

and must sign an agreement, with the concurrence of his parents or guardians if a minor, to enter the office of a surveyor approved by the council with the view of practising as a surveyor in the future, or as an alternative to engage in advanced research work in subjects approved by the council as of value to the profession, and in due course to sit for the intermediate and final examinations of the institution. Election to the scholarships will be by competitive examination conducted by the Oxford and Cambridge Joint Examination Board. In the examination candidates will be required to write an English essay chosen from four subjects set by the examiners and to present themselves for examination in either (a) language, (b) mathematics, or (c) science. If (a), not more than two of the following: Latin, Greek, French, German; if (b), mathematics only, or mathematics and one science subject; if (c), not more than two of the following: physics, chemistry, botany, physical geography, and elementary geology. The next examination will be held about the end of January. Entries should be addressed to the Secretary of the Surveyors' Institution, 12 Great George Street, Westminster, by December 15 next.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 26.—Sir J. J. Thomson, president, in the chair.—Dr. A. E. H. **Tutton**: Monoclinic double selenates of the cobalt group. This memoir deals with the four double selenates of the series $R_2M(SeO_4)_2 \cdot 6H_2O$, in which M is cobalt and R is potassium, rubidium, caesium, and ammonium. A complete crystallographic and physical investigation has been carried out on parallel lines to the work previously published concerning the magnesium, zinc, iron, and nickel groups, and to that concerning the complete analogous series of double sulphates. The results are in full accord with those derived from the previous investigations. Two dominant facts emerge, namely, (1) the progressive order of all the crystallographic and physical properties, following the progression of the atomic numbers (and therefore atomic weights) of the interchangeable alkali metals concerned, potassium, rubidium, and caesium; and (2) the almost perfect isostructure—that is, congruency, coincidence, and equality of dimensions of the elementary cells of the monoclinic space-lattices—of the crystals of the ammonium and rubidium salts of the group. The progression with atomic number referred to under (1) is completely explained by the operation of Moseley's law, governing the progressive structural complexity of the atoms in accordance with the sequence of the atomic number.—Hertha **Ayrton**: A new method of driving off poisonous gases.—Dr. F. W. **Aston**: Experiments with perforated electrodes on the nature of the discharge in gases at low pressure. Experiments are described on the discharge between electrodes of a large flat form perforated with a long narrow slit, the charge passing through the slit being collected and measured in a Faraday cylinder. Direct measurements made with the Faraday cylinder behind the cathode and at the same potential seem to indicate that about half the total current in the discharge is brought up to the cathode by positive ions. Attempts to discover the distribution of velocities in this stream show that this is not directly determinable, owing to the very high ionisation in the region of the slit and other reasons, which are discussed. Using a perforated anode, it is found that as the distance from the cathode is increased arithmetically the current carried by the cathode rays into the Faraday cylinder decreases geo-

metrically when the current is constant.—Mary **Seegar** and Prof. Karl **Pearson**: De Saint-Venant solution for the flexure of cantilevers of cross-section in the form of complete and curvate circular sectors; and the influence of the manner of fixing the built-in end of the cantilever on its deflection.—Dr. H. **Jeffreys**: The relation between wind and the distribution of pressure. A classification of some six hundred wind observations over the North Sea, according to their velocities and directions, showed that the most striking feature of the resulting values was their asymmetrical frequency distribution. From the fact that this was noticeable in nearly every class, it was inferred that it could be produced only by variation in turbulence or systematic contortion of the isobars, on a scale too small to be recorded on the weather map. The latter cause, however, and also such variations in turbulence as keep the coefficient of eddy viscosity the same at all heights, would lead to strong correlations between S/G and α , which are not observed. Hence it is concluded that the principal cause of variation in the relation of the surface wind to the gradient is variation in the vertical distribution of turbulence; and it is shown that such variation could give the effects actually observed.—Prof. C. H. **O'Donoghue**: The blood vascular system of the Tuatara, *Sphenodon punctatus*.—G. H. **Livens**: The fundamental formulations of electro-dynamics. The object aimed at in this paper is the removal of certain difficulties and discrepancies which exist in the usual formulations of electro-dynamic theory. After a brief statement of the differential theory in which a new equation,

