

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 25.—Sir Archibald Geikie, K.C.B., president, in the chair.—Sir W. de W. **Abney**: The change in hue of spectrum colours by dilution with white light. The author shows that by diluting the spectrum colours from the red to the green-blue with moderate percentages of white light, their hue travels towards the yellow, the change being dependent on the amount of red and green existing in the white added. At a point near λ 5780 the hue remains unaltered by the addition of white, and it is towards this point in the spectrum that the colours on each side of it travel. It is pointed out that this change in hue enables the relative amounts in green and red from λ 5000 to λ 6000 to be accurately determined.—Prof. G. E. **Hale** and F. **Ellerman**: The nature of the hydrogen foculi and their structure at different levels in the solar atmosphere.—Prof. H. L. **Callendar** and H. **Moss**: The boiling point of sulphur corrected by reference to new observations on the absolute expansion of mercury.—C. **Cuthbertson** and Maude **Cuthbertson**: The refraction and dispersion of neon. The refractivities of neon (Ne_2) for different wave-lengths are found experimentally to be

$\lambda \times 10^8$	$\mu - 1 \times 10^6$
6438	134.02
5461	134.30
4800	134.63

These can be expressed by the formula

$$\mu - 1 = \frac{5.133 \times 10^{27}}{38517 \times 10^{27} - n^2}$$

where n is the frequency V/λ . Owing to the feebleness of the dispersive power of neon, the accuracy of the value obtained for the dispersion is not to be relied on to less than 5 per cent. Revised formulæ for the refractive indices of helium, argon, krypton, and xenon are given, in the same form, which supersedes the use of Cauchy's formula.—C. **Cuthbertson** and Maude **Cuthbertson**: The refraction and dispersion of air, oxygen, nitrogen, and hydrogen, and their relations. The refractivities of these gases for different wave-lengths are found experimentally to be

$\lambda \times 10^8$	$(\mu - 1)10^6$			
	Air	Oxygen	Nitrogen	Hydrogen
6563 ...	291.92 ...	269.75 ...	298.16 ...	138.66 ...
5790 ...	292.98 ...	270.99 ...	— ...	139.33 ...
5461 ...	293.60 ...	271.70 ...	299.77 ...	139.71 ...
4861 ...	295.11 ...	273.45 ...	301.21 ...	140.64 ...

Cauchy's formula of two terms is shown to be inadequate to express the dispersion of a gas, and a formula of Sellmeier's type is adopted,

$$\mu - 1 = \frac{C}{n_0^2 - n^2}$$

In this form the refractivities of these gases are given by the constants shown in the table below. Revised values of the indices of sulphur, phosphorus, and mercury, expressed in the same form, are also given, and it is shown that, on the electronic theory of dispersion, the relative numbers of "dispersion electrons" in hydrogen, oxygen, and nitrogen are as 1, 2, and 3 almost exactly; in sulphur and phosphorus, to a less degree of accuracy, as 3 and $4\frac{1}{2}$. In mercury the number is in the neighbourhood of $4\frac{1}{2}$ to 5.

	$C \times 10^{-27}$	$n_0^2 \times 10^{-27}$	V	C/V
Air ...	4.6463	16125	—	—
Hydrogen.	1.692	12409	1	1.692
Oxygen ...	3.397	12804	2	1.699
Nitrogen...	5.0345	17095	3	1.678
Sulphur ...	4.808	4600	3	1.603
Phosphorus	7.61	6534	$4\frac{1}{2}$	1.691
Mercury ...	to { 7.82	{ 4360	{ $4\frac{1}{2}$	{ 1.74
	{ 8.371	{ 4740	{ 5	{ 1.68

—C. **Cuthbertson** and Maude **Cuthbertson**: The refraction and dispersion of sulphur dioxide and hydrogen sulphide, and their relation to those of their constituents.

The refractivities of sulphur dioxide for different wave-lengths are found experimentally to be

$\lambda \times 10^8$	$(\mu - 1)10^6$
6700	656.40
6500	657.10
5800	661.26
5461	663.97
5000	668.63

These can be expressed in a formula of Sellmeier's type,

$$\mu - 1 = \frac{5.728 \times 10^{27}}{8929 \times 10^{27} - n^2}$$

The refractivities of hydrogen sulphide for different wave-lengths are found experimentally to be

$\lambda \times 10^8$	$(\mu - 1)10^6$
6563	636.22
5790	641.17
5461	644.03
4861	650.98

