

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

A., I.—General, Physical, and Inorganic Chemistry

JANUARY, 1938.

New dissymmetry in the effect of the electric field on the red hydrogen line. J. STARK and R. RITSCHL (*Physikal. Z.*, 1937, **38**, 870—873).—The dissymmetry of the H_{α} line in an electric field is a definite effect not dependent on the conditions of experiment. The three p -components (± 2 , ± 3 , ± 4) show the effect. The theory of the effect is discussed. A. J. M.

Dissymmetry of intensity of light emission of positive rays. J. STARK and H. VERLEGER (*Physikal. Z.*, 1937, **38**, 873—880).—The dissymmetry of intensity of the light emission of positive rays in H_2 and He has been investigated. For H_2 , the forward radiation in the direction of the positive rays is less intense than the backward radiation. Along the series of H lines (H_{α} , H_{β} , H_{γ} , H_{δ}) the polarisation increases with increasing term no., but the dissymmetry of intensity varies only a little, and appears to increase. For He the direction of the intensity dissymmetry is different for ortho- and para-lines. There is no proportionality between the series of vals. of polarisation and intensity dissymmetry. Results are also given for Hg, C, and O lines. In the spark lines of O_2 and C, the polarisation is connected with the intensity dissymmetry. For all the spark lines investigated the backward radiation was more intense than the forward. The effect of intensity dissymmetry therefore appears to be a general phenomenon. The polarisation and intensity dissymmetry have a common axis, the velocity axis of the positive rays. They are not determined by the velocity, but are connected with the characteristic nature of the spectral line. The phenomenon is therefore due to axiality of at. structure. A. J. M.

Molecular spectrum of hydrogen in mixtures of hydrogen and helium. N. D. SMITH (*Physical Rev.*, 1937, [ii], **52**, 728—730).—An investigation of the anomalous rotation discovered by Richardson in the spectrum of H_2 mixed with He is reported. Results agree with Oldenberg's explanation (cf. A., 1934, 1153). N. M. B.

Physical processes in gaseous nebulae. II. Theory of the Balmer decrement. D. H. MENZEL and J. G. BAKER (*Astrophys. J.*, 1937, **86**, 70—77; cf. A., 1937, I, 436). L. S. T.

Hydrogen emission lines in the spectra of long-period variable [stars]. G. SHAJN (*Z. Astrophys.*, 1935, **10**, 73—85; *Chem. Zentr.*, 1936, i, 3794).—The emission of the Balmer series is correlated with the distribution and intensity of bands due to TiO , ZrO , C_2 , CN , CH , etc. H. J. E.

Spectrum of α -Lyrae. J. D. BABBITT (*Canad. J. Res.*, 1937, **15**, A, 161—180).—147 out of 156 lines in the spectrum are identified as arising from H and other elements, largely Fe. The profiles of the stronger lines agree with the results of Pannekoek and Verwey (A., 1935, 908). Total absorptions are recorded. F. R. G.

Fine structure of the helium line λ 4686. W. LEO (*Physikal. Z.*, 1937, **38**, 920—921).—The fine structure of the He 4686 line makes it unsuitable to confirm the Sommerfeld theory of at. structure. A. J. M.

Spectrum of nitrogen and atmospheric pressure at high altitudes. R. BERNARD (*Nature*, 1937, **140**, 930).—The spectrum of N_2 excited by electron bombardment varies greatly with pressure, but the spectral composition of auroras of a height of several hundred km. remains practically const. The energy of the electrons and not pressure is thus the factor affecting the relative intensity of the radiations emitted (cf. A., 1937, I, 479). L. S. T.

Excitation functions of the auroral bands of N_2^+ and the comet-tail bands of CO^+ excited by electron impact. F. P. BUNDY (*Physical Rev.*, 1937, [ii], **52**, 698—702).—Using a special discharge tube, the excitation functions were determined by photographic intensitometry. The functions were very similar for N_2^+ and CO^+ and rise rapidly from zero at the excitation potential to sharp max. at 2.5 times that potential and then diminish rapidly in exponential manner. The intensities of the 4018 and 4271 \AA . bands of CO^+ and the 3914 and 4278 \AA . bands of N_2^+ were measured. N. M. B.

Coronal emission lines observed at the total solar eclipse of June 19, 1936. (A) R. SEKIGUTI. (B) F. J. M. STRATTON (*Nature*, 1937, **140**, 724—725, 725).—(A) $\lambda\lambda$ are tabulated and the spectrogram is discussed. The existence of the line 4725 \AA . is confirmed.

(B) If the above identification is accepted then in the lines 6548 and 6584 \AA . there is evidence, for the first time, of a known element in the corona, since these lines are "forbidden" lines of N II. L. S. T.

Zeeman effect of the rare gases. J. B. GREEN (*Physical Rev.*, 1937, [ii], **52**, 736—738).—The g vals. are calc. from the at. coupling factors for the $np^5n'p$ configurations (cf. Shortley, A., 1933, 1226) and show good agreement with experiment. From the curves of the g vals. deductions on the genealogy of the terms in these configurations are drawn. N. M. B.

Stark effect of some singlet lines in the alkaline-earth spectra. B. SVENSSON (*Z. Physik*, 1937,

107, 485—492).—The Stark effect of the Cd lines 4663 and 6439 Å. and the 4630 Å. Zn line is studied. Results are examined, in conjunction with other work on Mg and Ca, in the light of Unsold's theory.

L. G. G.

Spectra of sulphur, potassium, and calcium. H. A. ROBINSON (Physical Rev., 1937, [ii], 52, 724—725).—Available data are extended by the classification of 27 lines in S III, locating six of the important singlet levels accurately with respect to the known triplets. S IV is completely revised and 14 new terms classifying 18 new lines are added; the corr. ionisation potential is 87.610 ± 0.003 v. In K VI and Ca VII two new singlet terms with intercombinations are found. One new singlet term is added to K IV and three terms to S VIII.

N. M. B.

Accidental induced predissociation in band spectra. E. OLSSON (Naturwiss., 1937, 25, 781—782).—In investigations of the stability of mols. which are acted on by a magnetic field as a function of the nuclear vibration quantum no. more selective max. than expected are sometimes found. The process to which these additional max. may be due is an accidental predissociation in the sense of Ittmann (A., 1934, 339). The method is applied to S.

A. J. M.

Absorption bands due to polarisation molecules of potassium vapour. S. DATTA and B. K. CHAKRAVARTI (Sci. and Cult., 1936, 1, 478).—Diffuse lines in the absorption spectrum of K vapour at 25 mm. were attributed to mol. formation arising from van der Waals forces.

CH. ABS. (e)

Determination of the relative transition probabilities in the Bergmann series of Ca. E. KATZ and L. S. ORNSTEIN (Physica, 1937, 4, 757—760).—Transition probabilities are deduced from the relative intensities of the Ca Bergmann lines (m^3F-3^3D) in a C arc with a CaF_2 core and a Ca electrode arc in N_2 .

K. S.

Absorption spectra of manganese and silver in Schumann region. F. W. PAUL (Physical Rev., 1937, [ii], 52, 923—929).—Using a method for observing absorption spectra of materials of high m.p. in the Schumann region, the absorption spectra of Mn and Ag were investigated in the range 800—1930 Å. Data, including identifications of new lines in Mn I and a new sequence of terms $d^9snp^6P^0$ in Ag I, are tabulated.

N. M. B.

Energy states of valency electrons in some metals. I, 6. Regularities existing in crystal level values and those of atomic spectrum of zinc. M. SATO (Sci. Rep. Tôhoku, 1937, [i], 26, 206—213).—The electron configurations of the four lowest levels in Zn are E_1 ($4s, 4p$; $4s, 5p$), E_2 ($4s, 4p$; $4s, 4d$), E_3 ($4s, 5p$; $4s, 9p$), E_4 ($4s, 5p$; $4s, 9d$).

F. J. L.

Emission spectrum of diatomic arsenic. II. G. D. KINZER and G. M. ALMY (Physical Rev., 1937, [ii], 52, 814—821).—Data and analyses previously reported for 2100—3700 Å. (cf. A., 1936, 1039) are extended to 7000 Å. The heat of dissociation is 3.9 v. Two new systems, one provisionally attributed to As_2^+ , have been found.

N. M. B.

Electric quadrupole moment of ^{115}In . R. F. BACHER and D. H. TOMBOULIAN (Physical Rev., 1937, [ii], 52, 836—839).—Measurements of the lines λ 7852 and 8241 Å. of In II show deviations from the interval rule, but these are accounted for by the presence of a nuclear electric quadrupole moment which from the first of the lines is found to be $Q = 0.82 \times 10^{-24}$ sq. cm. No trace of lines due to ^{113}In was found.

N. M. B.

Sensitised fluorescence of tin. J. G. WINANS and R. M. WILLIAMS (Physical Rev., 1937, [ii], 52, 930—932).—An energy level diagram and energy discrepancies with Hg for 15 lines of Sn (with estimated intensities) observed in sensitised fluorescence and in a low-voltage Tesla discharge are given and discussed.

N. M. B.

Electrical and optical properties of iodine vapour. K. G. EMELÉUS, E. B. CATHCART, and C. M. MINNIS (Proc. Roy. Irish Acad., 1937, 44, A, 11—17).—The intensity distribution and the abs. intensity in the electron affinity spectrum of the I atom are calc. The intensity max. is at 3000 Å., but even under the most favourable conditions is so feeble that it cannot be observed. The band at 3400 Å. is probably not the at. affinity spectrum.

F. J. L.

Flame spectrum of europium and persistence of three lines of low excitation. G. PICCARDI (Atti R. Accad. Lincei, 1937, [vi], 25, 730—733; cf. A., 1934, 49).—The intensities of lines in the flame spectrum of Eu have been studied.

O. J. W.

Energy distributions in the spectra of some gaseous discharge tubes. R. G. GIOVANELLI (J. Proc. Roy. Soc. New South Wales, 1937, 70, 392—401).—The energy distribution in the continuous spectrum and the energy associated with each line in the spectrum in terms of the energy of the neighbouring continuum were determined for discharge tubes containing Hg vapour mixed with He, Ne, A, and a mixture of inert gases, respectively. The luminosity is about equally divided between the continuous spectrum (due to inert gases) and the line spectrum (due to Hg).

A. J. M.

Coupling of p -electron configurations. H. A. ROBINSON and G. H. SHORTLEY (Physical Rev., 1937, [ii], 52, 713—723).—The structure and type of coupling of the observed p^2 , p^3 , and p^4 configurations are considered in detail in terms of the intermediate-coupling theory, in particular for recently analysed long isoelectronic sequences. Full data are tabulated and plotted, and a complete bibliography for atoms with p electrons in the normal configuration is given.

