no near affinity with any other, either palæontological or recent. While the structure of the stem resembles that of the *Calamarieæ*, the mode of formation of the spores is analogous to that of the *Lycopodiaceæ*.—On the development of *Tricholoma terreum*, by Signor P. Voglino.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, November 8.—Prof. A. W. Rücker, Vice-President, in the chair.—Mr. W. H. Everett read a paper on the magnetic field of any cylindrical coil or plane circuit. The method of treatment is based on the formula for the force due to an element of current. A single integration applied to one component of this force gives for any point in the field due to a plane circuit the force perpendicular to its plane; and a double integration gives the longitudinal force at any point due to a cylindrical coil of any cross-section, the depth of winding being supposed inconsiderable. For coils in which the latter condition does not hold, an approximate solution can readily be found. The force parallel to the plane of a circuit and the transverse force due to a coil are investigated in a similar manner. The general results are of a very simple form, and admit of easy approximate calculation. Special formulæ are deduced for coils of rectangular cross-section, the general expressions being in this case integrable. Appended to the paper are some numerical results giving the values of the forces at different points due to coils of various dimensions. Prof. Perry said he considered the paper to be a valuable one, particularly as illustrating a practical mathematical method of integrating. Mr. Trotter said the paper was of interest to him, as he considered that several of the author's results might be applied to the solution of problems on illumination—for instance, the illumination of a room by a circle of lamps. Mr. Rhodes regretted that it had not been possible to supply a proof of the paper before the meeting. The method in which the author obtained the force outside a solenoid as the difference of the forces due to two solenoids, reminded him of the method employed in calculating the attraction of, say, a truncated pyramid. Prof. Silvanus Thompson said the author had mentioned several previous papers on the subject, but had not referred to one by Prof. Viriamu Jones, in which the force due to a solenoid is obtained in terms of elliptic integrals. Another method of attack was to calculate the work done when a unit pole is carried through the solenoid and back outside to the starting-point. Prof. Ayrton said he also regretted the absence of a proof of the paper. He considered it of great importance to have exact and simple methods of calculating the forces due to a solenoid. The Chairman (Prof. Rücker) said he had made a somewhat similar calculation in connection with the magnetic effect of sheets of basalt below the surface of the earth.—Mr. E. H. Griffiths read a paper, by himself and Miss Dorothy Marshall, on the latent heat of evaporation of benzene. The method employed is similar to that used by one of the authors in the determination of the latent heat evaporation of water (*Phil. Trans.* 1895). The loss of heat due to the evaporation is balanced by (*a*) the heat supplied by an electric current; (*b*) a secondary supply due to the work done by the stirrer; (*c*) a slight gain or loss due to small unavoidable changes in temperature of the calorimeter. The comparative values of the various sources of heat (if we denote the supply due to the electrical current by 1000) is approximately:—Electrical = 1000; stirring = 11; changes in calorimeter temperature ± 5. The electrical supply could be measured with extreme accuracy, and the above table shows that small errors in the determination of the remaining thermal quantities are of little importance. The results may be summed up in the formula

