

than other minerals, and there is no plausibility in such a theory from the geological standpoint. My own opinion is that, in all probability, an element hitherto unknown exists in the mineral, from which the helium is generated. It may be objected that, in that case, the mineral ought to be radio-active. If, however, the radiation were emitted with less than the critical velocity, we should not be able to detect it, and nothing is known to make such an hypothesis improbable.

In conclusion, I shall be well content if I have convinced you that there is still something to be learnt from careful examination of the most commonplace materials. If there is nothing new under the sun, there are, at least, unsuspected things going on inside the earth, where the sun cannot penetrate.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

GLASGOW.—Dr. C. H. Desch, of University College, London, has been appointed university lecturer in metallurgical chemistry in the place of Dr. C. E. Fawsitt, the new professor of chemistry in the University of Sydney, New South Wales.

OXFORD.—Dr. Arthur J. Evans, F.R.S., has handed over as a free gift to the Ashmolean Museum the collection of Anglo-Saxon jewellery and other relics bequeathed to him by his father, the late Sir John Evans. With it is also a comparative series illustrating the early Teutonic art of the Continent, including specimens of Scandinavian, Frankish, Lombard, and Gothic work.

WE learn from *Science* that Colonel Oliver H. Payne, of New York, has given 10,000*l.* to the endowment fund of the University of Virginia.

WE have received a copy of the December issue of *The Record*, the magazine of the South-Western Polytechnic Institute, Chelsea. In addition to items of news about the work and play of students of the institution, the magazine contains short articles from members of the teaching staff and from students.

THE draft charter of incorporation of the University of Bristol has been issued. The following are to be the first chief officers of the new university:—Chancellor, Mr. H. O. Wills; pro-Chancellors, the Bishop of Hereford, the Right Hon. Lewis Fry, and the Right Hon. Henry Hobhouse; Vice-Chancellor, Prof. C. Lloyd Morgan, F.R.S.; and treasurer, Mr. G. A. Wills. Women are to be eligible for any office in the University and for membership of any of its constituent bodies, and all degrees and courses of study in the University are to be open to them. It has been announced that the authorities of the Bristol University College have purchased the blind asylum and its land which adjoin University College. The site thus secured will be used for the erection of part of the new university.

AN appeal is being made on behalf of the Bethnal Green Free Library Institute, which was founded thirty years ago. The institute has no endowment and no State or rate aid, but is entirely maintained by voluntary gifts. There is a lending library, a reading room, and a large reference library. Classes for instruction in various subjects are held, and lectures by Sir Robert Ball, F.R.S., Dr. Andrew Wilson, Dr. W. H. Dallinger, F.R.S., and others, have been provided. The library is entirely free. There is a debt of 250*l.* on the general fund, which the committee is anxious to clear off before the end of the year. Contributions may be sent to the treasurer, Mr. F. A. Bevan, 54 Lombard Street, E.C.

ON Wednesday of last week, December 9, the first annual dinner of old students of the Royal College of Science was held at the Criterion Restaurant, and was attended by more than a hundred old students, in addition to past and present members of the staff and members of the governing body of the Imperial College of Science and Technology, of which the college now forms a part. The chair was taken by Mr. H. G. Wells, who was a student of the college during 1884-7. The toast of the Royal College of Science was proposed by the Right Hon.

A. H. D. Acland, who, after making some happy allusions to the descriptions of college life in one of Mr. Wells's books, went on to say that the governing body of the Imperial College intends to do something to foster corporate life among the students by the erection of a suitable building for a students' club. He also made an important statement as to the future of the college, indicating that the governors are fully alive to its great traditions, and that the associateship will still continue to be given as the diploma in science, just as that of the School of Mines is to be the diploma in mining. Mr. A. E. Briscoe, who responded to the toast on behalf of the old students, said that students of the college have gone all over the world, and have had much to do in bringing about that efficient teaching of scientific method which has been so marked a feature of recent educational progress. Many of the old students have made great names for themselves, and he attributed their success to the thoroughness of their training, and especially to the laboratory training they received. He hoped that under the new régime research will be the main work of the college. Subsequent speakers included Dr. H. A. Miers, principal of the University of London, who referred to the imperial character of the work of the college as a valuable feature of modern university life, and Prof. W. P. Wynne, who spoke of the debt owed by many old students to that much-abused body, the Department of Science and Art. At the conclusion of the dinner the old students present proceeded to elect a provisional committee to draw up rules for an old students' association to be submitted to a special meeting at an early date. Mr. T. L. Humberstone, 3 Selwood Place, South Kensington, will act as secretary; all old students who are desirous of becoming members are requested to communicate with him.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 19.—"On the Refraction and Dispersion of Krypton and Xenon, and their Relation to those of Helium and Argon." By C. Cuthbertson and M. Cuthbertson. Communicated by Prof. F. T. Trouton, F.R.S.