N. M. B.

Recombination of ions in the afterglow of a caesium discharge. F. L. MOHLER (J. Res. Nat. Bur. Stand., 1937, 19, 447—456).—The radiation and electrical characteristics of the afterglow have been studied. At low pressures the purplish-pink of the discharge gives way to a pale yellow afterglow, but with increase of pressure the colour change is less marked. The rate of fading of the afterglow decreases with increasing pressure, becoming const. at 46 μ . (pressure in μ . of Hg). The appearance of the spectrum of the afterglow supports the view that the glow is a

recombination spectrum. Calculation of the recombination coeff., α , for pressures 46—110 μ . gives a val. 3.5×10^{-10} , assuming negligible diffusion to the walls. Spectral-intensity distribution data indicate that the temp. of the afterglow falls from 2700° K. (temp. of discharge) to 1350° K. at 0.9×10^{-3} and 1200° K. 1.7×10^{-3} sec. after interruption of the discharge, and that $\alpha = 3.6 \times 10^{-10}$. Electrical measurements of the total no. of ions in the afterglow, and of the flow of ions to the wall, lead to a val. for $\alpha = (3.4 \pm 0.5) \times 10^{-10}$ for pressures $> 30 \mu$.

C. R. H.

Development of the spark discharge. T. E. ALLBONE and J. M. MEEK (*Nature*, 1937, **140**, 804—805).

L. S. T.

Characterisation of the line emission in the long-period variable [stars] as chemiluminescence. K. WURM (*Z. Astrophys.*, 1935, **10**, 133—153; *Chem. Zentr.*, 1936, **i**, 3793—3794).—Readily-excited spectra are attributed to three-body recombination processes and inelastic collisions.

H. J. E.

Spectra of comets. M. N. SAHA (*Sci. and Cult.*, 1936, **1**, 476).—Ionisation of the upper atm. and the spectrum of the night sky are explained by supposing that the sun does not radiate as a black body in the ultra-violet, but has strong ultra-violet emission lines of He, He⁺, H, O, etc. Lines due to CO⁺ and N₂⁺ in comet-tail spectra are due to ionisation by such radiation.

CH. ABS. (e)

Unidentified interstellar lines. P. W. MERRILL (*Physical Rev.*, 1937, [ii], **52**, 761—762).—The origin of six slightly diffuse absorption lines in the range λ 5780—6614 is discussed.

N. M. B.

Analysis of the intensities of the interstellar D-lines. O. C. WILSON and P. W. MERRILL (*Astrophys. J.*, 1937, **86**, 44—69).—The interstellar D-line intensities measured in the spectra of numerous early-type stars are discussed. Intensities and displacements can be explained by the assumption that Na occurs in large clouds.

L. S. T.

Directional distribution of the X-radiation from a massive anticathode. H. DETERMANN (*Ann. Physik*, 1937, [v], **30**, 481—493).—The intensity distribution of X-rays from Be, C, and Al anticathodes has been measured at angles from 0° to 110° to the direction of the exciting electron beam and for electron velocities from 35 to 110 kv. The position of the intensity max. is independent of the nature of the anticathode and is not affected by filtering the X-rays through 0.4 mm. of Cu. The difference between max. and min. intensity increases with increasing tube voltage and decreases with increasing at. wt. of the anticathode. The influence of electron diffusion is important at high velocities; it causes an increase (7° at 140 kv.) in the angle between the normal plane and the position of max. intensity over that given by Sommerfeld's theory. It is suggested that greater efficiency could be obtained in high-voltage X-ray tubes by placing the exit window at an angle $< 90^\circ$ to the direction of the electron beam.

O. D. S.

Influence of lattice binding on the boron K line. E. GWINNER and H. KIESSIG (*Z. Physik*, 1937, **107**,

449—457).—The K radiation from B and a no. of its compounds, both conducting and non-conducting, is studied in relation to lattice binding.

L. G. G.

K Series X-ray emission lines of chromium in several compounds. S. TANAKA and G. OKUNO (*Proc. Phys.-Math. Soc. Japan*, 1935, **17**, 540—547; cf. *A.*, 1935, 1184).—Data for the Cr K_{α_1} , α_2 , β_1 , and β_3 lines from Cr₂O₃, Cr₂(SO₄)₃, K₂CrO₄, and (NH₄)₂Cr₂O₇ are recorded and discussed.

CH. ABS. (e)

Ionisation by radioactive gamma and cosmic rays in different gases. J. JULIFS (*Nature*, 1937, **140**, 767—768).—Data for the ionisation produced in H₂, N₂, air, O₂, and CO₂ and the rare gases of the atm. by γ -rays from Ra-C and by cosmic rays are recorded. Ionisation is directly \propto the d of the gases only in the case of the hard components of the cosmic rays at sea level.

L. S. T.

Shot effect of secondary electrons from nickel and beryllium. B. KURRELMAYER and (MISS) L. J. HAYNER (*Physical Rev.*, 1937, [ii], **52**, 952—958).—The secondary emission ratios and shot effects from Ni and Be were measured over a primary energy range up to 1600 v., and conclusions on true secondary electrons, reflected primaries, and primaries buried in the body of the metal and producing no secondaries are discussed in detail.

N. M. B.

Propagation of potential in discharge tubes. L. B. SNODDY, J. R. DIETRICH, and J. W. BEAMS (*Physical Rev.*, 1937, [ii], **52**, 739—746; cf. *ibid.*, 1936, [ii], **50**, 469).—The speed of propagation of potential waves in long discharge tubes, of internal diameter 1.7, 5, and 18 mm., containing dry air was measured as a function of pressure. The speed at const. pressure is approx. a linear function of applied voltage. The initial wave from the high-voltage end is followed immediately by a return discharge wave of approx. speed 10^{10} cm. per sec., independent of tube diameter.

N. M. B.

Influence of external fields on the electron emission constants of barium-covered platinum surfaces. R. SUHRMANN and J. L. VON EICHBORN (*Z. Physik*, 1937, **107**, 523—548).—Measurements of the interdependence of electron emission, incident light, externally applied voltage, and previous heat-treatment of Ba-covered Pt surfaces are reported and analysed.

H. C. G.

Normal energy distribution of photo-electrons from sodium. C. F. J. OVERHAGE (*Physical Rev.*, 1937, [ii], **52**, 1039—1047).—The Du Bridge theory of normal energy distribution of photo-electrons is re-formulated by including the effect of contact potential. Using a special apparatus, photo-electric currents from Na emitted by monochromatic light were measured after passage through a retarding field, and results varied with changes of the anode potential barrier. Energy distribution curves at different frequencies are mutually consistent, but do not agree with the theoretical normal distribution. The discrepancy is explained in terms of the structure of the anode potential barrier.

N. M. B.

Surface photo-electric effect. W. V. HOUSTON (*Physical Rev.*, 1937, [ii], **52**, 1047—1053).—Mathem-

atical. The probability of ejection of an electron is expressed in terms of a function of the potential barrier, energy after ejection, and frequency. The function is expanded in a power series leading to a series of distinctive functions, each having its own temp.-dependence. Results are examined in relation to available data (cf. preceding abstract). N. M. B.

Selenium photo-elements. I. Action of cathode rays of medium velocity. A. BECKER and E. KRUPPKE (Z. Physik, 1937, 107, 474—484).—The action of cathode rays in the velocity region 1—50 kv. on Se photo-cells sputtered with various thicknesses of Au was examined. Curves showing the interdependence of cell efficiency, intensity of incident electron stream, and electron velocity are given. Results are discussed in relation to the ordinary photo-electric action of the cell and with regard to its possible utility in cathode-ray measurements. H. C. G.

Normal energy distribution of photo-electrons from thin potassium films as a function of temperature. C. L. HENSHAW (Physical Rev., 1937, [ii], 52, 854—865).—Films $>$ and $<$ monat. thickness produced by the mol.-ray method were investigated and results are compared with the predictions of various theories. The temp. effects are: temp.-dependence of the rates of diffusion of K through and sublimation from the base metal, irreversible changes with temp. in the state of the K surfaces, reversible changes with temp. in the shape of the Fowler plots, and a change of photo-electric current with temp. only 10—30% of that predicted by Du Bridge's theory. The temp. effect seems less with thinner films, a result not predicted by theory. N. M. B.

Thermionic emission of positive ions from molybdenum. H. GROVER (Physical Rev., 1937, [ii], 52, 982—986).—An equation for the temp. variation of the e.d. of the thermionic positive ions is developed and discussed. Mass-spectrograph studies of Mo and W show that ions of alkali impurities may persist after ageing of the specimens for 1100 hr. and cause an apparent lowering of the measured work function of characteristic ions. An experimental method of eliminating the effect of these impurities is described. The ion work function thus obtained for Mo is 8.9 e.v. N. M. B.

Static measurements on electron beams. K. H. STEBERGER (Ann. Physik, 1937, [v], 30, 621—634).—By the application of a longitudinal magnetic field of 800 gauss to a slow, <22 -v. electron beam in vac. a "winding" beam is obtained in which little spreading occurs. The current between the beam and a cylindrical probe surrounding the beam is very small until electron velocities are reached at which positive ions are formed by collision with gas mols. Measurements have been made of the charge induced on the probe by the beam and of its variation with electron velocity. An electrometer making use of the winding beam is described. O. D. S.

Calculation of the penetration of electrons of some millions of volts. II. S. FRANCHETTI (Atti R. Acad. Lincei, 1937, [vi], 25, 607—614; cf. A., 1937, I, 591).—Theoretical. O. J. W.

Energy losses of fast electrons. L. J. LASLETT and D. G. HURST (Physical Rev., 1937, [ii], 52, 1035—1039; cf. Turin, A., 1937, I, 487).—Using activated Cl as an electron source, the energy losses experienced by electrons of energies 1.5—4.5 m.e.v. in traversing thin C and Pb laminae were investigated with a H₂-filled cloud chamber. The experimental average energy loss per g. per sq. cm. of Pb was markedly $>$ that predicted theoretically; this discrepancy cannot be explained on the basis of the obliquity of electron paths in the absorber. The abs. probability of large energy losses is \gg that expected from theory. N. M. B.

(A) **Dissociation processes produced in SbCl₃, AsCl₃, and PCl₃ by electron impact.** (B) **Dissociation of HCN, C₂H₂, C₂N₂, and C₂H₄ by electron impact.** P. KUSCH, A. HUSTRULID, and J. T. TATE (Physical Rev., 1937, [ii], 52, 840—842, 843—854).—(A) An investigation of dissociation products shows ions of the type $\bar{X}Cl_3^+$, XCl_2^+ , XCl^+ , X^+ , XCl_2^{++} , XCl^{++} , X^{++} , and Cl^+ . Production efficiencies for various electron energies were investigated, appearance potentials determined, and a partial analysis of results was made.

