SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, November 10.—Ordinary meeting held in the Physical Laboratory of the Central Technical College (by invitation of Prof. Ayrton).—Prof. Lodge, F.R.S., President, in the chair.—Mr. F. S. Spiers read a paper on contact electricity. The object of the paper was to determine, in a more satisfactory manner than has hitherto been attempted, the part played by the medium in the potential difference which arises when two dissimilar metals are put in contact. The first experiments were made with a piece of apparatus used by Profs. Ayrton and Perry about twenty years ago. This apparatus, in which the metals in contact are capable of a rotation of 180° about a vertical axis, and are placed between two vertical inductors connected to a quadrant electrometer, was afterwards considerably improved, and the compensation arrangement of Lord Kelvin was introduced so as to measure the potential differences by a null method. The metals first used were platinum and zinc, but on account of the low melting point of the latter metal it was replaced by aluminium. In order to try and remove the air sheets which cling to the surfaces of the metals, the tube was repeatedly heated and exhausted. The potential difference between the plates was found to gradually fall as this was done. It was proved that this was due to the oxidation of the aluminium, for on cleaning its surface the original effect was again obtained. Attempts were then made to remove the oxygen by displacing it with hydrogen; but after four washings with pure dry gas and at low pressures there was still enough oxygen left to completely oxidise the aluminium. The oxide of aluminium is not decomposed by hydrogen at a bright red heat. It was therefore decided to substitute iron and burn out the oxygen with hydrogen by encasing the lower part of the apparatus in a copper tube, and heating to bright redness with a blowpipe flame. By this means the value of the Volta effect between iron and platinum in an atmosphere of hydrogen was found to be 0·6 of a volt, the platinum being positive to the iron. This result is different both in magnitude and sign to that obtained when air is the medium. The Chairman said he had given the subject of contact electricity some attention during the last fifteen years, and the author had performed a valuable series of experiments which he should have liked to have seen done several years ago. He had always felt that a vacuum would never get rid of the condensed air films. The burning-out process used had provided the most trustworthy results upon the subject. Dr. Lehfeldt pointed out that the action of hydrogen upon ferric oxide was a limited one, and that it was impossible to bring about complete deoxidisation in that manner. At a dull red heat the ratio between the water vapour and oxygen present is about 20 to 1. Prof. Perry expressed his interest in the experiments, but said that they had not affected his opinion upon the nature of the Volta effect. Prof. Armstrong said he was not wholly satisfied with the results, although a substantial approach to a solution had been made. The author had fully realised the difficulties of the experiments, but he had treated the matter as a surface gas effect, and had not guarded against moisture. Gases must be both dirty and moist before chemical action can take place, and we cannot expect to arrive at a solution of the problem until we have removed not only oxygen but dirt and moisture. It is impossible to completely exhaust the apparatus, and a number of molecules must always be left which is more than necessary to produce the Volta effect. Moisture can never be got rid of by exhaustion. The method of Dewar of using liquid oxygen or liquid hydrogen would get rid of gases and water vapour, and in this manner it would be possible to perform experiments which could be regarded as final. If the effect disappeared at low temperatures it might be urged that the temperature was too low for it to be produced. The author must have been dealing with combination effects, for it had been proved that hydrogen alloyed both with platinum and iron at a dull red heat. Mr. Cooper said he would like to see the experiments repeated after precautions had been taken to remove nitrogen