute. President Lovett, who is in charge of the new institution, came from Princeton University, and spent a year visiting seats of learning throughout the world, so as to enable him to advise the trustees as to the character the buildings and work of the new institute might with advantage take. The result is that the first of the palatial buildings are now almost complete, and will form the nucleus of what will eventually be a much more extensive suite of halls and residences. For the present no upper limit will be assigned to the work of the institute, and the lower limit will be that of the more conservative of American universities. The initial teaching staff is to be organised for university work in science and letters, and it is intended to build up a school of pure and applied science of the highest grade. Men and women will be admitted, and there will be no charge for tuition. Rooms in the residential hall and board will be provided at actual cost price. It is interesting to record that the corner-stone of the administration building was laid last year on the seventy-fifth anniversary of the date when Texas declared its independence of Mexico. For the first few years this building will be used to meet some of the needs of instruction. The first building in the students' residential group for men has been begun, and the mechanical laboratory, machine shop, and power house are being erected north of the administration building.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 25.—Sir Archibald Geikie, K.C.B. president, in the chair.—Prof. J. S. **Townsend**: Determination of the coefficient of interdiffusion of gases and the velocity of ions under an electric force, in terms of the mean free paths. A method is described by which an expression for the rate of interdiffusion of gases may be easily found, either on the ordinary supposition that the effect of a collision makes all subsequent directions of motion of the molecules equally probable, or without specifying in any way the effect of a collision. Similar expressions are found for the velocity of ions under electric forces. In all cases the rate of diffusion of the ions is of the form $K=\frac{1}{3}LV$, and the velocity under the electric force $u=\frac{Xe}{m}\cdot\frac{L}{V}$. L does not, in general, represent the mean free path, but it has the same meaning in both expressions, so that when an ion is moving under the action of a force and also by the process of diffusion its velocity is given by the equation

$$u=\frac{-K}{n}\frac{dn}{dx}+\frac{Xe}{m}\cdot\frac{L}{V},$$

or

$$\frac{\frac{1}{3}mnV^2u}{K}=-\frac{mV^2}{3}\frac{dn}{dx}+Xen,$$

or

$$\frac{1}{K}(pu)=-\frac{dp}{dx}+nXe,$$

which is the well-known form to which Maxwell's equation reduces when external electric forces are acting. The general equations for the motion of ions may thus be easily found from the rate of diffusion and the velocity under an electric force when these quantities are correctly determined.—Dr. H. **Geiger**: Note on the scattering of α particles. In a previous paper experiments were described on the scattering of the α particles by foils of various materials and thicknesses. The present note deals with a theoretical examination of the question. The scattering is considered as the result of a multitude of small deflections of the α particle by the individual atoms of the matter traversed. The experimental curve of distribution with angle for a scattered pencil of α particles is found to be in good agreement with that derived from simple probability theory. The deductions also explain the experimental result that for thin foils, which do not appreciably alter the velocity of the α particles, the most probable angle of scattering varies as the square root of the thickness. To find the variation of the most probable scattering angle for large thicknesses of matter traversed, the change in velocity of the α particles has to be taken into account. Assuming, as found by experiment, that the most probable angle of scattering is inversely proportional to the third power of the speed, the theoretical curve is found to give a satisfactory explanation of the experimental results obtained with thick foils.—A. S. **Russell**: The effect of temperature upon radio-active disintegration. The effect of temperature upon the rate of decay, and the amount of β and γ-ray activity, of radium emanation, of active deposit, and of radium C has been investigated. The results are entirely negative. All abnormalities of activity of β rays obtained by previous authors, and by the author in this research, may be completely explained on two simple grounds. The first of these is a change of distribution of radium C caused by its partial volatilisation inside the quartz tube at temperatures greater than 320°. The second is a change in the partition of radium C between the walls of the quartz envelope and the space enclosed. At room temperature the greater part of the radium C is usually on the walls. At room temperature, after the tube has been cooled suddenly from high temperatures, it is entirely on the walls. Above 650° the radium C is distributed homogeneously throughout the volume of the tube. Each of these partitions gives a different β-ray ionisation in an electroscope, because the average path of the rays through the walls of the quartz envelope depends upon the partition. Under the conditions of experiment, radium B and radium C, and very probably radium A, may be completely volatilised inside sealed quartz tubes at a temperature of 650°. Radium B commences to volatilise at room temperature.—F. W. **Aston** and H. E. **Watson**: The relation between current, voltage, pressure, and the length of the dark space in different gases. In a previous paper one of the authors has shown that in the discharge between large plane aluminium electrodes in gases at various pressures the following empirical equations are approximately true:—

