SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 9.—Sir Archibald Geikie K.C.B., president, in the chair.—Sir William **Crookes**: The spectrum of boron. The physical properties of the element boron are almost unknown, notwithstanding the efforts of many chemists who have worked on the subject. Moissan, who came nearest to obtaining the pure element, only succeeded in getting it in the form of an amorphous powder. He said it was not possible to melt or volatilise it in a carbon crucible or arc as it was changed into carbon boride, and concluded that boron passed from the solid to the gaseous state without becoming liquid. Recently Dr. Weintraub, of the General Electric Company, U.S.A., has not only obtained boron in a state of purity, but has prepared it in a fused homogeneous state. His process consists in running an alternating-current arc between water-cooled copper electrodes in a mixture of boron chloride vapour with a large excess of hydrogen. The boron agglomerates on the ends of the electrodes, where it grows in the form of small rods. After a while the arc runs between two boron electrodes; and if the current is of proper value the rods melt down to boron beads, which eventually fall off, whereupon the same process repeats itself. The first specimens received from Dr. Weintraub were deposited from a vaporous state from boron chloride and hydrogen in the manner described. Subsequently he kindly sent the author some lumps of fused boron which had been prepared from magnesium boride. This boride dissociates at a relatively low temperature (1200°), especially *in vacuo*, and with rapidity at 1500°. The fusion is effected between copper electrodes, the affinity of copper for boron being so slight that it can be directly fused on to the electrode without being contaminated with copper. Another way of fusing boron is in what Dr. Weintraub calls a mercury arc furnace, based on the fact that most refractory bodies, such as tungsten, tantalum, boron, &c., have no affinity whatever for mercury. The result of the author's work on boron is to show its photographed spectrum consists essentially of three lines, the wave-lengths of which, according to accurate measurements, are 3451·50, 2497·83, and 2496·89. For more easy comparison the wave-lengths of these lines measured by different observers are given below in a tabular form:—

Hartley (1883)	3450·3	2497·0	2496·2
Rowland (1893)	—	2497·821	2496·867
Eder and Valenta (1893) ...	3451·3	2497·7	2496 8
Exner and Haschek (1897)..	3451·4	2497·8	2496·88
,, ,, (1902)...	3451·49	2497·79	2496·87
Hagenbach and Konen (1908)	3451	2498	2497
Crookes (1911)	3451·50	2497·83	2496·89