(B) The dissociation of HCN and C₂H₄ by electron impact has been investigated and an analysis of results and of those previously reported for C₂H₂ and C₂N₂ (cf. A., 1935, 1305) is presented. N. M. B.

Townsend method of measuring electron diffusion and mobility. W. P. ALLIS and (Miss) H. W. ALLEN (Physical Rev., 1937, [ii], 52, 703—707).—Mathematical. The theory of the Townsend experiment is examined by the Lorentz method. N. M. B.

Electron temperatures and mobilities in the rare gases. (Miss) H. W. ALLEN (Physical Rev., 1937, [ii], 52, 707—710).—The theory previously developed (see preceding abstract) is applied to the computation of electron temp. and drift velocities in He, Ne, and A. Results are in satisfactory agreement with experiment. N. M. B.

Plasma electron drift in a magnetic field with a velocity distribution function. L. TONKS and W. P. ALLIS (Physical Rev., 1937, [ii], 52, 710—713).—The Allis-Allen theory (see above) is used to replace previously approx. expressions for the drift motion of electrons in a magnetic field by exact expressions. Good agreement with experiment is found. Tonks' theorem on drift speed (cf. A., 1937, I, 338) is valid within 12%. N. M. B.

(A) **Theory of elastic scattering of a beam of particles by atoms.** K. C. DAR, M. GHOSH, and K. K. MUKHERJEE. (B) **Elastic scattering of hydrogen and helium.** K. C. DAR (Phil. Mag., 1937, [vii], 24, 964—971, 971—981).—(A) Theoretical. (B) The results obtained are extended and applied to the calculation of the intensity of scattered beams at various angles of scattering by H₂ and He. F. J. L.

Scattering of helium positive rays by helium atomic nuclei. C. GERTHSEN (Physikal. Z., 1937, 38, 833—836).—The angular distribution of He positive rays scattered in He has been investigated

for He rays of velocity 3×10^8 cm. per sec. The results are in agreement with wave-mechanics theory (Mott), rather than with classical theory (Darwin).

A. J. M.

Charge transfer of hydrogen and helium canal rays in the velocity range 30–200 e.k.v. H. MEYER (Ann. Physik, 1937, [v], 30, 635–649; cf. Bartels, A., 1932, 554).—The ratio of charged to uncharged particles in beams of H^+ and He^+ of velocities from 30 to 200 kv. has been measured after passage through He, H_2 , and air at different pressures and the equilibrium ratio, w , is calc. The mean free paths of the charged and uncharged particles are calc. l of H^+ increases rapidly with increasing velocity in all gases. For neutral H particles l increases with velocity in He and air, but decreases with velocity in H_2 . w of He^+ is $< w$ of H^+ at all pressures. l of He^+ and He are of the same order. For He^+ l increases with velocity in He and air, but shows a min. at about 80 kv. in H_2 . For He l decreases in air with increasing velocity, shows a min. in H_2 , and remains approx. const. in He.

O. D. S.

So-called ion pair. S. KANEKO (J. Chem. Soc. Japan, 1935, 56, 1265–1266; cf. A., 1933, 464).—An ion pair exists when the positive and negative ions are within the distance $e^2Z^2/3Dkt$.

CH. ABS. (e)

At. wt. of carbon. Ratio of benzoyl chloride to silver. A. F. SCOTT and F. H. HURLEY, jun. (J. Amer. Chem. Soc., 1937, 59, 1905–1909).—The mean val. of eight analyses gives the ratio $BzCl : Ag = 1.302999 \pm 0.0000035$, from which the at. wt. of C is 12.0102 ± 0.00006 . The agreement of this val. with that of Baxter and Hale (A., 1936, 540) suggests that the val. 12.010 should be adopted for the chemical at. wt. of C.

J. W. S.

At. wts. of sodium and carbon. A. F. SCOTT and F. H. HURLEY, jun. (J. Amer. Chem. Soc., 1937, 59, 2078–2079).—Taking the at. wt. of C as about 12.010 (cf. preceding abstract) it is deduced from existing measurements of mass ratios involving Na_2CO_3 that the present international val. of Na is 0.003–0.004 unit too high.

J. W. S.

Isotopic composition and at. wt. of neodymium. J. MATTAUCH and V. HAUK (Naturwiss., 1937, 25, 780–781).—The difference between Aston's val. for the at. wt. of Nd (143.5 ± 0.2) and that of Hönigschmid (144.27) obtained by chemical methods (A., 1937, I, 592) cannot be accounted for by the existence of only small proportions of ^{148}Nd and ^{150}Nd . The isotopic composition of Nd has therefore been redetermined. The % abundances of the isotopes in Nd were: 142, 25.9; 143, 13.0; 144, 22.6; 145, 9.2; 146, 16.5; 148, 6.8; 150, 5.9. Assuming a packing fraction of -5×10^{-4} , the at. wt. of Nd on the chemical scale ($O = 16$) is 144.29 ± 0.03 . No new isotopes were discovered. The abundances of any isotopes of mass no. < 141 , 147, 149, or > 150 is $< 0.3\%$.

A. J. M.

At. wt. of lutecium. O. HÖNIGSCHMID (Naturwiss., 1937, 25, 748–749).—Analysis of $LuCl_3$ by the Ag method gives 174.96 for the at. wt. of Lu, which, after correction for 1.18% Yb in the $LuCl_3$, gives 174.98. This is $>$ Aston's mass-spectrographic

val. (174.91). The difference is accounted for by the known existence of another Lu isotope (Gollnow, A., 1937, I, 57). The higher at. wt. requires this to be ^{177}Lu .

A. J. M.

Element 87 (MI). H. HULUBEI (Compt. rend., 1937, 205, 854–857; cf. A., 1936, 917).—The $L\beta$ and $L\gamma$ spectra of element 87 (moldavium, eka-Cs) have been studied, and feeble rays, distinct from those of other elements, have been detected: $L\beta_1$, 838, $L\beta_2$, 856, and $L\gamma_1$, 715 X.

R. S. B.

Mass spectrography and problems of nuclear structure. J. MATTAUCH (Naturwiss., 1937, 25, 738–747).—A lecture.

Doublets of the C_1 group and binding energy of nuclei between ^{12}C and ^{16}O . J. MATTAUCH and R. HERZOG (Naturwiss., 1937, 25, 747–748).—The mass differences of the doublets $^{12}CH_2$ - ^{14}N , $^{12}CH_4$ - $^{14}NH_2$, $^{14}NH_2$ - ^{16}O , $^{14}NH_3$ - ^{16}OH , $^{12}CH_4$ - ^{16}O , $^{13}CH_4$ - ^{16}OH , $^{13}CH_4$ - $^{14}NH_3$, and ^{12}CH - ^{13}C have been obtained. The mean for ^{12}CH - ^{13}C is $43.7 \pm 0.5 \times 10^{-4}$. A comparison of the results of mass-spectrographic and at. disintegration determinations for the doublets of the C_1 group is made. The binding energies of the nuclei from ^{12}C to ^{16}O are calc. on the basis of the mass differences of the doublets together with 1n - 1H and 1H_2 - 2D .

A. J. M.

Isotopic constitution of tungsten. A. J. DEMPSTER (Physical Rev., 1937, [ii], 52, 1074).—Using pure W electrodes, the existence of ^{180}W of estimated intensity 0.01 that of ^{183}W was confirmed.

N. M. B.

Isotopic constitution of osmium. A. O. NIER (Physical Rev., 1937, [ii], 52, 885).—Using an improved mass-spectrometer, the discovery of a new isotope ^{184}Os (1 part in 5700) is reported. The ^{184}Os abundance relative to ^{192}Os is 0.043. The corr. at. wt. is 190.21.

N. M. B.

Mass-spectrographic study of the isotopes of Hg, Xe, Kr, Be, I, As, and Cs. A. O. NIER (Physical Rev., 1937, [ii], 52, 933–937; cf. A., 1937, I, 57).—A new mass-spectrometer of high intensity and high resolving power for accurate relative abundance determinations is described. Mass-spectrum diagrams for Hg, Xe, and Kr are given. The non-existence of ^{197}Hg is confirmed; ^{203}Hg is very doubtful. Cs, As, and I are single to a very high degree. If 8Be exists it must be $< 10^{-5}$ of 9Be .

N. M. B.

Isotopic composition of ordinary and uranium-lead. J. MATTAUCH and V. HAUK (Naturwiss., 1937, 25, 763–764).—The % of ^{204}Pb , ^{206}Pb , ^{207}Pb , and ^{208}Pb in ordinary Pb, and in U-Pb from Katanga curite, has been determined. The % of isotopes in ordinary Pb are ^{204}Pb 1.15, ^{206}Pb 24.5, ^{207}Pb 21.35, ^{208}Pb 52.95, which deviate somewhat from Aston's vals. and give (assuming a packing fraction of +1) 207.21 ± 0.02 for the at. wt. ($O = 16$). The ^{208}Pb line was just visible in the mass spectrum of U-Pb, and was probably due to a slight admixture with ordinary Pb, which was allowed for in finding the % of isotopes present. The vals. for ^{206}Pb and ^{207}Pb were 91.1 and 4.9, respectively, giving 206.01 ± 0.02 for the at. wt. ($O = 16$).

A. J. M.

Statistic character of the laws of radioactive decay and impact distribution in an ionisation chamber. E. SCHÜTLÖFFEL (Z. Physik, 1937, 107, 425—440).—Experimental observations on radioactive decay are compared with data calc. from probability functions. L. G. G.

Rate of production of helium from radium. H. DAMIANOVITCH (Ann. Acad. Brasil. Sci., 1937, 9, 257—262).—The val. of 147.6 cu. mm. per g. per annum is in agreement with the mean val. of Boltwood and Rutherford (A., 1910, ii, 175). Prolonged preliminary heating is required to remove He (cf. A., 1936, 680). F. R. G.

Energy evolved by ionium. L. WINAND (J. Phys. Radium, 1937, [vii], 8, 429—432).—The energy evolved in the disintegration of Io has been measured directly with an adiabatic calorimeter. Assuming Geiger's val. for the range of the α -particles, the calc. no. of α -rays emitted per sec. by 1 mg. of Io is 18.04×10^4 , and the mean life 116,000 years. Assuming Curie and Cotellet's val. for the no. of particles emitted, their deduced energy and range are 4.751×10^6 e.v. and 3.28 cm., respectively. A. J. E. W.

Number of α -rays emitted by a thorium active deposit preparation, measured by its penetrating radiation. A. RICOUX (J. Phys. Radium, 1937, [vii], 8, 388—390).—The Ra-equiv. of the prep. was measured by its γ -ray activity, and the ionisation due to α -rays determined by the Curie abs. method. The ionisation current produced by the α -rays emitted by 1 mg. of Ra-equiv. is 2156 e.s.u.; this gives 1 mc. of Th active deposit = 0.91 mg. of Ra-equiv. A. J. E. W.

