Societies and Academies.

LONDON.

Royal Society, April 26.—W. A. **Bone,** D. M. **Newitt,** and D. T. A. **Townend**: Gaseous combustion at high pressures. Pt. III.—The energy-absorbing function and activation of nitrogen in the combustion of carbon monoxide. Nitrogen can no longer be regarded as an inert gas in the combustion of carbon monoxide, because when present as a diluent in a mixture of two volumes of carbon monoxide and one volume of oxygen undergoing combustion in a closed vessel under high pressure, it exerts an energy-absorbing influence which (*a*) retards attainment of maximum pressure, and (*b*) diminishes maximum temperature attained in explosion. The effects are much greater than those due to any other diatomic diluent. The energy so absorbed by nitrogen during the combustion period is slowly liberated as the system cools down after attainment of maximum temperature, and consequently the rate of cooling is greatly retarded. These effects are very marked in the case of a carbon monoxide-air mixture ($2CO + O_2 + 4N_2$). In consequence of such energy-absorption, nitrogen becomes chemically "activated" in such explosions, and while in this condition will combine with oxygen, forming oxides of nitrogen. If no nitrogen be present in a carbon monoxide-oxygen (2 : 1) mixture, carbon monoxide burns in oxygen at high pressures almost as rapidly as does hydrogen. There is no correspondingly large (if any) energy-absorbing effect (other than purely "diluent") when nitrogen is present in hydrogen and oxygen mixtures similarly undergoing combustion, and there is no evidence of nitrogen being then activated. Two or three per cent. of hydrogen in a carbon monoxide-air mixture undergoing combustion prevents any material activation of the nitrogen. It appears that the influence of nitrogen in the carbon monoxide-oxygen explosions is due to its ability to absorb the particular quality of radiation emitted; such radiation is known to be of a different wave-length from that emitted during the flame-combustion of hydrogen. In other words, there seems to be some constitutional correspondence between carbon monoxide and nitrogen molecules, whereby the vibrational energy (radiation) emitted when one reacts with oxygen is of a quality readily absorbed by the other, the two acting in resonance.—R. A. **Watson Watt** and E. V. **Appleton**: On the nature of atmospherics. Observations with a cathode ray oscillograph, on the temporal variations of the electric force occurring in radio telegraphic atmospherics are described. The principal constants of six hundred typical atmospherics are examined. A bare majority are quasi-periodic, consisting normally of one complete oscillation, of duration 2000 micro seconds, the mean change of field being 0·128 volts per metre, with no marked unbalanced transport of electricity on the whole group. The second group consists of aperiodic impulses, of duration generally about 1250 micro seconds, but frequently reaching 0·025 of a second, the mean change of field being 0·125 volts per metre, with a seven to one numerical predominance of discharges tending to carry negative electricity to earth in the receiving antenna.—I. **Masson** and L. G. F. **Dolley**: The pressures of gaseous mixtures. Measurements have been made at 25° of the compressibilities up to 125 atm. of ethylene, argon, oxygen, and a series of binary mixtures of these. The volume of a compressed mixture usually exceeds the sum of the separate volumes of its two components, the excess depending on the molecular ratio of the two gases chosen and upon the pressure. Thus with an equimolecular mixture of argon and ethylene at 80 atm. the volume is greater than the additive value by 24 per cent. At a given pressure there is an "optimum" composition, and with a given composition there is an optimum pressure. Oxygen-ethylene mixtures behave quantitatively in the same way as argon-ethylene; oxygen and argon when mixed show a negligible volume increase, and are individually equally compressible. The pressure of a mixture at high densities exceeds the sum of those measured for the separate constituents; at moderate densities it is definitely less. The former occurrence is due to the actual space filled by the molecules; the latter is due to a mutual cohesion between each.—T. R. **Merton** and R. C. **Johnson**: On spectra associated with carbon. The spectral changes due to the admixture of helium to vacuum tubes containing carbon compounds, and the conditions for isolating the band spectra associated with carbon, have been investigated. The "high pressure CO" bands can be isolated almost completely; the "comet-tail" bands are found in vacuum tubes containing helium and carbon monoxide. In the presence of helium the distribution of intensity in the comet-tail bands differs markedly from that observed by Fowler in tubes containing carbon monoxide at very low pressures. By the admixture of hydrogen the comet-tail bands are replaced by a system of triplet bands, and the wave-lengths of the heads of these bands fall into two distinct band series. In helium containing a small quantity of carbon monoxide a new line-spectrum has been observed under suitable conditions of excitation, which is attributed to carbon.—W. R. **Bousfield** and C. Elspeth **Bousfield**: Vapour pressure and density of sodium chloride solutions. A standard set of vapour pressure determinations at 18° C. for aqueous solutions of common salt at all concentrations was required. Water and the solution were introduced into the legs of a V tube surmounting a barometric column of mercury, excluding all air. This necessitated the boiling of the solutions so that they became of unknown concentration. The vapour pressure observations were therefore correlated to the densities of the solutions and the latter with a complete set of density observations at 18° C. made on solutions of known concentration accurate to ±2 in the fifth place of decimals.—F. A. **Lindemann** and G. M. B. **Dobson**: A note on the temperature of the air at great heights. The relatively high temperature of the atmosphere above 60 km. appears to be due to absorption of an appreciable amount of direct solar radiation. Thus there should be a large variation in temperature at these great heights. Some evidence of such variation has been found.—G. H. **Hardy** and J. E. **Littlewood**: On Lindelöf's hypothesis concerning the Riemann zeta-function.