The fourteen other lines given by Eder and Valenta, and the five other lines given by Exner and Haschek, failed to record themselves on the photographs, notwithstanding excessively long exposures given in the attempt to bring out additional boron lines. The most interesting property of solid boron is its extraordinary rise in electric conductivity with a slight increase in temperature. A piece of melted boron measured by Dr. Weintraub, which at the room temperature (27°) had a resistance of 5,620,000 ohms, dropped to 5 ohms at a dull red heat. Another noteworthy property of melted boron is extreme hardness. It comes next to the diamond in hardness, a splinter easily scratching corundum. Its fracture is conchoidal, and no decided crystalline structure is seen under the microscope. The agglomerated boron deposited in the arc from boron chloride and hydrogen is, on the contrary, highly crystalline.—Hon. R. J. **Strutt**: A chemically active modification of nitrogen produced by the electric discharge: II. (1) Oxygen destroys active nitrogen, but does not combine with it. Hydrogen has no action. (2) Active nitrogen, in reacting with nitric oxide to form the peroxide, gives the same greenish-yellow flame with continuous spectrum which may be obtained by stimulating oxides of nitrogen in other ways. (3) The reaction just mentioned is used to determine the percentage of active nitrogen present in ordinary nitrogen as it leaves the discharge. The result found is about 2·5 per cent., much higher than was formerly supposed. (4) When dilute phosphorus vapour is introduced into glowing nitrogen it does not react at once. It is not until some time after the glow has completely disappeared that the nitrogen gets into a state in which it can react with phosphorus. (5) The glow has a large electrical conductivity, comparable with that of a salted Bunsen flame. The ions are liberated in the glow, not merely carried forward from the original discharge. This ionisation is, as a rule, not very greatly affected when the spectra of other substances, such as metals or cyanogen, are developed by the active nitrogen in the space between the testing electrodes. (6) None of these spectra are visibly diminished in intensity when large electromotive forces are applied to remove the ions. (7) Ozone can in some cases develop metallic spectra when mixed at comparatively low temperatures with the metallic vapour.—Sir J. **Dewar**: Production of solid oxygen by the evaporation of the liquid.—Sir J. **Dewar** and Dr. H. O. **Jones**: The gaseous condensable compound, explosive at low temperatures, produced from carbon disulphide vapour by the action of the silent electric discharge: II.—Dr. T. H. **Havelock**: Optical dispersion: a comparison of the maxima of absorption and selective reflection for certain substances. This paper contains a discussion of various wave-lengths associated with each dominant region in a general type of dispersion formula. It is shown how the maxima of absorption and of selective reflection are, in general, separated from each other and from the wave-length corresponding to the natural vibrations in the molecule. Formulæ are obtained for some of these maxima in terms of the constants of the dispersion formula, and are confirmed by comparison with available experimental results. To estimate the magnitude of the differences in question, a numerical study is made of regions of selective absorption and reflection for carbon disulphide, rock salt, and sodium vapour; in particular, for rock salt it appears that the maximum of selective reflection in the infra-red is displaced considerably from the maximum of absorption and from the dominant wave-length of the dispersion formula.—Dr. T. H. **Havelock**: The influence of the solvent on the position of absorption bands in solutions. According to Kundt's rule, the effect of the solvent is to displace the absorption bands further to the longer wave-lengths the greater the refractive or dispersive power of the solvent. By using a suitable type of dispersion formula this rule is given a definite theoretical expression, and various experimental results are examined from this point of view. Although effects are complicated, in general, by molecular changes, it is possible to estimate in some cases how much can be ascribed to the operation of Kundt's rule.—Prof. F. G. **Donnan** and Dr. J. T. **Barker**: An experimental investigation of Gibbs's thermodynamic theory of interfacial concentration in the case of an air-water interface. The "surface" concentration of a dissolved substance in excess over that in the bulk of the solution is given by Gibbs's equation $\Gamma = -d\sigma/d\mu$, where Γ = excess of solute per unit of interface, σ = interfacial tension, μ = chemical potential of solute. Assuming the simple osmotic law of van 't Hoff for the solution, the above equation can be written in the form $\Gamma = -\frac{c}{RT}\frac{d\sigma}{dc}$, where c = bulk concentration of solute. The authors have tested this equation by measuring independently Γ, c, and $d\sigma/dc$ for the case of an air-water interface. The substances examined were pelargonic acid and saponin. The value of Γ was determined by finding the change in concentration of a given volume of solution caused by bubbling through it a known volume of air in the form of a known number of very small air bubbles. Steady streaming of the liquid was prevented by breaking up the column of liquid into a number of eddy chambers. The extremely small changes of concentration thus produced in excessively dilute solutions were measured by means of a dropping pipette, the same apparatus being also employed to measure $d\sigma/dc$. The values of the two members of Gibbs's equation were found to be in fairly good agreement, considering the difficulty of the experiments. In the case of aqueous solutions of pelargonic acid of concentrations varying between 0·008 and 0·0024 gram per 100 grams of water, the average value of Γ found experimentally was in round numbers one ten-millionth of a gram per square centimetre of interface at 15° C. In the case of saponin the values found were somewhat greater.