The authors have determined the refraction and dispersion of krypton and xenon with larger quantities of gas than were available at the time of their first isolation. The gases were prepared in the laboratory of Sir W. Ramsay by Prof. R. B. Moore. The atomic refractive index of krypton is found to be

$$\mu = 1 + 0.0008378 \left(1 + \frac{6.97}{\lambda^2 10^{11}} \right),$$

and that of xenon

$$\mu = 1 + 0.0013646 \left(1 + \frac{10.14}{\lambda^2 10^{11}} \right).$$

On comparing these figures with the refractive indices of helium and argon, as determined by W. Burton, it is shown that the refractivities for infinite wave-lengths are even more nearly in the ratios of whole numbers than the earlier values. Taking the value found for argon as the standard, the divergence from integral ratios is, for krypton, 0.0 per cent.; for helium, 0.34 per cent.; and for xenon, 2.25 per cent.

If the refractive indices are expressed by means of Cauchy's formula, $\mu - 1 = a(1 + b/\lambda^2)$, it is found that, plotting a against b for the four gases examined, the relation is linear.

Owing to the untrustworthiness of the existing determinations of the dispersion of oxygen, nitrogen, and hydrogen, comparison cannot be made with other groups of elements.

Physical Society, November 27.—Dr. C. Chree, F.R.S., president, in the chair.—A graphic method of dealing with refracting surfaces: H. S. Allen. A graphic method is given for finding the cardinal points for combinations of coaxial refracting surfaces. The method may be applied to such cases as that of two thin lenses a finite distance apart, two refracting surfaces forming a thick lens, or to the general case of the combination of two lens systems. —An accurate method of measuring moments of inertia:

the late Prof. W. **Cassie**. In this method use is made of the periods of small oscillations of a balance-beam. The method consists in taking as standard moment of inertia a known mass hung from the knife-edge of a balance and comparing others with it. The time of swing is taken with the standard mass in one pan and a counterpoise in the other. The body the moment of inertia of which is required is attached to the beam in such a manner that the coefficient of the directive couple is unaltered, and the time of swing is determined without weights in the pans. From these times, with a knowledge of the length of the beam and the masses used, the moment of inertia required is easily calculated.—The diffusion of actinium and thorium emanations: S. **Rues**. Experiments were described in which the emanation of actinium was allowed to diffuse into the following gases:—air, hydrogen, carbon dioxide, sulphur dioxide, and argon. The diffusion coefficients of the emanation in these gases agree in general with those calculated by means of Graham's law, making use of the diffusion coefficient in air. The variation with pressure of the diffusion coefficient of the actinium emanation in air was shown to be quite in accordance with the ordinary gas laws, down to a few centimetres pressure, the product of the pressure and diffusion coefficient remaining practically constant. Experiments under identical experimental conditions with thorium emanation over a similar range of pressure also yield nearly a constant value for the product of pressure and diffusion coefficient. The ratio of the two constants thus obtained leads directly to a ratio of the molecular weights of the two emanations, the result being that thorium emanation appears to have about 1.4 times the molecular weight of actinium emanation.—The elliptic polarisation produced by the direct transmission of a plane polarised stream through a plate of quartz, cut in the direction oblique to the optic axis, with a method of determining the error of a plate supposed to be perpendicular to the axis: J. **Walker**.—An experimental investigation of Gibbs's theory of surface-concentration regarded as the basis of adsorption: W. C. M. **Lewis**.

Geological Society, December 2.—Prof. W. J. Sollas, F.R.S., president, in the chair.—The geological interpretation of the earth-movements associated with the Californian earthquake of April 18, 1906: R. D. **Oldham**. At the time of the San Francisco earthquake movement took place along a fault, known as the San Andreas fault, which can be traced for a distance of about 200 miles. A re-measurement of the primary triangulation in the region shaken by the earthquake revealed considerable displacements, increasing in amount as the fault is neared, and of such nature that places to the east of the fault were shifted southwards, while those to the west of it were shifted northwards. The extent and peculiar distribution of these displacements negative the supposition that the fault was the cause—it must rather be regarded as a consequence of, or an incident in, the earthquake, this word being used to denote the disturbance in its entirety. The author considers that the displacements cannot be explained in a satisfactory manner on the supposition that they are the result of strains affecting the crust of the earth as a whole, but may be explained by the difference in character and behaviour of the materials composing the greater part of it, where pressures are great enough to produce the phenomena of solid flow, and of those in the outer skin, where the pressures are not great enough to produce any material difference in the behaviour of rocks from that which we associate with solidity, as experienced at the surface of the earth. The surface-displacements constituting the earthquake, as ordinarily understood, arise from disturbances in the outer skin; but in great earthquakes, like the one dealt with in the paper, these may be the result of more deep-seated disturbances affecting the whole crust of the earth.

