bequest of the late A. W. G. Allen. The studentship is of the value of 250*l.*, is tenable for one year, and is open in alternate years to students proposing approved courses of research in (1) literary subjects, or (2) scientific subjects.

Seventy-five candidates have presented themselves during the past year for the Sanitary Science Examination. Of these thirty-nine were successful in obtaining the University diploma in Public Health.

The Engineering Laboratory Syndicate have lost no time in proposing a plan for the Hopkinson Memorial Building. The new wing will adjoin the present laboratory, and provide a lecture-room, three laboratory-rooms, and small rooms for students engaged in research. For the completion of the plan some 500*l.* will be required, in addition to the 5000*l.* generously given by Mrs. Hopkinson and her children. It is expected that the building will be ready for occupation in October 1899.

Mr. W. N. Shaw, F.R.S., was on November 10 appointed Assistant-Director of the Cavendish Laboratory for one year.

IN Berlin the flowers gathered in the town gardens are placed in the municipal schools for the purpose of furthering the study of botany. Arrangements have now been made by the London School Board, and will come into operation in April next, whereby a gardener will collect, pack, and forward to the schools of the Board botanical specimens and flowers, budding plants, leaves, &c., required for teaching botany or for object-lessons, or for the combination of drawing and object-lessons.

IT is expected (states the *Athenaeum*) that the London University Commission will commence its sittings this month. Mr. Bailey Saunders, the secretary, has been collecting information in Germany, especially concerning the organisation of higher commercial education, which will be made an important element in the newly constituted university, with the co-operation, it is hoped, of the London County Council. It is probable that the headquarters will be removed from Burlington Gardens. Christ's Hospital is talked of as the new site.

THE Calendar of the Imperial Tientsin University for the year 1897 has been received. The University was established towards the end of 1895, and its faculty includes several graduates of colleges in the United States. Mr. C. D. Tenney is the president, Prof. Oliver C. Clifford occupies the chair of chemistry and physics, Prof. E. G. Adams the chair of civil engineering, and Prof. N. F. Drake the chair of mining. Most of the tutors and teachers are natives of China. It is announced that last year his Excellency Li Chung-ta'ng showed his good will towards the University by a present of a 4-inch telescope, a phonograph, and several things for the physical laboratory.

ALDERMAN JOHN HOPKINSON, the members of his family, and near relatives, have offered to the Owens College, Manchester, in memory of the late Dr. John Hopkinson, a gift of 1600*l.*, to cover the expense of building the dynamo house connected with the new physical laboratory. It is hoped that by additional contributions from friends who desire to see a suitable memorial of Dr. Hopkinson in Owens College, where he was a student for three years, it may be possible to complete and equip the annexe containing in addition to the dynamo house a number of other rooms devoted to electrotechnics, and that the whole may be known as the "Dr. John Hopkinson Electrotechnical Laboratory."