$$\frac{dB}{dt} = \frac{dH}{dt} + 4\pi \frac{dI}{dt} + 4\pi \text{Curl}[Iv],$$

is introduced to express the time-rate of change of the magnetic force H when the magnetic media are in motion with a velocity v , a general formulation of the theory based on the principle of least action is developed, in a manner which leads directly to expressions for the intrinsic energies of the polarised media, for the forces per unit volume on the polarised and charged media, and, finally, for the complete electro-motive force on the moving electrical elements.—Dr. A. E. **Oxley**: The influence of molecular constitution and temperature on magnetic susceptibility. Part iv.: Further applications of the molecular field. The main paper is a continuation of the work published in Royal Society Transactions, A, vols. ccxiv. (1914), and A, ccxv. (1915), and Royal Society Proceedings, A, vol. xc. (1918). It deals with the additional applications of the local molecular force in crystalline and vitreous media. It is shown that the change of volume on crystallisation can be interpreted as a magnetostriction effect of the molecular field. The molecular field is assumed to be proportional to the local intensity of magnetisation, the coefficient of proportionality being the reciprocal of the limiting susceptibility under field strengths equal to the respective molecular fields at different temperatures. A discussion of the nature of the molecular field is given, and the conclusion is reached that the forces of crystallisation are of a magnetic nature. The large value of the local magnetic force suggests that they may play an important part in chemical combination, and further evidence is given for the existence of the magneton in diamagnetic media.—A. **Mallock**: Diffusion of light by rain, cloud, or fog. In this note attention is directed to the similarity between the diffusion of light by small drops and the diffusion of heat by conduction. The drops under consideration are supposed to have, at least, diameters of many wave-lengths of the light scattered by them, so that peculiarities of diffusion dependent on the relation of

diameter to wave-length do not affect the results. Rain, cloud, and fog are formed of such drops. The opacity of a space containing a number of drops insufficient completely to obliterate objects on the far side depends on the lowering of the contrast between light and shade brought about by the light scattered by them, and not on any blurring or lack of definition. The amount of direct light which reaches the eye from a source within a fog or shower is proportional to 2^{-ml} , where ml is the distance of the source from the eye, and l is the thickness of the stratum which reduces the direct light by one-half. The reduction to one-half will be caused by such a number of drops as would, if placed side by side in a plane to which the ray is normal, cut off all the direct light; but when the same number of drops are distributed at random in a volume of thickness l in the direction of the ray, they allow half the direct light to pass, in consequence of the probability that some of them screen others, and thus leave space for direct radiation. A relation is shown between the rate of rainfall (1 in. per day = 1/86,000 in. per second) and the opacity of a shower.

Physical Society, June 13.—Prof. C. H. Lees, president, in the chair.—Dr. Balth. van der Pol, jun.: Comparison of the wave-form of the telephone current produced by a thermal detector and by a rectifier in heterodyne reception.—Prof. E. Wilson and E. F. Herroun: The magnetic properties of varieties of magnetite. The magnetic properties of certain varieties of magnetite as exhibited by crystallised, compact, or massive specimens and detached particles have been examined. In each case the susceptibility has been found to vary with the magnitude of the magnetising force after the manner of iron, the relative variation being much more pronounced in the case of those specimens having the higher susceptibility. The maximum susceptibility in the specimens examined occurs at a force ranging from 13 C.G.S. units in the crystal to 368, its magnitude varying from 3.12 to 0.127 C.G.S. units. The effect of heating has been greatly to increase susceptibility in some cases, and in others a negative effect has been produced. In the case of a specimen of Penryn magnetite, the large increase in the susceptibility was traced to the conversion of ferrous carbonate and ferric oxide into magnetite. Very high susceptibility in magnetite is never associated with high coercive force or retained magnetisation, the greatest values for the latter exhibited by specimens having an intermediate value of susceptibility of the order of 0.3 or 0.4. Lower susceptibility may be associated with high coercive force, but naturally the retained magnetisation is not very great, owing to the lower maximum of induced magnetisation.

Geological Society, June 25.—Mr. G. W. Lamplugh, president, in the chair.—A. E. Kitson: Outlines of the geology of Southern Nigeria (British West Africa), with especial reference to the Tertiary deposits. The oldest rocks in Southern Nigeria comprise a series of quartzites, schists of various kinds, blue and white marble, grey limestones, altered tuffs and lavas, amphibolites, and gneisses. They may be classed provisionally as pre-Cambrian. So far as they have been observed, there is a great hiatus between the pre-Cambrian and the next known sediments, the Upper Cretaceous. Normally, these are slightly inclined rocks. Flanking the Udi plateau on the south and south-east, and extending thence over the southern part of the great valley to the Cross River, is a series of Eocene estuarine shales, clays, and marls, with septarian nodules and pieces of coal and resin, and a rich fauna consisting principally of mollusca, but including frag-