Linnean Society, December 3.—Dr. D. H. Scott, F.R.S., president, in the chair.—Biscayan plankton: a memoir on the Ostracoda captured during the 1900 cruise of H.M.S. *Research*: Dr. G. Herbert **Fowler**. More than 7000 specimens had been identified, and in the case of more than 3000 the sex had been determined and the lengths of the shells measured. As the result of these

measurements, the writer was enabled to formulate provisionally a new law of growth in Crustacea:—"During early growth each stage increases at each moult by a percentage of its length, which is constant for the species and sex." For this the name of Brooks's law was suggested, Prof. W. K. Brooks having made the first observations which led to it; it had been checked to some extent by observations on lobsters (Herrick) and crabs (Waddington).—Mimicry in spiders: R. Innes **Pocock**.—Note on *Juniperus taxifolia*, Hook. and Arn.: Bunzo **Hayata**. This species had been described from specimens from the Bonin Islands, but had also been recorded from the province of Hupeh, China; further examination shows that the Chinese plant is specifically distinct from that occurring in the Bonin Islands.

Mathematical Society, December 10.—Sir W. D. Niven, president, in the chair.—The theory of waves propagated vertically in the atmosphere: Prof. H. **Lamb**. Two cases are considered. In one the undisturbed atmosphere is taken to be at a uniform temperature. In the second the temperature gradient is taken to be uniform, the temperature diminishing upwards. In both, the variations of pressure and density involved in the propagation of the waves are taken to follow the adiabatic law. Even when viscosity is taken into account, it appears that the amplitude of the waves, due to arbitrary initial disturbances, tends to increase indefinitely as the waves travel upwards. One unexpected result is that an unlimited atmosphere may possess a definite natural period of vibration in the sense that an impressed local periodic force, of this, but of no other, period, would generate an oscillation of continuously increasing amplitude.—The representation of a function by series of Bessel's functions: Dr. E. W. **Hobson**. The question considered is that of the convergence of a series of the kind that arises in the problem of the vibrations of a membrane or the two-dimensional vibrations of gas in a circular cylinder. It is shown that the series converges and its sum represents the function which it is meant to represent, in the same way as Fourier's series represents a function, provided that the function is integrable according to Lebesgue's extended definition, and that if the function is infinite at the origin, the infinity is not of too high an order. The order in question must be less than —Theory of Cauchy's principal values (fourth paper): G. H. **Hardy**. The paper deals with the possibility of interchanging the order of integrations in repeated infinite integrals which have finite principal values. A number of results bearing on the problem of the inversion of a definite integral are obtained.—Differentials: Dr. W. H. **Young**. It is shown that in the case of any number of variables the differentials take precisely the place in expansion theorems which are occupied by the successive differential coefficients in the case of functions of one variable.—The solution of the homogeneous linear difference equation of the second order: G. N. **Watson**. The problem is that of determining a function of the complex variable x which satisfies the equation

$$A(x)f(x+1) - B(x)f(x) + C(x)f(x-1) = 0,$$

wherein $A(x)$, $B(x)$, $C(x)$ are known uniform functions. It is shown that the required function can be determined provided the functions A , B , C satisfy restrictive conditions which are satisfied by wide classes of functions.—Four systems of three quaternary quadrics that can be expressed by means of five squares: Prof. A. C. **Dixon**.—(1) The reduction of a quaternary cubic from the sum of six cubes to the sum of five; (2) addition to a paper on the eliminant of three quantities in two independent variables: A. L. **Dixon**.—Note on a continued fraction equivalent to the remainder after n terms of Taylor's series: Prof. L. J. **Rogers**.—Solid angles and potentials of plane discs: **Balak Ram**.—A method of solving the problem of Mersenne's numbers: Dr. T. **Stuart**.

EDINBURGH.

Royal Society, November 16.—Dr. Burgess, vice-president, in the chair.—An investigation of the seiches of Loch Earn by the Scottish Lake Survey, parts iii.-v.: Prof. **Chrystal**. The part of this memoir communicated bore specially upon the endeavour, by critical examination of seiche records, chiefly on Loch Earn, to come to some definite conclusion as to the origin of the seiche.

