fogs, and even rain. Hence the strong tensions of atmospheric electricity so frequently signalled from the New York Observatory some days before the arrival of storms and wet weather on the west coast of Europe. During thirty-six years of constant study, the author has recorded thousands of similar observations, which have been overlooked by physicists dazzled by theories opposed to the natural conditions.—Further remarks on the question whether electricity is developed during the condensation of aqueous vapour, by Prof. Costantino Rovelli. In reply to the statements of Prof. Magrini, the author points out that, although his own experiments may have their weak side, the prolonged and repeated observations of Prof. Palmieri cannot be refuted by merely negative proofs.

SOCIETIES AND ACADEMIES

LONDON

Physical Society, February 12.—Annual General Meeting.—Prof. B. Stewart, F.R.S., President, in the chair.—In opening the proceedings the President regretted that in their Report the Council have to record the loss of one who took a prominent part in the proceedings of the Society, the late Dr. Guthrie. It was, however, satisfactory to learn that the appeal of the Guthrie Memorial Committee, under the presidency of Prof. Huxley, had been generously responded to. The Council also learn with regret from Dr. E. Atkinson that owing to pressure of work he is unable to retain the office of Treasurer to the Society, and desire to express their thanks to him for his past services. Prof. Rücker has consented to be nominated for the office thus rendered vacant, and the Council believe that by his election the connection between the Society and the Normal School of Science (which is so desirable) will be maintained.—The Report of the Council for the year 1886 was read and received, and the following gentlemen were elected Members of the Council for the present year:—President: Dr. Balfour Stewart, F.R.S.; Vice-Presidents: Dr. E. Atkinson, Prof. W. E. Ayrton, F.R.S., Shelford Bidwell, F.R.S., Prof. H. McLeod, F.R.S.; Secretaries: Prof. A. W. Reinold, F.R.S., Walter Baily; Treasurer: Prof. A. W. Rücker, F.R.S.; Demonstrator: C. V. Boys; other Members of Council: R. H. M. Bosanquet, W. H. Coffin, Conrad W. Cooke, Prof. G. Forbes, Prof. F. Fuller, Prof. J. Perry, F.R.S., W. N. Shaw, Prof. S. P. Thompson, C. M. Whipple, C. R. Alder Wright, F R.S.—The President proposed the following resolution: "That at the end of Clause 11 of the By-laws, which says, 'Every candidate for admission into the Society shall be recommended by not less than three members, to two of whom he must be personally known,' there be added, 'When a candidate living abroad is a member of a recognised scientific Society, such membership may, subject to the approval of the Council, be held equivalent to the personal knowledge aforesaid.'" The resolution was carried, subject to confirmation by a special general meeting to be held on February 26.—A vote of thanks, proposed by Prof. Ayrton and seconded by Prof. McLeod, to the Lords of the Committee of Council on Education, for the use of the rooms and apparatus of the Normal School of Science, was passed unanimously.—The Hon. R. Abercromby proposed a vote of thanks to the officers of the past year for their gratuitous services, which was seconded by Prof. Pickering.—Sir Philip Magnus proposed a vote of thanks to the auditors, Colonel Festing and Prof. Fuller, which was seconded by Mr. Lecky, and passed unanimously.—Mr. J. Brown was elected a Member of the Society.—The following communication was then read:—Note on the tenacity of spun glass, by E. Gibson and R. E. Gregory. The authors have experimented on the tenacity of glass rods and fibres made from the same piece of glass. The fibres varied from 1/25 to 1/50 mm. and the rods from about ½ to 1 mm. in diameter. They find the tenacity per square centimetre of rods increases as the diameter decreases, as in ordinary wires, whereas with fibres this is not shown. Experiments were shown illustrating the method of working, and the highest tenacity recorded was for a fibre of ·0340 mm. diameter, which gave 466×10^7 dynes per square centimetre, a value about half as great as that for steel wires. The authors refer to Quincke's suggestion that the increased tenacity of small wires is due to surface-tension, and may be represented by $W = Ad + Bd^2$, where W is the breaking weight and d the diameter, but their own results with glass do not agree with this formula. Sir Philip Magnus asked if the diameters were measured at the point of rupture, if the elongation was determined, and whether the authors were able to suggest any other formula which would express their results. Mr. C. V. Boys remarked that the tenacity being so much affected by accidental circumstances, such as rate of cooling, no such formula could be expected. Prof. Rücker, referring to Quincke's experiments, said that the surface-tensions of metals calculated from them appear improbable. After some further remarks by the President, Prof. Ayrton, Mr. C. V. Boys, Prof. McLeod, and Mr. Gregory, the proceedings terminated.