These can be expressed in the same form by

$$\mu - 1 = \frac{4.834 \times 10^{27}}{7808 \times 10^{27} - n^2}$$

The number of "dispersion electrons" in SO_2 is shown to be approximately equal to the sum of the numbers of "dispersion electrons" in S_2 and in O_2 . The number of "dispersion electrons" in H_2S is, approximately, one more than the sum of the "dispersion electrons" in H_2 and in S_2 .—Prof. M. F. **Fitzgerald**: Flapping flight.—Dr. W. **Rosenhain** and J. C. W. **Humfrey**: The crystalline structure of iron at high temperatures. The paper contains a preliminary account of observations on the effects of strain on iron at high temperatures. Polished strips of nearly pure iron were heated *in vacuo* and strained while hot, the central portions of the specimen attaining a temperature of about $1100^\circ C.$, while the ends remained below visible redness. Heating alone produced a surface pattern caused by a volume change in the metal when passing through the $\alpha = \beta$ transformation, and occasionally where the temperature was highest a slight tarnish which revealed the γ crystals. Heating and straining *in vacuo* showed that at all temperatures attained deformation took place by means of slip on the gliding planes of the crystals; three distinct regions could, however, be distinguished, and temperature estimations by the method of Joly's maldometer agree with the identification of these regions with the α , β , and γ ranges of Roberts-Austen. This identification is supported by differential heating and cooling curves given in the paper. In the α range the number and intensity of slip-bands increases rapidly with increasing temperature; at the transition point—which is seen as a well-defined line across the specimen—the bands suddenly cease and remain minute during the β range; in the γ range the bands are again numerous, but differ from those observed in the α range by their straightness and regularity and by the frequent occurrence of twin crystals. These observations are illustrated by three photomicrographs. The authors consider that their observations strongly support the allotropic theory of Roberts-Austen, particularly since they show that β iron, although at a higher temperature, is markedly harder and stronger than α iron. So much is this the case that when such a specimen was broken while hot, the fracture took place in the region of hottest α iron, just before the transition point. The present observations also demonstrate the similarity of γ iron, as found in nearly pure iron when heated, with the well-known " γ iron" found in alloy steels.—Dr. A. E. H. **Tutton**: The relation of thallium to the alkali metals: a study of thallium-zinc sulphate and selenate. This communication contains the results of an investigation of the thallium salts of the zinc group of the monoclinic series $R_2M(S_2O_4)_2 \cdot 6H_2O$, analogous to the previous investigation of the simple rhombic salts of the series $R_2S_2O_4$. The conclusions formed as the result of the latter research are fully confirmed and independently substantiated, as regards the relations of thallium to the alkali

metals and ammonium, and the nature of the isomorphism existing between the salts of these various bases. A large number of crystal measurements and determinations of physical constants are recorded in the paper. The main conclusion is that the morphological and physical properties of the crystals of these thallium double salts are such as quite entitle them to inclusion in the monoclinic isomorphous series of the general formula above given, but not to places in the more exclusive eutropic series within that isomorphous series. This eutropic inner series is confined to the salts the interchangeable metals of which belong to the same family group of the periodic classification, namely, to those of potassium, rubidium, and cesium, the crystals of which exhibit the regular progression of angles and physical constants, according to the atomic weight of the metal, already pointed out by the author in previous communications. The crystals of the thallium salts resemble very closely those of the ammonium salts—which are also outside the eutropic series, but are included in the isomorphous series—except as regards one outstanding specific property, that of refraction; for the crystals of the thallium double salts, like those of the simple sulphate and selenate of thallium, exhibit transcendent refractive power, which proves to be a characteristic property of the crystals of all the thallium salts yet studied by the author.

—P. F. **Everitt**: The nature of the diffraction figures due to the heliometer. This paper contains a discussion of the heliometer diffraction fringes. The matter is one of considerable importance, owing to its bearing on astronomical measurements taken with this instrument. A difficulty arose owing to the appearance of these fringes in heliometer work on an artificial double star. It was then found that, although the subject had been discussed by Bessel, Hansen, and Gauss, a good photograph of the actual fringes obtained by Scheiner and Hirayama, and a series given for the calculation of the fringes by Bruns, all attempts at their actual numerical determination had failed, owing to the extremely slow convergence of the series adopted, at a small distance from the centre of the system. By the adoption of a semi-graphic method, and the use of mechanical integrators, it has been found possible to carry out the calculations needful in order to obtain an accurate picture of the fringes. Photographs were taken of the fringes, and these, taken by the author, as well as the photograph taken by Scheiner and Hirayama, show a close agreement with the calculated contours, and enable one to obtain the proportions of the central (non-elliptic) oval, with which observers are chiefly concerned. The close agreement between the calculated and theoretical values of the different parts of the system is a further proof that the old undulatory theory suffices to determine in practice the true dimensions of such diffraction figures.

