

allotted for the development of accommodation in Dacca and the buildings required for the new university in that place. Lord Hardinge hopes that the liberality of the Government will be supplemented by private liberality, and that before many years have passed efficient teaching universities will take the place of the examining and federal universities which India has to-day.

THE attendance at German universities forms the subject of an article by Mr. R. Tombo, jun., in the issue of *Science* for April 26. Mr. Tombo analyses the statistics given in the *Deutscher Universitäts-Kalendar* for the summer semester of the present year. There are 57,398 students in German universities, as contrasted with 57,200 for the preceding summer semester. This is, however, exclusive of 5563 auditors, who, if added, would run the grand total to 62,961, as against 61,274 during the summer semester. The University of Berlin continues to lead the list with an enrolment of 9829 matriculated students. The University of Berlin is followed by the University of Munich, with an enrolment of 6797 matriculated students and 782 auditors. The University of Leipzig ranks third with 5170 matriculated students and 925 auditors. Of the remaining universities, Bonn, Breslau, and Halle each have more than 3000 students; Göttingen, Freiburg, Heidelberg, Münster, Strassburg, and Marburg each have more than 2000, and all the other universities, except Rostock with 955, have each more than 1000 students. Of the total number of students in German universities, 52,435 are from Germany, and of the remainder 160 only are from the British Isles.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 9.—Sir Archibald Geikie, K.C.B., president, in the chair.—A. Vernon Harcourt: The variation with temperature of the rate of a chemical change. In an inquiry into the connection between the conditions of a chemical change and its amount, one of the conditions varied was that of the temperature of the solution in which the change took place (*Phil. Trans.*, vol. clxxxvi., 1895, A, pp. 817-95). A relation was found to exist between this condition and the rate of change, expressed by the equation

$$a_1/a_0 = (T/T_0)^m,$$

where a is the rate of change, or the number of minutes in which a definite portion of chemical change is accomplished, T_0 the absolute temperature 273° , and T any other absolute temperature. Not only do the numbers found from this equation agree very closely with the observed numbers, but the equation expresses a natural law which is nearly related to that upon which all calculations of gaseous volumes have long been based. Several later measurements of the rate of change at different temperatures have been published and compared with numbers calculated from other formulæ. In an appendix to the present paper it is shown, by one of the authors of the previous paper, that the numbers thus calculated are in less close agreement with the actual measurements than numbers calculated from his formula given above, while also the formulæ have no physical interpretation.—Dr. C. Chree: Some phenomena of sun-spots and of terrestrial magnetism at Kew Observatory. An investigation made some years ago by the author indicated the probability that a relation existed between the amplitude of the daily range of the magnetic elements and the sun-spot area, not on the same day, but several days previously. The object of the present research was to inquire into the reality of

this connection. It was found that there is a well-marked period of about 27.3 days in magnetic phenomena, in this sense, that if a certain day exhibits magnetic disturbance attaining the international standard "2," as interpreted at Kew, a day which follows either 27 or 28 days after has nearly double the chance of attaining standard "2" that the ordinary day has. This 27-28-day period was not so clearly shown in the years of maximum sun-spot frequency of the epoch considered as in the years of minimum frequency, and was most clearly shown in certain intermediate years characterised by the number rather than by the magnitude of magnetic disturbances. The conclusion that a period of about 27.3 days exists in "magnetic storms" had been reached some years ago by Mr. Arthur Harvey and Mr. E. W. Maunder, independently, considering respectively data from Toronto and Greenwich, but their conclusions have not been universally accepted. The present investigation shows that the phenomenon is not confined to the large disturbances usually termed "magnetic storms," but is exhibited in the daily range of the average day.—Sir Walter Noel Hartley and H. W. Moss: The ultimate lines and the quantities of the elements producing those lines in spectra of the oxyhydrogen flame and spark. In a recent paper by one of the authors (*Proc. Roy. Soc.*, 1911, vol. lxxxv., p. 271, Hartley) on some mineral constituents of a dusty atmosphere as determined both by flame and spark spectra, a brief reference was made to the method employed for ascertaining the weights of matter necessary to give calcium and copper lines in the spark. This work has been extended to about twenty elements. The quantities of the elements which render the ultimate lines in the oxyhydrogen flame spectra had previously been carefully determined. With the alkali metals it is found to vary between 0.008 milligram in the case of potassium, 0.01 mgrm. rubidium and caesium, and 0.1 mgrm. lithium. In the alkaline earth group, 0.01 mgrm. strontium, 0.1 mgrm. calcium, and barium 1.0 mgrm. Silver 0.1 mgrm., copper 1.0 mgrm., and gold 50 mgrms. Gallium, iridium, and thallium 0.01 mgrm., manganese 0.001 mgrm., lead 0.1, and tin 100 mgrms. The gold spectrum shows the heads of very strong bands which correspond with lines in the spark spectrum. Tin shows no lines, but the edges of bands or flutings which are enfeebled until scarcely visible.—E. Marsden and C. G. Darwin: The transformations of the active deposit of thorium. The present paper is concerned with a series of experiments undertaken with the view of discovering the genetic arrangement of the various products in the active deposit of thorium, and more particularly the transformations occurring in the product or products included in thorium C. The results give strong reason for supposing that, of the atoms of thorium C, 35 per cent. emit α particles of range 4.8 cm., and become converted into atoms of thorium D, while the remaining 65 per cent. emit β particles and disintegrate into atoms of a very short-lived α -ray product, thorium C. The experiments also show that although the β rays of thorium C are extremely penetrating ($\mu = 13.5 \text{ cm.}^{-1} \text{ Al}$), yet they are practically unaccompanied by γ rays, while the relatively soft β rays of thorium D are accompanied by a very intense penetrating γ radiation containing more than six times the amount of energy of the β rays.—W. Wilson: The β particles reflected by sheets of matter of different thicknesses. (1) The radiation reflected when the β particles from uranium (*loc. cit.*) strike a screen can be split up into two parts, one with a very large coefficient of absorption, and the other with absorption coefficient of the same order as that of the