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, November 11.—Mr. Shelford Bidwell, F.R.S., President, in the chair.—The discussion on Mr. Albert Campbell's paper on the magnetic fluxes in meters and other electrical instruments was resumed. Prof. Ayrton said he wished to offer some remarks on behalf of Mr. Mather and himself. The paper would, perhaps, have received more adequate discussion at the Institution of Electrical Engineers, for it was chiefly of a technical character. The importance of neutralising the effect of leads when using instruments with very weak fields, such as a Siemens' electro-dynamometer, should be emphasised. In instruments of the Kelvin-balance type where two opposed coils carry two opposed currents, the field spreads at the edges; the true "working" flux is not that directly between the coils. Mr. Campbell would have done better if he had used a long search coil wound round one of the swinging coils, forming part of a vertical cylinder. It would have been well also to have supplied some experimental proof that the astatic arrangement of the swinging coils of the Kelvin balance makes the instrument independent of the earth's field. The effect of the earth's field is of the order 0·2, so that with instruments of the Weston type, with a field of the order 1000, it was sometimes assumed, erroneously, that the readings were practically independent of the earth's H. Prof. Ayrton's own tests showed that by turning a Weston voltmeter towards different points of the compass, the errors in a particular case were far greater than might be predicted from the above ratio; the induction in the voltmeter pole-space, due to the earth's field, was much higher than 0·2; the earth's field was exaggerated by the iron pole-pieces; it was not necessary to suppose that the magnetism of the permanent magnet caused the variation. The error observed was about 0·2 per cent. in a horizontal field, and 0·8 per cent. when the field of the voltmeter was parallel to the earth's induction. Here the induction in the gap was 1200, and H = 0·2. In tests relating to the Ayrton and Perry magnifying-spring voltmeter, it was more important to know the B in the air-space *near* the iron than the B *within* the iron. Eddy currents might account for the extraordinary results obtained with the Shallenberger meter. Mr. J. H. Reeves described a method he had adopted for measuring the effect of stray fields upon ammeters and voltmeters. The instrument to be tested is first mounted on a stand and is brought under the influence of a large coil carrying a current. In this way, fields of known magnitude can be superimposed on the working field, throughout the range of the instrument, and the change of deflection due to them can be observed. From these known values, the working field can be deduced. For let the current in the solenoid of the instrument at any moment be A amperes, producing a corresponding unknown working field of magnetic force X. Then X is proportional to the solenoid current, as measured by the indications of the instrument. If a magnetic force x is superimposed on X, then x is measured by x/X of A. If x is known, the working field X can be calculated from the change of deflection produced by the superposition. With Evershed ammeters, the field measured in this way was in one instrument 200, and in another 226; or about one-third of Mr. Campbell's figure (700) for the Evershed ammeter. Mr. Campbell's value of B did not represent the working field, but the field at the end of one of the fixed pieces of iron. Mr. Campbell, in reply, said he thought the theory of electrical instruments to be well within the limits of physics, and he had for that reason presented the paper to the Physical Society. The position chosen for the search coil in the Kelvin-balance tests may not have corresponded to the working flux, but it was near to the right position, and he had carefully specified the position chosen. His results as regards the Weston instrument differed from those of Prof. Ayrton, the errors he had observed for the particular ammeter used were under 0·1 per cent. The earth's field probably produced an effect different for different Weston instruments, according to the degree of saturation of the permanent magnet. In Mr. Campbell's tests, the Weston instrument did not have an iron case.—A paper by Prof. W. B. Morton, on the propagation of damped electrical oscillations along parallel wires, was then read by Prof. J. D. Everett. In a paper published in the *Phil. Mag.* for September 1898, Dr. E. H. Barton compared the attenuation of electrical waves in their passage along parallel wires, as experimentally determined by him, with the formula given by Mr. Heaviside in his theory of long waves. He finds close agreement as regards the effect of a terminal resistance, but large discrepancy in the case of the attenuation constant. Prof. Morton now investigates how far the results should be modified when it is supposed, as under actual conditions, that the oscillations propagated from the origin are damped, and that the circuit is not balanced, as in the ideal case of distortionless transmission. He finds (1) that the velocity of propagation is increased, while (2) the attenuation is increased, and (3) with infinite resistance between the ends of the wires, the waves are, as before, reflected completely with phase unchanged. As the resistance is diminished the amplitude of the reflected waves is decreased, and a phase-difference is introduced. For a certain value of the resistance the reflected amplitude is a minimum, and the phase-difference is $\pi/2$. When the resistance is zero there is again complete reflection, with the phase-difference π; *i.e.* the waves are reversed. The