Royal Meteorological Society, February 16.—Mr. W. Ellis, President, in the chair.—The adjourned discussion on the Hon. R. Abercromby's paper on the identity of cloud forms all over the world, and on the general principles by which their indications must be read, was resumed; and the following papers were read:—Remarks concerning the nomenclature of clouds for ordinary use, by Prof. H. H. Hildebrandsson; and Suggestions for an international nomenclature of clouds, by by the Hon. R. Abercromby. Both Prof. Hildebrandsson and Mr. Abercromby have paid great attention to the question of the forms of clouds, and having recently conferred together, they have agreed to recommend for international use the following ten principal varieties, viz.:—High-level clouds: cirrus, cirro-stratus, cirro-cumulus; middle-level: strato-cirrus, cumulo-cirrus; and low-level: cumulus, stratus, strato-cumulus, nimbus, cumulo-nimbus.—The influence of weather on the proportion of carbonic acid in the air of plains and mountains, by Dr. W. Marcet, F.R.S., and M. A. Landriset. The authors give an account of some experiments which they have made on the proportion of carbonic acid in the air at Geneva and on the summit of the "Dole," the highest point of the Jura chain, the difference in altitude being 4193 feet. The results of these experiments show: (1) that in fine clear weather on a mountain chain of moderate Alpine altitude, and in the adjoining valley or plain, the atmosphere holds the same mean proportion of carbonic acid at both places; and (2) that when the summit of a mountain chain is in a fog, a circumstance which frequently happens in an Alpine district, the air in the fog contains a smaller proportion of carbonic acid than it would hold in fine clear weather.—The Secretary, Dr. Tripe, read a letter received from Sir F. Abel, Organising Secretary to the proposed Imperial Institute, inviting the Society to draw the attention of the Fellows to the undertaking, with the view of their contributing towards it. The President stated that copies of the letter and of the accompanying paper, explanatory of the scheme, would be forwarded to each Fellow.

Mathematical Society, February 10.—Sir James Cockle, F.R.S., President, in the chair.—The following communications were made:—On the equation of Riccati, by the President (Prof. Hart, Vice-President, taking the chair).—The orthocentroidal circle (*i.e.* the circle whose diameter is the join of the orthocentre and centroid), by R. Tucker.—On polygons inscribed in a quadric and circumscribed about two confocal quadrics, by R. A. Roberts.—On the binomial equation $x^p - 1 = 0$; quinquisection, by Prof. Tanner.—Symmetrical determinant-formulæ in elliptic functions, by L. J. Rogers.—Notes on curves, by H. M. Taylor.—Some generalisations of differential formulæ connected with the change of the independent variable in a differential expression, with application to a new class of reciprocants, by C. Leudesdorf.

Geological Society, February 9.—Prof. J. W. Judd, F.R.S., President, in the chair.—The following communications were read:—Evidence of glacial action in the Carboniferous and Hawkesbury series, New South Wales, by T. W. Edgworth David.—The terraces of Rotomahana, New Zealand, by Josiah Martin.—The eruption of Mount Tarawera, by Capt. F. W. Hutton. The paper began with a description of the country in which the eruption took place. From Tongariro to White Island, in the Bay of Plenty, a distance of 130 miles, there extends a belt, 20 or 30 miles wide, abounding in solfataras, geysers, hot springs, &c., and composed of volcanic rocks, chiefly rhyolite, with some augite-andesite. About the middle of this belt lie the mountain and lake of Tarawera, and two or three miles further south Lake Rotomahana, the spot where the famous Pink and White Terraces existed. Before the recent eruption there were no craters on Mount Tarawera, the form of which was a ridge, apparently due to denudation. Having described the eruption, Capt. Hutton briefly noticed the results of the eruption in the form of fissures on Mount Tarawera, the change of Rotomahana from a lake to a crater of larger dimensions,

with precipitous walls, the formation of a new lake between this crater and Tarawera, and the formation of a number of small craters about Okaro. The materials ejected were composed of augite-andesite, and rhyolites, both compact and vesicular. The mineral structure and distribution over the surrounding country of various forms of pumice, scoria, and ash were described, and it was shown that there was a difference in the substances ejected from the mountain craters of Tarawera and those from the craters in the plain at Rotomahana and Okaro, the former comprising pumice and scoria, which were not thrown out from the latter, and but little steam issuing from the higher craters when compared with the enormous volumes emitted from the lower vents. The eruption was ascribed to the reheating of old lava-streams saturated with water. This reheating was apparently not due to crushing—for, had it been so, the preceding earthquakes would have been more violent—but probably to molten rock coming up from below and heating the rocks near the surface. The eruptions from Rotomahana and Okaro were purely hydrothermal.