$$D=\frac{A}{P}+\frac{B}{\sqrt{c}},\quad V=E+\frac{F\sqrt{c}}{P}$$

where D is the length of the dark space, V the voltage between the negative glow and the kathode, c the current density, P the pressure, and A, B, E, F constants depending on the nature of the gas. The first part of the present communication gives the results of the continuation of this work, with the values of the constants for hydrogen, nitrogen, air oxygen, carbon monoxide, helium, and argon. The second part deals with a systematic investigation into the behaviour of the inactive gases when in a pure state. It was found that these gases behaved in an anomalous manner, and by no means satisfied the above equations in general, but gave values in better agreement with a third equation obtained by eliminating P from the two above. The results are described for helium, neon, argon, krypton, and xenon. Peculiar interest attaches to these gases in that all of them exhibit to a more or less striking degree the primary dark space recently discovered by one of the authors in hydrogen and helium. The behaviour of helium was exceedingly erratic, and seemed to indicate that this gas could support the discharge in two entirely different ways.—Dr. A. O. **Rankine**: The viscosities of gaseous chlorine and bromine. By means of a method resembling in some respects that described by the author in earlier communications, the viscosities of chlorine and bromine have been compared with that of air. From these ratios the absolute values are deduced. The viscosities of chlorine having been obtained at two temperatures, it has been possible to calculate Sutherland's constant. The various values are as follows:—

Gas.	Temperature.	Viscosity in C.G.S.
Chlorine	12·7° C.	$1{\cdot}297\times10^{-4}$
Chlorine	99·1° C.	$1{\cdot}688\times10^{-4}$
Bromine	98·7° C.	$1{\cdot}869\times10^{-4}$

The value of Sutherland's constant for chlorine is

$$C=325.$$

The ratio of the critical temperature of chlorine (416° abs.) to this constant is 1·28, which is somewhat higher than the constant value (1·14) of the corresponding ratio for

most gases; but this might be accounted for by the uncertainty of the exact value of C, arising from the smallness of the temperature range. If the values of the viscosity of chlorine and bromine at *corresponding* temperatures are calculated, it is found that the squares of the viscosities are proportional to the respective atomic weights. (Corresponding temperatures signify those which bear equal ratios to the respective critical temperatures.) In this respect chlorine and bromine appear to conform with the same rule as has been shown to hold for the inert gases.—Dr. P. E. **Shaw**: The testing of plane surfaces. Scraped and lapped plane surfaces are found not only in surface plates supplied by the engineering trade, but also in several apparatus of precision, *e.g.* interferometers and measuring machines. It is quite possible that the errors of these surfaces may be the determining factor in the accuracy of the measurement made in using these apparatus. Yet up to the present there seems to have been no simple device for measuring these errors. To supply this want, two forms of surface-tester have been made by the writer:—(*a*) A stout wooden bar, 16 inches long, has twin feet half-inch apart at one end, whilst there is a third foot at the far end. Midway between the twin feet at one end and the third foot at the other is a micrometer screw. The instrument acts on the spherometer principle, but contact is made electrically with a telephone in circuit. (*b*) A steel bar, 12 inches long, has one foot quarter-inch diameter at one end and a similar foot at the other end, whilst midway between the feet is the end of a micrometer screw. Contact is generally made mechanically. This instrument must be made very carefully, the flat surfaces of the two feet and of the micrometer end being in one position truly in one plane. (*b*) is made in duplicate, so that by using first one tester and then the other on one place of a surface, and then "fitting" them together, the actual departure of the surface from planeness can be found. These testers read to 1/10,000 inch, and have an error on one reading of about that amount. Investigations have been made on a considerable number of "surface plates" and "straight edges" as supplied by the engineering trade. A bad plate shows errors of about 1/2000 inch from true plane, an average one only 1/5000 inch, and some special ones of small size, recently made, had a figure of only 1/10,000 as indicated by tester (*b*). Tests were also made by these instruments on many samples of plate-glass, for which the errors varied from 1/3000 inch to 1/300 inch on a length of 12 inches. Thus we have a means of revealing a surface out of truth, whether due to faulty making or to warping with lapse of time.—Captain A. D. **Fraser** and Dr. H. L. **Duke**: Antelope infected with *Trypanosoma gambiense*. (1) Antelope may remain in apparently perfect health for a year after having been infected with a human strain of *T. gambiense*. (2) One antelope was still capable of infecting clean laboratory-bred *Glossina palpalis* 315 days after it had been infected. (3) A small quantity of blood taken from one antelope 327 days after its infection was proved by inoculation into a white rat to be infective. (4) As the interval after the infection of the antelope increases, their infectivity, as tested by "cycle" transmission experiments, dissection of flies which have fed upon them, and by the injection of the buck's blood into susceptible animals, appears to diminish. (5) A duiker was infected with a human strain of *Trypanosoma gambiense* by feeding infected *Glossina palpalis* upon it.

