

opérations rationnelles ramener le problème au cas où le groupe est *semi-simple*, et même reconnaître d'avance la nature des sous-groupes invariants simples qui *contournent* le groupe. . . . Quant à la réduction à sa forme canonique de la structure d'un groupe simple, elle dépend d'une certaine équation algébrique dont le groupe de substitutions, au sens de Galois, est connu; cette équation s'appelle l'équation caractéristique du groupe. Les différents groupes de substitutions qui s'introduisent ainsi ne présentent rien d'intéressant et se relient immédiatement aux groupes symétriques de n lettres. Néanmoins trois d'entre eux offrent un intérêt particulier et sont isomorphes, l'un avec le groupe des 27 droites d'une surface du 3^e ordre, l'autre avec le groupe des 28 tangentes doubles d'une courbe du 4^e ordre, le dernier avec le 7^e groupe hypoabélien de 120 lettres. Ce n'est pas un des résultats les moins intéressants et les moins inattendus de cette étude, que d'établir une relation entre ces groupes de substitutions de Galois et les groupes de transformations de M. Lie.—Mr. A. L. Baker writes upon algebraic symbols. The symbols considered are $+$, $-$, $i(\sqrt{-1})$, and $-i$. The closing sentences will indicate the line of reasoning. "In tri-dimensional domains we have $(\sqrt{-1})^{\infty} x = x + iy + jz + kw$, a quaternion. Is this a hint that in the Calculus of Reals, Complex Functions and Quaternions, we have run the gamut of the Algebraic Calculi?" There is some (to us) novel notation in this article. To express the roots of the Solvable Quantics as symmetrical functions of homologues, is the title of an interesting algebraic article by C. H. Kummell. There is, it may be inferred, some stiff reading in these three articles.—Two short notes on singular solutions by J. M. Page, and on a point of the theory of functions by A. S. Chessin, close the number, which is adorned with a fine portrait of the French mathematician, M. Paul Appell.

Bulletin of the Mathematical Society, vol. ii. No. 4, January.—On the convergence of the series used in the subject of perturbations, by Dr. G. W. Hill. M. Poincaré ("Les Méthodes nouvelles de la Mécanique céleste") has recently insisted that certain series, in this subject, under a certain condition, are, in the rigorous mathematical sense, divergent. Dr. Hill thinks that the reasons brought forward to sustain this opinion are scarcely convincing, and so, without attempting to find a flaw in M. Poincaré's logic, he aims at pointing out a class of cases where the convergency can be shown in spite of the incommensurability of the component arguments.—Mr. R. A. Roberts contributes an article on the locus of the foci of conics having double contact with two fixed conics.—Note on the common tangents of two similar cycloidal curves, by Prof. F. Morley. This is the application of a new method, given by the writer in vols. xv. and xvi. of the *American Journal of Mathematics*, to a question proposed by Prof. Aiyar, in the *Educational Times* for November 1895.—The list of new publications is an extended one, and the notes, as usual, are of interest. There is, however, an error in the quotation from our pages. On p. 651 (vol. lii.) is given a list of names proposed for the Council of the London Mathematical Society, and at the end of the note it is stated that Mr. Jenkins and the late G. C. De Morgan were elected joint secretaries (in January 1866). The *Bulletin* says, "the late Prof. De Morgan." It is a matter of common knowledge that Prof. Augustus De Morgan was the first President. The Secretary was his son.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 23.—"An Attempt to Determine the Condition in which Helium and the Associated Gases exist in Minerals." By Prof. W. A. Tilden, F.R.S.

From the results of the experiments recorded in this paper, it seems that helium exists in the minerals in which it is found in a condition comparable with that in which hydrogen is associated with many metals, and carbonic oxide especially with iron. Whether this condition is rightly distinguished from ordinary chemical combination is a question which admits of debate. The stability of all dissociable compounds is influenced by pressure and by temperature in the same kind of way as "occlusion," which, like ordinary chemical combination again, is a phenomenon in which the bodies concerned exercise a power of selection.