Seven different causes might be assigned, namely, progression of the isobars, wind denivellation, rapid flooding, partial rainfall, squalls, impact of wind gusts, and periodic minor fluctuations of the atmospheric pressure. Lantern-slides were shown giving simultaneous microbarograms, anemograms, and limnograms taken on Loch Earn, and from these it appeared that the most frequent causes of seiches were squalls and periodic minor fluctuations of atmospheric pressure. The well-known embroderies which appear on limnograms during windy or unsettled weather were found to be due, in many cases, to solitary waves or groups of waves which are raised by small squalls. In some cases these wave-groups travel faster than the squall which produces them, so that the lake vibration at certain places precedes the wind disturbance which has caused it but is following after it. A particularly good instance was observed of an atmospheric-pressure fluctuation which was steadily periodic for several complete periods, and which was immediately responded to by a seiche of marked periodicity. An account of the mathematical theory was reserved for the next meeting.—Notes on hydrodynamics, chiefly on vortex motion: Prof. Andrew Gray. These depended upon a novel transformation of the usual hydrodynamical equations, leading to specially neat forms of solution of certain types of problem.

December 7.—Dr. Horne, F.R.S., vice-president, in the chair.—A monograph on the general morphology of the myxinoïd fishes, based on a study of Myxine, part iii.: Prof. F. J. Cole. The chief interest of this continuation of previous papers on the same subject lay in the illustrations, which had been carefully and elaborately drawn.—An investigation of the seiches of Loch Earn by the Scottish Lake Survey, parts iii.-v.: Prof. Chrystal. The memoir concluded with a mathematical appendix on the effect of pressure disturbances upon the seiches in a uniform parabolic lake. Rayleigh's method of normal coordinates was made use of with great advantage. The first problem solved was the effect of a uniform excess of pressure over a part of a lake, the excess being assumed to last for a definite time, usually the half-period of one of the seiches, the uninodal, binodal, or trinodal, as the case might be. The amplitudes of the seiches generated were calculated, and found to be of the same order of quantity as the pressure disturbance when estimated in terms of the water barometer. The disturbance caused by a suddenly generated distribution of pressure, expressible in a series of zonal harmonics, was then found, and this led, by use of the principle of superposition, to the calculation of the effect of a pressure disturbance varying both in space and time. The special case of a sudden rise of pressure, propagated with uniform velocity from one end of the lake to the other, was worked out in detail for a lake of parabolic bottom contour six miles long and 270 feet in depth. It was proved that the uninodal seiche was most affected when the disturbance was propagated with a speed of thirty-seven miles per hour.

MANCHESTER.

Literary and Philosophical Society, December 1.—Prof. H. B. Dixon, F.R.S., president, in the chair.—The dawn of human intention: an experimental and comparative study of eoliths: Prof. A. Schwartz and Sir Hugh R. Beevor. The term "eolith" was first used to designate certain flint chippings found by Mr. Benjamin Harrison in the chalk plateau in Kent, which bore traces that led him to suggest that they were really primitive tools of early man. This view, though receiving the support of De Barri Crawshaw and Prestwich, was not generally accepted, and evoked much controversy. The authors now sought to show that the existence of eoliths as the work of man was a fact which was capable of demonstration. They found from anatomical and mechanical considerations that the fundamental processes in which primitive man would need the aid of tools were:—(1) striking; (2) cutting; (3) scraping; (4) piercing; and (5) the production of fire. Then, selecting suitable fragments of flint, they performed with them the simple operations involved in these processes, carefully noting the effects of such use, and of the secondary work of re-sharpening, on the flints themselves. In this way they

were able to establish certain definite characters for each hypothetical class of tools. A comparison of eoliths, collected in considerable numbers from different sources, with the artificially produced tools showed a very close agreement in respect of their characters.

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 17.

LINNEAN SOCIETY, at 8.—The Anomura (of the Red Sea): W. Riddell.—Forms of Flowers in *Valeriana dioica*: R. P. Gregory.—Études sur les Cirrhépèdes du Cambridge Museum: Prof. A. Gruvel.—Rhynchota from the *Sealar* Expedition: W. L. Distant.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Electric Discharge and the Production of Nitric Acid: W. Cramp and B. Hoyle.

INSTITUTION OF MINING AND METALLURGY, at 8.—A Visit to the Mineral Districts of Canada: W. Frecheville and H. F. Marriott.—Notes on Plant in the Mining Districts of Canada: R. E. Commans.

FRIDAY, DECEMBER 18.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Type-casting and Composing Machinery: L. A. Legros.

INSTITUTION OF CIVIL ENGINEERS, at 8.—High-power Water-turbines on Moderate Falls: R. Wolfenden.

MONDAY, DECEMBER 21.

FARADAY SOCIETY, at 8.—The Influence of Cheap Electricity on Electrolytic and Electrothermal Industries: E. A. Ashcroft.

TUESDAY, DECEMBER 22.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Investigation of the Heat-losses in an Electric Power-station: F. H. Corson.

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