Societies and Academies.

LONDON.

Royal Society, May 19.—Lord **Rayleigh** : Studies of the mercury band spectrum of long duration. The stream of vapour is excited by a current of less than a milliampere, using a hot cathode. It is then observed spectroscopically after leaving the region of discharge. As in previous investigations, the resonance line λ2537 is associated with the band spectrum, but the resonance line λ1850 is absent. The important divisions of the band spectrum are : (a) The band at λ2345, with attendant bands of shorter wave-length ; (b) the resonance line λ2537, with bands within a few Ångströms of it ; (c) the fainter maximum at λ2650, and a series of flutings which are made out with difficulty but seem to be associated with it ; (d) the broad maximum at λ3300 ; (e) the broad visual maximum. When the vapour is examined *after excitation* all these features decay *pari passu*. The actual time taken to decay to half intensity under the conditions is $1 \cdot 82 \times 10^{-3}$ second. If the excited stream of vapour is passed through a tube locally heated to redness, the band (e) is extinguished, (a) and (c) are slightly weakened, but (b) and (d) are almost unaffected. As the vapour passes on to the cold part of the tube the visual light (e) reappears to some extent, and (a) and (c) tend to regain their intensities relative to (b) and (d).

A. **Fowler** and L. J. **Freeman** : The spectrum of ionised nitrogen (N II). Observations have been made over the range λ6836 to λ830. Of 340 lines recorded in this region, about one-half have now been classified, and of the remaining lines more than 100 are very faint. The spectrum is built up from triplet and singlet terms. The scheme of terms deduced from the Heisenberg-Hund theory of complex spectra has greatly facilitated the analysis of the spectrum. Of the 19 deepest terms predicted for transitions of a single electron, complex terms being counted as one, all but one have been identified. The term 1^3P_0 recently identified by Bowen from a multiplet at λ671 is probably the deepest, its value being 238850, corresponding to an ionisation potential of 29·5 volts. A few multiplets which appear in the spectrum are attributed to double electron transitions.

O. W. **Richardson** : The hydrogen band spectrum : new band systems in the violet. This paper describes the Q branches of some band systems which include much of the strength of the secondary hydrogen spectrum when this is excited by direct electron impact on the H_2 molecule and there are no additional complications. The final states of the bands appear to be the same as the initial states of the Lyman bands in the far ultra-violet (the B states of Dieke and Hopfield). All the bands are degraded towards the violet. The strongest band system, denoted by A, has its nucleus $(0 \rightarrow 0Q (1)$ line) at λ4633·95(9). The Q branch of the $1 \rightarrow 0$ band is the series 20 Q (m) of Richardson and Tanaka. There is a less strongly developed band system (B) with its nucleus at 3684·38(2) and a few Q(1) lines of a system (C) with its nucleus at 3368·47(0). A, B, and C all have the same set of final states. The terms are $2S = 33727 \cdot 12$, $3P = 12676 \cdot 47$, $4P = 7087 \cdot 66$, $5P = 4514 \cdot 14$. They are very close and similar to the corresponding terms of the principal series of He *singlets* but rather larger.

O. W. **Richardson** : Note on a connexion between the visible and ultra-violet bands of hydrogen. There is evidence in the visible secondary hydrogen spectrum of the existence of bands the final states of which are the same as the initial states of the bands found by Werner in the Lyman region. Some of the con-

sequences of this are discussed, including a recalculation of the moment of inertia of the normal hydrogen molecule. The value found is $4 \cdot 5 \times 10^{-41}$ gm. cm.[2]

C. N. **Hinshelwood** and P. J. **Askey** : Homogeneous reactions involving complex molecules. The kinetics of the decomposition of gaseous dimethyl ether. In the decomposition of dimethyl ether to form carbon monoxide and hydrogen the reaction is unimolecular at pressures above about 400 mm. At lower pressures it ceases to be independent of the initial pressure. The hydrogen seems to act only by maintaining the Maxwell distribution among the molecules of ether, when this would otherwise be disturbed by the chemical transformation of activated molecules ; for it can only restore the rate of reaction to its normal limiting value and cannot increase it beyond this. Nitrogen, helium, carbon monoxide, and carbon dioxide do not have a similar influence.

W. G. **Palmer** : An experimental test of the dipole theory of adsorption. The electric coherer functions normally when the loose contact is immersed in liquids, and the cohering voltage increases regularly in the homologous series of primary alcohols, fatty acids, and their ethyl esters, according to the rule $E^2/l = $ constant, where l is the length of the chain. This result indicates that the energy of desorption in a given series is proportional to the square of the electric moment of the adsorbed molecule, and supports the dipole theory of adsorption.