Zoological Society, October 24. — Sir John Rose Bradford, K.C.M.G., F.R.S., vice-president, in the chair. —Bruce F. **Cummings**: Distant orientation in Batrachia, based on observations and experiments made by the author in North Devon. Two species of newts had been used for the experiments, and the results obtained lent support to the hypothesis that these batrachians possessed a homing faculty, but no very definite instinct for detecting water, even from a short distance. Of the factors discussed in connection with amphibian migration, it was suggested that in regard to newts a combination of their homing faculty and their marked tendency to walk downhill was chiefly of assistance to them in finding water in which to breed.—Oldfield **Thomas**: Mammals collected in the provinces of Sze-chwan and Yunnan, western China, by Mr. Malcolm Anderson, for the Duke of Bedford's exploration of eastern Asia. The paper formed No. xv. of the series, and would be the last on Mr. Anderson's specimens, as he was now returning finally to America. During his work on the exploration he had obtained 2700 specimens, besides many birds, and had quite revolutionised our knowledge of the area explored. The present collection, given, as before, to the National Museum by the society's president, consisted of 160 specimens, belonging to thirty-three species.—E. P. **Stebbing**: Game sanctuaries and game protection in India. The author discussed the question of the formation of game sanctuaries and what had been already done in this direction in various parts of the country. Suggested additions to the proposed New Indian Game Act were given, and "close seasons" for certain species recommended as being necessary for the preservation of the game of the country.

Challenger Society, October 25.—Dr. G. H. Fowler in the chair.—Prof. D'Arcy W. **Thompson**: The scales of the herring as an index to age. In the herring, the rings or zones borne by the scales, which are constant in number for the same individual, and are undoubtedly correlated in some way with the size and age of the fish, are not, in the writer's opinion, so simply related to the years of life that the age of an individual fish can be determined with accuracy from an inspection of the scales. In any random sample of herring the frequencies of individuals at centimetre lengths and of numbers of rings each forms a probability curve grouped about a single mode. Either, then, the shoal is composed of herrings of uniform age and number of rings, or of various ages and ring numbers mixed in a definite and remarkable manner. While, on the usual hypothesis of each scale ring indicating a year of life, the facts may conceivably be explained as due to selective action of the net, the writer considers that it is more probable that the members of a herring shoal are of the same age.—Dr. W. T. **Calman**: Phototropism and the distribution of marine organisms (opening of discussion).

British Psychological Society, November 4. — Dr. Beatrice **Edgell** and W. Legge **Symes**: A preliminary note on visual flicker.—Dr. F. **Golla**: The vestibule and the concept of space.—J. **Kay**: (1) Apparatus for McDougall's dotting test; (2) apparatus for weight discrimination.

Mathematical Society, November 9.—Dr. H. F. Baker, president, in the chair.—J. E. **Campbell**: The invariants of the linear partial differential equation of the second order in two independent variables.—Colonel R. L. **Hippisley**: Closed linkages.—H. **Hilton**: Invariants of a canonical substitution.—G. T. **Bennett**: The system of lines of a cubic surface.—G. H. **Hardy** and J. E. **Littlewood**: The relations between Borel's and Cesàro's methods of summation.

CAMBRIDGE.

Philosophical Society, October 30.—Sir George Darwin, K.C.B., F.R.S., president, in the chair.—G. R. **Mines**: Note on the mode of discharge of the Cuverian organs of *Holothuria nigra*. The sea-cucumber, *H. nigra*, when irritated emits white conical bodies, the Cuverian organs, which rapidly elongate, shooting through the water while remaining attached at their bases to the animal, and forming long, intensely sticky tubes. These are then disconnected from the animal. The elongation of the Cuverian organs has been attributed to internal water pressure by some, but by others to an intrinsic activity of the tubes. The former view is strongly supported by the facts presented in this communication. Undischarged Cuverian organs removed from the body cavity of Holothuria can be made to elongate in a manner exactly resembling the normal discharge by injecting them with sea water or other fluid. The natural discharge of the Cuverian organs is always preceded and accompanied by a rise in the pressure within the body of the animal, and this pressure reaches the value needed to elongate an excised Cuverian organ. The arguments which have been adduced in favour of the intrinsic activity of the Cuverian organs are shown, by further experiments, to lack cogency. An account of this work will appear shortly in *The Quarterly Journal of Microscopical Science*.—Oswald H. **Latter**: The discharge of spermatozoa by *Unio pictorum*.

PARIS.