Measurements of the range of the α -particles of U-I and U-II with the "sphere method." G. J. SIZOO and S. A. WYTZES (Physica, 1937, 4, 791—809).—The relation between the range of α -particles measured by the "sphere method" and the extrapolated ionisation range is discussed. The measured ranges for U-I and U-II are 27.47 and 33.0 mm. at $15^\circ/760$ mm. The Geiger-Nuttall rule is only approx. obeyed. K. S.

γ -Rays of polonium. H. C. WEBSTER (Nature, 1937, 140, 852).—These rays may be due to the production of electron-pairs by internal absorption of α -rays (cf. A., 1937, I, 488). L. S. T.

Absorption, scattering, and secondary radiation of hard γ -rays. W. GENTNER (Physikal. Z., 1937, 38, 836—853).—A comprehensive review dealing with the theory of the Compton and photo-effects (as far as they concern hard γ -rays), the formation of pairs, and annihilation radiation. Experimental results of work on pair formation, the dependence of the absorption of γ -rays on the at. no., the absorption coeffs. in Pb, and the scattering and secondary radiation from hard γ -rays are summarised. A. J. M.

γ -Ray spectrum of ^{10}B . P. G. KRUGER and G. K. GREEN (Physical Rev., 1937, [ii], 52, 773—776; cf. Bonner, A., 1936, 1174).—An investigation of the γ -rays from ^{10}B , produced by bombarding Be with 1 m.e.v. deuterons, by an examination of the momentum distribution of Compton electrons ejected

from a thin mica foil in an expansion chamber shows a spectrum of six γ -rays of energies 0.51, 1.07, 1.44, 1.96, 2.81, and 3.21 m.e.v. resulting from all possible transitions between three excited levels and the ground state of ^{10}B . The energy levels agree with those obtained from a study of the neutron spectrum emitted by the same reaction. N. M. B.

Interaction of neutrons with normal and para-hydrogen. J. R. DUNNING, J. H. MANLEY, H. J. HOGE, and F. G. BRICKWEDDE (Physical Rev., 1937, [ii], 52, 1076—1077).—Scattering experiments with a beam of slow neutrons indicate that the cross-section for para- H_2 is $\sim 14 \times 10^{-24}$, and for normal H_2 $\sim 75 \times 10^{-24}$ sq. cm. Results show that spin-dependent forces exist, and that the singlet state of the deuteron is virtual. The *ortho* cross-section is 2.5—3 times the *para* cross-section (cf. Halpern, A., 1937, I, 489; Schwinger, *ibid.*, 543). Measurements of the neutron-proton cross-section, using H_2O , give an average of 42.2×10^{-24} for 300°K . neutrons, and 56.0×10^{-24} sq. cm. for $\sim 100^\circ \text{K}$. neutrons, a ratio of 1.325. Measurements of O and N cross-sections, using liquid O_2 and N_2 , give average vals. of 4.05 and 12.7×10^{-24} sq. cm., respectively, for 300°K . neutrons. N. M. B.

Capture of slow neutrons in light elements. O. R. FRISCH, H. VON HALBAN, jun., and J. KOCH (Nature, 1937, 140, 895).—Vals. for the capture cross-sections of H_2 and N_2 and upper limits in the cases of D_2 , C, and O_2 for neutrons of velocity 2.2×10^5 cm. per sec. have been obtained from measurements of the density distribution of neutrons around a Ra + Be source in different liquids or solutions containing H. The cross-sections of D and Be for photo-dissociation by the γ -rays of Ra have been determined. L. S. T.

Scattering and absorption cross-section of neutrons in cobalt. N. E. BRADBURY, F. BLOCH, H. TATEL, and P. A. ROSS (Physical Rev., 1937, [ii], 52, 1023—1026).—The low-voltage neutron source described employs the deuteron-deuteron reaction with a continuously renewable target of ND_2Cl formed by sublimation on a metal target cooled with solid CO_2 . The sum of the absorption and scattering cross-sections for Co is $26.1 \pm 2.6 \times 10^{-24}$, and the scattering cross-section alone is $5.6 \pm 1.8 \times 10^{-24}$ for C neutrons and $3.7 \pm 1.8 \times 10^{-24}$ sq. cm. for D neutrons. The anomalously large scattering cross-sections of Fe and Ni (cf. Mitchell, A., 1936, 1044) are independent of their ferromagnetism. N. M. B.

Neutron-proton scattering and the disintegration of deuterium by deuterons. T. W. BONNER (Physical Rev., 1937, [ii], 52, 685—687).—The angular distribution of the scattering by protons of neutrons from the nuclear reaction $^2\text{H} + ^2\text{H} \rightarrow ^3\text{He} + n + Q_1$, giving 2.6 m.e.v. neutrons at right angles to the bombarding deuterons, was observed by the method of recoil protons in a cloud chamber. The val. of Q_1 was 3.36 ± 0.20 m.e.v. The recoil proton distribution, showing a max. at 45° , agrees with theory. N. M. B.

Scattering of protons by neutrons. P. G. KRUGER, W. E. SHOUPP, and F. W. STALLMANN

(Physical Rev., 1937, [ii], 52, 678—684).—The neutrons used were produced by bombarding frozen D_2O with 1 m.e.v. deuterons and photographs of recoil proton tracks in a liquid-filled cloud chamber were measured. Corr. curves indicate that the scattering is approx. spherically symmetrical about the centre of gravity, in agreement with theory. N. M. B.

Neutrons from the deuteron-deuteron reaction.

R. LADENBURG and M. H. KANNER (Physical Rev., 1937, [ii], 52, 911—918; cf. A., 1937, I, 108).—The abs. no. of neutrons produced was determined for a target of heavy ice by measuring the scattering cross-section of liquid N_2 and O_2 for these neutrons, and by counting in an ionisation chamber the recoils in N_2 and in O_2 gas due to the scattering of the neutrons. The abs. yield of neutrons is $3.0 \times 10^5 \pm 20\%$ per sec. per $\mu a.$ of deuterons at 100 kv., and of protons, $(2.1 \pm 0.2) \times 10^5$. The effective cross-section for the neutron-producing reaction is approx. 2×10^{-26} at 100 kv., increasing to 4×10^{-26} at 300 kv., and to 1.3×10^{-25} at 700 kv. (cf. Amaldi, A., 1937, I, 438). The scattering cross-section of O_2 for the 2.4 m.e.v. neutrons is 0.75×10^{-24} sq. cm., or 0.6 that of N_2 ; of H_2 it is 2.1×10^{-24} sq. cm. N. M. B.

Neutron generator utilising the deuteron-deuteron reaction. W. H. ZINN and S. SEELY (Physical Rev., 1937, [ii], 52, 919—923).—A simple accelerating tube is described, and the neutron intensity from a heavy ice target is compared with that from a strong Rn-Be source. N. M. B.

Atomic nuclei with respect to radioactivity. J. GRÖGER (Tech. Obzor, 1934, 42, 387—390).—Theoretical. CH. ABS. (e)

Search for protons from lithium bombarded by radium-C' α -particles. W. G. SHEPHERD, R. O. HAXBY, and E. L. HILL (Physical Rev., 1937, [ii], 52, 674—678).—Investigations under improved conditions for proton emission in the angular range 50 — 120° by comparison of the yields from Li or LiOH and dicyanodiamide indicate that the protons detected from Li targets arose from N_2 contamination. Upper cross-section limits of 6Li and 7Li are computed. The relation of ${}^6Li + {}^4He \rightarrow [{}^9B] \rightarrow {}^8Be + {}^1H + Q_1$ and the reverse reaction ${}^8Be + {}^1H \rightarrow [{}^9B] \rightarrow {}^6Li + {}^2He - Q_1$ is discussed. N. M. B.

Radioactivity produced by bombardment of lithium with deuterons. J. C. BOWER and D. P. R. PETRIE (Proc. Camb. Phil. Soc., 1937, 33, 534—539).—The proposed reactions are ${}^7Li + {}^2H \rightarrow {}^8Li + {}^1H$, ${}^8Li \rightarrow {}^8Be + e^-$, ${}^8Be \rightarrow {}^4He + {}^4He$. The half-life of the excited 8Be nucleus is about 10^{-21} sec. and the time taken to reach the end of its recoil track is about 10^{-13} sec. Thus the particles leave the nucleus before it has lost its recoil energy. During the disintegration the particles often leave the nucleus in opposite directions with equal energies. J. A. D.

Nuclear physics. C. Nuclear dynamics. Experimental. M. S. LIVINGSTON and H. A. BETHE (Rev. Mod. Physics, 1937, 9, 246—390).—A comprehensive review dealing with the sources of nuclear projectiles, the properties of nuclear radiations, and the instruments available for the detection and observation of nuclear reactions. The theoretical

data required for working out results of experiments on nuclear reactions (range-energy relationship, momentum and recoil energy, extrapolated and mean range) are considered. A full summary of results of disintegration experiments up to July, 1937, is given. The results of the calculation of nuclear masses from mass-spectrograph and disintegration data are also given. A. J. M.

Ionisation power of fast lithium particles.

F. KIRCHNER, H. NEUERT, and O. LAAFF (Ann. Physik, 1937, [v], 30, 527—533).—The ionisation curve of fast 7Li particles produced by the process ${}^9Be (D; \alpha) {}^7Li$ has been obtained, by means of an ionisation chamber, for 8 mm. of the range. The total range is found to be 12 to 12.5 mm. Attempts to detect 8Be particles formed in the process ${}^{11}B (p; \alpha) {}^8Be$ were unsuccessful. This result is explained by the nature of the expected ionisation curve of 8Be . O. D. S.

Disintegration of beryllium and the masses of the beryllium isotopes.

J. H. WILLIAMS, R. O. HAXBY, and W. G. SHEPHERD (Physical Rev., 1937, [ii], 52, 1031—1034; cf. A., 1937, I, 593).—The disintegrations studied for bombarding energies up to 250 kv. are: ${}^9Be + {}^1H \rightarrow {}^8Be + {}^2H$ and ${}^6Li + {}^4He$; ${}^9Be + {}^2H \rightarrow {}^7Li + {}^4He + Q_2$, or ${}^8Be + {}^3H + Q_3$, or ${}^{10}Be + {}^1H + Q_4$. Efficiency curves are smooth and regular, and abs. yields from a thick target are given. From range measurements of the disintegration products the vals of Q_2 , Q_3 , and Q_4 are 6.95, 4.32, and 4.44 m.e.v., respectively, and the masses of 8Be , 9Be , and ${}^{10}Be$, 8.0081, 9.0150, and 10.0168. N. M. B.