from the apparatus. Prof. S. P. Thompson said he had recently taken part in a discussion upon the subject with some earnest followers of the old contact theory. They uphold that the property of metals which determines the potential difference when two are put in contact is as fixed and definite as other physical properties, such as density, and that the potential difference observed in air is approximately the same as the true potential difference. It has been agreed to call the former the apparent potential difference. Prof. Thompson said that according to Pellat the real Volta effect was near to the effect observed in air. In circuits formed of metals there are other electromotive forces of the order of a millionth of a volt. The chemical electromotive forces in a circuit are of the order of a volt. The value of the Volta effect derived from thermodynamical considerations concerning the Peltier effect is much smaller than observed chemical potential differences. If, however, we take into account not only the Peltier effect but also the Thomson effect, we will have other terms entering into the equations which may tend to give a value more nearly equal to a volt. Prof. Thompson said that in observing chemical E.M.F.s the Peltier effects did not come into the question because of their smallness compared with the value of the chemical effect. Prof. Perry pointed out that the Peltier effect was not distinct from the Volta effect, but was simply the differential coefficient of it. The Chairman said that if a circuit containing Peltier effects were treated thermodynamically as if it were a reversible heat engine, we could arrive at an equation connecting the value of the Peltier effects with the rate of change of the whole electromotive force in the circuit with temperature. The electromotive force which changed was not necessarily the Volta effect. Prof. Perry said he thought it was. Prof. Ayrton suggested that an advance might be made in the theoretical side of the question if the Chairman were to put in writing his objections to the statement that the E.M.F. concerned was the true Volta effect. The extent of the Peltier effect proves the variation of the Volta effect with temperature; but because it is small it does not necessarily follow that the Volta effect is small. Where the Volta effect is a maximum or a minimum the Peltier effect vanishes. The experimental work of the paper did not go far enough to convince him of the nature of contact electricity. Before we can hope to prove anything with respect to the two theories, we must be able to get a cyclic change of events; that is to say, we must be able to change our surfaces and media in a perfectly definite manner so as to be able at any time to return to the particular state from which we started. Prof. Everett said that as the variation in the potential difference between two metals in a medium was probably due to slow chemical action which caused the metals to become less and less susceptible, he should expect that changing backwards and forwards from one medium to another would give to the potential difference an oscillatory variation gradually becoming smaller and smaller. The Chairman said he would like to see experiments showing a cyclic effect similar to that mentioned by Prof. Ayrton. The difficulty in these experiments is to avoid chemical action. Chemical action is not necessary to get the Volta effect. The effect would be greatest in dry gas. Moisture tends to reduce the effect, and that is why its presence is unimportant. Prof. Callendar expressed his interest in the surface character of the effect and its independence of the manner in which the plates were touched. Dr. Stansfield suggested gold as a suitable metal to be experimented on because of its non-oxidisability. Mr. Spiers, in replying, referred to Dr. Lehfeldt's assertion that the whole of the oxygen cannot be removed by hydrogen. In his experiments, however, there was very little ferric oxide and a large quantity of hydrogen, and although it was possible that all the oxide was not reduced, still a large portion of it was. The experiments were to be carried on, and attempts would be made to get a cyclic effect.—A paper on the heat of formation of alloys was postponed until the next meeting.