Academy of Sciences, November 6.—M. Armand Gautier in the chair.—E. H. **Amagat**: The internal pressure of fluids and the determination of the absolute zero. In a previous paper the author has defined a function π as $\left(T\frac{dp}{dt} - p\right)$. It is now shown that the values of π for hydrogen, taken for pressures of 1 and 3 atmospheres, and taking 273 as the temperature of melting ice on the absolute scale, obey perfectly the law of the square of the volume, and this is not the case if 273·1 or 272·9 be assumed. It is possible to look at the problem from a different point of view, and determine the absolute zero from the condition that, starting with well-determined coefficients of pressure under 1 and 3 atmospheres, the values of π should rigorously satisfy the law of the square of the volume. This gives from the data for hydrogen 272·983, for nitrogen 272·999, and for oxygen 272·996 for the absolute zero.—C. **Guichard**: A very extended class of triple orthogonal systems.—J. **Meunier**: The conditions of production of the Swan spectrum, and on conclusions which may be drawn relating to comets which possess this spectrum. The Swan spectrum is regarded as essentially a spectrum of oxidation and explosive combustion, and additional experiments on this point are described. The Swan spectrum denotes not only the presence of a hydrocarbon, but also that of oxygen, and hence oxygen must be present in comets showing this spectrum.—A. **Guillet**: An induction-coil interrupter formed of a primary arc.—J. **Guyot**: The differences of contact potential apparent between a metal and electrolytic solutions.—Jacques **Danne** and Victor **Crémieu**: The quantity of radium emanation disengaged by one of the springs at Colombières-sur-Orb, Hérault. The amounts of emanation per 10 litres of gas have been determined for three springs. One of these, the Crémieu spring, is remarkable on account of the large quantity of gas spontaneously evolved—43,000 litres in twenty-four hours. The amount of emanation disengaged in twenty-four hours from this spring is more than double that of Ax (Viguerie); and, moreover, since 95 per cent. of the gas from the Crémieu spring is carbon dioxide, the concentration in the radium emanation is readily increased twenty times by simple treatment with alkaline solutions. —G. Ter. **Gazarian**: A general relation between the physical properties of bodies: application to densities. The comparison of physical properties, either at 0° C. or at the boiling point, or at corresponding temperatures according to Van der Waals's formula, is not altogether satisfactory; and in place of these the author proposes the following: at temperatures equally removed from the critical temperatures, the quotients of the numbers representing a property for any two bodies whatever are a linear function of the temperature. This holds for densities, viscosity coefficients, surface tension, the rectilinear diameter of Cailletet and Mathias, and the latent heat of vaporisation. The densities were compared at analogous emperatures (defined as above) of ammonia and pentane, carbon monoxide and pentane, benzene and pentane, acetic acid and pentane.—H. **Duval**: The molecular refraction of azo-compounds. The molecular refraction of solutions of azo-benzene was found to depend to a certain extent on the solvent. The ortho- or meta-position of a substituting group causes too slight a variation in the refraction to

conclude that these compounds have a different constitution.—A. **Boutaric**: Cryoscopy in fused sodium thiosulphate. $Na_2S_2O_3.5H_2O$ melts at 48·5° C. The temperature of equilibrium between the solid hydrates with $5H_2O$ and $2H_2O$ and the solution is 48·2° C. Various organic substances and salts of sodium give a molecular lowering in this solvent of 44°; salts of other metals produce about double this lowering.—A. **Besson**: The formation of hydrogen peroxide under the silent electric discharge. It is proved that H_2O_2 can be formed by the silent discharge acting on moist rarefied air at a moderately low temperature, conditions realised in the upper regions of the atmosphere. Although ultra-violet light may be one cause of the presence of hydrogen peroxide in rain water, these experiments prove that electrical phenomena may also be a contributory cause.—J. **Bougault** and C. **Charaux**: Lactarinic acid. This acid has been shown in a previous paper to be a ketostearic acid. The application of the Beckmann reaction proves the ketonic group to be in the position 6, the formula being