Beryllium of mass 8. F. KIRCHNER, O. LAAFF, and H. NEUERT (Naturwiss., 1937, 25, 794).—The stability of the unexcited 8Be nucleus has been investigated. It breaks down into two α -particles making a small angle with each other, the difference in energy between 8Be and the α -particles being small. The breakdown occurs after a very short time. A. J. M.

Maximum energy of the protons from the bombardment of boron by α -particles. E. POLLARD and G. BRUBAKER (Physical Rev., 1937, [ii], 52, 762).—A search for any long-range group of protons which would reconcile the experimental and calc. energy vals. (3.3 and 4.0 m.e.v., respectively) gave a small and inconclusive yield. The reaction is ${}^{10}B + {}^4He \rightarrow {}^{13}C + {}^1H$, so that the absence of a proton group of sufficient energy to balance the mass-energy equation indicates that an excited state of ${}^{13}C$ having a relatively long lifetime can exist. N. M. B.

Longest [range] proton groups in the transformation of boron with α -rays. H. MAIER-LEIBNITZ and W. MAURER (Z. Physik, 1937, 107, 509—512).—The proton spectrum of B obtained by bombardment with α -rays from Po has been found to extend to 91 cm. The energy tones of the process ${}^{10}B (\alpha; p) {}^{13}C$ are in reasonable agreement with the masses of the nuclei concerned. H. C. G.

A peculiarity in the transformation of ${}^{10}B$ into ${}^{13}C$. W. BOTHE and H. MAIER-LEIBNITZ (Z. Physik, 1937, 107, 513—522).—The energy balance of the

reaction $^{10}\text{B} (\alpha; p) ^{13}\text{C}$ is discussed on the basis of long-range proton measurements (cf. preceding abstract). Two energy tones exist; the first, 3.8 ± 0.1 e.M.v., gives rise to the ground state of ^{13}C ; the second, 3.0 ± 0.1 e.M.v., results either in an excited or metastable state of ^{13}C or in an isomeride. Attempts to prove the existence of the excited or metastable states by detection of γ -radiation or "phosphorescence" failed. H. C. G.

Artificial radioactivity produced by α -particles. L. N. RIDENOUR and W. J. HENDERSON (Physical Rev., 1937, [ii], 52, 889—900).—Half-lives and thick target yields were measured, and full data are tabulated for the following radioactive isotopes produced by 9 m.e.v. α -particles accelerated in a cyclotron: ^{13}N , ^{17}F , ^{23}Al , ^{30}P , ^{34}Cl , ^{38}K , ^{53}Fe (?), ^{56}Mn , ^{61}Cu , ^{62}Cu , ^{63}Zn , ^{66}Ga , ^{68}Ga , ^{78}Br , ^{82}Rb , and ^{84}Rb . N. M. B.

Efficiency of the production of artificial radioactive substances by slow neutrons. C. J. BAKKER (Physica, 1937, 4, 863—870).—The efficiency of slow neutrons, from a Ra-Be source (2×10^6 neutrons per sec.), in producing radioactive Cl (35 min.), Br (18 min.), Br (4 hr.), Br (36 hr.), I (25 min.), and Mn (2.5 hr.), using aq. salt solutions, was determined. From the activities 1, 16, 7, 0.6, 3, and 6%, respectively, of the neutrons were found to be effective. Min. vals. for the capture cross-sections were calc. K. S.

Induced radioactivity of scandium. H. WALKE (Physical Rev., 1937, [iii], 52, 669—673).— Sc_2O_3 bombarded with deuterons and slow neutrons gives ^{46}Sc (half-life 85 ± 2 days) which emits low-energy electrons and soft γ -radiation. The energy distribution of the electrons, investigated by means of a large H_2 -filled expansion chamber, shows an upper limit of the spectrum at 0.89₅ m.e.v. in fair agreement with range measurements with Al absorbers. Bombardment of Sc_2O_3 with α -particles gives rise to ^{48}V (half-life 16.2 ± 0.3 days) which emits positrons and γ -rays. Bombardment with fast neutrons from the $^9\text{Be} + ^2\text{H}$ reaction gives ^{42}K only, but with neutrons from the $\text{Li} + ^2\text{H}$ reaction gives ^{42}K and both ^{43}Sc and ^{44}Sc (cf. Pool, A., 1937, I, 489), half-lives ^{43}Sc 4.0 ± 0.1 hr., and ^{44}Sc 52 ± 2 hr.; both isotopes emit positrons. N. M. B.

Induced radioactivity of titanium and vanadium. H. WALKE (Physical Rev., 1937, [ii], 52, 777—787).—The radioactivities induced in Ti and V by irradiation with deuterons, slow and fast neutrons, and in Ti with 11 m.e.v. α -particles were investigated. Bombardment of Ti with deuterons induces emission of positrons and hard γ -rays. An analysis of the decay curve shows six isotopes; three chemically inseparable from V are probably ^{48}V (16.0 ± 0.2 days), ^{49}V (33 ± 1 min.), and ^{50}V (3.7 ± 0.2 hr.). The others appear to be ^{51}Ti (2.8 min.), ^{44}Sc (50 hr.) formed in the reaction $^{46}\text{Ti} + ^2\text{H} \rightarrow ^{44}\text{Sc} + ^4\text{He}$, and ^{46}Sc (85 ± 5 days). The energy distribution of the positrons emitted by ^{48}V was studied by means of a large H_2 -filled cloud-chamber. The max. energy of the positrons from ^{49}V is 1.9 m.e.v. ^{49}V and ^{50}V were formed by bombarding Ti with 11 m.e.v. α -particles, and two new unidentified periods of 68 ± 4 hr. and >180 days were detected.

Ti bombarded with fast neutrons probably gives ^{45}Ca , ^{48}Sc , and ^{46}Sc ; ^{48}Sc (41 ± 3 hr.) is also produced by the transmutation $^{51}\text{V} + ^1_0\text{n} \rightarrow ^{48}\text{Sc} + ^4_2\text{He}$; there is also evidence of the reaction $^{51}\text{V} + ^1_0\text{n} \rightarrow ^{50}\text{V} + ^2_1\text{n}$. ^{52}V (3.9 ± 0.1 min.) has been produced in several reactions. N. M. B.

Neutron-induced radioactivity of long life in cobalt. J. R. RISSER (Physical Rev., 1937, [ii], 52, 768—772; cf. Sampson, A., 1936, 1172).—The activity arising when Co is bombarded by neutrons is of approx. half-life 2.0 ± 0.5 years and is probably ^{58}Co . Radiations emitted on disintegration show a γ -ray with mass absorption coeff. in Pb of about 0.047 cm^2 per g., and a spectrum of soft β -rays of estimated limiting range 30 mg. per cm^2 of Al, representing an energy of 160 kv. A group of more penetrating particles, representing probably a relatively infrequent disintegration process, is indicated. N. M. B.

Radioactive isotopes of bromine: isomeric forms of ^{80}Br . A. H. SNELL (Physical Rev., 1937, [ii], 52, 1007—1022; cf. Blewett, A., 1936, 1043).—A study of nuclear reactions induced by bombarding As, Se, Br, Kr, and Rb with neutrons, deuterons, and electrically accelerated α -particles indicates that the active ^{80}Br exists in two isomeric forms of periods 18 min. and 4.5 hr. Two successive β -transitions occur in the active ^{83}Se and ^{83}Br , and the reaction $^{82}\text{Se} \rightarrow ^{82}\text{Br}$ is a new type of transmutation in which the emission of two neutrons apparently follows deuteron capture. Results and identifications are: ^{78}As (65 ± 3 min.), ^{83}Se (17 ± 5 min.), 79 or ^{81}Se (57 ± 1 min.), ^{78}Br (6.4 ± 0.1 min.; positron emitter), ^{80}Br (18.5 ± 0.5 min., and 4.54 ± 0.10 hr.), ^{82}Br (33.9 ± 0.3 hr.), ^{83}Br (2.54 ± 0.10 hr.), Kr 74 ± 2 min., 4.5 ± 0.1 hr., and 18 ± 2 hr., 86 and ^{88}Rb (18 ± 2 min., 18 ± 1 days). All these activities except ^{78}Br and possibly the very weak 18 hr. Kr emit negative electrons. Max. energies of the β -rays of the Br isotopes were found by absorption measurements. ^{78}Br , ^{80}Br (18 min.), and ^{82}Br emit γ -rays. N. M. B.

Induced radioactivity in strontium and yttrium. D. W. STEWART, J. L. LAWSON, and J. M. CORK (Physical Rev., 1937, [ii], 52, 901—906; cf. Pool, A., 1937, I, 490).—Sr and Y were bombarded with 6.3 m.e.v. deuterons, with 14—20 m.e.v. neutrons, and with slow neutrons. Sr activity arises from deuteron or neutron action on Sr, and possibly, with very weak intensity, by fast neutron action on Y with emission of a proton. Periods and max. energies in Sr, attributed to isomeric forms of ^{89}Sr , are: 3.0 ± 0.1 hr., 0.61 m.e.v., and 55 ± 5 days, 1.9 m.e.v., both negative activities. Activity in Y is obtained when Sr is bombarded with deuterons and when Y is bombarded with deuterons or neutrons. Periods, probably due to ^{88}Y and ^{90}Y , respectively, and max. energies, are: 120 ± 4 min., 1.2 m.e.v. (positive activity), and 60.5 ± 2.0 hr., 2.6 m.e.v. (negative activity). The possible formation of ^{90}Y from Sr + ^2H may involve the hitherto unobserved complete capture of a deuteron. N. M. B.

Radioactive isotopes of palladium and silver from palladium. J. D. KRAUS and J. M. CORK

(Physical Rev., 1937, [ii], 52, 763—768).—Bombardment of Pd with 6.3 m.e.v. deuterons yields activities (both negative) of period 17 min. and 13 hr., due to neutron capture and probably attributable to ^{111}Pd and ^{109}Pd , respectively. Bombardment of Pd yields also activities of 26 min. (positive) and 180 hr. (negative), the former due to ^{106}Ag isomeric with that of 180 hr. period due to fast neutron bombardment, and the latter due to ^{111}Ag which can be formed from ^{110}Pd directly by proton capture and indirectly by a chain reaction through ^{111}Pd . There is a strong γ -radiation accompanying the β -emission from 180 hr. ^{106}Ag and little or no γ -radiation from 180 hr. ^{111}Ag . The upper energy limits for the β -spectrum of the 26 min. ^{106}Ag , 13 hr. ^{109}Pd , and 180 hr. ^{111}Ag activities are 2.24, 1.08, and 0.80 m.e.v., respectively.

N. M. B.

Spacing of the resonance levels of silver, rhodium, and bromine nuclei. C. Y. CHAO and T. H. WANG (Nature, 1937, 140, 768—769).—The average spacings of the resonance neutron levels of these elements have been calc. from new measurements of the radioactivity induced in them by bombardment with neutrons (Be + Rn source) distributed more uniformly over the energy spectrum by a paraffin scatterer of only 2 mm. thickness.

