pump; a modification of Geissler's form.—A. Grosse, a wire-tape rheostat. Fine german-silver wires are spiralled around cotton threads, which are then woven into a sort of tape, the warps being thereby insulated from one another. A piece 2 cm. wide and 4 metres long has 1000 ohms resistance.—W. Holtz, a Wheatstone's bridge for air and water flow. An illustrative apparatus of tubes such as has often been used.

IN the *Scottish Geographical Magazine* for January there is an excellent bathy-orographical chart of the Clyde sea-area, constructed for Dr. H. R. Mill by Mr. J. G. Bartholomew. The colouring of the map is designed to show with special effect the area and depths of the Firth of Clyde and its inlets. For this purpose the land and sea have been treated separately, and coloured in strong contrast to each other. The system of colouring is, however, uniform, and in both cases the lowest or deepest areas are distinguished by the darkest tints, and graduated up to the lighter tints of the higher or shallower portions. The same number contains a paper on the configuration of the Clyde sea-area, which was read by Dr. Mill at the last meeting of the British Association.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, December 16 — "Note on Specific Inductive Capacity." By John Hopkinson, M.A., D.Sc., F.R.S.

Consider a condenser formed of two parallel plates at distance x from each other, their area A being so great, or the distance x so small, that the whole of the lines of force may be considered to be uniformly distributed perpendicular to the plates. The space between the plates is occupied by air, or by any insulating fluid. Let e be the charge of the condenser and V the difference of potential between the plates. If the dielectric be air, there is every reason to believe that $V \propto e$, that is, there is for air a constant of specific inductive capacity. My own experiments ([1880] Phil. Trans., vol. clxxii. p. 355) show that in the case of flint-glass the ratio of V to e is sensibly constant over a range of values of V from 200 volts per cm. to 50,000 volts per cm. From experiments in which the dielectric is one or other of a number of fluids and values of V upwards of 30,000 volts per cm. are used, Prof. Quincke concludes (Wiedemann, *Annalen*, vol. xxviii., 1886, p. 549) that the value of e/V is somewhat less for great electric forces than for small. From the experiments described in that paper, and from his previous experiments (Wiedemann, *Annalen*, vol. xix., 1883, p. 705, *et seq.*) he also concludes that the specific inductive capacity determined from the mechanical force resisting separation of the plates is 10 per cent. to 50 per cent. greater than that determined by the actual charge of the condenser. The purpose of the present note is to examine the relations of these important conclusions, making as few assumptions as possible.

In words, the specific inductive capacity as determined by charge or discharge of a condenser at any given potential and distance between the plates is the arithmetic mean of the inductive capacities determined by the force resisting separation of the plates and that determined by lateral pressure, the potential and distance being the same. This is true whatever be the relation between charge and potential difference, but it is at variance with the experimental result that K_p and K_s are both greater than K.

The results obtained by Prof. Quincke are not easy to reconcile. For that reason it is the more desirable that their full significance should be ascertained. Full information is given of all the details of his experiments except on one point. It is not stated whether, in the experiments for determining K by direct discharge of the condenser, the capacity of the connection and key was ascertained. It would in most ordinary arrangements of key be very appreciable in comparison with the capacity of the condenser itself. If neglected, the effect would be to a certain extent to give too low a value of K, the effect being most marked when K is large.

The property of double refraction in liquids caused by electrification is sometimes cited as showing that electrification is not proportional to electromotive force. The fact that the double refraction in a liquid under powerful electromotive forces is very small would further show that there is a close approximation to proportionality, and that the deviation from proportionality would be insensible to any electro-static test. Such conclusions, however, cannot be safely drawn in the case of bodies such as castor-oil, in which $K \pm \mu^2$. In such bodies, assuming the electro-magnetic theory of light, the yielding to electromotive force is much greater if the force be applied for such time as 10^{-4} second than when applied for 10^{-14} second, and it is quite possible that the law of proportionality might be untrue in the former case, but very nearly or quite true in the latter.

"On the Dielectric Constants of Fluids." (Addendum to Dr. Hopkinson's "Note on Specific Inductive Capacity.") By Prof. G. Quincke, For. Mem. R.S.

In investigating the properties of dielectric fluids (*Wiedemann's Annalen*, vol. xix. 1883, p. 707; vol. xxviii., 1836, p. 529), I found the dielectric constants with the electric balance or by the hydrostatically measured pressure of an air-bladder greater than when measured by the capacity of a condenser surrounded by air or the insulating fluid, and discharged by turning a key through a ballistic galvanometer.