$$CH_3—(CH_2)_{11}—CO—(CH_2)_4—CO_2H.$$

—J. B. **Senderens** and J. **Aboulenc**: The catalytic esterification of the dibasic acids in the wet way. Quantitative studies of the formation of esters of malonic, succinic, oxalic, and phthalic acids in presence of small quantities of sulphuric acid, aluminium sulphate, or potassium bisulphate as catalysts.—A. **Roussy**: The life of fungi in the fatty acids. It is shown that moulds which grow well in a medium containing a certain quantity of fat owe their development rather to the fatty acids than to the glycerol. It is only in rare cases, in particular for Aspergillus and Penicillium, that glycerol is as good a medium as the fatty acids.—Raoul **Combes**: Researches on the formation of the anthocyanic pigments.—J. **Dumont**: A new method for the physical analysis of soil.—Louis **Gaucher**: The digestion of casein. Milk is only coagulated in the stomach, and the clots reduced to a fine state of division by the contractions of this organ. The peptonisation occurs in the intestine, and may even be continued in the duodenum. The coagulation of the milk in the stomach is not a necessary condition of its digestion.—F. **Houssay** and A. **Magnan**: The wing surface, the weight of the pectoral muscles, and the feeding process in certain birds.—A. **Desgrez**: The influence of the chemical constitution on the toxicity of nitriles and amides. Unsaturated nitriles are more toxic than saturated nitriles containing the same number of carbon atoms.—E. **Voisenet**: New considerations on the disease of bitterness in wines in its relations with the acrylic fermentation of glycerol. The acrylic fermentation of glycerol is at least one of the essential processes undergone by wine when it develops bitterness.—A. **Daniel-Brunet** and C. **Rolland**: Contribution to the chemical and physiological study of the hepatic gland in cattle.—P. **Mazé**: Experimental chlorosis in maize.—Raphaël **Dubois**: Microbioids.—M. **Fournier**: The existence of coal at Franche-Comté, at Saint Germain near Lure (Haute-Saône). Details are given of the strata found in three trial borings; the coal found is similar to the Ronchamp coals.—L. **Cayeux**: The existence of organic remains in the ferruginous rocks associated with the Huronian iron minerals in the United States.

BOOKS RECEIVED.

Account of the Operations of the Great Trigonometrical Survey of India. Vol. xix. Levelling of Precision in India (1858–1909). By Col. S. G. Burrard, F.R.S. Pp. xiii+484+xviii plates. (Dehra Dun: Office of the Trigonometrical Survey of India.) Rs. 10.8.

An Introductory Course of Mechanics and Physics for Technical Students. By W. M. Hooton and A. Mathias. Pp. vii+148. (London: W. B. Clive.) 1*s*. 6*d*.

Kulturpflanzen und Haustiere in ihrem Übergang aus Asien nach Griechenland und Italien sowie in das übrige Europa. Historisch-Linguistiche Skizzen von V. Hehn. Achte auflage neu herausgegeben von O. Schrader. Mit Botanischen beiträgen von A. Engler und F. Pax. Pp. xxviii+665. (Berlin: Gebrüder Borntraeger.) 17 marks.

The Home-life of the Osprey. Photographed and described by C. G. Abbott; with some photographs by H. H. Cleaves. Pp. 54 and 32 mounted plates. (London: Witherby and Co.) 6*s*. net.

Treatise on Practical Light. By Dr. R. S. Clay. Pp. xv+519. (London: Macmillan and Co., Ltd.) 10*s*. 6*d*. net.

The Rubber-planter's Notebook. Compiled from the most reliable and modern sources by F. Braham. Pp. viii+108. (London: Crosby Lockwood and Son.) 2*s*. 6*d*. net.

The Story of the Zulus. By J. Y. Gibson. New edition, revised and extended. Pp. vii+338. (London: Longmans and Co.) 7*s*. 6*d*.

The Life of Paracelsus, Theophrastus von Hohenheim, 1493–1541. By A. M. Stoddart. Pp. xv+309. (London: Murray.) 10*s*. 6*d*. net.