—E. **Cunningham**: The motional effects of the Maxwell æther-stress. There is an outstanding gap in electromagnetic theory in respect to the attempt to reconcile the analysis of æthereal stress on the lines initiated by Maxwell with Newton's third law and with the law of the conservation of energy. In the present condition of theory there are assigned to the æther certain distributions of electromagnetic energy and momentum. The hypothetical distribution of energy is necessarily associated with the Poynting vector which measures its rate of transference. The distribution of momentum is so defined that the rate of increase of the total amount within any given volume supposed at rest in the æther is equivalent to the resultant of the Maxwell stresses on the bounding surface. There is, however, no connection established between the transference of energy across an area and the stress across that area. Such a connection would require that it should be possible to assign to the medium in which stress and energy reside a state of motion whereby the stresses might do the necessary amount of work; and this, again, would require the revision of the specification of stress, inasmuch as the ordinary expressions are computed for an element of surface which is at rest. In the first section of the present paper it is shown that, if g is the intensity of electromagnetic momentum ($[EH]/4\pi c$) and w the energy intensity ($[E^2+H^2]/8\pi$), and the velocity v is taken in the direction of g of magnitude, such that $(c^2+v^2)g=2vW$, the same stress system which would account for the transfer of momentum will account for the transfer of energy, pro-

vided the æther is assumed to be moving with velocity v . The stress system is not the ordinary Maxwell one, but reduces to it in the electrostatic case. In this case it is known that the Maxwell stress may be analysed into a tension along the lines of force, together with a uniform pressure at right angles to those lines. This property of the stress system, commonly given, is not true of the total stress (electric and magnetic) in the general field. It is shown, however, that the stress system obtained in the paper can always be reduced to this form. The direction of one of the principal stresses is always along the velocity v . It is shown, further, that at the surface of a perfect reflector, stationary or moving, the velocity v is equal to that of the reflector combined with a velocity tangential to it, that is to say, a perfect reflector is analogous to an impenetrable boundary. In the second part of the paper a similar analysis is applied to radiation such as would exist in the interior of a cavity the walls of which are moving, so that, although the electric and magnetic forces vary extremely rapidly and in an irregular manner, there is necessarily a transfer of energy. Taking ϵ and γ as the mean values of the energy and momentum over intervals of time, which are short as compared with those which are appreciable by mechanical means, but long as compared with the period of the irregular fluctuations which constitute natural radiation, it is found that the mechanical properties of the radiation may be represented as those of a continuous quasi-fluid, in which there is a definite pressure p at every point (the same in all directions) and a definite velocity v , the relations connecting the several quantities being

$$\begin{aligned} 2p &= \epsilon - v\gamma & \dots & \dots & (1) \\ c^2\gamma &= v(\epsilon + p) & \dots & \dots & (2) \end{aligned}$$

If a small volume V is followed in its motion with the quasi-fluid, it is found that the quantity

$$pV^{4/3}(c^2 - v^2)^{-2/3} \dots \dots \dots (3)$$

remains constant. If v^2 is neglected this becomes the known equation connecting the pressure and volume of steady radiation for adiabatic changes. Finally, it is shown that if a state of the radiation differing slightly from the actual is conceived, and dQ is the difference in the energy of the small volume V , after allowing for the change due to mechanical causes, such as increase of momentum and volume, the condition that the expression dQ/T should be a perfect differential is that

$$p(c^2 - v^2)^2 = kT^4 \dots \dots \dots (4)$$

This with (3) involves the equation

$$pV/T = \text{constant.}$$

—Dr. H. C. **Pocklington**: The aberrations of a symmetrical optical instrument. The doubly modified characteristic function is written down, and the singly modified function derived from it correct to terms of the fourth order of small quantities. This is transformed so as to take account of the existence of an exit pupil, and formulæ are found giving the aberrations for any position of the object and pupil in terms of the six coefficients of aberration of the system. Some relations are found between these aberrations, and connection is established with the methods of numerical calculation given in Whittaker's tract on "The Theory of Optical Instruments."—H. E. **Watson**: The spectrum of radium emanation.—Prof. E. G. **Hill** and Dr. A. P. **Sirkar**: The electric conductivity and density of solutions of hydrogen fluoride.—Sir David **Bruce**, Captains A. E. **Hamerton** and H. R. **Bateman**, and Captain F. P. **Mackie**: Sleeping sickness in Uganda. Duration of the infectivity of the *Glossina palpalis* after the removal of the lake-shore population.