Physical Society, March 23.—Dr. A. Russell in the chair.—W. J. H. **Moll**: (1) A new moving-coil galvanometer of rapid indication. The galvanometer is designed to secure rapid indication and steadiness of reading without unduly sacrificing the sensibility. The coil is long and narrow, and therefore of small moment of inertia; the mirror is supported by the wires forming the coil, between which it is slipped, and the coil is supported between an upper and a lower vertical wire, as distinct from strips, made of silicium bronze and put in tension. (2) A thermopile for measuring radiation. The thermopile is designed to be quick-reading and free from zero-errors, as well as sensitive. The cold junctions are in contact with metal masses, and in order that the

hot junctions may have small heat capacity, the bi-metallic strips composing the thermopile are made of plates of constantan and manganin silver-soldered along an edge, rolled in a direction parallel to the edge into thin foil, and then cut into strips perpendicular to the edge.—C. W. **Hume**: A note on aberration and the Döppler effect as treated in the theory of relativity. Aberration has been explained as due to the compounding of the velocity of light with the velocity of the earth relative to the ether; hence it appears to conflict with the principle of relativity. Simple methods are given of treating this problem consistently with the restricted principle, and of finding the Döppler effect. The result differs from the non-relativity result by terms of the second and higher orders in v/c.—C. R. **Darling** and C. W. **Stopford**: Experiments on the production of electromotive forces by heating junctions of single metals. When a circuit is closed through a junction of a cold metal with a hot piece of the same metal, large electromotive forces are often noticed; *e.g.* a bare copper wire connected to the terminals of a galvanometer was cut at the middle, one of the cut ends heated and brought into contact with the cold end, and a large deflexion was obtained. Electromotive forces up to 0·25 volt may thus be produced.—R. H. **Humphry**: The double refraction due to motion of a vanadium pentoxide sol, and some applications. In linear flow the liquid behaves in the same way as a plate of uniaxial crystal cut parallel to the axis and placed with axis parallel to the direction of flow. The field between crossed nicols lights up near an obstacle interposed in a stream of the liquid. Similar effects due to efflux of the sol from a jet, to the convective stream from an electrically-heated wire, etc., were also described.