The capacity of the key and of the short thin junction-wire connecting the key with the condenser was, however, in that calculation left out of account as being evanescently small.

In consequence of a written communication from Dr. John Hopkinson, I quite recently compared the capacity of the key and the junction-wire with the capacity C of the condenser by observations with the ballistic galvanometer with the same difference of potential between the surfaces, and thereby found the relation—

$$\frac{x}{C} = 0{\cdot}1762;$$

greater, therefore, than I had conjectured.

Let there be subtracted from the observed galvanometer readings s_1 and s_{11} for the condenser in air and in the dielectric fluid, the deflection calculated for the electricity on the key and junction-wire, then there will actually be obtained from the ratio of the readings thus corrected (s_1) and (s_{11}) values of the dielectric constants (K) of the fluid almost exactly coinciding with the measurements of the electric balance. The agreement is indeed as perfect as might be expected, considering the difference in the methods of observation employed.

Thus, for example, it was found:

	Dielectric constants with Ballistic galvanometer (K)	Weighing K_p
Ether	4·211	4·394
Carbon disulphide ...	2·508	2·623
,, ,, ...	2·640	2·541
Benzole	2·359	2·360
Petroleum	2·025	2·073

[Note added by Dr. Hopkinson.—Prof. Quincke's explanation sets the questions I have raised at rest. There can be little doubt that K, K_s, and K_p are sensibly equal and sensibly constant. The question what will happen to K_p and K_s if K is not constant has for the present a purely hypothetical interest.

Physical Society, January 22.—Prof. McLeod, Vice-President, in the chair.—Dr. F. Wormack was elected a Member of the Society.—The following papers were then read:—The permanent and temporary effects on some of the physical properties of iron produced by raising the temperature to 100° C., by Mr. Herbert Tomlinson, B.A.—On some new measuring-instruments used in testing materials, by Prof. W. C. Unwin, F.R.S. In most measuring-instruments previously used, it has been considered sufficient to make the measurement of elongation from one side of the bar, but this, the Professor showed, was liable to serious errors owing to the fact that test-bars are not always perfectly straight, and to the possibility of originally straight bars being bent by improper fixing in the testing-machine. In such cases the modulus of elasticity calculated from the apparent elongations are subject to considerable error. In endeavouring to overcome these difficulties the author has devised several new forms of measuring-apparatus, which are attached to two sides of the bar by steel points, and the mean elongation of the two sides determined. The first apparatus described consists essentially of sliding calipers read by microscopes to 1/10,000 of an inch. Another form has two clamps provided with sensitive levels. Each is attached to the bar by two steel points, the line joining which is

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perpendicular to the direction of the stress, and the clamp can rotate in a vertical plane about this line as an axis. The lower clamp is levelled by a screw pressing against the surface of the bar, and the upper one by means of a micrometer-screw parallel to the axis of the bar, the nut of which is secured to the bottom clamp. By this means the elongation can be measured to 1/10,000 of an inch. In a third form two similar clamps without levels are kept apart by a steel rod ending in knife-edges. One of the clamps carries a small roller, which turns about an axis parallel to the line joining the steel points above mentioned, and the axis carries a small plane mirror. The other clamp supports a projecting arm parallel with the axis of the test-piece, and which presses on the surface of the roller. When the bar is elongated the mirror is turned through a small angle and the elongation is determined by a reading-telescope and vertical scale to 1/100,000 of an inch. A similar apparatus is used for testing the compression of stone, but in this the compression is multiplied by a lever and measured by a micrometer microscope to 1/100,000 of an inch.—At the conclusion of the meeting Prof. Unwin invited the members to visit the Engineering Laboratory of the City and Guilds of London Central Institution, where he broke a bar of Staffordshire iron in the 100-ton testing-machine, the force and elongation being automatically recorded.