Institution of Mining and Metallurgy, November 18.—Mr. Edgar Taylor, president, in the chair.—L. D. **Ricketts**: Experiments in reverberatory practice at Cananea, Mexico. A detailed description of the installation of a reverberatory furnace and McDougal calciners at the Cananea Consolidated Copper Co.'s Works, and of the difficulties that were encountered in connection with

the fuel available. The coal that was obtainable was of so unsuitable a quality that, after experiments with it whole and pulverised, none of which was attended with success, recourse was had to oil fuel. A feature of the smelting operation is the relatively large proportion of flue dust treated. Full details are given of the quantities of materials treated and of the costs of the various operations, and the author goes minutely into the circumstances attending the failure of the coal-firing and difficulties encountered during that and the subsequent oil-firing. The paper is principally composed of observed facts.

Physical Society, November 26.—Dr. C. Chree, F.R.S., president, in the chair.—Dr. J. W. **Nicholson**: The effective resistance and inductance of a helical coil. This paper deals with a determination of the effective resistance and inductance of a helical coil of great length, composed of thin wire, wound on a cylinder the radius of which is large in comparison with that of the wire. The pitch of the winding is not small, so that the problem cannot be treated by the method of Cohen. The method employed depends upon the use of a type of "helical coordinates" defining the position of any point, and of the general theorem relating to orthogonal systems of coordinates. A solution is obtained for the internal and external forces, corresponding to a given impressed electromotive force, in the form of a Fourier series of which only the initial terms require calculation. The value of the effective current across any section is obtained, and thence the inductance and resistance. For a high frequency it is found that the change of self-inductance due to twisting of the wire tends to vanish, and that the change of resistance tends towards a value independent of the frequency.—W. A. **Scoble**: Ductile materials under combined stress. The author further considers the results from some earlier tests made on mild steel bars, $\frac{3}{4}$ -inch diameter and 30 inches effective length, under combined bending and torsion. It is pointed out that the yield-point is usually selected as the criterion of strength, because it is more easily determined than the elastic limit, it is less affected by special treatment of the material, and it is assumed that the failure of Hooke's law between the elastic limit and the yield-point is due to local yielding. The elastic limit is the correct point, and is used throughout, because the intermediate state mentioned above does not appear in bending. The results of tests on steel and copper tubes under combined bending and torsion are also given. All the results indicate that the maximum stress and maximum strain laws do not apply to ductile materials. The stress difference or shear stress law is approximately true, but there is, in each case, a deviation from the law which is opposed to the other theories mentioned. The shear stress law appears to state the average behaviour of ductile materials, but there are considerable deviations from the law, which are usually opposed to the other theories. Other tests by the author indicate that brittle materials obey the maximum stress law, and it is therefore suggested that the value of "*m*" depends chiefly on the degree of ductility of the material considered, and to a lesser extent on the system of loading.—Drs. W. **Makower** and S. **Russ**: The recoil of radium C from radium B. It has been shown in a previous paper that, during a radioactive transformation involving the expulsion of an α particle, the residue of the atom from which the α particle has been expelled recoils in an opposite direction to that in which the α particle is emitted, and can travel a considerable distance through a gas if the pressure is sufficiently low. A similar effect was also demonstrable in the case of the transformation of radium B into radium C, although this transformation is supposed to be accompanied by only β rays. The phenomena associated with this recoil are studied in this paper. In the first place, it was found that it was only in certain circumstances that pure radium C free from radium B was projected from a plate coated with radium B and radium C. Secondly, the active deposit on a plate appears to be concentrated into heaps, so that radium C, in breaking up, mechanically carries with it some radium B. If, however, sufficient time is allowed after removing a plate from the emanation for Radium A to decay completely, and if, further, sufficiently small quantities of deposit are used to avoid