result is that the reflection-factor for amplitude *seems* to pass continuously from (+1) to (−1) *without* passing through zero. Using the numbers given by Dr. Barton, it is found that the corrections to the simple theory are extremely small, so that in actual cases the damping may be ignored, and the circuit may be regarded as distortionless.—Mr. Oliver Heaviside (abstract of communication): Mr. Heavisde, using his own notation, exhibits mathematically the connection between the case investigated by Mr. Morton, of a wave-train arising from a damped source, and the standard case of an undamped source. The cause of the attenuating coefficient coming out twice as great in Dr. Barton's experimental conditions, as when the resistance is calculated by Lord Rayleigh's formula, is attributed to lack of correspondence between the experimental conditions and those of the ideal theory. For: (1) The external resistance, of unknown amount, is ignored. (2) It is not certainly to be expected that the formula in question is true for millions of vibrations per second. It may, however, be concluded from the experiments that the theory furnishes an approximation to the real resistance. (4) The magnetic vibrations to which the wires are subjected are not long-continued and undamped, as assumed by the formula. When a wave-train passes any point on a wire, its surface is subjected to an impulsion vibration lasting only a very minute fraction of a second; a vibration, moreover, which is very rapidly damped. So there is no definite resistance, and the resistance is greater than according to Lord Rayleigh's formula. (5) Perhaps, also, the terminal-reflections involved in Dr. Barton's calculations may introduce error.—The President proposed votes of thanks to the authors, and the meeting was adjourned until November 25.

Chemical Society, November 3.—Prof. Dewar, President, in the chair.—The following papers were read:—Determination of the equivalent of cyanogen, by G. Dean. By determining the quantity of potassium bromide which will react with a known weight of silver cyanide dissolved in nitric acid, the equivalent of cyanogen was ascertained to be 26·065; if the atomic weight of carbon be 12·01, that of nitrogen is 14·055.—The composition of American petroleum, by S. Young. The hydrocarbons boiling between 25° and 115° contained in American petroleum are isopentane, pentane, pentamethylene, isohexane, hexane, methylpentamethylene, benzene, isoheptane, heptane, methylhexamethylene and toluene.—The separation of normal and isoheptane from American petroleum, by F. E. Francis and S. Young. The presence of naphthenes in American petroleum renders it impossible to separate pure iso- and normal heptane from this source by fractional distillation; the impure heptane was brominated, and the heptyl bromides separated by distillation, The pure hydrocarbons were then isolated by reduction with a copper-zinc couple.—The boiling points and specific gravities of mixtures of benzene and normal hexane, by D. H. Jackson and S. Young. It is impossible to separate pure normal hexane by distilling mixtures of this hydrocarbon with benzene.—The action of fuming nitric acid on the paraffins and other hydrocarbons, by F. E. Francis and S. Young. The isoparaffins react readily with fuming nitric acid yielding nitrocompounds, but the normal paraffins are only very slowly attacked.—A composite sodium chlorate crystal in which the twin law is not followed, by W. J. Pope. In a composite crystal of sodium chlorate a four-fold axis of symmetry of the one individual was found to coincide in direction with a three-fold symmetry axis of the other; the plane (011) on the latter is parallel to the plane (010) upon the former.—Stereoisomeric bromonitro- and chloronitro-camphors, by T. M. Lowry. Nitric acid acts on bromo- or chloro-camphor with production of only one nitro-derivative in each case; on brominating or chlorinating nitrocamphor in alkaline solution, however, two stereoisomeric nitro-halogen derivatives are obtained in each case.—Camphoryloxime (camphonitrophenol), by T. M. Lowry. Camphonitrophenol is an oxime of camphoric anhydride.—The formation of ethereal salts of polycarboxylic acids, by S. Ruhemann and A. V. Cunnington.—Note on the action of light on platinum, gold and silver chlorides, by E. Sonstadt. During the action of light on wet silver chloride, a subchloride, hydrogen chloride and hydrogen peroxide are formed.—Methanetrisulphonic acid, by E. H. Bagnall. Fuming sulphuric acid acts upon diacetylbenzidine, its dichloro-derivative, α-acenaphthalide and acetanilide with formation of methanetrisulphonic acid, $CH(HSO_3)_3$.—The nutrition of yeast, by A. L. Stern. An increase of nutriment beyond a definite limit does not materially increase the amount of nitrogen assimilated by yeast, the percentage of nitrogen in the yeast, the weight of the yeast, or the amount of sugar fermented.—The yellow colouring matters of *Rhus cotinus* and *Rhus rhodanthea*. Part vi., by A. G. Perkin. Venetian sumach, the leaves of *R. cotinus*, contains myricetin; the leaves of *R. rhodanthea*, the yellow cedar of New South Wales, contain quercetin and gallotannic acid. The stems of both plants contain fisetin.—Colouring matters of the New Zealand dyewood "puriri," by A. G. Perkin. The New Zealand tree, "puriri" (*Vitex littoralis*) contains two colouring matters as glucosides; these are vitexin $C_{15}H_{14}O_7$ or $C_{17}H_{16}O_8$ and homovitexin $C_{16}H_{16}O_7$ or $C_{18}H_{18}O_8$. The former yields a penta- or hexa-acetyl derivative.—Cannabinol, by T. B. Wood, W. T. N. Spivey, and T. H. Easterfield. A number of derivatives of cannabinol are described.—Derivatives of hesperitin, by A. G. Perkin. Hesperitin combines with sodium or potassium acetate yielding crystalline compounds; the examination of these shows hesperitin to have the composition $C_{32}H_{28}O_{12}$. The azobenzene derivative and hexacetyl derivative of hesperitine have been prepared.