The presence of hydrogen as well as carbon dioxide in granite,

is already observed, is not known to geologists generally. From observation on variations in the critical point of carbon dioxide in minerals (*Journ. Chem. Soc.*, 1876, ii. 248), Hartley seems to infer that the incondensable gas present with carbon dioxide, is usually nitrogen. A passage in Geikie's "Text-Book of Geology," third edition, p. 110, refers to the presence of hydrogen in cavities; but no information is given as to the evidence upon which this statement is based. The presence of hydrogen in such a rock as granite must be attributed to the existence of this gas in large proportion in the atmosphere in which the rock was crystallised. Whether this was the primeval atmosphere of the earth before the hydrogen had escaped or had been oxidised into water, or whether it resulted from the local action of water upon unoxidised metals or other materials in the interior of the earth, is a question which may be of some interest to the geologist. If the former hypothesis were adopted, it would perhaps be difficult to explain the absence of helium from the gas included in the rock; and, on the whole, the latter view appears to afford the more probable explanation.

Experiments show that hydrogen is present in even larger proportion in the granite from the neighbourhood of Dublin, and it is proposed to examine some other examples of the ancient crystalline rocks in order to determine the nature of the gases enclosed in them.

Physical Society, February 14.—Annual General Meeting.—Captain W. de W. Abney, President, in the chair.—The Chairman, after referring to the position of the Society, called upon the Treasurer to read the balance-sheet. After a discussion on the financial status of the Society, in which a number of members took part, the ballot was held for the election of a President and Council for the ensuing year. The following gentlemen were declared duly elected: President—Captain W. de W. Abney, C.B., F.R.S. Vice-Presidents—Shelford Bidwell, F.R.S.; Major-General E. R. Festing, F.R.S.; Prof. J. Perry, F.R.S.; G. Johnstone Stoney, F.R.S. Secretaries—T. H. Blakesley, 3 Eliot Hill, Lewisham, S.E.; and H. M. Elder, 50 City Road, E.C. Treasurer—Dr. E. Atkinson, Portesbery Hill, Camberley, Surrey. Demonstrator—C. Vernon Boys, F.R.S. Other members of Council—Walter Baily, Dr. C. V. Burton; L. Fletcher, F.R.S.; R. T. Glazebrook, F.R.S.; Prof. A. Gray, G. Griffith, Prof. G. M. Minchin, F.R.S.; Prof. W. Ramsay, F.R.S.; Prof. S. P. Thompson, F.R.S.; and Prof. S. Young, F.R.S.—The Chairman read an obituary notice of the late Right Hon. T. H. Huxley.—A vote of thanks to the auditors was proposed by Prof. Carey Foster, seconded by Mr. Enright, and carried unanimously. A vote of thanks to the officers was proposed by Prof. A. Gray, seconded by Mr. Rhodes, and carried unanimously. A vote of thanks to the Chemical Society for the use of their rooms, was proposed by the Chairman, and carried by acclamation.—The meeting was then resolved into an ordinary science meeting, and a paper, on the determination of high temperatures by the meldometer, by Prof. Ramsay and Mr. Eumorfopoulos, was read by the latter. The meldometer—an instrument invented by Dr. Joly, of Dublin—consists essentially of a thin platinum strip which can be heated by the passage of an electric current. Small fragments of a solid substance are placed on the platinum strip, and the temperature at which they melt is deduced from the length of the platinum strip, which has been previously calibrated by means of solids of known melting-point. The authors have used gold for the purpose of calibrating the strip, and have assumed Violle's value, 1045° C., for the melting-point of gold. A number of measurements have been made of the melting-point of salts of sodium, lithium, strontium, barium, calcium, and lead. The results obtained, however, differ considerably from those of Heycock and Neville, and the authors have not been able to account for these differences. Prof. Ramsay said the chief advantage of the meldometer was that only a very minute fragment of the substance was required for the measurement, so that extreme purity of the sample could be secured. There was the disadvantage, however, that many substances undergo some change when heated in air. In reply to a question from Mr. Blakesley, Prof. Ramsay said that the property of the platinum which was used to measure the temperature was its expansion. Mr. Campbell asked whether the zero of the instrument was found to be constant. In Cardew voltmeters it often took several hours for the needle to come back to zero after heating. Mr. Eumorfopoulos, in reply, said that the zero was constant to within a quarter of a degree.—Prof. Ramsay also exhibited a small direct-vision spectroscope, in which the eye-piece is moved