mentary remains of whales, birds, fishes, and turtles. A thick series of sandstones, mudstones, shales, and seams of brown coal forms a large portion of the basin of the Niger, west of the Udi plateau. In the Ijebu Jebu district are bituminiferous sands and clays with Pliocene estuarine shells. Extending over practically the whole of the country south of lat. $7^{\circ} 10' N.$, and west of the great valley of the marine Cretaceous, is a varying thickness of (usually unstratified) clayey sands, probably late Pliocene—the Benin Sands series of Mr. J. Parkinson. Along the coast-line and extending for considerable distances up the Niger and Cross Rivers are fluviatile, deltaic, littoral, and swamp gravels, sands, and muds of Pleistocene and Recent age. In the Cross River basin, intruded into the marine Cretaceous, are volcanic necks of decomposed agglomerate, and sills (?) and dykes of olivine-dolerite. These are probably pre-Eocene. The Yorubaland crystalline rocks contain magnetite in considerable quantities, while these and the crystalline rocks of the Oban Hills show smaller quantities of cassiterite, gold, monazite, and columbite.—J. B. Harrison and C. B. W. Anderson: Notes on the extraneous minerals in the coral-limestones of Barbados. Characteristic representative specimens of the fossil reef-corals and of the beach-rock of the high-level and low-level limestone terraces of Barbados were examined chemically and microscopically in order to ascertain the composition, nature, and origin of their extraneous mineral contents. Chemical analyses of the residua were made, and the results of these and of the microscopical examinations are tabulated in the paper. The extraneous minerals present were found to be apparently fresh and largely unaltered fragments of wind-borne volcanic minerals and glass. It was found that the volcanic minerals enclosed in the reef-corals on which they fell have been protected from change; those in the clastic limestone or bed-rock show signs of detrition and weathering prior to the consolidation of the limestone. Similar minerals separated from clay normally formed and accumulated in a pothole in the limestone supply evidence of weathering changes after being set free from the rock. It is shown that the composition of the sedentary residual soils on the higher limestone-terraces of Barbados corresponds in its essential parts with the residua separated, either naturally or artificially, from the limestone. The proportions of magnesium carbonate present in the coral-rock are briefly discussed, and complete analyses of the high-level and the low-level limestones are given.

DUBLIN.

Royal Irish Academy, June 23.—The Most Rev. J. H. Bernard, president, in the chair.—A. Henry and Miss M. G. Flood: The history of the Dunkeld hybrid larch, *Larix eurolepis*. This tree is raised in large quantities from the seed of ten Japanese larches (*L. leptolepis*) growing at Dunkeld in the vicinity of numerous European larches (*L. europaea*), from which pollen is wafted by the wind. The seedlings are intermediate between the two parents, as shown by microscopical examination of the sections of the leaves, by the colour and form of the bracts and scales of the cones, and by the colour of the twigs, leaves, etc. The hybrid seedlings, of which more than 100 acres have been planted on the Dunkeld, Athol, and Murthly estates, are very vigorous. Attention is directed to the function of the papillae on the surface of the leaf, which are constant in *L. leptolepis*, absent in *L. europaea*, and only present on a few cells in the case of the hybrid. Reference is also made to other hybrid conifers, including *L. marschlinii*, Coaz, which has recently appeared in Switzerland; *L. pen-*

dula, Salisbury; and *Tsuga jeffreyi*, A. Henry. The last is a peculiar hemlock spruce, originally raised at Edinburgh in 1851 from seeds collected by Jeffrey. It has recently appeared again at Cowichan Lake, Vancouver Island, from which locality a single plant has been sent to Knapton, Abbeyleix, Ireland.

CALCUTTA.

Asiatic Society of Bengal, June 4.—**N. Nath Sen**: Interaction of phosphorus halides and arsenious and arsenic compounds.—**H. H. Haines**: Some new species of plants from Bihar and Orissa.—**H. C. Das-Gupta**: Notes on the Panchet reptile. In part i. a few bones of the celebrated Panchet reptile obtained from the neighbourhood of Asansol are described, and in part ii. the question of the systematic position of the reptile is reviewed, as of late doubts have been raised regarding its Dicynodont nature. An examination of all the materials available shows the author that though, without the discovery of an entire skull, the zoological position of the Panchet reptile cannot be definitely settled, there is no reasonable ground to suppose that Lydekker was mistaken when he placed the Panchet reptile under his new generic name *Ptychosiagum*=*Ptychognathus*, Owen. The only other genus with which some of the Panchet bones agree is *Oudenodon*, but the presence of tusks shows that it cannot be assigned to that genus.—**H. C. Das-Gupta**: Note on a mammalian fossil from Bhavanagar (Kathiawar). In this paper the author has described a mammalian humerus obtained at Hathab. The fossil is fragmentary, and no generic determination is possible. It is, however, interesting as being the first record of a Gáj mammal obtained in Kathiawar.