Optical Society, April 12.—Prof. A. Barr, president, in the chair.—F. **Twyman**: The Hilger microscope interferometer. The instrument is used for measuring the aberrations of microscope objectives. A collimated beam of monochromatic light is separated into two beams at the transmissively silvered surface of a plate of plane parallel glass. The transmitted beam passes through the lens under test, and is reflected back from the surface of a convex mirror, which coincides nearly with the approximately spherical wave front of the light as it converges after passage through the lens. The second beam is reflected back along its own path by a mirror so that the two beams recombine at the silvered surface of the plane parallel plate. Portions of each beam then pass on together through a lens to the observer, who sees an interference pattern apparently located on the surface of the lens under test, which is a contour map, to a scale of half wave-lengths of the light used, of the aberrations of wave-surface caused in a plane wave.—A. **Whitwell**: On the form of the wave-surface of refraction. A series of wave-surfaces is drawn for each of a number of refracting surfaces or lenses. Each series consists of the following forms, which always follow each other in the same order. (1) Saucer type; convex to the incident light when the refracted pencil is converging, and concave when the pencil is diverging. (2) Saucer with inturned edges; like (1), but the edges of the wave-surface which have passed through the primary focus are concave towards the incident light when the refracted pencil is converging. (3) Closed surface type; the wave-surface is completely closed like a cone with a dished bottom, the axis of the cone being coincident with the optic axis. (4) Goblet type; somewhat like a champagne glass set sideways, the bowl being towards the incident light and the base towards the secondary focus. (5) Basin type; the base of the goblet has disappeared and just beyond the focus the surface is like a basin concave towards the incident light. The diffraction spectra are found in the neighbourhood of the edges of the saucers, of the apex of the closed surface type, and of the rims of the goblet and basin type. Interference patterns occur in the region bounded by the caustic and by the extreme marginal rays. By drawing wave-surfaces half a wave-length apart lines of maximum and minimum intensity are found which are the sections of surfaces of revolution on which the intensity is a maximum or minimum. Sections of these surfaces by a plane at right angles to the axis show interference rings. The goblet type of wave-surface always occurs between the focus for marginal rays and that for paraxial rays, and may be called the characteristic of the focus.

Linnean Society, April 19.—Dr. A. Smith Woodward, president, in the chair.—A. B. **Rendle**: The structure of the fruit of the mare's-tail (*Hippuris vulgaris* Linn.). The fruit is a drupe, the upper portion of which around the persistent base of the style, with the seedcoat, is developed in the form of a stopper which is easily withdrawn on soaking the ripe fruit. The embryo ultimately fills the seed, and has the large radicle and hypocotyl so often found in water plants. The radicle is placed directly beneath the stopper which provides a place of exit on germination.—B. Daydon **Jackson**: History of botanic illustration during four centuries (Colour). In the early years of printing, copper-plate engraving was employed in providing outlines for hand-colouring and was in use until the last century, when it was ousted by lithography. In Redouté's method of semi-stipple for coloured prints each colour was separately applied to the plate and cleaned off, before finally heating the plate and pulling the print. Chromo-lithography has greater permanence, if lasting colours are employed, than hand-coloured plates. In the three-colour process three (or four) half-tone blocks are prepared, each to print its own colour, to give a complete colour scheme. The weakness of the process lay in this, that it almost demanded a paper coated with baryta or china-clay, which could not be guaranteed as permanent: in addition was the temptation to use inks, made from aniline dyes, which were fugitive.

CAPE TOWN.

Royal Society of South Africa, March 21.—Dr. A. Ogg, president, in the chair.—B. T. **Schönland**: On the passage of cathode rays through matter. The absorption, reflexion, and secondary emission involved in the passage of fast cathode rays through thin foils of various metals, and their variation with the velocity of the rays, were examined. Accurate measurements were possible up to 0·4 of the velocity of light. The results show that Lenard's Law is only an approximation. The existence of a "range" for these particles appears to be established, two independent methods of measuring it agreeing very satisfactorily. The values obtained are in agreement with the theory of absorption due to Bohr.—T. **Stewart**: Holtzhuisbaaken Spring, Cradock. The spring is a typical Karroo spring. Measurements of the flow have been taken over a period of 38 years. The rainfall of a particular season is found to be reflected in the flow, but is not necessarily proportional to it; regard must be had as well to the rainfalls of previous seasons and the "tail" of the flow produced by them.—Gertrud **Theiler**: Two new species of nematodes from the zebra. *Cylindro-*