Geological Society, January 10.—Prof. W. W. Watts, F.R.S., president, in the chair.—S. H. **Warren**: A late glacial stage in the valley of the river Lea, subsequent to the epoch of River-drift man. With reports on the flowering plants, by F. J. **Lewis**; on the mosses, by H. N. **Dixon**; on the Mollusca, by A. S. **Kennard** and B. B. **Woodward**; on the Coleoptera, by C. O. **Waterhouse**; on the Entomostraca, by D. J. **Scourfield**; and on the microscopic examination of the sandy residue, by G. M. **Davies**. A carbonaceous deposit embedded in the low-level river-drift gravel of the Lea Valley, in the neighbourhood of Ponder's End, is described. It belongs to the close of the Pleistocene period, and is much later than the Moustierian deposits. It may be of Magdalenian age. It is more probably post-Magdalenian, formed during the time of the supposed archæological hiatus between the Palæolithic and the Neolithic epochs. The deposit yields a varied fauna and flora. The conclusions arrived at indicate climatic conditions similar to those now found in Lapland. The evidence of this comparatively late Arctic climate in the south of England is important. It throws light on many questions with regard to the relationship of Palæolithic man to the Glacial period. It may have been the Arctic conditions represented by the Ponder's End stage (as it might appropriately be named) which caused the migration of Palæolithic man to less inclement regions. The evidence is interesting as showing another important fluctuation of climate during the Pleistocene period.

Royal Meteorological Society, January 17.—Dr. H. N. Dickson, president, in the chair.—Dr. H. N. **Dickson**: Some meteorological observations. Meteorology has at the present time reached an important and critical phase in its history. This is due, in the main, to the operation of three principal factors:—(1) by the effluxion of time a mass of observational material has been accumulated which urgently requires examination and discussion with the object of ascertaining the precise meaning and value of the records and of improving routine methods for the future; (2) the rapid increase of knowledge of the conditions obtaining in the upper atmosphere has modified and is modifying current views as to atmospheric phenomena generally, and new interpretations must be placed upon the distributions observed at the surface of the earth; (3) the importance of applied meteorology in relation to agriculture and other activities of everyday life is becoming more generally recognised. It follows that there is in many directions urgent need for the extended prosecution of research work. Increase of popular interest and public support is necessary, and the active assistance of research workers must be enlisted. It is to be noted that the investigations required are of many different qualifications; they include the criticism and improvement of methods of routine observation, participation in organised exploration of the upper air, investigation of statistical and analytical methods of dealing with data already collected, investigation of mathematical or physical problems stated as the result of observation, and the examination or restatement of geographical or other questions affecting the relation of meteorology to the problems of botany and other applied sciences.

Institution of Mining and Metallurgy, January 18.—Mr. H. Livingstone Sulman, president, in the chair.—Frank **Reed**: A submerged flexible-joint main. A brief description of the construction and laying of a 30-inch water-main across the valley of the mountain river Taramakau, New Zealand. For reasons of economy, the author decided to adopt the use of a submerged flexible-joint main in preference to a pipe bridge, despite the somewhat hazardous nature of the operation, due to the rapid flow and treacherous nature of the river to be crossed. The pipes used were 30 inches in diameter, with a length of 12 feet, with flanges at each end reinforced by brackets, and between each set of three of these sections a flexible joint was bolted, consisting of a ball and socket connection, sealed with a lead filling, which was found to be quite watertight. The pipe was laid in the river bed from a special pontoon moored between a line of piles. The main was laid on the river bed and then moored, and it was found that the bed silted over it and prevented it from shifting with variations in the current.—Cyril **Brackenbury**: Unwatering Tresavean Mine. A description of the method adopted during the past five years to unwater the Tresavean Mine in Cornwall, which was not only flooded, but in many parts of the shaft either partially or completely choked by débris. The depth of the main shaft was 1422 feet. Electrical high-lift turbine pumps were used for the unwatering process, but the operation involved a number of problems due to the existence of a former timbering and the extensive choking encountered, together with varying quantities of incoming water, according to the rainfall at different seasons of the year. Consequently, the average rate of sinking was subject to many fluctuations, and was sometimes for a brief period a minus quantity. Much valuable experience was gained during the process of unwatering the mine, which is given in detail by the author.—Humphrey M.