MANCHESTER.

Literary and Philosophical Society, October 31.—Prof. Horace Lamb, F.R.S., President, in the chair.—Dr. Broadbent introduced the subject of the well at Giggleswick, known for the ebb and flow of its water, and asked whether an explanation of what is known locally as the "silver thread" could be offered by any member. The well consists of a stone cistern, at the top and back of which the water enters from the Giggleswick Scars, there being two small outlets about half-way down each side of the tank and opposite each other. Under certain conditions there appears extending through the water, from one outlet to the other, a thread apparently formed of air. Prof. O. Reynolds suggested that the phenomenon might be explained by the inflow producing a circulation of the water having its vortex parallel between the two outlets, the reduction of pressure thus permitting a passage of air from one orifice to the other.—Mr. J. Cosmo Melvill communicated a paper by Mr. Peter

Cameron, entitled "Hymenoptera Orientalia; or, contributions to a knowledge of the Hymenoptera of the Oriental zoological region. Part ix. The Hymenoptera of the Khasia Hills. Second paper."—A paper "On the question of Irish influence on early Icelandic literature, as illustrated by the Irish MSS. in the Bodleian Library," was read by Miss Winifred Faraday (communicated by Mr. F. J. Faraday).

PARIS.

Academy of Sciences, November 6.—M. van Tieghem in the chair.—Researches on the diamines: piperazine, by M. Berthelot. The heats of solution of anhydrous diethylenediamine and its hydrate are given; and also the heats of combustion and formation, and of neutralisation with hydrochloric acid.—On some characters of the diamines deduced from their neutralisation, by M. Berthelot.—Preparation and estimation of glycogen, by M. Armand Gautier. The author had observed that when a slight excess of mercuric acetate is added to an animal or vegetable extract, dilute potassium carbonate solution being added at the same time to keep the liquid neutral, the nitrogenous bodies are nearly wholly precipitated. Liver or muscle is treated with boiling water, and the liquid pressed out on cloth. The neutralised liquid is concentrated by rapid boiling to half its bulk. The exact quantity of mercury solution is then added, the precipitate separated by a centrifugal machine. The clear liquid is acidified with acetic acid and poured into alcohol, when crude glycogen is precipitated. The method is a quantitative one, 1000 grams of fresh human liver giving 20·5 grams of glycogen, and of rabbit's liver 14·0 grams. Glycogen is apparently dissolved by water, but filtration through porcelain shows that the glycogen is not really dissolved, as the whole of the sugar is found on the outside of the filter, pure water only passing through. Its copper reducing power is slightly less than that of anhydrous glucose (97·8 : 100).—On the theory of the hydraulic brake in guns, by M. Vallier.—On the mass of the cubic decimetre of water, by MM. Ch. Fabry, J. Macé de Lepinay and A. Pérot. The authors have shown in previous papers how to measure the dimensions of a quartz cube in terms of a wave-length of light as a unit of length, and now give a method for obtaining, by a photograph of the fringes, the exact deviations of opposite faces from parallelism. These curves, together with the absolute thickness at one point, give the mean thickness corresponding to the pair of faces considered. The results of measurement of the mass of water at 4° C. displaced by this cube show that the mass of 1000 c.c. at 4° is 21·4 mgr. less than 1 kilogram, showing a remarkable agreement with an unpublished result of M. Chappuis (1 kgr. − 24 mgr.) obtained by a different method.—Microphonic registration of the beat of chronometers, by M. Alphonse Berget. The apparatus described, consisting of a small Hughes microphone working a relay, gave clear curves very easily read. The method has the advantage of suppressing the personal error in reading the chronometer, and also renders it possible to apply the method of coincidences with great accuracy to the comparison of a chronometer and a pendulum. It is also possible in this way to make one chronometer govern several pendulum clocks.—On the radio-activity induced by the Becquerel rays, by M. P. Curie and Mme. M. P. Curie. A disc of an inactive substance, placed immediately over a radio-active substance (polonium or radium), acquires the property of emitting Becquerel rays, and rendering air capable of conducting. The activity so induced increases with the time of exposure to the radium, but tends to a limit. Discs of various substances were tried—zinc, aluminium, brass, lead, platinum, bismuth, nickel, paper, barium carbonate, bismuth sulphide—but the effects produced were all of the same magnitude. Experiments were made showing that these results cannot be explained by the assumption of an actual transference of the radio-active material, either as powder or vapour, but that there really exists an induced radio-activity.—Remarks by M. Becquerel on the preceding paper.—On the spectrum of radium, by M. Eug. Demarçay. As the barium chloride gained in radio-activity new rays appeared in the spectrum, which it would appear reasonable to attribute to the radiating element. In the latest specimens prepared by M. and Mme. Curie, besides the spectra of barium, platinum, lead and calcium, were fifteen new lines, the most marked being one $\lambda = 3814{\cdot}7$, 4683·0, and a nebulous band having $\lambda = 4627{\cdot}4$ as a centre.—Electrical reproduction of Savart's figures, obtained by the aid of liquid layers, by M. P. de Heen.—Transformation of styrolene into metastyrolene under the influence of light, by M. Georges Lemoine. A quantitative study of this isomeric change, including the effect of the thickness of liquid layer, nature of the radiations, temperature.—On molybdenum dioxide, by M. Marcel Guichard. Pure MoO_2 can be prepared in several ways, by the action of molybdic anhydride upon ammonium molybdate, by heating ammonium molybdate alone, or by the electrolysis of fused molybdic anhydride, in all cases the final purification from unchanged molybdic anhydride being effected by washing with 10 per cent. soda solution, which gives much better results than the ammonia solution used by previous workers.—On rhamninose, by MM. Charles and Georges Tanret. Xanthorhaminose, which on hydrolysis gives ultimately rhametine, rhamnose and galactose, by careful treatment with very dilute sulphuric acid gives an intermediate sugar, rhamninose, besides galactose and rhamnose. The ferment rhamnose gives better yields of the new sugar, whose composition is $C_{18}H_{32}.O_{14}$, its hydrolysis being represented by the equation