the formation of heaps, practically pure radium C is emitted. The law according to which the radiation fell off with distance was also studied, and it was found that radium C is not emitted from an active plate equally in all directions, a greater quantity being emitted normally to the plate than in directions making an angle with the normal. The absorption by air of radium C when it recoils from radium B was investigated. It was found that about half the radium C projected from a plate was stopped by 2.5 cm. of air at a pressure of 0.04 mm. mercury. Since radium B emits only β particles, the energy of recoil in this case should be less than one-millionth of the energy of recoil in a transformation in which an α particle is emitted. The fact that the penetration of radium C when it recoils is as much as one-fortieth of that previously found for radium A and radium B is therefore surprising.—Dr. C. V. **Burton**: The sun's motion with respect to the æther. Notwithstanding the well-known "principle of relativity," it is theoretically possible to determine the motion of the solar system with respect to the æther from observations of the eclipses of Jupiter's satellites, and the possibility was indicated by Maxwell some thirty years ago. For convenience, the motion of the æther with respect to the sun may be called a wind, and the method proposed is based on the consideration that the tidings of an eclipse will travel towards us more rapidly when the Jovian system is to windward of us than when it is to leeward. The residual discrepancies between the observed and calculated times of eclipses have to be analysed for systematic differences depending on the direction in space of the straight line drawn from the earth to Jupiter, and formulæ are given for finding by the method of least squares the most probable values of a , b_1 , c_1 , the components of the sun's velocity with respect to the æther. The material available is to be found in Prof. R. A. Sampson's discussion of the Harvard photometric eclipse observations, about 330 eclipses of Jupiter's satellite I. being included. In order to obtain a preliminary notion of the accuracy to be expected, a simplified system has been considered in which (for one thing) the eccentricity of the orbits was virtually neglected, and it appears that some advantage is to be gained by taking the plane of Jupiter's orbit, rather than the ecliptic, as one of the coordinate planes. The axis of x is drawn from the sun's centre through the node of Jupiter's orbit, the axis of y lying also in that orbit, and the axis of z being perpendicular thereto. Taking 4.5 seconds as the "probable" discrepancy between theory and observation for a single eclipse, the following preliminary estimates are obtained:—probable error in a = 43.6 km. per second; probable error in b_1 = 45.6 km. per second; probable error in c_1 = 10,000 km. per second.

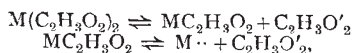
Royal Anthropological Institute, November 30.—Dr. A. C. Haddon, F.R.S., in the chair.—Canon **Greenwell** and the Rev. R. A. **Gatty**: Pit-dwellings at Holderness. An interesting discovery of pit-dwellings has been made by Mr. William Morfitt, of Atwick, near Hornsea, in Holderness. Mr. Morfitt for the past twenty years has devoted his attention to these dwellings, which are excavated 5 feet deep in the Boulder-clay, and are covered by an unbroken surface soil to the depth of 18 inches. The pits are filled with black mud, which on being removed discloses the original floor of the dwelling, with its hearth and broken pottery, the remains of past feasts in the form of broken bones, and the rude flint tools of the dwellers, for no well-shaped implement has come to light. About thirty of these dwellings have been examined and the pottery restored. Their great antiquity is proved by the fact that long after the inhabitants had ceased to occupy the pits, and mud had filled them up, a surface soil had formed to the depth of 18 inches, upon which late Neolithic implements and bronze implements have been found. This shows the dwellers to have been earlier than the Bronze age. The pottery is of the rudest kind, with no decoration. The bones remaining from the feasts include those of red deer, horse, Celtic ox, goat, and pig. Although the pits are now close to the sea, no fish bones or shells have been found in them, which proves that when they were occupied their position was far inland. The rapid

demolition of the land by the sea in this part of Holderness accounts for this, but it also shows that a long period of time must have elapsed. In all probability these pit-dwellings are among the earliest habitations of Neolithic man which have been found in England. Prof. Boyd Dawkins was present when a fall of cliff had exposed one of these pits on the estate of Colonel Haworth Booth, and verified the fact that the surface soil covering the pit was unbroken, and must have been deposited after the pit had become filled with mud.

Faraday Society, November 30.—Mr. James Swinburne, F.R.S., president, in the chair.—Dr. H. J. H. Sand: The electroanalytical determination of lead as peroxide. This investigation was carried out with the object of elucidating the cause of the discrepancy between the statements of various experimenters regarding the behaviour of an electrolytic lead peroxide deposit on drying at 200°. All authors agree that the peroxide deposit retains water at this temperature, but whereas Hollard and Bertiaux give an analytical factor of 0.853, most other investigators find a factor of approximately 0.864, the theoretical factor being 0.866. Incidentally, the effect of varying conditions on the coherence of the deposit was also studied. It was found that at 200° a lead peroxide precipitate is capable of absorbing moisture from a damp atmosphere, and an increase of as much as 1.7 per cent. of the weight of the deposit has thus been obtained. On heating in a dry atmosphere at the same and higher temperatures the peroxide loses its water exceedingly slowly.—A. Jaques: The influence of dissolved gases on the electrode potential in the system of silver—silver acetate, aq. Variable values were found for the E.M.F. of the cell