BOOKS RECEIVED.

A Comparative Study of the Bantu and Semi-Bantu Languages. By Sir H. H. Johnston. Pp. xi+815. (Oxford: At the Clarendon Press, 1919.) 3l. 3s. net.

Eugenics and Environment. By Prof. C. L. Morgan. Pp. 82. (London: John Bale, Sons, and Danielsson, Ltd., 1919.) 2s. net.

The Problem of Sex Diseases. By Major A. Corbett-Smith. Second edition. Pp. xv+107. (London: John Bale, Sons, and Danielsson, Ltd., 1919.) 2s. 6d. net.

Salt and the Salt Industry. By A. F. Calvert. (Pitman's Common Commodities and Industries Series.) Pp. vii+151. (London: Sir Isaac Pitman and Sons, Ltd., n.d.) 2s. 6d. net.

The Return to Oxford: A Memorial Lay. By W. Garstang. Pp. 14. (Oxford: B. H. Blackwell, 1919.) 1s. net.

The Mechanism of Evolution in Leptinotarsa. By W. L. Tower. (Publication No. 263 of the Carnegie Institution of Washington.) Pp. viii+384+19 plates. (Washington: Carnegie Institution, 1918.)

History of the Theory of Numbers. Vol. i., Divisibility and Primality. By Prof. L. E. Dickson. (Publication No. 256 of the Carnegie Institution of Washington.) Pp. xii+486. (Washington: Carnegie Institution, 1919.)

The Adolfo Stahl Lectures in Astronomy. Delivered in San Francisco, California, in 1916-17 and 1917-18, under the auspices of the Astronomical Society of the Pacific. Pp. xiv+257+liii plates. (San Francisco: Astronomical Society of the Pacific.) 2.75 dollars.

Problèmes Scientifiques d'Alimentation en France pendant la Guerre. Bibliographie Analytique des Travaux Français publiés pendant la Guerre (1914-18). Par R. Legendre. Pp. 160. (Paris: Masson et Cie, 1919.) 6 francs net.

Number Stories of Long Ago. By Prof. D. E. Smith. Pp. vii+136. (Boston, Mass., and London: Ginn and Co., 1919.) 2s. 3d. net.

Number Puzzles before the Log Fire: Being those Given in the "Number Stories of Long Ago." By Prof. D. E. Smith. Pp. iv+14. (Boston, Mass., and London: Ginn and Co., 1919.) 6d. net.

Board of Agriculture and Fisheries. Guides to Smallholders. No. 3: Co-operation for Small Producers. Pp. 15. (London: Secretary of Board, 3 St. James's Square, London, S.W.1, 1919.) 2d.

Board of Scientific Advice for India. Annual Report for the Year 1917-18. (Calcutta: Superintendent, Government Printing, India, 1919.) 14 annas, or 1s. 3d.

DIARY OF SOCIETIES.

THURSDAY, JULY 17.

SOCIETY OF CHEMICAL INDUSTRY (at the Salters' Hall, St. Swithin's Lane, E.C.), at 10.30 a.m.-1 p.m., and 3-5 p.m.—Conference on Dye Stuffs, Synthetic Drugs, and Associated Products. Dr. Herbert Levinstein: Progress in the British Dyestuff Industry.—James Morton: Dyestuffs and British Textiles.—Prof. G. T. Morgan: Certain Colour-producing Intermediates.—E. V. Evans: The Manufacture of Intermediates.—F. H. Carr: The Manufacture of Synthetic Drugs.—Dr. W. R. Innes: Photographic Chemicals.—Dr. M. O. Forster: The Organised Preparation of Laboratory Chemicals.—At the Goldsmiths' Hall, Foster Lane, E.C., at 10.30 a.m.-1 p.m.—Conference on the Chrome Tanning Industry. Prof. D. McCandlish: The Development of the Chrome Tanning Industry in the United States of America.—M. C. Lamb: The Progress of the Chrome Tanning Industry in Great Britain.—Dr. Gordon Parker: The War Services of the Chrome Tanning Industry.—At 3-5 p.m.—Conference on Recent Developments in the Fermentation Industries. Sir Frederick Nathan: The Manufacture of Acetone.—Amos Gill: The Acetone Fermentation Process and its Technical Applications.—A. Chaston Chapman: The Employment of Micro-organisms in the Service of Chemical Industry—A Plea for a National Institute of Micro-biology.

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