Morgans: Notes on the operation of two winding engines. The operations of the winding engines while engaged on various classes of work were recorded by means of a tachograph, the readings of which in diagram form were reproduced by the author, and afforded an interesting evidence of the characteristics of the different operations and their influence on the winding power.—E. P. Corbett **Sullivan**: Stoping at the Calamon Mine. A note on the method of stoping and filling adopted recently at the Calamon Mine. A conspicuous feature of the work is the preparation of inclined cuts, which are worked from the level upwards, and filled in practically in an automatic manner as the work proceeds.

PARIS.

Academy of Sciences, January 22.—M. Lippmann in the chair.—B. **Baillaud**: The accuracy of the knowledge of the time at the Observatory of Paris during the last months of 1911 and the commencement of January, 1912. A description of a new astronomical clock, Riefler D No. 228, recently presented to the observatory. The correction formula deduced from two months' observations is $C = -1{\cdot}54s. - 0{\cdot}20s.\, t - 0{\cdot}0015s.\, t^2$, and a comparison of the deviations of the observed values and those calculated from this formula gives a mean deviation of 0·03s.—L. E. **Bertin**: Presentation of some documents relating to the protection of warships and to dynamic stability.—Charles **Moureu** and Amand **Valeur**: The degradation of sparteine. The formation of a new hydrocarbon, sparteilene. In a previous paper it has been shown that by the successive application of Hofmann's method to the alkaloid sparteine an unsaturated base, methylhemisparteine, was the final product. Further application of the same method gives a dimethylhemisparteilene and a hydrocarbon, sparteilene, $C_{15}H_{20}$, the physical and chemical properties of which are given. Lack of material has prevented the determination of the constitution of this hydrocarbon.—A. **Müntz** and H. **Gaudechon**: The awakening of the soil. Experiments are given tending to show that the nitrifying organisms in soil commence to become active at a definite date, and this activity is not due to changes of temperature. The samples of soil, taken at different dates, were preserved at a constant temperature of 2° C., and all the other conditions of the experiments, including that of temperature, were kept rigorously constant. The maximum action was found to be between March 28 and April 25.—Léon **Labbé**: A potato disease, *la teigne*. An account of the measures taken to combat this disease.—A. **Lacroix**: The volcano of Reunion. A detailed description of the present condition of the volcano.—Paul **Sabatier** and A. **Mailhe**: The catalytic formation of the esters of the formenic series, starting with the formic esters. A mixture of isobutyric acid and methyl formate was passed in the state of vapour over titanium oxide at a temperature of about 250° C. Carbon monoxide was evolved, and the condensed liquid contained, besides methyl alcohol and unchanged isobutyric acid, methyl isobutyrate and an appreciable quantity of isobutyric aldehyde. No isobutyrone was found. Similar results were obtained by substituting isoamyl formate for the methyl formate. The substitution of thoria for titanium oxide as the catalytic material somewhat modifies the reaction.—M. **Bourgeois**: The results of the observations made by wireless telegraphy of the difference of longitude between Paris and Bizerta obtained by MM. Noirel and Bellot. Details are given of the method of observation, the mean error of the mean of a series being 0·04 to 0·05 sec.—Serge **Bernstein**: The asymptotic value of the best approximation of $|x|$.—H. **Parenty**: The progressive regulation of pressures at the entrance of a main distributing water, gas, or vapour. A detailed description of the instrument, with diagrams.—F. **Ollive**: The elastic pressure of saturated vapours. A new exponential formula is developed, and the figures calculated according to this formula for water vapour are compared with the experimental results.—L. **Decombe**: The theory of dielectrics. An investigation into the causes of the residual effects in dielectrics.—A. **Rothé**: The reception of meteorological radio-telegrams with reduced antennæ.