Royal Meteorological Society, January 19.—Mr. W. Ellis, President, in the chair.—Mr. J. Willis Bund was elected a Fellow of the Society.—The following papers by the Hon. R. Abercromby, F.R.Met.Soc., were read:—(1) On the identity of cloud-forms all over the world, and on the general principles by which their indications must be read; (2) On the cloud to which the name "Roll-Cumulus" has been applied.—After the reading of these papers the annual general meeting was held, when the Report of the Council was read by Dr. Tripe, which showed the Society to be in a satisfactory condition. The number of Fellows is 524.—The President, Mr. W. Ellis, then delivered his address.—The Officers and Council for the ensuing year were elected:—President: William Ellis; Vice-Presidents: George Chatterton, Charles Harding, Cuthbert Edgar Peek, George Mathews Whipple; Treasurer: Henry Perigal; Trustees: Hon. Francis Albert Rollo Russell, Stephen William Silver; Secretaries: George James Symons, F.R.S., John William Tripe, M.D.; Foreign Secretary: Robert Henry Scott, F.R.S.; Council: Hon. Ralph Abercromby, Edmund Douglas Archibald, Francis Campbell Bayard, William Morris Beaufort, Arthur Brewin, Frederic William Cory, Henry Storks Eaton, Richard Inwards, Baldwin Latham, William Marcet, M.D., F.R.S., Edward Mawley, Charles Theodore Williams, M.D.

Entomological Society, January 19.—Mr. R. McLachlan, F.R.S., President, in the chair.—This was the fifty-fourth anniversary meeting.—An abstract of the Treasurer's accounts was read by Mr. Stainton, one of the auditors; and the Secretary read the Report of the Council.—The following gentlemen were elected as Officers and Council for 1887:—President: Dr. David Sharp; Treasurer: Mr. Edward Saunders; Secretaries, Mr. Herbert Goss and the Rev. W. W. Fowler; Librarian: Mr. Ferdinand Grut; and as other Members of the Council: Messrs. Robert McLachlan, Gervase Mathew, R.N., George T. Porritt, Edward B. Poulton, Osbert Salvin, F.R.S., Henry T. Stainton, F.R.S., Samuel Stevens, and J. Jenner Weir.—The retiring President delivered an address, and a vote of thanks to him was moved by Mr. E. B. Poulton, and seconded by Prof. Meldola, F.R.S.—A vote of thanks to the Treasurer, Secretaries, and Librarian was moved by Mr. McLachlan and seconded by Mr. Stainton; and Mr. Goss and Mr. Grut replied.

Middlesex Natural History and Science Society, January 18.—Dr. Archibald Geikie, F.R.S., in the chair.—Mr. Robert B. Hayward, F.R.S., read a paper on the water in the Chalk, beneath the London Clay, of the London Basin. The geology of the area in question was described, and the water in the beds above the Chalk briefly referred to. Mr. Hayward then drew attention to the great extent of the Chalk area, to the rainfall, and other atmospheric conditions affecting the water-supply, and gave detailed chemical analyses of the waters of a large number of wells in and near London, which draw their supplies from the Chalk. Those of Harrow and the north of London, being well known to the lecturer, received special attention. The water-levels were described and elucidated by Joseph Lucas's hydro-geological maps, and the movements of the underground waters fully treated of. A table of the above-mentioned chemical analyses was distributed to the members present. In the discussion which ensued, Dr. Geikie gave some interesting observations upon the probable origin of Harrow Hill, and the other hills of London Clay to the north of London, and was followed by Mr. Clement Reid, Mr. Mattieu Williams, and Mr. Klein.