pharynx intermedia inhabits the pelvic flexure and dorsal colon of the host, of which it is one of the commonest parasites, and *Habronema zebræ* occurs in fairly large numbers in the stomach.—Sir Thomas Muir: Note on Zeipel's condensation-theorem and related results. Both Zeipel's papers on determinants are now over fifty years old and have been somewhat neglected. One or two of the basic results of Zeipel's first paper are discussed and a number of deductions that cluster somewhat picturesquely round them.

Official Publications Received.

Mysore Agricultural Calendar, 1923. Pp. iii+54. (Bangalore: Government Press.) 1 anna.

The Journal of the Royal Agricultural Society of England. Vol. 83. Pp. 8+260+cxlviii+24. (London: J. Murray.) 15*s*.

Thirty-fourth Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, 1912-13. (With accompanying paper, "A *Prehistoric Island Culture Area of America*," by J. Walter Fewkes.) Pp. 281+120 plates. (Washington: Government Printing Office.)

Report of the Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii for the Biennial Period ended December 31, 1922. Pp. vi+102+16 plates. (Honolulu, Hawaii.)

Diary of Societies.

SATURDAY, MAY 5.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Dr. L. L. B. Williams: The Physical and Physiological Foundations of Character (2).

MONDAY, MAY 7.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.—General Meeting.

SOCIETY OF ENGINEERS, INC. (at Geological Society), at 5.30.—P. Mauclère: Pneumatic Handling of Petrol and other Inflammable Liquids.

ARISTOTELIAN SOCIETY (at University of London Club, 21 Gower Street), at 8.—L. J. Russell: Some Points in the Philosophy of Leibniz.

ROYAL SOCIETY OF ARTS, at 8.—S. S. Cook: The Development of the Steam Turbine (2). (Howard Lecture.)

SURVEYORS' INSTITUTION, at 8.—C. H. Bedells: Some Functions of a Surveyor under the Settled Land Acts 1882-1890, and Part II. of the Law of Property Act, 1922.

ROYAL GEOGRAPHICAL SOCIETY (at Æolian Hall), at 8.30.—F. Kingdon Ward: The Tibetan Border; Yangtse to Irrawaddy.

ROYAL SOCIETY OF MEDICINE (Tropical Diseases and Parasitology Section) (Annual General Meeting), at 8.30.—Lt.-Col. A. E. Hamerton: The Establishment of an Anti-rabic Institute in the Tropics.

TUESDAY, MAY 8.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Prof. A. C. Seward: The Ice and Flowers of Greenland.

INSTITUTION OF PETROLEUM TECHNOLOGISTS (at Royal Society of Arts), at 5.30.—W. A. Guthrie: Heavy Grade Egyptian Crude Petroleum.

ZOOLOGICAL SOCIETY OF LONDON, at 5.30.—The Secretary: Exhibition of Photographs of Big Game from Choma, Northern Rhodesia.—Miss L. E. Cheesman: (1) Exhibition of Living Specimens of *Peripatus* from Trinidad. (2) Exhibition of Section of a Nest of the Stingless Bee from Australia.—H. Burrell: Note on a Hibernating Female Specimen of the Marsupial *Acrobates pygmæus*.—F. Martin Duncan: The Microscopic Structure of Mammalian Hairs.—I. The Hairs of the Primates.

ROYAL SOCIETY OF MEDICINE (Psychiatry Section), at 5.30.—Annual General Meeting.

BRITISH PSYCHOLOGICAL SOCIETY (Education Section) (at London Day Training College), at 6.—R. R. Dobson: Mental Tests.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Scientific and Technical Group), at 7.—E. Kilburn Scott: The Pioneer Work of Le Prince in Moving Pictures.