PARIS.

Academy of Sciences, November 7.—M. Wolf in the chair.—Preparation of lithium-ammonium, calcium-ammonium, and the amides of lithium and calcium, by M. Henri Moissan. At low temperatures lithium and calcium dissolve in liquid ammonia, forming deep blue solutions similar to those obtained from sodium and potassium. The lithium and calcium-ammoniums are more stable than the other analogous alkali compounds. Analyses showed that these substances are represented by the formulae $LiNH_3$ and $Ca(NH_3)_4$; both catch fire in contact with air at the ordinary temperature.—Remarks by M. Guntz relating to the preceding communication.—Preliminary note on the presence of free hydrogen in atmospheric air, by M. Armand Gautier. Air taken from the open sea or from mountains at high altitudes is very free from combustible hydrocarbons, traces of which are always present in the air of towns. The pure air, however, contains small quantities of free hydrogen amounting to about 11 to 18 c.c. per 100 litres, about one-half the carbonic acid present in the same air.—Comparison between the methods of Lagrange and Gauss for the resolution of entire numbers of indeterminate equations of the second degree, by M. de Jonquières.—Effects of the section of the nerves of the *sphincter ani* on the functions, physiological and anatomical properties of this muscle, and on the organism in general, by MM. S. Arloing and Edouard Chantre. If the muscle is completely isolated from the spinal column, real incontinence does not necessarily follow, the elasticity of the sphincter being sufficient to cause the expulsion of the faeces and urine.—On the genesis of epithelium, by MM. Armand Sabatier and Étienne de Rouville. It is generally admitted that epithelium is always capable of regenerating itself, and that it borrows nothing from the neighbouring tissues. This is contrary to the results obtained by the authors, who find that in many cases the underlying conjunctive tissue also takes an active part in this regeneration.—Observations on the sun, made at the Observatory of Lyons during the first quarter of 1898, by M. J. Guillaume.—Geodesic, magnetic, and astronomical surveys of Madagascar, by M. P. Colin.—On the convergence circle of some series, by M. Lean.—On stability, by M. J. Andrade.—Hertzian telegraphy without wires between the Eiffel Tower and the Pantheon, by M. E. Ducretet. The space over which the signals were transmitted was about four kilometres, and the clearness of the record showed that this distance could be considerably increased.—On the compound winding of alternators of constant voltage, by M. Maurice Leblanc. An alternator constructed on the principles here laid down was found to have a very constant voltage, even when changed rapidly from no load to full load. The residual magnetism is sufficient to render the dynamo self-exciting.—Contribution to the study of the boric ethers. Properties of triethyl borate, by M. H. Copaux. Chlorine gives trichlorethylether, $CH_2Cl_2.CHCl.O.C_2H_5$; sodium ethylate in absolute alcohol gives a precipitate of $BNa(OC_2H_5)_4$.—Combinations of phenyl-hydrazine with the halogen salts of the alkaline earth metals, by M. J. Moitessier. A description of the preparation of $CaBr_2.3H_2O.4C_6H_5N_2H_3$; and $SrI_2.4C_6H_5.N_2H_3$.—Estimation and detection of gelatine in gums and food substances, by M. A. Trillat. The aqueous solution of the gum is treated with formaldehyde. The gelatine is rendered insoluble.

