Electrical phenomena in connection with ballooning have been the subject of various communications to the committee.

Vertical Motion in the Air.—With reference to the first of the three memoranda above mentioned, the method which has up to the present been employed for the study of vertical motion in the air consists in observing, by means of self-recording theodolites, the variations in azimuth and altitude of a pilot balloon. With two such theodolites the path of the balloon can be determined both as regards its horizontal and its vertical motion, and the changes in vertical velocity due to air currents can be identified.

For the purpose of this work special self-recording gear was designed for attachment to an existing theodolite; two theodolites fitted with this self-recording gear, and specially constructed for the work, are now being provided. The apparatus is one which may be useful for many purposes besides that which has immediately led to its construction. The azimuth and altitude at any instant can be read off from the record with an accuracy of about one-tenth of a degree; this is sufficient for the purpose. The process of observing is thus simplified; with the self-recording instrument a balloon can be followed continuously without moving the eye from the instrument, and, further, the record can be taken by one observer only, whereas two are necessary in working with the eye-observing instrument.

A considerable number of records with this apparatus have already been obtained, and the results are in every way satisfactory. The records furnish definite evidence of the existence of vertical currents, but it is not yet possible to give any general discussion as to the conditions affecting vertical motion in the air as deduced from these observations.

Rotary Motion in the Air.—For the study of rotary motion in the atmosphere a special anemometer head has been designed to indicate both velocity and direction, with an apparatus to record automatically vector diagrams of the wind, from which the velocity and direction at any instant can be read. Full details of the construction are given in Mr. Dines's description.

In the earlier observations the head was mounted at a height of 36 feet above the ground; more recently a steel windmill tower has been erected for the purpose of these observations, and the head is now mounted on this at a height of 98 feet above the ground. There is no noticeable difference in the character of the diagrams taken at the two levels. The observations do not support the idea that eddy motion is the cause of the gustiness of the wind.

Some interesting particulars are given in Mr. Dines's report of comparisons between simultaneous records of velocity obtained from this anemometer and from a standard anemometer mounted on a house at a distance of 150 yards. As was anticipated from the work of previous experimenters, the individual gusts were not, as a rule, in agreement on the two records, but it is surprising to find that in certain cases squalls of five minutes' duration recorded by the anemometer on the house did not appear at all on the 98-foot record. A possible explanation of these differences is that an increase of wind velocity of as long as five minutes' duration may be confined to quite a narrow belt.

Gustiness of the Wind.—To aid in the study of gustiness, apparatus has been designed to register simultaneously the pull of a kite wire and the length of wire paid out. The tension record shows the fluctuations due to gusts, while, from the length of wire, with a knowledge of the vertical angle, the height of the kite can be approximately determined. A number of records have been obtained with this apparatus, and the discussion of these records by Mr. Dines will, it is thought, be found of great interest.

The mean gustiness found at altitudes from 500 to 1000 feet was 60 per cent. of the gustiness from 0 to 500 feet. Above 1000 feet no certain rule can be deduced from the observations. Easterly winds gave uniformly high gustiness factors; the anemometer at Pyrton Hill, where these records were obtained, is situated at the foot of the western slope of the Chiltern Hills, so that the gustiness of this easterly group of winds may be due to the previous passage of the air over the range. The decrease of gustiness with height does not appear to be dependent upon direction to any noticeable extent.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—At the Degree Congregation held on July 8 the honorary degree of Doctor of Laws was conferred on the Rt. Hon. Sir Joseph Ward, Bart., K.C.B., Premier of New Zealand. The following were admitted to the degree of D.Sc.:—William Ernest Fisher, David Frazer Harris, and Frederick Steward.

The Worcestershire County Education Committee has made a grant of 300*l.* to the University.

Mr. R. R. Cormack, lecturer in economic mineralogy, has resigned.

Mr. F. Lawrence Talbot has been appointed external examiner in the biology and chemistry of fermentation.

The following gentlemen have been appointed honorary assistant curators of the pathological museum for three years:—Dr. Stanley Barnes (medicine), Mr. A. W. Nuthall (surgery), Mr. J. T. Hewetson (diseases of women), and Mr. L. S. Sedgwick (comparative pathology).

Mr. J. Furneaux Jordan has been appointed Ingleby lecturer for 1912.

Prof. R. Beazley is to represent the University at the laying of the foundation-stone of the National Library of Wales, at Aberystwyth, by the King on July 15.

The tenure of the Walter Myers travelling studentship by Dr. John Dale has been extended for a further period of six months.