QUEKETT MICROSCOPICAL CLUB, at 7.30.—R. Paulson: Fungi and Birch Trees.

WEDNESDAY, MAY 9.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Prof. G. Keynes: Chronic Mastitis.

ROYAL SOCIETY OF MEDICINE (Surgery: Sub-section of Proctology) (Annual General Meeting), at 5.30.—Sir Humphry Rolleston, Sir Thomas Horder, W. E. Miles, P. Lockhart-Mummery, Prof. L. S. Dudgeon, Dr. W. E. Carnegie Dickson, and Dr. A. F. Hurst: Discussion on Ulcerative Colitis.

INSTITUTE OF PHYSICS (at Institution of Electrical Engineers), at 5.30.—Dr. J. W. Mellor: The Application of Physics to the Ceramic Industry.

INSTITUTION OF AUTOMOBILE ENGINEERS, at 7.30.—Col. R. E. Crompton: The Effect of Motors on Roads.

ROYAL SOCIETY OF ARTS, at 8.—Prof. W. A. Bone: Recent Developments in Surface Combustion, with Special Reference to Recent Developments in Radiophragm Heating.

THURSDAY, MAY 10.

IRON AND STEEL INSTITUTE (at Institution of Civil Engineers), at 10 a.m.—Report.—Presentation of Bessemer Medal to Dr. W. H. Maw.—E. K. Sutcliffe and E. C. Evans: The Reactivity of Coke as a Factor in the Fuel Economy of the Blast Furnace.—F. Clements: British Steel Works Gas Producer Practice.—J. E. Fletcher: Some Characteristics of Moulding Sands and their Graphical Representation.—J. H. Whiteley and A. Braithwaite: Some Observations on the Effect of Small Quantities of Tin in Steel.—L. Northcott: Note on Temper Carbon.—J. W. Landon: Change of Density of Iron due to Overstrain.

IRON AND STEEL INSTITUTE (at Institution of Civil Engineers), at 2.30.—Prof. H. C. H. Carpenter: The Production of Single Metallic Crystals and some of their Properties.—Prof. J. O. Arnold: The Co-relation of the Chemical Constitutions of "True Steels" to their Micrographic Structures.—D. Hanson and J. R. Freeman: The Constitution of the Alloys of Iron and Steel.—T. F. Russell: The Potential Energy of Cold Worked Steel.—F. C. Thompson and A. Goffey: The Changes in Iron and Steel below 400° C.—L. E Benson and F. C. Thompson: Some Experiments on Grain-growth in Iron and Steel.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Prof. J. T. MacGregor-Morris: Modern Electric Lamps (3); Glowing Gases (Neon Lamps).

ROYAL SOCIETY, at 4.30.—Prof. A. Fowler: The Series Spectrum of Trebly-ionised Silicon (Si IV).—Sir Robert Robertson and W. E. Garner: Calorimetry of High Explosives.—Dr. H. S. Hele-Shaw: Stream Line Filter.—Dr. F. W. Aston: A Critical Search for a Heavier Constituent of the Atmosphere by means of the Mass-Spectrograph.—Prof. H. E. Armstrong: Electrolytic Conduction; sequel to an attempt (1886) to apply a Theory of Residual Affinity.—Prof. H. E. Armstrong: The Origin of Osmotic Effects. IV. Hydrono-dynamic Change in Aqueous Solutions.—Prof. R. W. Wood and A. Ellett: The Influence of Magnetic Fields on the Polarisation of Resonance Radiation.—W. G. Palmer: A *Study of the Oxidation of Copper* and the Reduction of Copper Oxide by a new Method.—E. A. Fisher: Some Moisture Relations of Colloids. II. Further Observations on the Evaporation of Water from Clay and Wool.

ROYAL SOCIETY OF MEDICINE (Neurology Section), at 5.—Annual General Meeting, to be followed by a Clinical Meeting.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Dr. J. A. Fleming: Problems in Telephony, Solved and Unsolved (Fourteenth Kelvin Lecture).