Sir Robert **Hadfield** : Thermal changes in iron-manganese alloys low in carbon. The temperature at which the final recovery of magnetism occurs on cooling, with its accompanying evolutions of heat, is progressively lowered with increasing manganese percentage. The transformation, however, becomes gradually weaker in intensity and finally vanishes while still at a temperature of about 100° C., and at a manganese percentage just short of that at which non-magnetic qualities are reached, namely, 16 per cent. Thus the explanation that the alloys exceeding this percentage owe their non-magnetic qualities to their critical change points being below atmospheric temperature, is not tenable. The present work gives further support to the belief that the suppression of the magnetic qualities of the iron may be due to its actual combination with the manganese.

K. S. **Krishnan** and C. V. **Raman** : The magnetic anisotropy of crystalline nitrates and carbonates : Crystals of sodium and potassium nitrates exhibit a marked diamagnetic anisotropy, the susceptibility perpendicular to the plane of the NO_3-ion being greater than for directions in the plane ; the difference of susceptibility in the two directions is the same for the two crystals. Attributing this anisotropy to that of the NO_3-ion, its magnitude is exactly what we should expect from the known value of the magnetic birefringence (Cotton-Mouton effect) of nitric acid liquid. An explanation is suggested on the basis of its electronic structure ; the CO_3-ion, which has essentially the same structure, gives almost the same anisotropy.

C. G. **Darwin** : The Zeeman effect and spherical harmonics. The problem of a spinning electrified sphere moving in a central orbit in a magnetic field is solved in spherical harmonics by the method of the wave mechanics. It leads to a set of simple arithmetical equations which give exactly all the features of the standard Zeeman effect in all strengths of field. Strictly the model only yields the odd multiplicities, but the same system of equations is just as competent to give the even.

D. **Jack** : The band spectrum of water vapour. Evidence on the nature of the emitter of the water vapour bands is in favour of the OH ion. The band

2608 is similar in structure to the others and leads to the same final moment of inertia as the bands 3064 and 2811. The scheme of bands suggested by Dieke has been extended, and verified by taking differences of the wave numbers of corresponding lines in the various bands.

L. S. Ornstein, H. C. Burger, J. Taylor, and **W. Clarkson** : The Brownian movement of a galvanometer coil and the influence of the temperature of the outer circuit. A particular form of theory suitable to the requirements for the more complicated case of a galvanometer having an external inductance L, of ohmic resistance r, at an absolute temperature T^0, is developed.

W. A. Bone and **D. M. Newitt** : Gaseous combustion at high pressures (Part vii.). A spectrographic investigation of the ultra-violet radiation from carbonic oxide—oxygen (or air) explosions. The resultant ultra-violet radiation from $2CO + O_2 + 4R$ explosions at corresponding high initial pressures, where R is a diatomic diluent, is much less when the latter is carbon monoxide or nitrogen than when it is oxygen ; this result indicates that the former strongly absorbs the ultra-violet radiation emitted by the burning carbon monoxide in such circumstances. The marked nitric oxide formation which always occurs in a carbon monoxide excess-air explosion at an initial pressure of 25 atmospheres does not take place during the actual combustion, but after all the resulting radiation capable of effecting a sensitive photographic plate has been emitted. When nitric oxide is present during the actual combustion period in such an explosion, a definite absorption band spectrum is superposed upon the characteristic continuous ultra-violet spectrum of the burning carbon monoxide. The resultant ultra-violet radiation from a $2CO + O_2 + 4Ar$ explosion at an initial pressure of 14 atmospheres is very much stronger than that for a $2CO + O_2 + 4He$ explosion at the same pressure, although the maximum temperatures attained in the two cases differ by 130° C. only.

O. W. Richardson and **M. Brotherton** : Electron emission under the influence of chemical action at high gas pressures, and some photoelectric experiments with liquid alloys. The reaction investigated is that of $COCl_2$ at pressures not less than 0·001 mm. on drops of the liquid alloys of sodium and potassium. The electric currents are (1) proportional to the rate of drops (2) independent of the pressure of $COCl_2$ over a wide range. The distribution of velocity among the higher velocity electrons is Maxwellian ; there is no sharp limit as in the photoelectric effect. The average energy is equivalent to a temperature of 2370° K. The chemical currents can be used to determine the contact potential between the drops and a second electrode. The results seem to agree with the hypothesis that the chemical action is propagated sideways at the edges of infected patches.

P. A. M. Dirac : The quantum theory of dispersion. One can consider a field of radiation to be a dynamical system whose canonically conjugate variables are the energies and phases of its Fourier components. One can then describe its interaction with an atom by a Hamiltonian function and obtain a satisfactory quantum theory of all radiative processes. The theory, when applied to the scattering of radiation by an atom, shows that two kinds of scattering processes can take place, namely, single processes for which a light-quantum simply changes its direction of motion, and double processes which are combinations of an absorption and emission. The sum of the two, when account is taken of their mutual interference, gives (excluding the case of resonance) just Kramers' and Heisenberg's dispersion formula. When the incident frequency coincides with that of an absorption line, practically the whole of the scattered radiation comes from transitions to the higher state and down, again governed by Einstein's laws.