L. S. T.

Angular distribution of the secondary pairs emitted by the action of ultra-radiation and hard γ -rays on lead. H. ADAM (Physikal. Z., 1937, 38, 824—831; cf., A., 1937, I, 106).—The angular distribution of the electron-positron pairs emitted from Pb by ultra-radiation and hard γ -rays was investigated. For ultra-radiation, the upper limit of the angle of the secondary bundles is about 30° . For hard γ -rays from Th-C'' there was a max. in the angular distribution curve at 30° , in agreement with the theory of Bethe *et al.* (A., 1934, 1150).

A. J. M.

Angular distribution of the secondary pairs emitted by the action of ultra-radiation and hard γ -rays on lead. G. BURKHARDT (Physikal. Z., 1937, 38, 831—833).—A more accurate comparison of the results of Adam (preceding abstract) with the theory of Bethe *et al.* is given.

A. J. M.

Radio-elements formed in uranium irradiated by neutrons. I. CURIE and P. SAVITCH (J. Phys. Radium, 1937, [vii], 8, 385—387; cf. A., 1937, I, 338, 423).—The formation of elements of periods 40 sec., 2, 16, 23, and 59 min., and 2.7 days, on bombardment of U by neutrons from a Rn-Be source, has been confirmed. An element of period 3.5 hr. is also produced, probably by the reaction $^{238}_{92}\text{U} + \frac{1}{2}\text{n} \rightarrow ^{235}_{90}\text{R} + \frac{1}{2}\text{He}$, R being an isotope of Th. Absorption measurements show that the β -rays from the 2 min., 16 min., and 3.5 hr. period elements have high energy, probably $< 6 \times 10^6$ e.v.

A. J. E. W.

Artificial radioactivity produced by cosmic rays. J. CLAY and M. A. VAN TIJN (Physica, 1937, 4, 909—912).—Evidence for the production of artificial radioactive material, with a decay time of 8.6 min., by cosmic radiation using an Fe-shielded ionisation chamber is given.

K. S.

Cloud-chamber investigations of some cosmic-ray interactions with matter. G. L. LOCHER (J. Franklin Inst., 1937, 224, 555—582).—Cloud chambers controlled by coincidence counters were used in investigating tracks produced by cosmic rays, groups of two or three counters being used side by side in a horizontal line. Post-expansion electron tracks were observed in many cases. There is no evidence of β or γ radioactivity induced by the cosmic rays. Ion counts were made on some shower electrons. A few photographs showed nuclear tracks due to cosmic-ray interaction, but the α -emission is low. These nuclei are probably not all due to the same type of agent or process.

A. J. M.

Cosmic-ray burst at a depth equivalent to 800 m. of water. Y. NISHINA and C. ISHII (Nature, 1937, 140, 774).—A correction (cf. A., 1937, I, 6).

L. S. T.

Cosmic rays on the Pacific Ocean. A. H. COMPTON and R. N. TURNER (Physical Rev., 1937, [ii], 52, 799—814).—A survey and discussion of records with reference to latitude, season, and temp.

N. M. B.

Abnormal zenithal distribution of cosmic rays. M. G. E. COSYNS (Nature, 1937, 140, 931).—This can be explained by taking into account the diffusion of cosmic rays in air.

L. S. T.

Existence of a particle of mass intermediate between the proton and electron. J. C. STREET and E. C. STEVENSON (Physical Rev., 1937, [ii], 52, 1003—1004; cf. Neddermeyer, A., 1937, I, 390).—In an attempt to distinguish the singly occurring cosmic-ray particle from an electron or proton, its track density and magnetic deflexion were observed near the end of its range. Results indicate a particle of negative sign and rest mass $130 \pm 25\% >$ the rest mass of the electron.

N. M. B.

Passage of very energetic corpuscles through the atomic nucleus. W. HEISENBERG (Naturwiss., 1937, 25, 749—750).—Theoretical. The processes expected to occur when a neutron or proton of very high energy penetrates the nucleus are considered. The process is very similar to the passage of rapid electrons through ordinary matter.

A. J. M.

Potassium-argon transformation. A. BRAMLEY (Science, 1937, 86, 424—425).—A discussion.

L. S. T.

Interaction between nuclei and electromagnetic radiation. A. J. F. SIEGERT (Physical Rev., 1937, [ii], 52, 787—789).—Mathematical.

N. M. B.

Field theory of nuclear interaction. N. KEMMER (Physical Rev., 1937, [ii], 52, 906—910).—Mathematical.

N. M. B.

Validity of methods used in nuclear calculations. D. T. WARREN and H. MARGENAU (Physical Rev., 1937, [ii], 52, 1027—1031).—Mathematical. A consideration of the Schrödinger perturbation scheme and the linear variation method.

N. M. B.

Relation of proton-deuteron to neutron-deuteron scattering. H. PRIMAKOFF (Physical Rev., 1937, [ii], 52, 1000—1002; cf. Tuve, A., 1937, I, 5).—Mathematical.

N. M. B.

Metrical field associated with heavy particles. W. H. BARKAS (Physical Rev., 1937, [ii], 52, 1074).—The identification of the neutrino model with certain solutions of the field equations of the general relativity theory is suggested. N. M. B.

Normal states of nuclear three- and four-body systems. H. MARGENAU and D. T. WARREN (Physical Rev., 1937, [ii], 52, 790—798).—Mathematical. A variational method is used for calculating the binding energies of ^3H and ^4He . N. M. B.

Thomas-Fermi statistical method. E. FEENBERG (Physical Rev., 1937, [ii], 52, 758—760).—Mathematical. N. M. B.

Neutrino theory of light in three dimensions. A. SOKOLOW (Nature, 1937, 140, 810—811). L. S. T.

Physical world-constants. A. HAAS (Naturwiss., 1937, 25, 733—734).—Theoretical. A. J. M.

Values of the fundamental atomic constants. (A) S. VON FRIESEN. (B) R. T. BIRGE (Physical Rev., 1937, [ii], 52, 886).—(A) A criticism of Birge (cf. A., 1937, I, 491). (B) A refutation. N. M. B.

$^1\Sigma^* - ^1\Sigma$ band system of ionised zinc deuteride. J. W. GABEL and R. V. ZUMSTEIN (Physical Rev., 1937, [ii], 52, 726—727).—An analysis of five bands of the $\lambda\lambda$ 2300—2100 system is tabulated and discussed. N. M. B.

Ultra-violet absorption spectrum of ruthenium tetroxide. B. QVILLER (Tids. Kjemi, 1937, 17, 127).—The absorption spectrum of RuO_4 vapour, and in aq. and CCl_4 solution has been measured. In the gas, maxima occur at 3100 Å. and 3850 Å. The spectrum is very similar to that of OsO_4 . M. H. M. A.

Spectroscopy of ionic crystals and its application to the alkali halides. A. VON HIPPEL (Z. Physik, 1937, 107, 559; cf. A., 1937, I, 8).—A reply to criticism. H. C. G.

Electron band spectra of the linear triatomic molecules HgCl_2 , HgBr_2 , and HgI_2 . M. WEHRLI (Naturwiss., 1937, 25, 734—735).—The band spectra in the Schumann region of the Hg^{II} halides have been photographed and analysed. A. J. M.

Absorption spectrum of uranyl sulphate in aqueous solution. P. PRINGSHEIM (Physica, 1937, 4, 810).—A correction (cf. A., 1937, I, 574). K. S.

Near ultra-violet absorption spectrum of acetone vapour. W. A. NOYES, jun. (Trans. Faraday Soc., 1937, 33, 1495—1498; cf. A., 1935, 10).—Spectra have been measured at 20° and 200°. Each "band" consists of a series of subsidiary max. Complete classification is at present possible only by empirical methods. F. L. U.

Flame spectra of some aliphatic halides. I. (1) Methyl iodide. W. M. VAIDYA (Proc. Indian Acad. Sci., 1937, 6, A, 122—128).—The flame of MeI shows, in addition to bands due to CH , C_2 , and OH , about 35 bands in the range 5900—4260 Å., degraded towards the red, and belonging to two systems with one common level. Comparison with the flame spectrum of I indicates that the bands are due to IO . A. J. M.

Ultra-violet absorption spectra of the isomerides of Δ^{β} -butene and Δ^{β} -pentene. E. P. CARR and H. STÜCKLEN (J. Amer. Chem. Soc., 1937, 59, 2138—2141).—The spectra of *cis*- and *trans*- Δ^{β} -butene, *cyclohexene*, and different samples of Δ^{β} -pentene have been examined in the vapour phase in the Schumann region. The *cis*-configuration for the Δ^{β} -butene of higher b.p. is confirmed by the similarity of its spectrum to that of *cyclohexene*. The *cis*-configuration is assigned to the Δ^{β} -pentene of higher b.p. The comparative yields of the isomerides of Δ^{β} -pentene prepared by different methods have been estimated from their absorption spectra. E. S. H.

Substitution and absorption band displacement. X. Pyrene derivatives. G. FÖRSTER and J. WAGNER (Z. physikal. Chem., 1937, B, 37, 353—364; cf. A., 1937, I, 280).—The ultra-violet absorption spectra of solutions of pyrene and mono-substituted derivatives with the substituents Me, Cl, OH, CN, CO_2H , and NH_2 have been determined. The rule previously formulated for the effect of substituents in band displacement (A., 1933, 445) has only limited validity. R. C.

Absorption bands of oxycytochrome-C.—See A., 1937, III, 457.

Structure of bodies coloured in the visible from their absorption spectra. (MME.) RAMART-LUCAS (Compt. rend., 1937, 205, 864—866).—The relation between structure and absorption spectra for org. chromogens is discussed. The absorption spectra of solutions of fluorescein show that two forms are present, a quinonoid (coloured and fluorescent) and a lactonoid (colourless and not fluorescent), of which the first is present in notable quantity in EtOH , but in scarcely detectable amount in Et_2O . R. S. B.

Organic photochemistry. VII. Spectrochemical and photochemical study on cyanine dyes. S. YOSHIMURA and S. SAKURAI (Bull. Inst. Phys. Chem. Japan, 1937, 16, 1270—1311).—The symmetrical and asymmetrical carbocyanines, di- and tri-carbocyanines have been studied. E. S. H.

Light absorption and constitution of some chlorophyll derivatives. A. STERN and F. PRUCKNER (Z. physikal. Chem., 1937, 180, 321—358; cf. A., 1937, I, 165, 442).—The effects of various substituents on the absorption spectra of the chlorin, purpurin, and porphyrin systems have been examined in dioxan solution, and are discussed with reference to regularities previously observed between light absorption and constitution of chlorophyll derivatives. The ketonic formulation of purpurin is the most probable. Possible structures for chlorin lactone Me_1 ester are discussed. The two isomeric rhodoporphyrin- γ -carboxylic acids have distinct absorption spectra. J. W. S.