$$L = 107{\cdot}05 - 0{\cdot}1981\,\theta$$

where θ is the temperature and the thermal unit at 15° C. is used. The discussion on this paper was postponed till after the reading of the paper by Prof. Ramsay and Miss Marshall, on a method of comparing the heats of evaporation of different liquids at their boiling points. The method employed has already been described before the Society (January 11, 1895). The liquid to be experimented on is put into a glass bulb enclosed in an outer jacket filled with the vapour of the same liquid. An open tube is attached to the top of the bulb, so that there is free communication between the interior and the vapour jacket, and no loss of material. Inside the bulb is a spiral of fine platinum wire, attached to stout platinum terminals which are sealed into the glass. The temperature of the liquid in the bulb is raised to the boiling point by the vapour jacket; thus when a current is sent through the wire, the whole of the heat developed is spent in converting a portion of the liquid into vapour. Two such bulbs are connected in series, and the ratio of their losses of weight is the inverse ratio of the heats of evaporation of the liquids. A correction is made for the inequality in resistance of the spirals, and the ratio of the differences of potential between the ends of the spirals, when the current is passing, is determined in each experiment by Poggendorff's method. Results are given for fourteen liquids. Prof. Ramsay drew special attention to the table giving the values of the quotient ML/T, where M is the molecular weight, T the absolute temprature, and L the latent heat. Very curious differences are noticeable in the case of water, alcohol, and acetic acid. Prof. Carey Foster expressed his admiration for the method, since it obviated the necessity of knowing the specific heat of the liquid vapour. Prof. Silvanus Thompson said the difficulty experienced in the case of water due to electrolysis might be obviated by the employment of a spiral of lower resistance and a larger current, so that the difference of potential between the ends of the spiral should be less than 1·7 volts. The Chairman said Captain Abney had asked him to inquire to what extent the temperature of the liquid was affected by radiation. Mr. J. W. Rodger asked if any direct experiment had been made to determine if the temperature of the liquid was not above its true boiling point. In some cases differences of as much as 2° might exist between the temperature of the liquid and that of the vapour given off. The differences in the value of ML/T in the case of water, alcohol and acetic acid might be due to the fact that the vapours of alcohol and water were simple, while the vapour of acetic acid was complex. Mr. R. Appleyard suggested that the differences obtained in the case of water might be due to the presence of dissolved air. Mr. Griffiths said that the objection to the adoption of Prof. Thompson's suggestion was the fear that with short wires an excessive difference in temperature between the wire and the liquid might exist. Mr. Rhodes asked if Mr. Griffiths could trust his determinations of temperature to $\frac{1}{80000}$th of a degree. Mr. Griffiths, in reply, said that he thought there was no limit to the accuracy with which a difference of temperance could be measured; the absolute temperature, however, he only relied upon to $\frac{1}{3000}$th of a degree. Prof. Ramsay said the fact of superheating existing would not affect the results, since near the temperatures at which they were working the latent heat did not vary appreciably with the temperature. In reply to Captain Abney, he said some previous experiments by Dr. Young and himself had shown that the vapour jacket was quite impervious to radiant heat from without

PARIS.

Academy of Sciences, November 4.—M. Marey in the chair.—Action of silicon on iron, chromium, and silver, by M. Henri Moissan. By heating silicon with soft iron, chromium, or silver in the electric furnace or otherwise, compounds having the composition Fe_2Si and Cr_2Si are produced by the two former metals, and silver dissolves a notable proportion of silicon, but deposits it again on solidification in the crystalline state. The silicides of iron and chromium are produced at temperatures below the melting points of either constituent, probably owing to the vapour tension of silicon at the temperature of formation; the whole process much resembles cementation. These silicides are readily attacked by hydrofluoric acid or aqua regia, slowly acted on by hydrochloric acid and unacted on by nitric acid. Fused potassium nitrate and chlorate do not act on these compounds, but they are easily decomposed by fusion with a mixture of nitrate and carbonate.—M. de Freycinet describes the aim of his book, "Essays on the Philosophy of the Sciences," of which a copy is presented to the Academy.—Elements of Swift's comet (1895 II), by M. L. Schulhof. These elements are compared with the elements for Lexell's comet given in Le Verrier's table (for $\mu = +0{\cdot}9$), and show very near agreement.—Spectroscopic researches on the star Altaïr. Recognition of an orbital movement and of an atmosphere, by M. H. Des landres. (See our Astronomical Column.) On the binomial differential equation of the first order, by M. Michel Petrovitch.—New method for the extraction of roots of numbers, by M. Manuel Vazquez Prada.—Expression of the pressure supported by the shaft of a hydraulic turbine at work. Theorem concerning the dynamical effect of the water. Note by M. Bertrand de Fontviolant. It is concluded that: The