Royal Microscopical Society[1] (Liverpool Conference), Mar. 30 and 31.—**Eric Ponder** : The diameter of the red cells of man before and after exercise. The red cells of man, or of any animal, may be measured without being brought into contact with any atmosphere other than one which is in equilibrium with the blood from which the cells are derived (technique of Dryerre, Millar, and Ponder). The preparations of cells, immersed in the plasma of the subject whose cells are to be measured, are made in a special chamber containing a gas mixture in equilibrium with the blood at rest or after exercise, as the case may be, the gaseous tensions of this blood being determined by preliminary analyses. These preparations are then photographed, and the diameter of the cells determined from the plates. There appears to be no difference in the mean diameter of the cells of the same individual before and after severe exercise.— **W. Ramsden** : Surface phenomena. Aqueous solutions of many organic solids of high molecular weight can be made to yield visible solid masses by treating them in such ways as will sweep up any particles present on their air-surfaces. The solutes used are solids which diminish the tension of a water-air surface, and the heaped-up surface-particles are termed ' massed adsorpta.' With the three proteins egg-albumin, fibrinogen, and edestin, the massed adsorpta undergo irrevisible coagulation and are insoluble in the mother liquids. With all other substances tested, including in these very many proteins, the massed adsorptum rapidly goes back into solution. The ' adsorptum-coated ' surfaces are in some cases freely mobile (sodium oleate, bile-salts, quinine). In other cases (nearly all proteins, and saponin) sulphur grains or magnets floated on the surface are mobilised. All solutions capable of being blown into more than fugitive bubbles, or of forming stable emulsions with oils, contain solutes adsorbable at the interfaces concerned. — **J. Ross-Mackenzie** : The causes and correction of cloudiness in malt liquors. Brewing materials are extremely complex in composition, and the ever-changing character of nitrogenous substances produces cloudiness. The permanently soluble nitrogenous constituents are divided into two groups, ' assimilable nitrogen ' and ' non-assimilable nitrogen.' The amount and type of assimilable nitrogen absorbed depends on the class of yeast used. A beer produced from British barley-malt and hops only would contain an excess of crude nitrogen ; to overcome this excess the brewer is compelled to employ materials free from nitrogen as diluents. Composite yeasts are mainly used in breweries and ' wild yeasts,' in excess, are the main cause of cloudiness, abnormal flavours and odours, and general instability in beers.—**A. C. Thaysen** and **H. J. Bunker** : Some observations on the microscopical study of deteriorated fabric from early Egyptian tombs. Swabs were taken in the sepulchral chamber of Tut-ankh-amen's tomb immediately after opening and were tested for live bacteria and fungus spores. Though such were undoubtedly present when the tomb was sealed, no viable spores existed. Linen fabrics from this tomb and that of Queen Hetepheres, *circa* 3000 B.C., was examined to determine the cause of tendering. Probable fungus spores and fragments of mycelium were found in the Tut-ankh-amen material, but on swelling the fibres with sodium hydroxide, the appearance was typical of that produced when tendering is caused by

[1] Continued from p. 766.

chemical agencies. It seems that though microbiological activity occurred on the fibres to a limited extent and in localised areas, such action ceased comparatively soon after the sealing of the tomb and was superseded by a different type of deterioration, usually referred to as ' ageing.'

DUBLIN.

Royal Irish Academy, April 25.—E. J. **Sheehy** : The relative food values of brown (from entire wheat grain) and white (from endosperm of grain) wheaten flour, and their comparative potency for the prevention of xerophthalmia in guinea-pigs. Results of prolonged feeding experiments on guinea - pigs with restricted diets bear evidence of the superiority of brown over white flour as regards the content of vitamin A. Xerophthalmia appears earlier and more frequently in the group of animals fed on white flour and mangels than in the brown flour and mangel lot. The progress made by the group of animals fed on mangels, brown flour, and hydrogenated soya bean oil is similar to that made by those animals fed on mangels, white flour, and cod-liver oil.

Royal Dublin Society, April 26.—W. R. G. **Atkins** : The soluble silicate content of soils. The colorimetric method of Diénert and Wandenbulcke may be used to estimate the soluble silicate in an aqueous extract. Calculated on the weight of the air-dried soil the silicate, as SiO_2, was found to vary from 18 to 124 parts per million. No constant relation was observed between these figures and those for electrical conductivity or pH values, but the soils used had been stored.—M. **Grimes**, H. S. **Boyd Barrett**, and J. **Reilly** : Methylene blue (reductase test) in milk grading.