PARIS

Academy of Sciences, January 24.—M. Gosselin, President, in the chair.—Fresh statistics of persons that have been treated at the Pasteur Institute after having been bitten by animals either mad or suspected of madness, by M. Vulpian. This report covers the whole period from October 1885 to December 31, 1886, the tabulated results showing 2682 subjects treated in the Institute, of whom only 31, or 1·15 per cent., succumbed.—On the direct fixation of the gaseous nitrogen of the atmosphere by vegetable soils, by M. Berthelot. The experiments are here described which the author carried on during the year 1886 at the Meudon establishment for agricultural chemistry. As a general result it appears that vegetable soil is incessantly fixing free atmospheric nitrogen, apart even from any vegetation properly so called. Nor can the phenomena be attributed to the exclusive action of rain-water, for it was shown that in some cases the rain carried off under the form of nitrates alone more nitrogen than it had contributed under the combined forms of ammonia and nitric acid. In a future paper the experiments will be described that have been carried on simultaneously on the same soil with the co-operation of plant life.—The mechanism of the flight of birds studied by chrono-photography, by M. Marey. This is a further application of the author's new chrono-photographic method, already so successfully applied by him to the study of human motion. The paper is provided with four illustrations, one of which shows fifty images per second of a bird on the wing. Measured by the metric scale, the distance traversed during one complete revolution of the wing was 1·37 metre, or 6·85 metres per second, and 24,660 metres per hour.—Solar observations for the second half of the year 1886, by M. P. Tacchini. The results, as here tabulated, show a progressive diminution of spots and faculæ, with a very marked minimum in November. The phenomenon of protuberances also shows a falling off, although not to the same extent as that of the spots. This result appears to be in harmony with the fact that the maximum of protuberances always occurs after the maximum of spots.—On surfaces whose isothermal lines are constituted by a family of circles, by M. Demartres.—On the theory of algebraic forms with p variables, by M. R. Perrin. It is shown that a form of order m with p variables possesses a pure covariant, distinct or reducible, of $2p-3$ degree and order $(2p-3)m-2p$.—On the action of the tetrachloride of carbon on chlorochromic acid and the phosphates of sesquioxide, by M. H. Quantin. To the reactions of the tetrachloride of carbon already described by M. Demarçay, the authors here add two others, dealing fully with that produced by making this substance act on the oxygenated salts. They describe the action that it exercises, without previous decomposition, on the neutral phosphate of the sesquioxide of iron. They hope by the dry method to be able to apply this reaction to the separation of minute quantities of phosphoric acid.—Preparation, properties, and constitution of inosite, by M. Maquenne. This substance, hitherto unavailable in sufficient quantities for the purpose of experiments, the author has succeeded in producing by a process here described, very rapidly and easily. The analysis of anhydrous inosite yields carbon 40·00, and hydrogen 6·66, and its formula, $C_6H_{12}O_6 + 2H_2O$, is shown to be correct.—On the separation of mono- and di-isobutylamine by means of oxalic acid, by M. H. Malbot.—On the preparation of a silicostannate of lime corresponding to sphene, by M. L. Bourgeois. The object of this paper is to show the possibility of preparing a silicostannate of lime, CaO,SiO_2,SnO_2, isomorphous with sphene, CaO,SiO_2,TiO_2. In solving the question, the author has employed the same method by which Hautefeuille obtained some fine specimens of the latter mineral.—Description of a lamellary thomsonite from Bishopton, Renfrewshire, by M. A. Lacroix. This specimen, picked up by the author in 1884, shows the same optical properties as the substance known as Stirlingshire gyrolite, and contains a considerable proportion of aluminium. At 13° C. the density is 2·34.—Note on a white epidote from Beagle Channel, Tierra del Fuego, by M. A. Lacroix. This specimen, brought back by

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Prof. Domenico Lovisato, of the Cagliari University, is remarkable for its richness in aluminium, and the highly oxidised state of the iron contained in it. Outwardly it strongly resembles zoisite, although its crystalline system and optical properties leave no doubt as to its true character.—On some peculiarities in the organisation of the Schizonemertians, by M. Remy Saint-Loup. The exact disposition of the cephalic fossettes is here determined by a comparative study of three types of these organisms.—On the colonial vascular system of the Tunicata, by M. F. Lahille. A careful study of this system leads the author to the conclusion that there is no valid reason for separating the Monascidians and Synacidians into two distinct orders of Tunicata.—On the cranial nerves of a human embryo thirty-two days old, by M. C. Phisalix. Balfour's theory, based on negative grounds, that the cranial nerves are disposed on a type absolutely different from the spinal nerves, seems disproved by the anatomical study of this subject.—Researches on the physiological action of methylal, by MM. A. Mairet and Combemale. These researches show that, in whatever way introduced into the system, methylal always produces the same hypnotic effects, but more rapidly by hypodermic than by pulmonary injection.—On the existence of submerged valleys in the Gulf of Genoa, by M. A. Issel. From the recent hydrographic surveys of Capt. J. B. Magnaghi, it appears that the valleys of the Bisagno, Polcevera, Quiliano, and other Ligurian streams are continued seawards by submarine valleys, which retain the same fluvial direction, and are perfectly distinct to a depth of at least 900 metres.—On the Artesian wells and new oases created in the Wed Rir', South Algeria, by M. G. Rolland. Since 1859, the French have sunk 117 wells in this region, creating five new oases, and increasing fivefold the value of the land. In the same period the population has been doubled, and many thousands of date-palms planted.