in a plane perpendicular to the axis of the instrument by means of a micrometer screw. This form of spectroscope was found to be of great utility in verifying the position of lines in the spectrum.

Geological Society, London, February 5.—Dr. Henry Woodward, F.R.S., President in the chair.—On the Morte Slates and Associated Beds in North Devon and West Somerset.—Part I, by Dr. Henry Hicks, F.R.S. In a paper read before the Society in 1890 the author stated that he had found the Morte Slates to be fossiliferous, and had come to the conclusion that they were the oldest rocks in the North Devon area and had been thrust over much newer rocks, producing a deceptive appearance of conformity; and that there was not a continuous upward succession in the rocks from the Bristol Channel to the neighbourhood of Barnstaple. Since that paper was read, the author has obtained much additional evidence bearing on the succession, which was described so far as the position and age of the Morte Slates in the Ilfracombe area are concerned.—Evidences of glacial action in Australia in Permo-Carboniferous Time, by Prof. T. W. Edgeworth David. The author, after summarising the work of previous observers, gave an account of recent observations made by himself. In Hallett's Cove, near Adelaide, the pre-Cambrian rocks were strongly glaciated, striae being seen when the overlying glacial beds are removed, as sharply cut as though caused by recent glacial action, and trending nearly north and south, the ice having come from the south. The overlying glacial beds were in places fairly stratified, while parts contain abundance of well-striated boulders; these beds are from 23 to over 100 feet thick. Proofs were obtained that in this case the glaciation occurred in an age intermediate between Miocene and pre-Cambrian, and probably did not antedate the close of the Paleozoic period. In Wild Duck Creek, near Heathcote, Lower Silurian (Ordovician) beds exhibited strongly-grooved, polished surfaces, the grooves being from S. 5° E. to N. 5° W., the ice having probably come from the south. They were succeeded by Permo-Carboniferous glacial beds, consisting chiefly of mudstones with well-glaciated boulders. At Bacchus Marsh Ordovician beds were also well-striated and polished, and more or less *moutonnés*. There also the ice came from a southerly point. These beds were succeeded by Permo-Carboniferous glacial beds having an approximate thickness of at least 2000 feet, consisting of mudstones with well-glaciated boulders. It was extremely probable that the glacial beds of Bacchus Marsh, Wild Duck Creek, and Springhurst in Victoria were of homotaxial if not contemporaneous origin, and they may probably be correlated with the glacial conglomerates at Mount Reid in Tasmania, these correlations being mainly based on lithological evidence.

CAMBRIDGE.

Philosophical Society, January 27.—Prof. Liveing, Vice-President, in the chair.—On longitudinal vibrations in connection with recent photographic discoveries, by Prof. J. J. Thomson (see p. 379).—On the equilibrium of isotropic elastic solid shells of nearly spherical form, by Dr. Chree. Attention was chiefly devoted to the case of a thin shell exposed to uniform, but different, normal pressures over its two surfaces. The effect of external pressure, it was proved, is to increase, while that of internal pressure is to diminish the original departure from sphericity.—A harmonic analysis of the amount of solar radiation received at the different latitudes on the earth's surface, by Mr. R. Hargreaves. The amount of solar radiation falling on the earth's surface in any latitude is expressed by a harmonic series containing constant, annual, semi-annual terms, and so forth. The dependence of the coefficients on latitude, and also on the astronomical elements obliquity of the ecliptic, eccentricity, and longitude of perihelion, was fully discussed. Numerical results were given in connection with each point, showing the extent to which the present values may be modified by such secular changes as are known to astronomers; and complete numerical data are thus provided for the discussion of the question whether these astronomical changes are a *vera causa* in the explanation of changes of climate.