PRINCETON UNIVERSITY, it is announced in *Science*, has received gifts amounting to more than 20,000*l.*, of which 8000*l.* is for a lectureship in public affairs.

MISS STANCOMBE WILLS, an adopted daughter of the late Lord Winterstoke, has presented 10,000*l.* to Bristol Grammar School in memory of Lord Winterstoke.

DR. R. A. HARPER, since 1898 professor of botany in the University of Wisconsin, has accepted the offer of the Torrey chair of the same subject at Columbia University. Prof. Harper has had a somewhat unusual record, having begun his academic career as professor of the Greek and Latin languages at Gates College. From 1891 to 1898 he was professor of botany and geology at Lake Forest University.

THE Toronto correspondent of *The Times* states that Sir William Macdonald has completed a large purchase of land on the slope of the mountain adjoining Mountroyal Park, and will give the property to McGill University for a new campus and residential buildings. The purchase price was more than 200,000*l.* Including the cost of Macdonald College and its endowment, this brings Sir William Macdonald's total gifts to McGill University to about 2,000,000*l.*

IT was announced at the prize distribution at University College, London, last week, that Mr. R. C. Forster has made a further gift of 30,000*l.* to the fund for providing new chemical laboratories at University College. As Prince Arthur of Connaught, president of the appeal committee, wrote in acknowledging Mr. Forster's generous gift, this method "of commemorating Coronation year by promoting scientific study and research is a most happy one," and it may well be hoped that other wealthy men may adopt it so that the remainder of the sum required for the new laboratories may be subscribed at an early date. Early in the year, as was announced in NATURE (vol. lxxxv., p. 448), Mr. Forster gave 4500*l.* to complete the purchase of the site for the new laboratories. We trust that his generosity may inspire others to contribute, as further sums are still needed to complete the fund to supply a pressing need at University College.

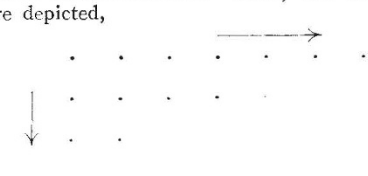
A RURAL SCHOOLS' EXHIBITION was one of the features of the Royal Agricultural Society's Show held recently at Norwich, and in connection with it the County Councils Association arranged on July 1 a conference on rural education. After a paper by Mr. Cloudesley Brereton on education in relation to agriculture, Sir George White, M.P., gave an address, in which he referred to the further education of school children. A leaving age of even fifteen years, he said, may be of little real value unless the great object of the teacher is to make the child think. "People," he remarked, "see a number of boys working in a manual class, say a carpenter's shop, and the first question they ask is, Are you going to make them all carpenters? They do not see that it is not the wood or the tools that are of consequence, but the play of intelligent thought that brings them together to produce a certain object which has been already formed in the brain. Those who assist in production should know something of the processes—such as a knowledge of mechanics—the principles upon which an industry depends, and the nature and property of the material they are using; then the work becomes more interesting, and the proficiency of the worker a matter of concern to himself as well as to his employer, and it is this conviction which has produced our technical schools. The time has surely come when manual training should be available and free to every scholar in our schools, and domestic economy in all its branches to every girl."