Berlin

Physical Society, December 3, 1886.—Prof. von Helmholtz in the chair.—Dr. König exhibited a von Kries colour-mixing apparatus, the third specimen of the kind hitherto turned out in the factory of Schmidt and Hänsch, and discussed in a searching manner the construction of this instrument. The instrument contained essentially two displaceable slits, the light of which was by a prism decomposed into two spectra falling on each other and producing the mixture of the colours. A second double slit, and a simple fifth slit allowed a comparison of the mixed colours and an admixture at pleasure of white light.—Dr. Weinstein reported on his deductions from observations of the earth's current in the telegraph lines of the German Empire. Among the results already elsewhere published of his calculations (*vide* NATURE, vol. xxxiii. p. 624) it may here be brought out that, apart from its disturbances, the earth's current showed a daily period with eight fluctuations, which, however, did not occur throughout the whole year, nor always in a similar direction. These fluctuations were least in the morning between five and seven o'clock. They were the cause that the statements respecting the daily maxima and minima differed so considerably among the different authors. The earth's current showed an intimate relation to the earth's magnetism, and especially to the declination. The speaker failed, however, to discover a relation in the earth's current to the period of the sun's rotation, although such a relation was asserted for the earth's magnetism. The latter, too, was a point which the speaker doubted, and that because he had been unable to confirm the relation, which was likewise affirmed, between the aurora and the sun's rotation. It was true he obtained an average period of about twenty-five days, but the minima amounted to twelve and the maxima to thirty-seven days, and between such extremes a mean was not allowable. For the earth's current likewise he found minima of twelve days and maxima of thirty-seven days, and this result appeared to him to conflict with the assumption of a connection between the earth's current and the sun's rotation. He conjectured that in the case of the earth's magnetism single values deviating too strongly from one another had been united into a mean. Be it further related that the intensity of the earth-current proved itself to be nearly proportional to the length of the lines. In the discussion following this address, Dr. Brix spoke of the earth plates which had been introduced in the lines used for measurements of the earth-currents, and which had hitherto proved so little disturbing that for the present the introduction of unpolarisable plates was desisted from.

Christiania

Society of Science, October 15, 1886.—Herr Schöyen announced that through experiments carried out during the summer he had succeeded in demonstrating that the parasite *Tylenchus hordei*, described by him, which in the district of Lom causes the remarkable disease on rye termed "krok," also attacks *Elymus arenarius*, whereby his opinion that the parasite was transmitted from the latter to the rye-fields has been confirmed. He further stated that he had received samples of rye affected with the same disease from Heligoland; here, too, it extended along the coast in the proximity of *Elymus arenarius*.

BOOKS AND PAMPHLETS RECEIVED

Die Klimate der Erde, 2 vols.: Dr. U. Woeifog (Kostenoble, Jena).—The Factors of Organic Evolution: H. Spencer (Williams and Norgate).—Beiblätter zu den Annalen der Physik und Chemie, 1886, No. 12 (Barth, Leipzig).—The Electrician's Directory (Tucker).—Outlines of Classification and Special Morphology of Plants: Dr. K. Gould (Clarendon Press).—Travels in the Wilds of Ecuador: A. Simson (Low).—Meteorological Observations at Stations of the Second Order, for the Year 1882.—Hourly Readings, 1883, part iv.—Resultate der Polarlicht Beobachtungen augestellt im Winter 1882 und 1883: Dr. K. R. Koch (Asher, Berlin).—Gold Fields of Victoria: Reports of the Mining Registrars for Quarter ended September 30, 1886 (Ferres, Melbourne).—Report on the Administration of the Meteorological Department of the Government of India in 1885-86.—An Explanatory Arithmetic, 3rd edition: G. E. Spickernell (Griffin, Portsmouth).—An Elementary Treatise on the Differential Calculus, 6th edition: B. Williamson (Longmans).—Celestial Motions, 5th edition: W. T. Lynn (Stanford).—Year-Book of Pharmacy (Churchills).—Catalogue of Canadian Plants, part 3, Apetalæ: J. Macoun (Dawson, Montreal).—Archives Italiennes de Biologie, tome viii. fasc. 1 (Loescher).—Aluminium: J. W. Richards (Low).—Examples of Exercises given in the National Philosophy Class of Glasgow University: M. Maclean (MacLehose, Glasgow).—Report on the Medusæ collected by the U.S. Fish Commission in 1883-84: G. W. Fewkes (Washington).—The Blue Hill Meteorological Observatory: A. L. Rotch (Boston).

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