Chemical Society, February 3.—Dr. Hugo Müller, F.R.S., President, in the chair.—The following papers were read:—The absorption of gases by carbon, by Charles J. Baker.—An explanation of the laws which govern substitution in the case of benzenoid compounds, by Henry E. Armstrong. Certain mono-derivatives of benzene, especially those containing a hydrocarbon radicle, one of the halogens, hydroxyl or amidogen, yield a mixture of the para- and ortho-di-derivatives in proportions which vary both according to the nature of the compound dealt with and of the reagent, and the conditions under which the change is effected; and if produced at all, the meta-derivative is formed in but a small proportion. If, however, the radicle present in the mono-derivative be—

$$NO_2,\ COH,\ CO_2H,\ SO_3H,$$

the meta-di-derivative appears invariably to be the chief product. Hitherto no explanation of this difference in the behaviour of the two series of mono-derivatives has even been suggested. In seeking to arrive at an explanation it is necessary to form a clear conception of the manner in which "substitution" is effected. The author is of opinion that in the first instance an additive compound is formed; and he points out that Kekulé has long since insisted in the plainest terms on this interpretation of those cases of change which are commonly spoken of as "double decompositions." He is inclined to believe that the tendency of negative to attract and combine with negative elements—to which he has of late frequently directed attention—is the effective cause; and that the additive compound is formed from those mono-derivatives which obey the "para-ortho law" by the fixation of the reacting molecule upon the carbon-atom which carries the radicle; separation of water or halogen hydride ensuing thereon, the radicle of the reacting molecule assumes the place either of an ortho- or of a para-hydrogen atom. It is easy to understand the formation of the ortho-di-derivative, as the hydrogen-atom displaced is associated with a carbon-atom contiguous to that to which the reacting molecule attaches itself. The formation of the para-compound is attributed by the author to the tendency towards symmetry, so frequently evidenced in cases of isomeric change and in other ways by benzenoid compounds; and not to the existence of any direct connection between carbon-atoms relatively in the para-position. The formation of meta-derivatives is believed by the author to result from the addition of the reacting molecule, not to the carbon-atom of the benzene-ring, but *to the radicle* which in the mono-derivative is attached to one of the carbon-atoms of the ring; he is, however, of opinion that in order to explain why the additive compound thus constituted yields a meta-di-derivative, it will be necessary to obtain further information regarding the "dynamics" of such changes.—Some derivatives of tetramethylene, by G. H. Calman and Dr. W. H. Perkin, Jun.—Derivatives of pentamethylene, by Dr. W. H. Perkin, Jun.—The decomposition of potassium chlorate and perchlorate by heat, by Dr. Percy F. Frankland and John Dingwall.—The action of chlorine on methyl thiocyanate, by Dr. J. William James.