EDINBURGH.

Royal Society, May 9.—D. Noël **Paton** : Submergence and postural apnœa in the swan. An investigation of the apnœa in the swan in feeding, showing that it is postural and that both labyrinthine and neck reflexes are involved.—H. Graham **Cannon** : On the feeding mechanism of *Nebalia bipes*. Nebalia is a mud-living form feeding on food filtered from an antero-posterior food stream produced by the oscillatory movements of its trunk limbs. The latter are armed along their inner edges with four rows of setæ. The first and third rows are hooked and those of successive limbs interlock, forming a continuous filter wall. The fourth row are stiff setæ which comb the filtered food off the filter walls and the second are brush setæ which sweep the food so gathered forwards to the mouth. The mouth parts both functionally and structurally resemble those of a mysid, and Nebalia probably arose from such a primitive form that took to mud-living habits, the foliaceous limbs having developed in correlation with this new habitat. —A. H. R. **Goldie** : The structure and movement of the atmosphere as affected by diurnal variations. The main processes are (*a*) gravitational mass convection, transferring heat upwards in accordance with Sandstrom's principle, which would in the long run lead to extreme stability in the vertical direction and great frequency of inversions were it not for the operation of (*b*), the waves and vortices due to discontinuous motions, however local, which operate to transfer heat downwards or horizontally at the cost of some of the energy of the general horizontal circulation and tend to obliterate the discontinuities. The final result is a stratification of the atmosphere with a fair degree of ' resilience ' and in particular a semidiurnal variation ; turbulence, initiated in the forenoon by such solar

radiation as reaches ground level and initiated in the evening mainly by outgoing radiation from cloud masses or from air masses raised convectionally in the morning, leads at these times to a certain amount of mixing of layers with consequent retardation ; on the other hand, in the late afternoon and the latter part of the night the laminarity of flow is improved.— A. W. **Greenwood** and F. A. E. **Crew** : On the quantitative relation of comb size and gonadic activity in the fowl. The law of ' all-nothing ' formulated by Pezard does not hold in the case of comb volume. The degree of development of head furnishings is dependent not on the amount but on the degree of spermatogenic activity of the gonadic tissue.

ROME.

Royal National Academy of the Lincei, Mar. 6.— L. **Tonelli** : An approximation polynomial and the area of a surface.—C. **Somigliana** : Determination of geodic constants by means of measurements of gravity alone.—O. M. **Corbino** : Realisation of high positive and negative self-inductions by means of a three-electrode lamp and induction circuits.—A. **Lo Surdo** : The saturation current of thermionic valves. Experiments with various thermionic valves show that, in the phase of saturation, the current intensity is not constant but varies very nearly in proportion to the potential difference between the plate and the filament. Moreover, for any temperature of the filament of any one valve, the increases of the saturation current corresponding with definite increments of the anode voltage are, within wide limits, approximately constant fractions of the respective currents.—J. M. **Burgers** : Some investigations of Helmholtz and of Wien relating to the form of the waves at the surface of separation between two liquids.—L. **Fernandes** and F. **Palazzo** : Investigations on sulpho-salts (ii). Sulphoxypolymolybdates of ammonium and of guanidine. Treatment of the solution of a normal sulphomolybdate with even a relatively weak acid, such as acetic or formic acid, results in decomposition of the salt with evolution of hydrogen sulphide and precipitation of molybdenum sulphide. On the other hand, the sulphoxy-salts, although they are decomposed by strong mineral acids, undergo polymerisation similar to that experienced by the oxygenated salts under the action of weak acids in low concentration. A number of ammonium and guanidine sulphoxypolymolybdates have been prepared in this way.—Remo de **Fazi** : Alcoholic fermentation of glucose solutions exposed to the action of ultra-violet rays. When a glucose solution is exposed to the rays emitted by a quartz mercury vapour lamp, its optical rotation remains unchanged, but its subsequent fermentation by yeast is accelerated, often considerably, and the final liquid is appreciably more free from bacterial contamination than the untreated solution similarly fermented.—G. **Cotronei** : New observations on the influence of the nervous system in relation to nutrition with thyroid in the morphogenesis of the *Anura amphibia*. — P. **Pasquini** : Investigations on the experimental embryology of the echinoderms (i). Atypical segmentation and successive development of the egg of *Arbacia punctulata* (Grey) centrifuged after fertilisation. The resistance of the egg of Arbacia to centrifugal force is immediately modified by fertilisation, the plasma becoming more sensitive in some respects.—U. **D'Ancona** : Investigations on the increase in size of the eye of the eel in relation to sexual maturity, and considerations on its biological significance.—L. Volterra **D'Ancona** : Further as to the variability of the pelagic Daphnia of Lake Nemi.