$$C_{18}H_{32}O_{114} + 2H_2O = 2C_6H_{12}O_5(\text{rhamnose}) + C_6H_{12}O_6(\text{galactose}).$$

Rhamninose is lævorotatory, $[\alpha]_D = -41°$, and melts with some decomposition at 140°. Its reducing power is one third that of glucose, and it is not fermentable by yeast. With sodium amalgam it gives rhamninite, $C_{18}H_{34}.O_{14}$, from which dulcite and rhamnose are obtained by hydrolysis. Galactonic and mucic acids are produced on oxidation by nitric acid.—Researches on the progressive development of essence of bergamot, by M. Eugène Charabot.—On a new disease of carnations, by M. Louis Mangin.—On the actual state of the volcanoes of Southern Europe, by M. Matteucci.—On the innervation of the pancreas, by MM. E. Wertheimer and L. Lepage.

AMSTERDAM.

Royal Academy of Sciences, September 30.—Prof. Van de Sande Bakhuyzen in the chair.—Prof. Beyerinck, on the production of indigo from woad (*Tsatis tinctoria*). The generally accepted opinion that woad contains the glucoside indican is erroneous. The chromogene, present in all growing parts of this plant, is indoxyl C_8H_7NO in the free state. *Polygonum tinctorium* and *Indigofera leptostachya* on the other hand contain indican, which can be split up into indoxyl and sugar by a peculiar enzyme, present in the species, but absent in the woad, by certain bacteria and yeasts and by boiling with acids. The woad, as an "indoxyl plant," when exposed to the vapour of ammonia in a confined atmosphere, at once produces indigo blue, whereas *Indigofera leptost.* and *Polyg. tinct.* as "indican plants" do not become blue by the action of ammonia, the indigo enzyme being destroyed by it. "Indican plants" can, however, be converted into dead "indoxyl plants" when slowly killed by the exclusion of air, which is best performed by complete submersion in mercury. If then exposed to alkaline vapour and extracted with alcohol, which dissolves the chlorophyll pigment, they become dark blue. Indigo plants do not contain a peculiar oxydase, but produce some alkali when slowly dying in the air.—Prof. Bakhuis Roozeboom communicated the results of an inquiry, made by Dr. W. Reinders, concerning the mixture crystals of HgI_2 with $HgBr_2$. The melted mixtures of these substances solidfy into a continuous series of rhombic mixture crystals. No chemical combination takes place. The temperatures of solidification show a minimum at 59 per cent. Mol. $Hg.Br_2$. Below 127° the mixture crystals change from rhombic yellow ones into tetragonal red ones. Moreover, the transition temperature varies within a transition interval, which has been studied down to 0° partly in the optical way, partly through crystallisation of the mixture crystals out of solutions. With due allowance for the composition of the two kinds of coexisting mixture crystals, the fall of the conversion temperature is in accordance with the laws of diluted solutions. Prof. Bakhuis Roozeboom also presented, on behalf of Dr. Ernst Cohen and Dr. C. van Eyk, a paper entitled "The enantiotropy of tin (II.)."—Prof. Lobry de Bruyn presented, on behalf of Mr. H. Bijl and himself, a paper on isodialdane, a substance analogous with cane sugar. (These communications will be inserted in the *Proceedings.*)—The following were further presented for publication in the *Proceedings*: (*a*) by Prof. Bakhuis Roozeboom, on behalf of Dr. Ernst Cohen, a paper entitled, "On a new kind of transition elements (sixth kind)"; (*b*) by Prof. Kamerlingh Onnes, on methods and apparatus employed in the cryogen laboratory," and (1) on behalf of Mr. Fritz Hasenoehrl, "Die Dielektricitäts constante von verflüssigtem