and the variations were traced to the presence of dissolved air in the silver acetate solution. Measurements were made with saturated and 0.5 N silver acetate solutions saturated with hydrogen, oxygen, nitrogen, and carbon dioxide respectively, and reproducible values were obtained for the solution saturated with hydrogen which agreed with those calculated from the determinations of the E.P. of silver by G. N. Lewis and by Brislée. The values for solutions saturated with carbon dioxide also approximated to this. On blowing hydrogen into the solution saturated with carbon dioxide the potential fell about 30 millivolts, then gradually rose to about the normal value. With oxygen and nitrogen equal values were obtained—about 20 millivolts below that found with hydrogen. In 0.01 N silver acetate saturated with hydrogen the values were not reproducible. Similar measurements with 0.1 N silver nitrate and 0.5 mol. N lead acetate and lead nitrate showed that in these solutions the electrode potential is practically unaffected by the presence of dissolved gases.—A. Jaques: Contributions to the study of ionisation in aqueous solutions of lead acetate and cadmium acetate. From measurements of electrode potentials in solutions of lead and cadmium acetates, and their freezing points, and the solubility of silver acetate in them, it appears that in dilute single solutions ionisation occurs chiefly, though not entirely, according to the scheme



where M represents Pb or Cd. Approximate values for the corresponding dissociation constants are calculated.—Prof. F. G. Donnan and Dr. G. D. Hope: The calorimetric analysis of hydrated salts. The authors point out that the interpretation of the heats of solution of hydrated and partially dehydrated salt given by Thomsen in his "Thermochemische Untersuchungen" is in various cases either erroneous or unsatisfactory. It is shown that Thomsen's data for sodium carbonate indicate, when correctly interpreted, the existence of only the hydrates with 1, 7, and 10 mols. water per mol. anhydrous salt. The authors' experiments confirm this result. In the case of copper sulphate, neither the experiments of Thomsen nor those of the authors indicate more than the existence of the hydrates $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ and $\text{CuSO}_4 \cdot \text{H}_2\text{O}$, though the hydrate $\text{CuSO}_4 \cdot 3\text{H}_2\text{O}$ is known to exist.

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Linnean Society, December 2.—Dr. D. H. Scott, F.R.S., president, in the chair.—Sir Charles Elliot: Nudibranchs from the Indian Ocean.—Dr. Georg Ulmer: Trichoptera von Mr. Hugh Scott auf den Seychellen gesammelt.—Dr. W. H. Dall: Report on the Brachiopoda obtained from the Indian Ocean by the *Sealark* Expedition, 1905.—Prof. J. S. Gardiner and others: Narrative of the *Sealark* Expedition, part iii.

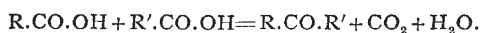
PARIS.

Academy of Sciences, November 29.—M. Bouchard in the chair.—L. Maquenne and M. Demoussy: The blackening of green leaves. The blackening of leaves by the ultra-violet rays is not due to a specific action of this radiation; it takes place equally under all influences which determine the death of the protoplasm, such as heat, chloroform, or mechanical rubbing. This phenomenon is a consequence of diastatic action, and falls into the same category as the facts observed for the first time by M. Guignard in his researches on the localisation of plant principles.—A. Witz: The regeneration of the exhaust gases from internal-combustion motors. The author suggests that the exhaust gases, taken from the cylinder without cooling, should be passed over a column of incandescent coke. The gas thus produced, containing carbon monoxide, is washed and re-admitted with pure oxygen to the gas-engine cylinder. It is assumed that the price of the oxygen, prepared from liquid air, is now sufficiently low for use in this manner commercially. The utilisation of the heat in the exhaust gases is calculated to give an economy of about 30 per cent.—S. Arloing: Antituberculous vaccination in the ox. An account of the practical results which have been obtained in the direction of obtaining immunity against tuberculosis in cattle in experiments which have been carried on for more than twenty-five years.—M. Jarry-Deeloges: The period of rotation of Mercury. The surface of Mercury presents a certain number of dark spots, often well defined. The chief difficulty in perceiving these is the bad quality of the telescopic images. The rotation of Mercury from these observations would appear to occupy a long period, and is probably equal to the time of revolution.—Robert Jonckheere: Study of the planet Mars at the Observatory of Hem. Details are given of observations taken between July 16 and November 1 of this year.—Jean Merlin: Algebraical equations.—M. and Mme. Paul Dienes: Algebraico-logarithmic singularities.—Frédéric Riesz: Linear functional operations.—L. Lichtenstein: The determination of the integrals of the equation

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + a \frac{\partial u}{\partial x} + b \frac{\partial u}{\partial y} + cu = f.$$