THE will of the late Dr. Harry Bolus, of Kenilworth, near Cape Town, contains a munificent provision for scientific and educational objects. Dr. Bolus's herbarium and library, the collection of which had been one of the principal works of his life, are left to the South African College, Cape Town, an institution in which he had previously shown his interest by a large contribution to the foundation of the chair of botany, which is called by his name. He leaves a sum of 20,000*l*., invested in Government Stock at 4 per cent., on trust for the upkeep and extension of the herbarium and library. This amount will later be increased by an additional sum of 7000*l*. A further amount of 21,000*l*. is also left to the same college for the foundation of scholarships. It is directed that in the selection of scholars to benefit under this fund regard shall be paid to necessitous circumstances and proof of industry, and not exclusively to ability. Eventually Dr. Bolus's landed property, on which is situated the house in which he lived and in which he did the greater part of his botanical work, becomes the property of the college, the proceeds to be applied to the purposes previously indicated. This is the largest bequest ever made to an educational institution in South Africa.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 29.—Sir Archibald Geikie, K.C.B., president, in the chair.—Francis **Darwin** and Miss D. F. M. **Pertz**: A new method of estimating the aperture of stomata. The apparatus here described under the name of *porometer* is similar in principle to that devised in 1873 by N. J. C. Müller, but differs from it completely in construction. By a simple arrangement a current of air is drawn through the stomata of a living leaf, its velocity being measured by the fall of a water-column. At a constant pressure the rate of air-flow is necessarily dependent on the size of the stomatal pores, and it is accordingly found that agencies such as darkness or loss of water supply, which are known to diminish stomatal aperture, cause a striking drop in the rate of air-flow as recorded by the porometer. In studying the effect of severing the leaf stalk, and thus cutting off the water supply, it has been proved that the first effect of withering is a wide opening of the stomatal pore, confirming F. Darwin in Phil. Trans., B, vol. cxc., 1898, p. 548. The porometer has been found of value in attacking the question of the causal relation between stomatal aperture and transpiration. This subject, on which a large number of observations have been made, will be fully treated elsewhere. In the present paper a single experiment is given illustrating the parallelism between the transpiration rate and the condition of the stomata as revealed by the porometer.—S. **Chapman**: The kinetic theory of a gas constituted of spherically symmetrical molecules. This paper may be regarded as a sequel to Maxwell's kinetic theory of a gas the molecules of which repel one another according to the famous fifth-power law (Phil. Trans., 1867). Maxwell's deductions from his hypothesis were found not to agree with fact, but the theory was valuable, because it was the only mathematically rigorous kinetic theory in existence. When he wrote a later paper on the same subject (Phil. Trans., 1879) he was aware of the defects of his assumption, but was prevented by certain analytical difficulties from generalising his theory by adopting a wider hypothesis. In this paper these difficulties have been very largely overcome. With the same rigour as in Maxwell's theory, formulæ are deduced for the coefficients of viscosity, diffusion, and thermal conductivity in a simple or compound gas. The molecules are assumed to be spherically symmetrical, but no particular kind of interaction is postulated. The latter, however, is involved in the formulæ by the occurrence, as factors, of two definite integrals. Certain relations may be deduced without the evaluation of these factors. The most interesting of these is $\delta = \frac{5}{2}\mu C_v$, where δ is the thermal conductivity, μ the viscosity, and C_v the specific heat at constant volume. This formula, which was also obtained by Maxwell, has always been regarded as a special consequence of his hypothesis, whereas it only depends on the spherical symmetry of the molecules, and is true for rigid-elastic spheres, among other cases. In general, the formulæ can be completed only by the evaluation of the before-mentioned factors. In the paper this is done for the case of rigid-elastic spherical molecules, for centres of force repelling according to the inverse *n*th power law of distance, and for the case of rigid-elastic spheres surrounded by fields of attractive force. The last case furnishes a rigorous proof of Sutherland's formula for viscosity, and some important corrections to his theory are made. Finally, the formulæ obtained are compared with experimental results to test the accuracy of the various laws considered, and to obtain improved data concerning the molecules and other physical constants of gases.—Major P. A. **MacMahon**: Memoir on the theory of the partitions of numbers. Part vi.—Partitions in space of two dimensions, to which is added an adumbration of the theory of partitions in space of three dimensions. In this part the author considers the partitions of a number, the parts being placed at the nodes of an incomplete lattice in two dimensions. Thus, the lattice being of the nature depicted,



the parts are in descending order of magnitude in each row and in each column. The enumerating generating function is required. It is found that for a lattice of given specification and a given restriction upon the part magnitude the generating function satisfies a functional equation. From this the functional equation satisfied by the corresponding inner-lattice function, as is defined in part v., is deduced. This investigation then turns upon the determination of the fundamental solutions of this equation and the expression of the generating function by means of them. The complete solution of the problems in hand is thence obtained, and the inner-lattice function is shown to be expressible in an elegant determinant form. At the end of the paper the subject of three-dimensional partitions is broached. It is shown that the method of lattice functions is again available, and the particular case of partition at the summits of a cube is worked out in detail from this point of view. The further investigation of this interesting question is reserved for a future communication.—W. T. **David**: Radiation in explosions of coal gas and air.—Dr. T. E. **Stanton**: The mechanical viscosity of fluids. The paper deals with the experimental determination of the ratio of the shearing stress to the rate of change of distortion in fluids which are in sinuous or eddying motion. Thus in a fluid in eddying motion flowing through a parallel pipe of circular cross-section, if F is the mean shearing stress on any cylindrical surface of radius r concentric with the pipe, and v the average velocity in the axial direction of the fluid in this surface, then writing $F = \mu' \frac{dv}{dr}$ the object of the experiments was the determination of μ' as a function of the dimensions