Group resonators. XXIII. Influence of physical factors on the absorption spectra of group resonators. XXIV. Spectra of bixin derivatives. D. RĂDULESCU and F. BĂRBULESCU (Bull. Soc. Chim. România, 1936, 18, 151—160, 161—165; cf. A., 1936, 920).—XXIII. Observations on solutions

of anthracene and pyrene in EtOH, 50% EtOH-glycerol, and paraffin show that the absorption spectra are not affected by the viscosity of the solvent; changes observed in other cases are probably due to solvation effects. Addition of $MgCl_2$ to the EtOH solutions did not affect the spectrum.

XXIV. Extinction coeff. curves in the λ range 2000—5500 Å. are given for bixin, its K salt, and its Me ether, and for norbixin; the differences observed are analogous to those occurring in phenols, Na phenoxides, and phenolic ethers. The displacement of the absorption spectrum of crocetin, which otherwise resembles that of anthracene, is due to the polar CO_2H groups. A. J. E. W.

Rotation-vibration spectra of molecules containing the hydrogen isotope of mass 2 in the photographic infra-red. III. The 1.161 μ . band of HDO. L. HERZBERG (Z. Physik, 1937, 107, 549—558; cf. A., 1934, 1055).—From an analysis of the fine structure of the 1.161 μ . band of HDO, the moments of inertia are obtained for HDO and D_2O and compared with Mecke's vals. for H_2O . The internuclear distance (O—D) and the O valency angle differ but little from the corresponding distance (O—H) and angle in H_2O . L. G. G.

Absorption spectra in the near infra-red of systems composed of hydrogen chloride gas and an organic oxygenated solvent. R. FREY-MANN and J. GUÉRON (Compt. rend., 1937, 205, 859—861).—The infra-red spectra between 0.8 and 1.2 μ . of HCl gas dissolved in MeOH, EtOH, $COEt_2$, Et_2O , dioxan, and C_6H_6 have been studied at -73° to room temp. The CH bands are displaced towards higher frequencies by the HCl, excepting with C_6H_6 . The band near 0.94 μ . in Et_2O and dioxan due to C—O—C is strongly suppressed by HCl. In the alcohols the $(OH)_s$ band near 1.04 μ . and the $(OH)_v$ band near 0.96 μ . disappear in presence of HCl. All changes are observed up to room temp. It is inferred that the absence of $(OH)_s$ and $(OH)_v$ bands is incompatible with the formulæ usually assigned to oxonium compounds. R. S. B.

Infra-red spectrographic study of intermolecular linkages. J. ERRERA (Physica, 1937, 4, 1097—1104).—A general account is given of the spectroscopic evidence for interaction between the OH groups of mols. of the same kind (cf. A., 1936, 776, 1179; 1937, I, 9, 112, 167), and between the OH of H_2O and the O in dioxan, $COEt_2$, and Et_2O , and the N in C_5H_5N . F. L. U.

Infra-red absorption of HCl in oxygenated solvents. W. GORDY and P. C. MARTIN (Physical Rev., 1937, [ii], 52, 1075; cf. West, A., 1937, I, 112).—In view of the absence of HCl lines in the Raman spectra of HCl in non-ionising solvents, transmission curves were obtained for conc. solutions of HCl in dioxan, Et_2O , and EtOAc for the region 2.6—5.8 μ . For each solution, around 4 μ ., there is a broad intense unsymmetrical band, very diffuse on the long- λ side, and a less intense band at 3 μ ., the former being probably the HCl fundamental. N. M. B.

Infra-red absorption of carbon disulphide. C. R. BAILEY (Nature, 1937, 140, 851).—The band at

11.4 μ . is a triplet with max. at 884, 878, and 870 cm^{-1} . In spite of the non-polar nature of CS_2 , shifts of ~ 30 cm^{-1} occur in many bands on passing from the gaseous to the liquid state. The 4.61 μ . band has peaks at 2190.2, 2177.1, and 2165.4 cm^{-1} . L. S. T.

Rotation-vibration bands of methyl fluoride in the photographic infra-red at 11,250 Å. S. M. NAUDE and H. VERLEGER (Physikal. Z., 1937, 38, 919—920).—The rotation-vibration band of MeF at 11,250 Å. is composed of a simple series of lines. Every third line is stronger than its neighbours, an effect due to the three H atoms with spin 1/2. A. J. M.

Fundamental frequencies of dicyanogen molecule. S. C. WOO (Z. physikal. Chem., 1937, B, 37, 399—402).—The fundamental frequencies previously suggested (A., 1932, 558) lead to acceptable vals. for the force consts., whereas Eucken and Bertram's val. $\nu(a) = 740$ cm^{-1} (A., 1936, 557) does not. R. C.

Comparison of absorption spectra in the infra-red of vaporous and liquid amines. (MME.) M. FREYMAN (Compt. rend., 1937, 205, 852—854; cf. A., 1937, I, 282).—For the third harmonic of the NH band near 1.04 μ . the frequencies are: NH_3Pr^{β} 10,455, 10,168, and 10,064 (*l*), 10,466, 10,394, 10,130, and 10,000 (*v*); $C_5H_{11}NH_2$ 10,452, 10,168, and 10,064 (*l*), 10,401, 10,349, 10,130, and 10,000 (*v*); N_2H_4 10,654, 10,557, 10,317, and 10,189 (*l*), 10,583, 10,547, 10,401, 10,362, 10,176, and 10,020 (*v*); NH_2Ph 10,289, and 9999 (*l*), 10,156, 10,054, 9851, and 9727 (?) (*v*); $NHPhMe$ 10,427, 10,212 (*l*), 10,085 (*v*); piperidine 10,801, 10,692, 10,542, and 10,478 (*l*), 10,732, 10,635, 10,500, and 10,375 (*v*); pyrrole 10,413 and 10,116 (*l*), 9961, 9890, and 9818 (*v*). The NH bands of primary aliphatic amines have three components. The four components of piperidine and the two of pyrrole are considered to indicate the existence of several mol. forms in equilibrium, and persist on passage from liquid to vapour. R. S. B.

Variation of the combination spectrum of water with density and pressure. S. A. UCHOLIN (Compt. rend. Acad. Sci. U.R.S.S., 1937, 16, 395—398).—With rising temp. the 3200 cm^{-1} max. in the combination spectrum of H_2O decreases in intensity, disappearing almost completely at $>200^\circ$, whereas the band with max. at 3530 cm^{-1} increases in intensity. At d 0.0964 and 135 atm. a line is observed at 3646 cm^{-1} , characteristic of the isolated mols., which increases in intensity with decreasing pressure, whereas the intensity of the band diminishes, and finally disappears. The results are interpreted on the basis of interaction between the mols. J. W. S.

Frequency of oscillation on the hydroxyl group in methyl alcohol and its variation with density. G. S. LANDSBERG and S. A. UCHOLIN (Compt. rend. Acad. Sci. U.R.S.S., 1937, 16, 391—393).—The combination spectra of liquid and gaseous MeOH have been studied at various temp. and pressures yielding d 0.78—0.015. As d decreases, the OH band max. is displaced from 3402 cm^{-1} at d 0.78 to 3535 cm^{-1} at d 0.57, without change in the band width. This band almost disappears as the crit. state is approached. At 190° and d 0.577 a narrow line

appears, characteristic of isolated mols., the intensity of which increases with decreasing d . J. W. S.

Homopolar linkings in some paramagnetic chlorides. D. C. CHAKRABARTY (Sci. and Cult., 1935, 1, 158; Chem. Zentr., 1936, i, 3977).—Raman lines which would be expected for undissociated mols. of $MnCl_2$, $CeCl_3$, $NiCl_2$, and $CoCl_2$ in conc. HCl and EtOH solution were not observed. They may be masked by strong absorption. H. J. E.

Raman effect. LXXIV. Cyanamide and derivatives. L. KAHOVEC and K. W. F. KOHLRAUSCH (Z. physikal. Chem., 1937, B, 37, 421—436).—The Raman spectra of $CN \cdot NH_2$, $CN \cdot NHNa$, and $CN \cdot NR_2$ ($R = Me, Et, \text{ and } Pr$), but not those of $CN \cdot NH_2 \cdot 2HCl$ and dipropylcarbodi-imide, exhibit a C:N frequency. The spectra show that in solid, molten, or dissolved $CN \cdot NH_2$ there are present at least two mol. forms in equilibrium. One form is certainly $NH_2 \cdot C:N$ and the other is probably $NH:C:NH$; a third form may also be present. Force consts. of the C:N linking have been calc. The utility of the concept of "characteristic group vibration frequency" is discussed. R. C.

Raman effect. LXXV. Imido-ethers. K. W. F. KOHLRAUSCH and R. SEKA (Z. physikal. Chem., 1937, B, 38, 72—80).—The Raman spectra of $NH:C(OEt)_2$, $NHAcEt$, and various imido-ethers (I) have been determined. The results show that (I) have the structure $NH:CR \cdot OR'$. In the transition from $C \cdot NH \cdot C$ to $C:NH$ the NH-frequency does not change, which agrees with Förster's theory (A., 1937, I, 398). R. C.

Raman spectra of dextro-, laevo-, and racemic forms of borneol and camphor. B. V. THOSAR and B. K. SINGH (Proc. Indian Acad. Sci., 1937, 6, A, 105—111).—The Raman spectra of the above compounds in the cryst. state have been examined. The spectra of d - and l -forms of borneol and camphor are identical in position, intensity, and structure. The dl -forms give the same Raman lines as the d - and l -forms of the two substances. The lines are thus unaffected by the intermol. forces binding d - and l -mols., which forces must, therefore, be small. The Raman frequencies are considered in connexion with the constitution of the compounds. A. J. M.

Quenching of fluorescence of mercury halides by different gases. S. TIBILOV (J. Phys. Chem. Russ., 1937, 9, 71—87).—Excited HgX mols. ($X = I, Br, Cl$) have been produced by optical dissociation of HgX_2 mols.: $MgX + h\nu \rightarrow (HgX)^* + X$, and the effect of $NH_3, O_2, CO_2, N_2, CO, A, \text{ and } H_2$ on the intensity of fluorescence was investigated. The quenching efficiency decreases from NH_3 to H_2 ; HgI fluorescence is more easily quenched than that of $HgBr$ and especially that of $HgCl$. Strongly vibrating mols. show an easier exchange of energy by collisions than the non-vibrating ones. E. R.