—H. Pellat: The bifilar pendulum. A supplementary note to a recent paper on this subject dealing with the error introduced by the defective flexibility of the suspending metallic ribbons.—H. Merzcyng: Studies on very short electromagnetic waves. Reflection and anomalous dispersion of liquids. These measurements necessitated the exact determination of the wave-length of the electromagnetic waves, and the method based on the dimensions of the vibrators not being sufficiently accurate, an interference method was worked out. The dielectric constants with these short waves (4.5 cm.) and the optical refractive indices were compared for several liquids, including glycerin, methyl and amyl alcohols, acetic acid, aniline, and ethyl ether.—Edm. van Aubel: The production of ozone under the influence of ultra-violet light. Experiments are described proving that ozone is formed by the rays from a quartz mercury lamp.—Laurent Raybaud: The destructive effect of the solar radiation. An account of the action of various radiations on cultures of *Phycomyces nitens*.—Georges Meslin: Magnetic dichroism and the orientation of crystals of siderose in the field.—Edmond Bauer and Marcel Moulin: The constant in Stefan's law. A possible source of error in the determination of this constant by M. Féry is pointed out, and the constant re-determined. The value 6.0×10^{-12} is considered to be correct within 1 per cent.—E. Rengade: The theoretical form of the cooling curves of binary mixtures: the case of mixed crystals.—Paul Sacerdote: Changes in the colour of the diamond under the action of various physical agents. The

X-rays do not sensibly modify the colour of the diamond, but considerable change is brought about by the action of the kathode rays, the diamond developing a yellow tint. This tint is permanent at the ordinary temperature, but an exposure to a temperature of 300° to 400° C. rapidly restores the original tint.—**André Meyère**: The influence of radium, the X-rays, and the kathode rays on various precious stones. The stones examined in these experiments were the diamond, and white, blue, and rose corundums. One effect only was produced by all three radiations—the stone became more or less tinted yellow.—**J. B. Senderens**: The catalytic preparation of unsymmetrical fatty ketones. Thoria is the most suitable catalyser for the purpose of these experiments, and is employed at a temperature of 400° to 430° C. A mixture of fatty acids passed over this reagent gives the ketone according to the equation



Small quantities of the two symmetrical ketones are formed simultaneously, but the three ketones are readily separated by fractional distillation.—**G. Vavon**: Hydrogenations in the terpene series. Pinene rapidly absorbs hydrogen in the presence of platinum black, giving a nearly quantitative yield of the hydrocarbon $C_{10}H_{18}$. Camphene and limonene behave similarly. In alcoholic solution hydrogen can be added in this way to maleic, fumaric, and cinnamic acids, and to erucic acid in ethereal solution.—**T. Klobb**: The phytosterols from the flowers of *Tussilago farfara*. Two new alcohols are described, one being a monovalent phytosterol, the other divalent and resembling arnidol in its behaviour.—**Georges Darzens**: The catalytic hydrogenation of the quinoline and aromatic bases. The exact temperature at which the nickel oxide is reduced, and the temperature at which the catalysis is carried out, are the two essential factors in the successful reduction of quinoline and aromatic bases. The preparation of tetrahydroquinoline is described.—**Paul Gaubert**: The polychroism of artificially coloured crystals.—**H. A. Brouwer**: Certain lujaurites from Pilsandberg, Transvaal.—**Lucien Daniel**: A new graft hybrid.—**F. Bordas** and **M. Touplain**: An anaëroxydase and a catalase in milk. Repeating some work of M. Sarthou, the authors come to the conclusion that the existence of an anaëroxydase and a catalase in cow's milk has not been demonstrated; the colour reactions produced in milk on treatment with hydrogen peroxide are due to casein or its compound with lime.—**L. Cuénot** and **L. Mercier**: Studies on the cancer of mice. Relation between the grafting of the tumour, gestation, and lactation.—**C. Levaditi** and **K. Landsteiner**: The transmission of infantile paralysis to the chimpanzee.—**Jacques Pellegrin**: A new parasitic fish of the genus *Vandellia*.—**A. Gruvel**: The dispersion of some species belonging to the marine fauna of the coasts of Mauritania.—**Paul Lemoine**: The subterranean folds of the Gault in the Paris basin.—**André Delebecque**: The origin of the plain of Rocailles (Haute Savoie).—**M. Répelin**: The rôle of the most recent dislocations (post-Miocene) in the earthquake of June 11, 1909.

DUBLIN.