PARIS

Academy of Sciences, February 14.—M. Gosselin, President, in the chair.—On waterspouts and M. Ch. Weyher's recent experiments, by M. Faye. While fully appreciating M. Weyher's novel and interesting essays, the author makes certain reservations, especially as regards the term *trombe marine* ("waterspout") applied by him to one of the results. This, he submits, was not a true waterspout, but only a rotatory movement of a volume of air without any defined limits, and with aspiration towards the axis of the ventilator. But a true waterspout is characterised by a cylindro-conical funnel sharply outlined, descending from the clouds to the ground or to the surface of the sea, without exercising on it any perceptible aspiration.—Note on MM. Paul and Prosper Henry's photograph of the nebula No. 1180 of Herschel's general catalogue, by M. Mouchez. During their photographic operations on Orion on January 27, MM. Henry obtained an image of a nebula of 3′ to 4′ diameter with stars of the 17th magnitude, invisible to the observer with the equatorial of the East Tower. This nebula, which has also since been photographed by Roberts in England, has now been identified with that discovered at the Cape by Herschel, and by him indicated with the number 1180 in his catalogue.—Reply to M. Houzeau's recent note on a method to determine the constant of aberration, by M. Lœwy. It is shown that M. Houzeau's method of determining the constant from the differences in right ascension or in declination as measured at dfferent epochs, is liable to the most serious errors. In virtue of the diurnal movement, the two images are displaced in the field of the telescope at different rates of velocity and in any direction, their relative position changes from instant to instant, and under the given conditions cannot be accurately defined.—On a sandstone of organic origin discovered in the coal-fields of the Loire basin, by MM. Favarcq and Grand'Eury. Notwithstanding their chemical composition these remarkable deposits belong evidently to fresh-water organisms, which cannot at present be further identified. They abound especially in the Rive-de-Gier and Saint-Etienne districts.—The inauguration of railways in France: its true date, by M. Léon Aucoc. It is pointed out that the proposed celebration in 1887 of the fiftieth anniversary of this event rests on an historical error. The first line actually completed was that between Saint-Etienne and Andrezieux, 23 kilometres long, opened on October 1, 1828; that is, nine years before the assumed date 1837.—Remarks on the palæontological researches made in the Lower Tertiary deposits in the neighbourhood of Rheims, by M. V. Lemoine. The author gives the general results of his investigations carried on uninterruptedly for the last fifteen years, and constituting the Rheims district one of the points where the beginning of Tertiary life may be best studied in Europe. The fossil vertebrates alone studied by him now number 94, of which not more than 8 or 10 were previously known. Amongst them are 40 mammals belonging to 23 different genera, of which 8 only had hitherto been observed in later Tertiary beds.—On the mode of formation of the striated Bilobites, by M. Ed. Bureau. The author has obtained plaster casts of most of these Bilobites, from a careful study of which he concludes that they must represent imprints of animals on the sands of shallow Silurian waters.—Combined action of belladonna and opium in a case of acute diabetes, by M. Villemin. After the usual remedies had failed, this treatment was lately tried in an extreme case of diabetes at the Val-de-Grâce Hospital, with complete success.—Determination of the position of the shaft corresponding to a given position of the piston in a steam-engine, by M. H. Léauté. Two remarkably simple graphic constructions designed in 1869 by M. Marcel Deprez are described, by means of which the position of the shaft for each position of the piston may be determined with sufficient accuracy, when the length-ratio of connecting-rod and shaft is greater than 3.—On the application of photography to M. Lœwy's new methods of determining the elements of refraction and aberration, by M. Ch. Trépied. An inquiry is here made into the conditions and means by which M. Lœwy's new and effective method of photographic registration might be utilised in determining the elements of astronomic refraction.—Observations of Barnard's and Brooks's comets made with the 0·38 m. equatorial, Bordeaux Observatory, by MM. G. Rayet and Courty.—On surfaces where the difference of the chief radii of curvature is constant at each point, by M. R. Lipschitz.—On a certain class of recurrent sequences, by M. Maurice d'Ocagne.—On the specific heats of liquids, by M. Marcellin Langlois. By the process here described the author determines the specific heats of water, sulphuret of carbon, chloroform, chloride of carbon, ether, alcohol, and acetone.—Researches on the specific inducting power of liquids, by M. Negreano. The author determines the dielectric constants of a series of homologous and liquid carburets of hydrogen for the purpose of

comparing the dielectric constants with the molecular weights and densities. He also determines the index of refraction of these different liquids with a view to the verification of Maxwell's law.—On the variable period of the current in an electro-magnetic system, by M. R. Arnoux.—Physical researches on the isomery of position, by M. Alb. Colson. Having succeeded in transforming orthoxylene and metaxylene into alcohols, glycols, ethers, &c., isomerous with the known compounds of paraxylene, the author here inquires whether bodies so closely related in their chemical properties may not also be connected by some physical relations. The best results have been obtained by the calorimetric process.—Action of the oxide of mercury on some dissolved chlorides, by M. G. André. In this preliminary paper the author deals with the chlorides of barium, calcium, strontium, and magnesium.—On the action of hydrochloric acid on the solubility of the chlorides, by M. R. Engel. His further studies enable the author to generalise the law already announced by him in the *Comptes rendus* for March 1886.—A new process of analysing the carbonic acid emitted, and the oxygen inhaled, in the act of breathing, by MM. M. Hanriot and Ch. Richet. The differential method here described as applicable, with some modifications, to the analysis of various gaseous mixtures, constitutes a simple and rigorous method for the quantitative analysis of those of respiration.—The formic salts, by MM. Gréhant and Quinquaud. The authors here discuss the question as to what becomes of the formic salts introduced into the system, and find that the formiate of soda injected into the digestive organs or into the blood mostly passes unchanged into the urine.—On the properties of colchicine, by MM. A. Mairet and Combemale. Their experiments on dogs and cats satisfy the authors that this substance is an irritant poison which attacks all the organs, but especially the digestive tube and the region of the kidneys.—On the effects of the transfusion of blood into the head of decapitated animals and men, by M. J. V. Laborde. The author refers to his numerous experiments on this subject, which were overlooked in the paper recently presented to the Academy by MM. Hayem and Barrier.—On the comparative morphology of the brain in insects and crustaceans, by M. H. Viallanes.—The males of *Lecanium hesperidum* and the question of parthenogenesis, by M. R. Moniez.—On the zoological researches carried out during the second scientific expedition of the *Hirondelle*, in 1886, by Prince Albert of Monaco.