Land and Peoples of the Kasai: being a Narrative of a Two Years' Journey among the Cannibals of the Equatorial Forest and other Savage Tribes of the South-western Congo. By M. W. Hilton-Simpson. Pp. xx+356. (London: Constable and Co., Ltd.) 16*s*. net.

Pflanzengeographische Wandlungen der deutschen Landschaft. By Prof. H. Hausrath. Pp. vi+274. (Leipzig: Teubner.) 5 marks.

Chemisch-technisches Praktikum. By Dr. W. Moldenhauer. Pp. vii+206. (Berlin: Gebrüder Borntraeger.) 6.80 marks.

Handbuch der vergleichenden Physiologie, herausgegeben von H. Winterstein. Sechzehnte Lieferung. Band iv. Erste Hälfte. Pp. 321–480. (Jena: Fischer.) 5 marks.

Physiology. By Prof. W. D. Halliburton, F.R.S. Pp. xi+176. (London: J. M. Dent and Sons, Ltd.) 1*s*. net.

Roses. By H. R. Darlington. Pp. xiii+193. (London: T. C. and E. C. Jack.) 2*s*. 6*d*. net.

Gardens Shown to the Children. By J. H. Kelman and O. Allen. Described by J. A. Henderson. Pp. xii+100. (London: T. C. and E. C. Jack.) 2*s*. 6*d*. net.

The British Bird Book. Edited by F. B. Kirkman. Section vi. Pp. 379–540. (London: T. C. and E. C. Jack.) 10*s*. 6*d*. net.

In Northern Mists. Arctic Exploration in Early Times. By Prof. F. Nansen, G.C.V.O. Translated by A. G. Chater. Vol. i. Pp. xi+384. Vol. ii. Pp. iii+416. (London: Heinemann.) Two vols. 30*s*. net.

Through Trackless Labrador. By H. H. Prichard. With a chapter on Fishing by G. M. Gathorne-Hardy. Pp. xv+254. (London: Heinemann.) 15*s*. net.

Pictures of British History. By E. L. Hoskyn. Pp. 64. (London: A. and C. Black.) 1*s*. 6*d*.

Year Book of the Indian Guild of Science and Technology, 1911. Pp. 135. (Letchworth: The Letchworth Printers, Ltd.)

The Canadian Rockies: New and Old Trails. By Prof. A. P. Coleman, F.R.S. Pp. 383. (London: T. Fisher Unwin.) 12*s*. 6*d*. net.

A Text-book of Physiological Chemistry. By Prof. O. Hammarsten. Authorised translation from the author's enlarged and revised seventh German edition by Prof. J. A. Mandel. Sixth American edition. Pp. viii+964. (New York: J. Wiley and Sons; London: Chapman and Hall, Ltd.) 17*s*. net.

Tables of Physical and Chemical Constants and some Mathematical Functions. By Dr. G. W. C. Kaye and Prof. T. H. Laby. Pp. vi+153. (London: Longmans and Co.) 4*s*. 6*d*. net.

Rifle, Rod, and Spear in the East, being Sporting Reminiscences. By Sir E. Durand, Bart. Pp. xi+200. (London: Murray.) 8*s*. net.

Fourth Scientific Report on the Investigations of the Imperial Cancer Research Fund. By Dr. E. F. Bashford. Pp. xxi+223. (London: Taylor and Francis.)

The Elements of Plane and Spherical Trigonometry. By J. G. Hunt and C. R. MacInnes. Pp. vii+205. (London: Macmillan and Co., Ltd.) 6*s*. net.

Dairy Cattle and Milk Production. By Prof. C. H. Eckles. Pp. xii+342. (London: Macmillan and Co., Ltd.) 7*s*. net.

Beginnings in Agriculture. By A. R. Mann. Pp. xii+341. (London: Macmillan and Co., Ltd.) 3*s*. 6*d*. net.

The Conquest of Nerves. By Dr. J. W. Courtney. Pp. v+209. (London: Macmillan and Co., Ltd.) 5*s*. 6*d*. net.

The Learning Process. By Prof. S. S. Colvin. Pp.