and can be weighed after thorough washing by decantation. Test experiments gave results within one per cent.—The culture of some lower organisms in modified sea water, by MM. P. Duflocq and P. Lejonne. Several pathogenic organisms can become accustomed to grow in a medium containing sea water, also certain moulds (*Aspergillus niger*, *Muguet*, *Actinomyces*).—Action of the bacterium of sorbose on the aldehydic sugars, by M. Gabriel Bertrand. Arabinose, dextrose, and galactose are converted by the action of the sorbose bacteria into arabonic, gluconic, and galactonic acids respectively.—Instantaneous submarine photography, by M. Louis Boutan. In the earlier attempts at submarine photography, at least half an hour's exposure was required. The apparatus has now been so far improved that photographs have been taken of fish at distances at 1·5 to 2 metres from the lens, without any artificial light being necessary.—The post-larval stages of *Arenicolae*, by M. Pierre Fauvel.—The cephalic eyes in Lamellibranchs, by M. Paul Pelseneer.—On the Chamydomonadineae, by M. P. A. Dangeard.—On some new facts in the geology of the Dauphiny Alps, by M. W. Kilian.—On some lakes in the Eastern, Upper, and Lower Pyrenees, by MM. André Delebecque and Etienne Ritter.—Barometer movements on the meridian of the moon, by M. A. Poincaré.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 17.

ROYAL SOCIETY, at 4.30.—Further Note on the Sensory Nerves of the Eye-Muscles: Prof. Sherrington, F.R.S.—Further Observations on the Effects of Partial Thyroidectomy: W. Edmunds.—Contributions to our Knowledge of the Formation, Storage, and Depletion of Carbohydrates in Monocotyledons: J. Parkin.—An Experiment in Search of a Directive Action of One Quartz Crystal on another: Prof. Poynting, F.R.S., and P. L. Gray.—The Electrical Conductivity and Luminosity of Flames containing Vaporised Salts: Prof. Smithells, H. M. Dawson, and H. A. Wilson.

LINNEAN SOCIETY, at 8.—On some Spiders from Chile and Peru, collected by Dr. Platte of Berlin: F. Pickard Cambridge.—The Botanical Results of a Journey into the Interior of Western Australia; with some Observations on the Nature and Relations of the Desert Flora, and on the Probable Origin of the Australian Flora as a whole: Spencer Le M. Moore.

CHEMICAL SOCIETY, at 8.—Preparation of Hyponitrite from Nitrite through Oxyamidosulphonate: Dr. E. Divers, F.R.S., and T. Haga.—(1) Absorption of Nitric Oxide in Gas Analysis; (2) Interaction of Nitric Oxide with Silver Nitrate; (3) Preparation of Pure Alkali Nitrites; (4) The Reduction of an Alkali Nitrite by an Alkali Metal; (5) Hyponitrites: their Preparation by Sodium or Potassium and Properties: Dr. E. Divers, F.R.S.

FRIDAY, NOVEMBER 18.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Production of Liquid Air, and its Application to Chemical and other Industries: Cecil Lightfoot.

QUEKETT MICROSCOPICAL CLUB, at 8.

MONDAY, NOVEMBER 21.

SOCIETY OF ARTS, at 8.—Acetylene: Prof. Vivian B. Lewes.

IMPERIAL INSTITUTE, at 8.30.—The Stalactite Caves of New South Wales: Frederick Lambert.

TUESDAY, NOVEMBER 22.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Paper to be further discussed: Electrical Transmission of Power in Mining: William Beedie Esson.

ANTHROPOLOGICAL INSTITUTE, at 8.30.—The Hill Tribes of the Central Indian Hills: their Ethnology, Customs, and Sociology (with Lantern Illustrations): Wm. Crooke.

WEDNESDAY, NOVEMBER 23.