Stickoxydul und Sauerstoff"; (2) on behalf of Dr. W. van Bemmelen, a paper on spasms in the earth's magnetic force. Dr. Van der Stok, correspondent of the Section, showed some seismograms and magnetograms illustrating Mr. Van Bemmelen's paper. Magnetical curves, obtained by means of a self-registering instrument, exhibit oscillations of the same kind as those observed on photographic lines produced by seismographs of various patterns, which oscillations are known as earthquake motions, pulsations and tremors. Seismographs have been in actual use for a few years only, while magnetical curves have been known for a period of about twenty years; the latter may, therefore, be considered more sufficient data for an investigation into these oscillations by statistical methods than the former. Dr. Van Bemmelen has investigated those movements of short duration, which he calls "spasms," and also the oscillations of a well-defined zigzaggy description and longer duration, viz. pulsations. In both phenomena the author has found well-marked diurnal and annual variations, but no connection between their frequency and cosmical causes can be traced. Dr. Van Bemmelen has also tried to investigate these movements by means of a very sensitive bifilar, which inquiry takes a great deal of time and trouble, because it is not possible to make this instrument self-registering, owing to the enlarged time scale and the lack of sensitiveness of the photographic paper. This inquiry by ocular observation has hitherto not yielded any definite results.—(*c*) By Prof Hubrecht, on behalf of Dr. J. F. van Bemmelen, a paper entitled "Results of a comparative inquiry into the palatine orbital and the temporal region of the skull of the monotremata."—(*d*) By Prof. V. A. Julius, on behalf of Dr. A. Smits, a paper entitled "On decreases in the tension of solution vapours at 0°." The previous experiments with the micromanometer on solutions of NaCl, KOH and sugar were repeated, and it was again found that the molecular decrease of vapour tension increased with the concentration. The inquiry was then extended to H_2SO_4, $CuSO_4$ and KNO_3. In the case of H_2SO_4 and $CuSO_4$ the molecular decrease of vapour tension increased with the concentration; while, on the contrary, in the case of KNO_3 the decrease of vapour tension became smaller on the concentration becoming greater.—(*e*) By Prof. Cardinaal, on behalf of Mr. K. Bes, a communication concerning the formation of the ultimate equation.—(*f*) By Prof. Zaayer, on behalf of Prof. W. Einthoven, a paper on the theory of the capillary electrometer. The mechanical friction in the capillary tube and the resistance of the circuit influence both time relations of the capillary electrometer. The amount of either of these influences has been measured. The experiments show that in many capillary electrometers the influence of the resistance of the circuit is far surpassed by that of the mechanical friction. Hermann's theory of the capillary electrometer is rejected.—(*g*) By Prof. Van der Waals, on behalf of Mr. E. H. J. Cunaeus, a paper entitled "Refractivity determination as a method of inquiry into the composition of the coexisting phases in the case of mixtures of acetone and ether." The inquiry comprises, besides the determination, by Lord Rayleigh's method, of the refractivity of some mixtures of H_2 and CO_2, also the determination of the refractivity of the vapour above various mixtures of acetone and ether, in order to derive therefrom the composition of the coexisting liquid and vapour phases with the appertaining pressure.—Prof. Haga showed a negative, obtained by means of Uran-rays, yielded by the "A" preparation from de Haën's manufactory (*Wied. Ann.*, August 1899).