—G. **Austerweil**: The passage of hydrogen through the rubber tissue of aërostats. Rubber, which is commonly employed as a waterproofing agent in balloon fabrics, is not a very suitable material for this purpose, as it absorbs hydrogen and allows the passage of the gas. Figures are given of the actual losses of hydrogen over a period of twenty days.—E. **Baud**: A general law of solution.—Daniel **Berthelot** and Henry **Gaudechon**: The photolytic decomposition of smokeless powders by the ultra-violet rays. The effects of the light from a quartz mercury vapour lamp on pure nitroglycerol and nitrocellulose were first studied, and then smokeless powders containing amyl alcohol and diphenylamine were examined. Tables are given showing the amount and composition of the gases evolved.—Camille **Matignon**: The synthetic formation of nitrous oxide. The application of the Nernst formula to the known thermochemical data of nitrous oxide shows that the amount of this gas formed from a mixture of nitrogen and oxygen at atmospheric pressure at a temperature of 2700° C. would be of the order of 2 in 100,000; at high pressures the amount might be higher.—D. **Tschernobaeff** and L. **Wolgodine**: The heats of formation of some silicates.—Louis **Hackspill** and Robert **Bossuet**: Some new alkaline phosphides. By working in a high vacuum with highly purified materials it has been found that the four alkali metals may be combined with phosphorus without explosion. The phosphides of cæsium, rubidium, potassium, and sodium thus obtained had the composition expressed by the formula M_2P_3.—G. D. **Hinrichs**: The true atomic weight of silver deduced from the experimental results of more than a century. The graphical method used in previous communications by the author has been applied to the data of Berzelius, Mather, Marignac, Stas, Maumené, Dumas, Baxter, Penny, Smith, and Richards. Taking the atomic weight of carbon as 12, the author concludes that the true atomic weight of silver is 108 exactly.—MM. **Portevin** and **Nusbaumer**: The influence of tempering upon bearing bronzes.—V. **Hasenfratz**: The bromine compounds of the alkaloids of *Peganum harmala*, and their basic derivatives.—P. **Carré**: The constitution of the glycerophosphoric acid obtained by the esterification of glycerol by means of phosphoric acid or the monosodium phosphate.—Marcel **Guerbet**: The action of caustic potash upon the secondary alcohols. The diagnosis of primary and secondary alcohols of high molecular weight. If an alcohol of high molecular weight is heated in a sealed tube to 230° C. with its own weight of potash, a primary alcohol gives a product entirely soluble in water; secondary alcohols undergo condensation, and the product on treating with water separates into two layers.—Étienne **Foëx**: The presence of two sorts of conidiophores in *Oidiopsos taurica*.—W. **Lubimenko** and A. **Froloff-Bagreief**: The influence of light on the fermentation of grape must.—Raoul **Dupuy**: Backwardness in infants and endocrinian polyopotherapy.—M. **Stapfer**: The utero-ovarian rhythm in woman.—R. **Pigache** and I. **Worms**: The thymus considered as an internal secretion gland.—H. **Colin** and A. **Sénéchal**: Is iron the catalysing agent in the oxidation of phenols by Raifort's peroxydiastase?—O. **Boudouard**: The smells of Paris. Unpleasant smells were particularly marked during the summer of 1911. A study of the conditions under which unpleasant smell may arise from manure works in Paris.—Georges **Bohn**: The sensibility of animals to variations in pressure.—Louis **Calvet**: *Watersia paessleri*, a parasite of *Polyzoa gordiana*.—A. **Legendre**: The *massif* of Ya-Long, western China, between 28° and 30°.

BOOKS RECEIVED.

A Monograph of the Mycetozoa. A Descriptive Catalogue of the Species in the Herbarium of the British Museum. By A. Lister, F.R.S. Second edition, revised by G. Lister. Pp. v+302+201 plates. (London: British Museum (Natural History); Longmans and Co., and others.) 30*s*.

The Evolution of Animal Intelligence. By Prof. S. J. Holmes. Pp. v+296. (New York: H. Holt and Co.)

Heaton's Annual, 1912. Pp. 562. (Toronto: Heaton's Agency; London: Simpkin and Co., Ltd.) 5*s*.

Wonders of Plant Life. By S. L. Bastin. Pp. x+136. (London: Cassell and Co., Ltd.) 3*s*. 6*d*. net.

Heredity in Relation to Eugenics. By C. B. Davenport.