OPTICAL SOCIETY (at Imperial College of Science and Technology), at 7.30.—Dr. J. W. French: Stereoscopy restated.

CHEMICAL SOCIETY (at Institution of Mechanical Engineers), at 8.—Prof. W. H. Perkin: Adolph von Baeyer Memorial Lecture.

FRIDAY, MAY 11.

IRON AND STEEL INSTITUTE (at Institution of Civil Engineers), at 10.—Announcement of award of the Andrew Carnegie Research Scholarship.—C. A. Ablett: Economic Principles governing the Use of Electrical Power in Iron and Steel Works.—T. P. Colclough: The Constitution of Basic Slags—its Relation to Furnace Reactions.—Prof. C. H. Desch and A. T. Roberts: Some Properties of Steels containing Globular Cementite.—K. Honda and T. Murakami: The Structural Constitution of Iron-Carbon-Silicon Alloys.—T. Matsushita: Some Investigations on the Quenching of Carbon Steels.—E. J. L. Holman: Note on a Value for the Surface Tension of Iron Sulphide.

IRON AND STEEL INSTITUTE (at Institution of Civil Engineers), at 2.30.—C. A. Edwards and C. R. Austin: A Contribution to the Study of Hardness.—F. C. Langenberg: An Investigation of the Behaviour of Certain Steels under Impact at Different Temperatures.—J. Stead: The Cold Working of Steel with Reference to the Tensile Test.—J. J. A. Jones: The Acl Range in Alloy Steels.—C. R. Austin: Some Mechanical Properties of a Series of Chromium Steels.—H. O'Neill: Variation of Brinell Hardness Number with Testing Load.

ROYAL ASTRONOMICAL SOCIETY, at 5.

PHYSICAL SOCIETY OF LONDON (at Imperial College of Science and Technology), at 5.—J. H. Jeans: The Present Position of the Radiation Problem (Eighth Guthrie Lecture).

ROYAL SOCIETY OF MEDICINE (Clinical Section), at 5.30.—Annual General Meeting.

BRITISH PSYCHOLOGICAL SOCIETY (Æsthetics Section) (at Bedford College), at 5.30.—Prof. C. W. Valentine: The Place of Imagery in the Appreciation of Poetry.

MALACOLOGICAL SOCIETY OF LONDON (at Linnean Society), at 6.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—W. F. C. Cooper: The Theory of Resistance to the Flow of Gases and Fluids in Pipes (Durham Bursar's Lecture).

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Prof. W. A. Bone: Gaseous Combustion at High Pressures.

PUBLIC LECTURES.

MONDAY, MAY 7.

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, at 5.15.—Prof. W. de Sitter: Problems of Fundamental Astronomy.

TUESDAY, MAY 8.

UNIVERSITY COLLEGE, at 5.—Prof. H. R. Kruyt: The Electric Charge of Colloids.—At 5.30.—J. H. Helweg: Danish Scenery.

KING'S COLLEGE, at 5.30.—Prof. H. Wildon Carr: Blaise Pascal: Tercentenary of his Birth, June 19, 1923 (1) (succeeding Lectures on May 15, 22, and 29).

BIRKBECK COLLEGE, at 6.—Sir Richard Gregory: The Worth of Science.

WEDNESDAY, MAY 9.

UNIVERSITY COLLEGE, at 5.15.—Sir Thomas H. Holland: Phases of Indian Geology (succeeding Lectures on May 23 and 30).

THURSDAY, MAY 10.

ST. MARY'S HOSPITAL (Institute of Pathology and Research), at 4.30.—Dr. H. H. Dale: The Physiology of Insulin.

KING'S COLLEGE, at 5.30.—Principal L. P. Jacks: Reality in Religion and Education (Hibbert Lecture).

FRIDAY, MAY 11.

SCHOOL OF ORIENTAL STUDIES, at 5.—Dr. P. Giles: The Aryans (succeeding Lectures on May 25 and June 8.