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 16.

ROYAL SOCIETY, at 4.30.—Note on the E.M.F. of the Organ Shock, and on the Electrical Resistance of the Organ in *Malapterurus electricus*: Prof. F. Gotch, F.R.S., and G. J. Burch.—On the Formation of the Pelvic Plexus, with especial reference to the Nervus Collector in the Genus Mustelus: R. C. Punnett.—On the Least Potential Difference required to produce Discharge through various Gases: Hon. R. J. Strutt.—Mathematical Contributions to the Theory of Evolution. VII. On certain Formulæ in the Theory of Correlation, and their Application to the Inheritance of Characters not capable of Quantitative Measurement: Prof. Karl Pearson, F.R.S.—On the Propagation of Earthquake Motion to Great Distances: R. D. Oldham.—An Experimental Research on some Standards of Light: J. E. Petavel.

LINNEAN SOCIETY, at 8.—The Comparative Anatomy of certain Species of *Encephalartos*, a Genus of the *Cycadaceae*: W. C. Worsdell.—On a Collection of *Brachyura* from Torres Straits: W. T. Calman.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.

CHEMICAL SOCIETY, at 8.—The Chlorine Derivatives of Pyridine. Part IV. Constitution of the Tetrachloropyridines: W. J. Sell and F. W. Dootson.—Contributions to our Knowledge of the Aconite Alkaloids. Part IV. On Japaconite and the Alkaloids of Japanese Aconite: Wyndham R. Dunstan, F.R.S., and H. M. Read.—On the Determination of Transition Temperatures: H. M. Dawson and P. Williams.

FRIDAY, NOVEMBER 17.

ANATOMICAL SOCIETY, at 4.—A Persistent Left Inferior Vena Cava: Stanley Boyd.—Specimen of Sacculated Œsophagus: Miss Stoney.—Child's Skull, showing Parietal Perforations: Prof. A. M. Paterson.—Note on the Morphology of the Biceps Flexor Cruris: Prof. B. C. Windle, F.R.S., and F. G. Parsons.—Lantern Demonstration of certain Points in the Lymphatic System of the Appendix: C. B. Lockwood.

EPIDEMIOLOGICAL SOCIETY, at 8.30.—Presidential Address on the Comparative Mortality of English Districts: Dr. Franklin Parsons.

MONDAY, NOVEMBER 20.

SOCIETY OF ARTS, at 8.—Enamelling upon Metals: H. H. Cunynghame.

TUESDAY, NOVEMBER 21.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Papers to be further discussed*: The Waterloo and City Railway: H. H. Dalrymple-Hay.—The Electrical Equipment of the Waterloo and City Railway: Bernard M. Jenkin.

ANTHROPOLOGICAL INSTITUTE, at 8.30.—The Nature of the Arab Jinn illustrated by the Present Beliefs of the People of Marocco: Dr. E. Westermarck.

ROYAL STATISTICAL SOCIETY, at 5.—Notes on the Food Supply of the United Kingdom, Belgium, France and Germany: R. F. Crawford.

WEDNESDAY, NOVEMBER 22.

SOCIETY OF ARTS, at 8.—National Forestry: D. E. Hutchins.

GEOLOGICAL SOCIETY, at 8.—On some Remarkable Calcisponges from the Eocene Tertiary Strata of Victoria (Australia): Dr. G. J. Hinde, F.R.S.—The Silurian Sequence of Rhayader: H. Lapworth.

THURSDAY, NOVEMBER 23.

ROYAL SOCIETY, at 4.30.

SOCIETY OF ARTS, at 4.30.—Old and New Colombo: John Ferguson.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Cost of Steam Raising: John Holliday.—Influence of Cheap Fuels on the Cost of Electrical Energy: R. E. Crompton.

FRIDAY, NOVEMBER 24.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Openings for Mechanical Engineers in China: The Right Hon. Rear-Admiral Lord Charles Beresford, C.B.

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