primary beam. (2) The absorption coefficient of the more penetrating part of the reflected beam decreases with increasing thickness of the reflector. (3) The final absorption coefficient of the rays reflected from thick sheets of aluminium, copper, and lead are 33.7, 26.6, and 20.2 cm.^{-1} respectively. (4) The coefficient of absorption of the easily absorbed part of the radiation reflected by aluminium is about 235 cm.^{-1} . The absorption coefficients of the corresponding rays reflected from copper, lead, and air have not been determined with any degree of accuracy, but are of the same order of magnitude as that of the rays reflected by aluminium. (5) An expression has been obtained for the variation of the amount of reflected radiation with the thickness of the reflector, and has been shown to be in good agreement with the results obtained experimentally by Schmidt.

Geological Society, May 1.—Dr. Aubrey Strahan, F.R.S., president, in the chair.—P. Lake and Prof. S. H. Reynolds: The geology of Mynydd Gader, Dolgelly; with an account of the petrology of the area between Dolgelly and Cader Idris. Mynydd Gader lies immediately south of the area described by the authors in a previous paper (Q.J.G.S., vol. lii., 1896, pp. 511–21). The Tremadoc beds are here succeeded by a group of rocks which are, for the most part, of volcanic origin. These may be divided into a rhyolitic series below and an ashy series above. The rhyolitic series is formed chiefly of lava-flows; the ashy series consists mainly of volcanic ashes and slates, the ashes predominating below and the slates above. *Didymograptus bifidus* occurs near the base of the ashy series, *D. purchisoni* in the upper part. The rhyolitic series appears to be older than the main mass of volcanic rocks in the Arenig area, but it may be contemporaneous with the Calymene ashes of that district. It is probably of approximately the same age as the volcanic series of Skomer Island, and the fact that in both places the rhyolitic rocks are soda-rhyolites is of considerable interest. H. Bolton: Insect-remains from the midland and south-eastern coalfields. The writer describes a series of three insect-wings obtained by Dr. L. Moysey from the Shipley clay-pit near Ilkeston (Derbyshire), and a blattoid wing, and three fragments from the borings of the Kent Coal Concessions Company, Ltd., in East Kent. The first series of insect-wings occur in greyish-brown ironstone nodules, which lie in bands in a yellow clay about 30 or 40 ft. below the top hard coal. The East Kent insect-remains occur in core shales, the horizon of which is not yet determined. The East Kent insect-remains contain one wing, referable to the genus *Soomylacris* (*Ettoblattina*), a species of which is already known from the Forest of Dean coalfield. The finding of two species of the same genus in coalfields so widely separated as those of the Forest of Dean and East Kent is not without interest, in view of the generally-accepted belief in the former continuity of the Coal Measures across the south of England.

Linnean Society, May 2.—Dr. D. H. Scott, F.R.S., president, in the chair.—Miss T. L. Pranker: The structure of the Palæozoic seed *Lagenostoma ovoides*, Will.—Dr. Karel Domin: Additions to the flora of western and north-western Australia. The account was drawn up from undescribed material in the herbarium of the Royal Botanic Gardens, Kew, consisting chiefly of collections by Dr. E. Clement and Captain A. A. Dorrien-Smith. Beside many new varieties, the author characterises fourteen new plants, one being *Casuarina dorrieni*, eight grasses, three being species of *Panicum*, and five other Monocotyledons.—G. H. Wailles: Fresh-water Rhizopoda from the

States of New York, New Jersey, and Georgia, with a supplementary account of some species from the Seychelles. The gatherings forming the basis of the present paper were collected in the autumn of 1911; the Rhizopod fauna is summed up as being rich in species and individuals, about 80 per cent. being similar to those found in Europe. The remainder of the paper was devoted to a systematic account of the species found, including three new species of *Nebela*, one of *Euglypha*, and many varieties.