EDINBURGH.

Royal Society, January 20.—Rev. Prof. Flint in the chair.—Dr. Buchan read a paper on the recent great atmospheric pressure. So far, the highest reading had been that recorded at Ochtertyre, in Perthshire, where 31·107 inches was registered on the 9th. This place, curiously enough, had the "record" for low read-

ings, a pressure of 27·333 inches having been recorded there in January 1884. This was the lowest ever recorded anywhere.

—Prof. Crum Brown showed and discussed an experiment illustrating the modern theory of salt solutions.—Dr. A. Lockhart Gillespie gave statistics from the Infirmary records of the past fifty years, illustrating the relations of weather, influenza, and disease. Diseases of the respiratory system were more common during cyclonic weather, and cardiac troubles showed a marked increase after epidemics of influenza. The idea that influenza was more severe than it used to be was not borne out by facts.—Dr. John Murray and Mr. Robert Irvine contributed a paper, replying to criticism, on the chemical changes in marine deposits.—Prof. Tait illustrated the looped, concave-upward path of a rotating spherical projectile by means of a spherical india-rubber balloon.

January 27.—Prof. McKendrick in the chair.—By request of the Council, Mr. Frederick Ives, of Philadelphia, gave an address on the stereo-photochromoscope. The essential features of Mr. Ives' method are as follows. By means of a specially constructed stereoscopic camera, three pairs of negatives are taken at once. Each pair, by a suitable intervention of colour-filters, secures those parts of the object from which one of the Young-Helmholtz three primary colours is reflected. When the six positives are subjected to the synthetic action of the photochromoscope, a coloured, solid-looking, optical illusion is the result. Not the least interesting feature of the process, as was remarked at the meeting, is the light which it throws on the Young-Helmholtz theory of colour vision.

February 3.—Prof. Chrystal in the chair.—Prof. Tait read an obituary notice of Prof. Blackie by the Rev. Dr. Walter Smith.—Dr. W. W. J. Nicoll described experiments he had carried out on the behaviour of the iodine molecule in solution. His method was different from any yet tried, viz. the determination of the molecular volume of the iodine in different solutions, and his results agreed well with those of others approaching the problem from different sides. He found that the value of the iodine molecule in solution was about 85, and this whether it was of the form I₂ or I₄. His conclusion was that the molecules, in the gaseous form, and in dilute solution, were truly comparable.—In Dr. E. H. Barton's absence, Prof. Tait read a paper on the temperature-variation of the magnetic permeability of magnetite. His results, as exhibited graphically, showed that the permeability reached its maximum about 300°, suffered a very sudden decrease about 500°, and remained constant afterwards.—Prof. Tait gave a note on centrobatic shells. Thomson and Tait prove the proposition that a shell, whose density is inversely as the cube of the distance from an internal point, has a true centre of gravity, by considering the forces of attraction. Prof. Tait gave a demonstration of a very much simpler and shorter proof, which had since occurred to him, from the point of view of potential.

PARIS.