Royal Irish Academy, November 8.—**Dr. F. A. Tarleton**, president, in the chair.—**Dr. R. F. Scharff**: The evidences of a former land-bridge between northern Europe and North America. The author explained that he was only dealing with the most recent land-bridge of which we had any evidence between the two continents. The testimony in favour of this theory is of a two-fold character. It is based on an investigation of the sea-floor and on a study of the plants and animals of the countries supposed to have been joined to one another by land. The author alluded principally to the continental shelves and to the researches of Prof. Hull, Dr. Spencer, and Dr. Nansen. He also brought forward botanical and zoological evidence pointing to the existence of a former continuous land surface between north-western Europe and eastern North America. The theory of accidental transport of species across the ocean was especially commented upon and discussed, but the author was inclined to adopt the

view that the similarity between the fauna and flora of the two continents was mainly due to a pre-Glacial land-bridge connecting Scotland with the Færøes, Iceland, Greenland, and Labrador.

NEW SOUTH WALES.

Linnean Society, September 29.—**Mr. C. Hedley**, president, in the chair.—**E. W. Ferguson**: Revision of the Amycteridæ (Coleoptera), part i., the genus *Psalidura*. The family Amycteridæ comprises several groups of hard-shelled, apterous, and solely terrestrial weevils. The genus *Psalidura* comprises the group the distinguishing character of which is that the males possess anal forceps. The previously described species, numbering 37 in Masters's Catalogue, have been revised, and reduced to 24, to which number 22 new species are added, making a total of 46 species. Of these, it has not been possible to examine any specimens of four species, of which three—*P. D'urvillei*, *P. mirabunda*, and *P. squalida*—were described originally from female specimens only (and the descriptions are, therefore, almost valueless).—**T. H. Johnston**: The Entozoa of monotremes and Australian marsupials.—**T. H. Johnston** and **Dr. J. B. Cleland**: Notes on some parasitic Protozoa.—**J. H. Maiden** and **E. Betche**: Notes from the Botanic Gardens, No. 15, on a plant, in fruit, doubtfully referred to *Cymodocea*.

October 27.—**Mr. C. Hedley**, president, in the chair.—**A. M. Lea**: Revision of Australian Curculionidæ, subfam. Cryptorhynchides, part x. The tenth instalment of the revision continues the consideration of the genera allied to *Chætectetorus*, all of them belonging to the "Cryptorhynchides vrais" of Lacordaire. Twelve genera, and thirty-eight species, including fifteen proposed as new, are described.—**A. F. B. Hull**: The birds of Norfolk and Lord Howe Islands. The number of species actually known to breed at the present time amounts to twenty-nine for Norfolk and twenty-one for Lord Howe Island.—**R. J. Tillyard**: Studies in the life-histories of Odonata. No. 3. Notes on a new species of *Phyllopetalia*, with descriptions of nymph and imago. The species here named *Phyllopetalia patricia*, n.sp., was described by the author in 1906 under the name of *P. apollo*, Selys. Further investigation has shown it to be possessed of a number of important peculiarities, marking it out as a distinct species. The discovery of the nymph by Mr. Keith Brown at Leura, Blue Mountains, is of the greatest importance to ontogenists, as the specimen is the only known form of the *Petalia* group of dragon-flies. Evidence is brought forward, mainly on the form of the labium, strongly supporting the view advocated by Dr. F. Ris, that the *Petalia* group is not referable to the *Cordulegasterinæ* at all (though at present placed in that subfamily), but is an archaic remnant of the true *Æschinæ*.—**Dr. H. I. Jensen**: Notes on some recent work on the rocks of Samoa. Prof. M. Weber, of Munich, recently published an exhaustive report on the petrography of the Samoan Islands, based upon the examination of a very complete series of rocks collected by Herr J. Friedländer in 1907. Additional light is thrown upon two problems discussed in the author's two papers on the geology of Samoa, &c., in the Proceedings for 1906 (p. 164) and 1907 (p. 706), namely, the significance of the case of a recently erupted basalt which, on analysis, showed a higher soda content than was to be expected from the results of the petrological examination; and the bearing of the sub-alkaline composition of the Samoan lavas now established by Weber, upon the hypothesis that the eruptions along the Samoa-Tonga-Taupo line depend upon an earth-folding movement (*loc. cit.*, 1906, pp. 661-2).

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 9.

ROYAL SOCIETY, at 4.30.—The Hexosephosphate formed by Yeast-juice from Hexose and Phosphate: **W. J. Young**.—On the Presence of Hæm-agglutinins, Hæm-opsontins, and Hæmolysins in the Blood obtained from Infectious and Non-infectious Diseases in Man (Third Report): **L. S. Dudgeon** and **H. A. F. Wilson**.—Gametogenesis of the Gall-fly *Neuroterus lenticularis* (*Spathogaster baccharum*). Part I: **L. Doncaster**.—Preliminary Note upon the Cell Lamination of the Cerebral Cortex of