dynamical effect is equal to the geometrical variation of quantity of movement suffered by the volume of water delivered per second in its passage across the turbine.—On the time distribution of rain at Athens, by M. D. Eginitis.—On the process of attacking the emerald and the preparation of pure glucina, by M. P. Lebeau.—On a group of mineral waters containing ammonia (bituminous waters), by M. F. Parmentier.—On the estimation of tannins in wines, by M. E. Manceau.—Action of chlorine on normal propyl alcohol, by M. André Brochet. Two of the products of chlorination in the cold are α chloropropionic aldehyde, $CH_3.CHCl.COH$, and dipropyl chloropropional, $CH_3.CHCl.CH(OC_3H_7)_2$.—On ozotoluene, by M. Adolphe Renard. Ozotoluene resembles the ozobenzene previously described. It is a white opaque mass, commencing to decompose at about 8°. It detonates on heating or by shock, but less easily than ozobenzene. Its composition is represented by the formula $C_7H_8O_6$.—Study on the nitration of menthone, by M. Konovaloff. By heating with nitric acid at 100° in a sealed tube menthone yields nitromenthone $C_{10}H_{17}(NO_2)O$. The alcoholic solution of the latter with sodium ethoxide gives a salt, undecomposed by boric, carbonic, or hydrosulphuric acids, corresponding to the acid $C_{10}H_{19}NO_4$ set free by sulphuric acid. The nitromenthone is reduced with formation of a basic substance. It is probably a tertiary nitromenthone of the composition

$$CH_3.CH\begin{cases}CH_2-CH_2\\ CH_2-CO\end{cases}C(NO_2).C_3H_7.$$

—On the fermentation of cellulose, by M. V. Omelianski. The specific ferment destroying cellulose has been isolated by the author, and is described in the paper.—Anatomy of the digestive apparatus of the Orthoptera of the family of the *Forficulidæ*, by M. Bordas.—On the application of the experimental method to the orogenic history of Europe, by M. Stanislas Meunier.—Experiments relative to the direct manufacture of pure ethyl alcohol, by the fermentation of *Asphodelus ramosus* and *Scilla maritima* with cultivated pure wine yeasts, by M. M. G. Rivière and Bailhache.—On the reclamation of the heath-lands of the Dordogne, by M. Raoul Bouilhac. It is shown that the reclamation of these sandy barrens is possible by the use of a lime phosphatic manure.—Experimental congenital deformities, by MM. Charrin and Gley.

AMSTERDAM.