Physical Society, April 26.—Mr. A. Campbell, vice-president, in the chair.—The adjourned discussion on Mr. H. Donaldson's paper on the coefficients of expansion of fused silica and mercury was resumed. Prof. H. L. Callendar opened the discussion by communicating a paper on the expansion of vitreous silica. The expansion of vitreous silica at ordinary temperatures had acquired special interest recently in connection with mercurial thermometry and standards of length and expansion. The majority of observers had used the Fizeau method with specimens 10 mm. to 15 mm. long. Somewhat different values had been found for different specimens with different standards of comparison. For a cylindrical specimen on a platinum-iridium tripod Chappuis found 50×10^{-6} for the expansion from 0°C. to 100°C. and 0.385×10^{-6} for the coefficient at 0°C. Scheel, for a similar specimen, tested against a quartz-crystal ring, found 45.5×10^{-6} from 0°C. to 100°C. and 0.217×10^{-6} at 0°C. For a ring specimen tested in a vacuum by the absolute method he found values almost identical with Chappuis; but Randall, employing a similar ring specimen, also made by Zeiss, found the mean coefficient from 16°C. to 80°C. (which is nearly the same as that from 0°C. to 100°C.) to be only 0.424×10^{-6} . Such differences might be due to accidental errors, or to differences in form and treatment of the specimens employed, or to differences in the standards of comparison. But since the whole expansion of 1 cm. of fused silica between 0°C. and 100°C. was only of the order of one wave-length of light, it was also possible that small constant errors might arise in so delicate an experiment from gas-films or other surface effects variable with temperature. It seemed, therefore, desirable to measure the expansion of the long silica rods at low temperatures by a direct interference method in which such sources of error were excluded. The method used gave a smaller and more rapidly diminishing value for the expansion of the silica rods than that obtained by other observers employing the orthodox Fizeau method with short specimens. With the assistance of Mr. A. Eagle, the author had made some observations on the difference between the radial and axial expansion of a silica tube similar to that from which the bulbs of the mercury weight thermometers employed by Harlow and Eumorfopoulos had been constructed. Three sets of determinations had been made by Mr. Eagle on three different days with closely concordant results. The mean of these showed that the axial coefficient of expansion of the specimen tested exceeded the radial coefficient by 0.20×10^{-6} over the range 18°C. to 90°C. This result agreed as closely as could be expected with the values of the cubical coefficient deduced from the weight thermometer observations of Harlow and Eumorfopoulos when the values of Callendar and Moss for the absolute expansion of mercury were assumed.—R. Appleyard: The solution of network problems by determinants. The paper is a practical application of the method described before the Physical Society in 1885 by Dr. J. A. Fleming. Let it be supposed that cyclic currents have been assigned to all the meshes of a given network, and that all capacities (K, in farads), inductances (L, in henries),

and leakances (S, in mhos) have been converted into resistances in ohms

$$\left(\frac{1}{k_i \rho}, L_i / S, \text{ where } \rho = 4\pi \sim \right)$$

The general network problem then is to find the current, in amperes, in any given branch, corresponding to the application of an E.M.F. of sine form, between any two fixed points in the network.

MANCHESTER.

Literary and Philosophical Society, April 23.—Prof. F. E. Weiss, president, in the chair.—R. L. Taylor: The action of bleaching agents on the colouring matter of linen. The author showed that the colouring matter of unbleached linen is quite abnormal with regard to the action of the ordinary bleaching agents upon it, and differs from every other colouring matter with which he is acquainted. Whereas colouring matters, such as indigo, Turkey-red, and the colouring matter of cotton, are bleached much more rapidly by free chlorine or hypochlorous acid than by a hypochlorite, with the colouring matter of linen the exact opposite is the case, this being bleached more rapidly by a solution of a hypochlorite. Apparently the maximum bleaching effect on unbleached linen is produced by a solution of a hypochlorite which contains no free alkali, but rather some free chlorine or hypochlorous acid. Excess of alkali retards the bleaching action, just as it does in the case of other colouring matters. The addition of a chloride to the solution sometimes accelerates and sometimes retards the bleaching action (this depending upon the amount of alkali in the solution), instead of, as is the case with other colouring matters, always accelerating it.

CAPE TOWN.