Academy of Sciences, February 10.—A study of uranium carbide, by M. H. Moissan.—Action of high frequency currents upon bacterial toxins, by MM. d'Arsonval and Charrin. In these experiments especial care was taken to eliminate, as far as possible, all electrolytic action of a chemical nature. Two different cultures were used (pyocyanic and diphtheric toxins), and in both cases these were found to have their virulence diminished after passage of the high frequency current. It was also noticed that this attenuated virus more or less protected the animals against further injections of the original virus.—On the application of the Röntgen rays to surgical diagnosis, by MM. Lannelongue and Oudin. An application to some diseases of the knee and thigh. The conclusion is drawn that although the application of the new light to surgery has not led to the discovery of any points previously unnoticed, yet it has in all the experiments given results in agreement with the clinical diagnosis.—Microbial associations and tuberculous suppurations, by MM. Lannelongue and Achard. A discussion of the conditions under which other microbes are associated with the tubercle bacillus.—On the structure of Mount Joly, near Saint-Gervais, by MM. Marcel Bertrand and E. Ritter. The view previously held about this mountain, that it had escaped the violent actions to which the neighbouring rocks had been subjected, and that foldings had not taken place, is shown to be untenable. This spot is, in fact, the region where the displacements of the strata have been pushed to the greatest extent.—On campholide, the reduction product from camphoric anhydride, by M. A. Haller. Camphoric anhydride reduced

with sodium amalgam in acid solutions gives the lactone campholide, $C_{10}H_{16}O_2$, not identical with the substance of the same composition obtained by Dr. M. O. Foster (*J. C. S.*, January 1896).—Copernicus and the geographical discoveries of his time, by M. Daubrée.—On the equation of the tides, by M. Maurice d'Ocagne.—On surfaces of lines of spherical curvature, by M. E. Blutel.—On a generalisation of the formula for the area of a spherical triangle, by M. X. Stouff.—Note on the resistance of beams, by M. Paul Toulon.—Method of measuring double refraction in monochromatic light, by M. R. Dongier.—Influence of the chemical nature of substances on their transparency to the Röntgen rays, by M. Maurice Meslans. Compounds of carbon, hydrogen, oxygen, and nitrogen are very nearly transparent for these rays, but the introduction of phosphorus, sulphur, or the halogens (especially iodine) largely increases their opacity.—Application of the method of M. Röntgen, by M. A. Londe. The dark and light parts of a photographic negative are equally transparent to the rays.—Increase of the photographic effect of the Röntgen rays by phosphorescent zinc sulphide, by M. C. Henry. It was found that by coating coins opaque to the rays with phosphorescent sulphide of zinc, photographic impressions of substances beneath the coins could be obtained, metals coated in this manner appearing to lose their opacity to the Röntgen rays.—Photographs obtained by means of the X-rays, by M. C. V. Zenger.—On a mechanical action proceeding from a Crookes' tube, analogous to the photogenic action discovered by Röntgen, by MM. Gossart and Chevallier. In attempting to show the heating effect of a Crookes' tube by means of a radiometer, it was found that the latter, instead of rotating, took up a fixed position under the control of the tube. If the radiometer arms were set in motion by heat, oscillations about this fixed direction ensued, which were the more rapid the smaller the distance between the tube and the radiometer. This force was stopped by the same media as the X-rays.—On the silicide of copper, by M. Vigouroux. Silicon and copper, heated in the electric furnace, give homogeneous products which may contain silicon up to 15 per cent. Prolonged heating at a temperature sufficiently high to drive off excess of copper, leaves the definite compound $SiCu_2$.—On the bromide and chlorobromide of thionyl, by M. A. Besson. Dry HBr, acting on $SOCl_2$ at its boiling-point, gives rise to a mixture from which $SOClBr$, $SOBr_2$, and S_2Br_2 , which can be separated by fractional distillation under reduced pressure. Thionyl bromide is not formed by the action of sulphur dioxide upon phosphorus pentabromide.—On a crystallised sulpho-phosphide of tin, by M. A. Granger. Tin sulphide, acted upon by phosphorus vapour, gives the compound SnP_2 .—Oxyiodides of zinc, by M. Tassily.—Method for determining the purity of butter by means of the density, by M. R. Brullé.—Retinal stroboscopy, by M. Aug. Charpentier.—The expulsion of blood as a means of defence in some Sauterelles, by M. E. Cuénot.—On the frontal expansion of some insects of the family of the Muscides, by M. J. K. d'Herbulais. A criticism of a note on a recent communication on the same subject by M. A. Labboulbène.—On the significance of the fertilisation in the Uredineae, by M. Sappin-Trouffy.—On the sugars produced in leaves, by M. G. Bonnier. It is shown that in many cases these sweet liquids are directly exuded from the stomata of the leaf, and are not always of animal origin. The rate of production of this vegetable honey is at a maximum during the night.—*Mucor* and *Trichoderma*, by M. J. Ray. Reply to a criticism of M. Paul Vuillemin.—The Hippurite bearing layers in the Valley of the Rhône, by M. H. Douville.—On the existence of numerous Radiolaria in the Ardèche, by M. L. Cayeux.—On the mode of formation of the auriferous minerals of the Witwatersrand in the Transvaal, by M. L. de Launay. The hypothesis of a chemical precipitation of the gold and pyrites during the actual sedimentation is shown to be the most probable.—On a hypothetical mode of formation of the auriferous conglomerates of the Transvaal, by M. E. Cumenge.—On some new and rare forms of calcite at Couzon (Rhône), by M. F. Gonnard.—On the high atmospheric pressures during the month of January 1896, by M. P. Dechevrens.