BERLIN

Physical Society, January 7.—Prof. von Helmholtz in the chair.—Dr. R. von Helmholtz developed theoretically the formulæ expressing the relations subsisting between vapour-pressure, the melting-point, pressure, and volume, and enabling the vapour-pressures in the fluid and solid state, or the freezing-points and the change of the melting-point with that of the pressure, to be calculated.—Dr. Thiesen, while engaged in working experiments instituted by Schellbach respecting the resistance of air, had found an expression for the force of resistance in accordance with which a medium with less interior friction must necessarily offer a greater resistance than did a medium with more friction. This induced him to carry out experiments of his own with cylindrical rods regarding the resistance of air. On a hardened steel point a brass cylinder open at the bottom and bearing at its lower end externally two conjoined pieces, into which the steel rods 1 metre long and 1 English inch thick could be inserted horizontally and diametrically opposite to one another, was able to rotate. By means of a cord circulation, the cylinder was set rotating, and the abatement of speed consequent on the resistance of the air was noted by each half-revolution being marked electrically. These experiments yielded the same formula for the resistance as had been obtained from the earlier experiments. Another important result was that the method employed for the measurement of the resistance of air had maintained its validity remarkably well. In the discussion following this address, Prof. von Helmholtz took part. He called attention to the formation of whirling surfaces and whirls on the rotating bodies, a matter which in a high degree complicated the phenomenon.—Dr. Thiesen made a further communication respecting the determination of the national standard kilogramme. The cylinders of platinum-iridium, weighing rather more than 1 kilogramme, which were cast in London, were tested in respect of their density, and so often as fissures were detected they were re-cast. They were thereafter polished and again tested. Forty-two such standards were next compared with one another, and their uniformity and non-liability to be affected by transport having been ascertained, they had then to be compared with the kilogramme of the Archives, and after examination by the International Commission were despatched to the different Governments.

BOOKS AND PAMPHLETS RECEIVED

Histoire des Sciences Mathématiques et Physiques, vol. x. : M. Marie (Gauthier-Villars, Paris).—Proceedings of the Linnean Society of New South Wales, 2nd series, vol. i. part 3 (Cunninghame, Sydney).—Nomenclature of Color for Naturalists: R. Ridgway (Little, Brown, and Co.).—Bulletin of the Philosophical Society of Washington, vol. ix. (Washington).—Hourly Readings, 1884, part 2, April to June (Eyre and Spottiswoode).—The Origin of the Fittest: E. D. Cope (Macmillan).—Geographical and Geological Distribution of Animals: A. Heilprin (K. Paul).—Hints for the Solution of Problems of Solid Geometry: P. Frost (Macmillan).—Levelling and its General Application: T. Holloway (Spon).—Observations Météorologiques de Godthaab: A. F. W. Paulsen (Gad, Copenhague).—*Challenger* Expedition Reports—Zoology, vol. xvii.; Botany, vol. ii.—Philosophische Studien, Vierter Band, 1 Heft (Engelmann, Leipzig).—Encyklopædie der Naturwissenschaften, Erste Abth., 50 Lief.; Zweite Abth. 39, 40, 41 Lief. (Trewendt, Breslau).—City Government of Boston, Mass.: J. M. Bugbee (Baltimore).—Annual Address to the Asiatic Society, Calcutta, February 2, 1887: E. T. Atkinson.—Halifax, Annual Report of Public Library Committee, 1885-86.—Beiblätter zu den Annalen der Physik und Chemie, Band x. (Barth, Leipzig).

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