Royal Society of South Africa, March 20.—Mr. S. S. Hough, F.R.S., president, in the chair.—L. Perin-guey: Bushman sticks decorated on intaglio and poker-work, a note on the decorative skill of the Bush people and other aborigines. Specimens of sticks, decorated with drawings and carvings, also bust models, &c., were exhibited. On the sticks the intaglios were extremely fine, and represented hunting scenes, in which men in police uniform and on horseback were depicted with most consummate skill; other sticks were ornamented with poker-work and line drawings of very great artistic merit, but representing modern subjects, a railway train among them. Poker-work was, in his opinion, probably of Kafir origin, and it was quite possible that the Bush people had obtained it from the latter, but improved on it through their natural artistic disposition. He had at one time doubted the authorship of rock-graving in connection with the Bush people, but he exhibited a Bush painting in which the back of the animals had been graved. The Bushman thus combined the two arts, graving and painting.—J. R. Sutton: Some meteorological conditions controlling nocturnal radiation. According to the results obtained, it appears that after allowance has been made for the state of the sky and the movement of the air, the only factor of real importance determining the radiation temperature gradient is the relative humidity.—T. Muir: The resultant of a set of homogeneous lineo-linear equations. Three different methods are given for obtaining the resultant, but the main interest is concentrated on one of them, because of two or three somewhat obscure references made to it by Sylvester when studying the problem in 1863.—W. A. Douglas Rudge: The variation in the value of the atmospheric electrical potential with the altitude. This paper gives some account of observations taken at various places in South Africa in order to find the relation which

exists between the atmospheric potential gradient and the altitude of the places of observation. Observations were taken between Lourenco Marques and Durban, *via* Johannesburg, passing thus from sea-level to sea-level over a considerable stretch of country in which the altitudes rose to nearly 7000 ft. The general result is that there is a great change in the value of the potential gradient with the altitude, the extreme value at the highest point (6500 ft.) being not more than one-eighth of that at sea-level. Similar differences having been observed on previous occasions at other places, led to the investigations being conducted. The maximum values were about 500 volts per metre at Lourenco Marques and Durban, and 58 volts at Belfast, 6500 ft. above sea-level, and at places in between values were obtained which showed that the greater the altitude the smaller the potential gradient. An exception to this rule was seen at Johannesburg, where the potential gradient was very variable and changed signs at different points in the neighbourhood. These variations were traced to the clouds of steam, and especially of dust, proceeding from the mine heaps. Steam has the effect of increasing the positive gradient, while dust lowers it.—H. A. Wager: Respiration and cell energy.

BOOKS RECEIVED.

The Mechanics of the Aëroplane. By Captain Duchêne. Translated by J. H. Ledebor and T. O'B. Hubbard. Pp. x+231. (London: Longmans and Co.) 7s. 6d. net.

Richtlinien des Entwicklungs- und Vererbungsproblems. By Prof. A. Greil. Erster Teil. Pp. iii+352. (Jena: G. Fischer.) 10 marks.

Building Stones and Clays: their Origin, Characters, and Examination. By E. C. Eckel. Pp. xv+264. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd.) 12s. 6d. net.

German Varnish-making. By Prof. M. Bottler. Authorised translation, with Notes on American Varnish and Paint Manufacture, by A. H. Sabin. Pp. vii+363. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd.) 15s. net.

Canada. Department of Mines. Mines Branch: an Investigation of the Coals of Canada with reference to their Economic Qualities, as conducted at McGill University, Montreal, under the Authority of the Government of the Dominion. By Drs. J. B. Porter and R. J. Durley and others. Vol. i. Pp. xxiii+243+maps+plates. (Ottawa: Government Printing Bureau.) 1 dollar.

The Elements of Statistical Method. By W. I. King. Pp. xvi+250. (London: Macmillan and Co., Ltd.) 6s. 6d. net.

Zoology. By Prof. J. G. Kerr. Pp. vii+99. (London: J. M. Dent and Sons, Ltd.) 1s. net.

A Class Book of Physical Geography. By A. T. Simmons and E. Stenhouse. Pp. viii+436. (London: Macmillan and Co., Ltd.) 4s. 6d.

An Outline of the Russo-Japanese War, 1904-1905. By Colonel C. Ross. Vol. i. Pp. xxv+490+maps. (London: Macmillan and Co., Ltd.) 10s. 6d. net.

Studies in Seeds and Fruits: an Investigation with the Balance. By H. B. Guppy. Pp. xii+528. (London: Williams and Norgate.) 15s. net.

Scientific Papers. By John William Strutt, Baron Rayleigh. Vol v., 1902-1910. Pp. xiii+624. (Cambridge University Press.) 15s. net.

Petrographisches Praktikum. By Dr. R. Reinisch. Zweiter Teil, Gesteine. Zweite Auflage. Pp. vii+217. (Berlin: Gebrüder Borntraeger.) 7.60 marks.