BERLIN.

Physical Society, January 17.—Prof. du Bois Reymond, President, in the chair.—Dr. Frölich spoke on the protection of physical laboratories from the effects due to electric tram-lines, and described the arrangement used by Siemens and Halske.

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This consists of two coils of wire-netting at right angles to each other, which being stretched round a wooden frame, and surrounding the instrument it is desired to protect, are put into metallic contact by a cable with the conducting rail of the tram-line. The disturbance due to the passage of a car is thus compensated, and the effect on a magnetised needle is reduced to a small percentage.

January 31.—Prof. du Bois Reymond, President, in the chair.—Dr. Kaufmann gave an elaborate demonstration of Röntgen's X-rays. He also exhibited a very striking photograph of a mouse, which showed in detail the separate vertebrae of the tail, the ribs, and other bones.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—Chemistry for Engineers and Manufacturers: B. Blount and A. G. Bloxam, Vol. 1 (Griffin).—A New Natural Theology based upon the Doctrine of Evolution: Rev. J. Morris (Rivington).—Universal Electrical Directory (Alabaster).—Geology: C. L. Barnes (Rivington).—Life and Exploits of Alexander the Great: Dr. E. A. W. Budge (Clay).—Grundriss der Krystallographie für Studierende und zum Selbstunterricht: Dr. G. Linck (Jena, Fischer).—Traité des Matières Colorantes: L. Lefèvre, 2 Vols. (Paris, Masson).—Electrician Electrical Trades' Directory and Handbook for 1896 (Electrician Company).

PAMPHLETS.—Report of S. P. Langley, Secretary of the Smithsonian Institution, for the Year ending June 30, 1895 (Washington).—Classification Chart of the Commoner British Orders of Flowering Plants: W. P. Winter (Cheltenham).—Über Germinal-Selection eine quelle Bestimmt Gerichteter Variation: A. Weismann (Jena, Fischer).

SERIALS.—Journal of the Franklin Institute, February (Philadelphia).—American Naturalist, February (Philadelphia).—Journal of the Chemical Society, February (Gurney).—The Asclepiad, Vol. 44, Vol. xi. (Longmans).—Proceedings of the Physical Society of London, Vol. 14, Part 2 (Taylor).—Journal of the Institution of Electrical Engineers, No. 119, Vol. xxiv. (Spon).—Internationales Archiv für Ethnographie, Band ix. Heft 1 (Leiden, Brill).—Astrophysical Journal, February (Wesley).—Strand Magazine, February (Newnes).

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