SOCIETY OF ARTS, at 8.—Long Distance Transmission of Electric Power: Prof. George Forbes, F.R.S.

GEOLOGICAL SOCIETY, at 8.—Note on a Conglomerate near Melmerby, Cumberland: J. E. Marr, F.R.S.—Geology of the Great Central Railway—Rugby to Catesby: Beeby Thompson.—On the Remains of *Amia* from Oligocene Strata in the Isle of Wight: E. T. Newton, F.R.S.

THURSDAY, NOVEMBER 24.

ROYAL SOCIETY, at 4.30.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Rotatory Converters: Prof. S. P. Thompson, F.R.S.

FRIDAY, NOVEMBER 25.

PHYSICAL SOCIETY, at 5.—On the Properties of Liquid Mixtures: R. A. Lehfeldt.—On certain Diffraction Fringes as applied to Micrometric Observations: L. N. G. Filon.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—La Cytologie Expérimentale: Dr. A. Labbé (Paris, Carré).—Publications of the British Fire Prevention Committee, Vol. 1 (1 Waterloo Place).—Allgemeine Biologie: Prof. M. Kassowitz, 1. Band (Wien, Perles).—General Report on the Operations of the Survey of India Department during 1896-97 (Calcutta).—From Matter to Man: A. R. Dewar (Chapman).—Wild Animals in Captivity: A. D. Bartlett (Chapman).—Leçons de Chimie Physique: Prof. J. H. Van 't Hoff, translated by Prof. Corvisy, Part 1 (Paris, Hermann).—Traité Élémentaire de Mécanique Chimique: Prof. P. Duhem, Tome iii. (Paris, Hermann).—Through Arctic Lapland: C. Hyne (Black).—The Total Solar Eclipse, January 22, 1898 (Debra Dûn).—Traité d'Astronomie Stellaire: Prof. C. André, 1 Partie (Paris, Gauthier-Villars).—Practical Inorganic Chemistry for Advanced Students: C. Jones (Macmillan).—Birds of the British Isles: J. Duncan (Scott).—Aperçus de Taxinomie Générale: J. P. Durand (Paris, Alcan).—Life of Man on the High Alps; A. Mosso, translated by E. L. Kiesow (Unwin).

PAMPHLETS.—Review of Mineral Production in India for 1897 (Calcutta).—Replica di Krupp alla Protesta del Signor Bashforth: translated by F. Bashforth (Cambridge University Press).—Mines and Quarries: General Report and Statistics for 1897, Part 3, Output (Darling).—Temperature Entropy Chart; Captain Sankey (Rugby, Frost).—Sections and Thickness of the Lower Silurian Formations on West Canada Creek and in the Mohawk Valley: C. S. Prosser and E. R. Cumings (New York).—The Classification and Distribution of the Hamilton and Chemung Series of Central and Eastern New York: J. Hall and C. S. Prosser, Part 1 (New York).—Zwanzig Briefe g. z. Jöns Jakob Berzelius und Christian Friedrich Schönbein, 1836-1847, Herausgegeben von Prof. Kahlbaum (Basel, Schwabe).

SERIALS.—Morphologisches Jahrbuch, 26 Band, 2 Heft (Leipzig).—Scribner's Magazine, November (Low).—Observatory November (Taylor).—Encyklopaedie der Naturwissenschaften, Erste Abthg., 73 and 74 Liefg.; Dritte Abthg., 44 and 45 Liefg. (Breslau).—Engineering Magazine, November (222 Strand).—Himmel und Erde, November (Berlin),—Quarterly Journal of the Geological Society, November (Longmans).—American Naturalist, October (Ginn).—Astrophysical Journal, October (Chicago).—The Process Photogram, November (Dawbarn).—Transactions of the Edinburgh Field Naturalists' and Microscopical Society, Vol. iii. Part 7 (Blackwood).—American Journal of Science, November (New Haven).—Psychological Review, November (Macmillan).—American Journal of Mathematics, October (Baltimore)—Journal of the Chemical Society, November (Gurney).

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