Royal Academy of Sciences, September 28.—Prof. Van der Waals in the chair.—Mr. Jan de Vries read a paper on addition theorems for elliptic integrals.—Prof. Kamerlingh Onnes communicated measurements, made in the Leyden laboratory, and already published in Dr. Lebret's dissertation (July 1895) on the variation with temperature of the Hall effect in bismuth, the temperatures ranging from −74° to + 240°. Two samples of pure bismuth were experimented upon. The temperature curve of one of the specimens showed a maximum point at −20°; that of the other was not examined far enough. The latter specimen was melted up into a glass tube, and the variation in the electrical resistance measured between −76° and +240°.—At the request of Prof. Cohn of Strassburg and of Dr. Zeeman of Leyden, Prof. Onnes gave an account of experiments, made partly at Strassburg and partly at Leyden, on the propagation of electrical waves in water. The result was: (1) there is no dispersion for waves of the oscillation frequency of 27 to 97 millions per second; (2) the refractive index for waves of which there are a hundred millions a second, is equal to the square root of the specific inductive capacity as measured by the statical method.—Prof. Onnes further communicated: (1) a measurement on the refractive index of glowing platinum, made by Dr. Zeeman in the Leyden laboratory. With Babinet's compensator it was impossible to establish a variation with temperature of the principal incidence and the principal azimuth, even when the platinum mirror was heated to 800° C. Hence within the limits of the errors of measurement the refractive index does not change; (2) a chart, showing the secular variation of magnetic declination, by Dr. W. van Bemmelen; (3) photographs of vibrating strings made by a new method, that of intermitting photography, by Dr. H. J. Oosting.—On behalf of Messrs. C. A. Lobry de Bruyn and W. Alberda van Ekenstein, Prof. Franchimont presented a paper on the reciprocal conversion of glucose, fructose and mannose into one another under the influence of alkalis.—Mr. van Diesen called attention to a copy, now in the library of the Academy, of the second edition of the map of North Holland, made in 1575, by order of the Duke of Alva, by Joost Jansz. Beeldsnyder. Of the first edition no copy seems to be extant in Holland. The copy shown is the edition published in 1610 by H. A. van Warmenhuysen. Though the map seems to have been prepared with care as regards local details, the triangulation is not correct. The "mile," given as scale, probably the Spanish mile, has on this copy a length of 73 m.m.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—The Story of the Earth in Past Ages: Prof. H. G. Seeley (Newnes).—Birds from Moidart and Elsewhere: Mrs. H. Blackburn (Edinburgh, Douglas).—Zoological Record, Vol. xxxi. (Gurney).—Histoire de la Philosophie Atomistique: L. Mabilleau (Paris, Alcan).—Geological Survey of Canada, various Maps, (Ottawa).—An Introduction to the Algebra of Quantics: Prof. E. B. Elliott (Oxford, Clarendon Press).—The Reliquary and Illustrated Archæologist, new series, Vol. 1 (Bemrose).—Analyse des Alcools and des Faux-de-Vie: X. Rocques (Paris, Gauthier-Villars).—Applications Scientifiques de la Photographie: G. H. Niewenglowski (Paris, Gauthier-Villars).—Fourth Volume of Reports upon the Fauna of Liverpool Bay, &c. (Liverpool, Dobb).—A Primer of the History of Mathematics: W. W. R. Ball (Macmillan).—Science Readers: V. T. Murché, Books v. and vi. (Macmillan).—The Natural History of Eristalis Tenax, or the Drone Fly: J. B. Buckton (Macmillan).—Studies in Economics: Dr. W. Smart (Macmillan).—The Life of Joseph Wolf: A. H. Palmer (Longmans).—Stanford's Compendium. Africa, Vol. 2: South Africa: A. H. Keane (Stanford).—Elementary Physical Geography: Prof. R. S. Tarr (Macmillan).—Elementary Physiography: J. Thornton, 8th edition (Longmans).—The Intellectual Rise in Electricity: Dr. P. Benjamin (Longmans).

PAMPHLETS.—De la Double Réfraction Elliptique et de la Tétraréfringence du Quartz: Prof. G. Quesneville (Paris).—The Rutherfurd Photographic Measures of Sixty-two Stars about η Cassiopeiæ: H. S. Davis (New York).—Clouds and Weather: Captain D. Wilson-Barker (*Shipping World* Office).

SERIALS.—Princeton Contributions to Psychology, September (Princeton, N.J.).—Zeitschrift für Wissenschaftliche Zoologie, lx. Band, 2 Heft (Leipzig, Engelmann).—Geographical Journal, November (Stanford).—Bulletin of the American Mathematical Society, October (New York, Macmillan).—L'Anthropologie, tome vi. No. 5 (Paris, Masson).—Zeitschrift für Physikalische Chemie, xviii. Band, 2 Heft (Leipzig, Engelmann).—Scribner's Magazine, November (S. Low).—Geological Magazine, November (Dulau).—Journal of the Chemical Society, November (Gurney).—History of Mankind: F. Ratzel, Part 2 (Macmillan).—Mathematical Gazette, October (Macmillan).—Science Progress, November (Scientific Press, Ltd.).—The Evergreen, Autumn (Unwin).—Journal of the American Public Health Association, October (Concord).—Proceedings of the Physical Society of London, November (Taylor).—Journal of the Franklin Institute, November (Philadelphia).—American Naturalist, November (Philadelphia).—Engineering Magazine, November (Tucker).

CONTENTS.