Modification of the phosphorescence of a zinc sulphide semi-conductor under the influence of an electric current. G. DÉCHÈNE (Compt. rend., 1937, 205, 850—852).—The extinction of the phosphorescence of a ZnS screen by an electric current (cf. A., 1935, 1055) is sometimes preceded by a brief over-excitation of the phosphorescence. The influence

of the current has been studied on the phosphorescence appearing on heating some time after the extinction.

R. S. B.

Dielectric constant of a space containing electrons. S. P. PRASAD and M. N. VERMA (Z. Physik, 1937, 107, 441—448; cf. A., 1936, 666).—The influence of "life-period" of the electron and the magnitude of the high-frequency potential on ϵ for electron-containing spaces is discussed. In contradiction of the simple Larmor formula, it is shown that ϵ is not < 1 . The variation in ϵ with applied high-frequency potential is a parabolic function. L. G. G.

Electric spectrum of liquid water for $\lambda\lambda$ 5—20 cm. H. W. KNERR (Physical Rev., 1937, [ii], 52, 1054—1067).—Using a magnetron generator to produce continuous electromagnetic radiation, n and the absorption index of H_2O were determined for 19 wave-lengths in the range 5—20 cm. by the conventional free wave method and by a more convenient wire wave method, the two showing close agreement. The absorption index increased steadily from 0.048 at 20.44 cm. to 0.153 at 4.80 cm. The average val. of n was $8.80 \pm 0.6\%$. There was no certain evidence of dispersion, but a slight variation is to be expected. N. M. B.

Absorption bands in polar substances at very high radio-frequencies. III. n -Propyl and octyl alcohol. L. CAVALLARO (Atti R. Accad. Lincei, 1937, [vi], 25, 626—631; cf. A., 1937, I, 601).—Measurements for $Pr^{\omega}OH$ and $C_8H_{17}OH$ are recorded. With increasing no. of C atoms, the max. absorption is displaced towards longer $\lambda\lambda$, in agreement with Debye's theory. O. J. W.

Analogy between the structures of polar liquids and electrolytic solutions. F. H. MÜLLER (Z. Elektrochem, 1937, 43, 863—869).—Just as an ion in solution is surrounded by a preponderance of ions of opposite sign, so in a polar liquid each dipole is surrounded by preferentially oriented dipoles. These atmospheres have analogous influences on certain physical properties. Among properties considered are: osmotic behaviour (with analogies between effects formerly attributed to incomplete dissociation in electrolytes and to association in polar liquids), behaviour in the electric field (Λ on the one hand and ϵ on the other), η , and effects due to relaxation time (change of Λ and ϵ , respectively, at high frequencies). F. J. G.

Dielectric properties of acetylenic compounds. IX. Acetylenic aldehydes and ketones. H. L. GOEBEL and H. H. WENZKE (J. Amer. Chem. Soc., 1937, 59, 2301—2302; cf. A., 1937, I, 498).—The electric moments of $PhCHO$, butyl-, amyl-, and phenyl-propionaldehyde, $COPhMe$, butyl-, amyl-, and phenyl-acetylacetylene are, respectively, 2.77, 3.17, 3.18, 3.36, 2.77, 3.20, 3.20, 3.23 ($\times 10^{18}$). The higher moments of the acetylenic aldehydes and ketones in comparison with those of the alkyl and Ph derivatives are explained by the contribution of highly polar structures in resonance with the classical form. E. S. H.

Effect of pressure on refractive index of CO_2 . The Lorentz-Lorenz formula. A. MICHELS and J. HAMERS (Physica, 1937, 4, 995—1006).—The n

of CO_2 has been measured at pressures up to 2400 atm. at 25° , 32° , 50° , and 100° , for six different λ . The apparatus is described. The Lorentz-Lorenz function decreases, to a max. of 2.3%, with increase of pressure. It is suggested that the decrease is partly due to deformation of the electronic orbits of the mols.

F. L. U.

Refractive index of the alkali halides. L. W. PARKIN (Phil. Mag., 1937, [vii], 24, 890—904).— n of 0.002—0.0002N-CsCl, -LiF, -NaF, -KF, -NaI, -KI, and -CsI solutions has been measured, using a Hilger Rayleigh refractometer. The refractivity function $\psi = (1000/c_v)[(n^2 - 1)/(n^2 + 2) - (n_0^2 - 1)/(n_0^2 + 1)]$ increases linearly with dilution as far as 0.0008N, and then remains const. The difference between these const. vals. for two salts containing a common ion is const., indicating that ionic deformation is absent.

F. J. L.

Relationship between deviations from the additivity of the refraction of halogenated methane derivatives and some of their physical and chemical properties. J. M. STEVELS (Chem. Weekblad, 1937, 34, 678—681).— n_D^{20} and d_4^{20} have been measured for CH_2Cl_2 , CHCl_2F , CHCl_3 , CCl_3F , CCl_4 , CH_2ClBr , CHCl_2Br , CCl_3Br , CH_2Br_2 , CHBr_2F , CHClBr_2 , CHBr_3 , CBr_4 , MeI , CH_2IF , CH_2ClI , CHCl_2I , CCl_3I , CH_2I_2 , and CHI_3 . The results are discussed briefly.

S. C.

Refractivity intercept and the specific refraction equation of Newton. II. Electronic interpretation of the refractivity intercept and of the specific refraction equations of Newton, Eykman, and Lorentz-Lorenz. S. S. KURTZ, jun., and A. L. WARD (J. Franklin Inst., 1937, 224, 583—601; cf. A., 1937, I, 13).—The physical bases of the Lorentz-Lorenz and the Sellmeier-Drude equations are compared. Empirical evidence shows that the former equation is invalid for non-polar liquids. On the other hand, the validity of the Eykman equation for the effect of temp. and pressure on n or dielectric const. and that of the Sellmeier-Drude dispersion equation is confirmed. Equations available for correlating n and d with electronic properties of mols. are collected according to type. The derivation of the Sellmeier-Drude and Lorentz-Lorenz equations from the fundamental electrostatic field relations is considered, and indicates the superiority of the former.

A. J. M.

Molecular refractions and molecular volumes of glasses. W. BILTZ, F. WEIBKE, and L. SCHRADER-TRAEGER (Z. anorg. Chem., 1937, 234, 253—288).— $[R]$ for glasses is strictly additive in terms of the component oxides. The mol. vol. is additive to within 1% when account is taken of the state of combination of SiO_2 . n can be calc. within a few hundredths of 1% from ρ and analytical data. The results are discussed in the light of theories of the structure of glasses.

F. J. G.

Rotatory dispersion in the amine series. I. *d*-spiroheptanediamine and its derivatives. T. M. LOWRY and W. C. G. BALDWIN. **II. *l*-sec.-Butylamine and its derivatives.** **III. Absorption spectra of diamines.** W. C. G. BALDWIN (Proc. Roy. Soc., 1937, A, 162, 204—214, 215—227, 228—

C (A., I.)

232).—I. Theoretical rotatory powers of a series of spiroheptane derivatives, calc. from Born's theory, agree with observed vals. when long side-chains are absent. The absorption spectra of spiroheptanediamine, its salts, and Ac and Bz derivatives have been examined and discussed. The rotatory dispersions of these compounds and of "diamidocarbon-aminospiroheptane" were correlated with absorption measurements. Bases on neutralisation undergo large changes of rotatory power due to saturation of the "lone pair" of electrons on the N atom, which usually give rise to circularly dichroic absorption bands. Amino-bases are divided into two classes according as the absorption bands in the 2300 Å. region are active or inactive. When these bands are inactive, neutralisation of the base produces practically no change in rotatory power; the spiroheptane base belongs to this class.

II. The change of sign in passing from *l*-sec.-butylamine (I) to its hydrochloride is discussed with reference to Boys' rule. The rotatory dispersion of (I) is attributed to circular dichroism in the absorption bands at 2200 Å. associated with a "lone pair" of electrons on the NH_2 -N atom, and anomalous rotatory dispersion of (I) is explained. The rotatory dispersion of acylbutylamines, butylcarbamide, and NH_3BuCl is simple, activation of the "lone pair" of electrons occurring only in the free base. A new theory accounting for the observed changes of rotatory power of amino-bases on neutralisation is confirmed by the observation that saturation of the "lone pair" of NEt_2Bu displaces the active λ from Drude dispersion equations towards the ultra-violet. Lowry's results for nicotine are re-interpreted according to this theory.

III. Absorption spectra of aq. solutions of N_2H_4 and $(\text{CH}_2\text{NH}_2)_2$ and their hydrochlorides seem to indicate that the band at about 2200 Å. is characteristic of the "lone pair" of electrons on the N atom and can be suppressed progressively as the basicity of the solutions is decreased.

W. R. A.

Magnetic rotation spectra of diatomic molecules. T. CARROLL (Physical Rev., 1937, [ii], 52, 822—835).—The general theory of the Faraday effect associated with a single mol. absorption line is presented. The effect of the perturbation of the transition probabilities by the field in producing asymmetrical rotation is discussed, and calc. for alkali band systems and for I_2 .

N. M. B.

Kerr effect and molecular association in benzene derivatives. N. DALLAPORTA and G. DASCOLA (Nuovo Cim., 1936, 13, 1—10; Chem Zentr., 1936, i, 3813).—Kerr consts. for *o*-, *m*-, and *p*-xylene, *o*-, *m*-, and *p*- $\text{C}_6\text{H}_4\text{Cl}_2$, and *o*-, *m*-, and *p*- $\text{C}_6\text{H}_4\text{MeCl}$ are determined; they bear a const. ratio to the calc. vals. but the cause of the divergence is not clear. For $\text{C}_6\text{H}_4\text{MeCl}$ the change of the const. with temp. is in agreement with theory.

H. N. R.

Molecules. N. V. SIDGWICK (Science, 1937, 86, 335—340).—A lecture.

L. S. T.

Arrangement of the valencies in four-coordinated palladium and platinum. Crystal structure of potassium palladchloride. W.

THEILACKER (*Z. anorg. Chem.*, 1937, **234**, 161—178).—The results of Dickinson (*A.*, 1923, ii, 25) for the crystal structure of K_2PdCl_4 are confirmed. The optical activity shown by certain spiran-like four-co-ordinated Pd and Pt compounds can be reconciled with a coplanar arrangement of valencies around the central atom by supposing that the chelate 5-rings are non-planar, and support for this view is obtained by considering space-models in which account is taken of the bond lengths. F. J. G.

Energy bands in the body-centred lattice. M. I. CHODOROW and M. F. MANNING (*Physical Rev.*, 1937, [ii], **52**, 731—736).—Slater's method of finding electronic energy band structure (cf. *A.*, 1934, 828) is extended to satisfy boundary conditions at 14 points of the polyhedral cell surrounding an atom. N. M. B.

Spectrum of normal frequencies of a polar linear lattice. E. K. BROCH (*Proc. Camb. Phil. Soc.*, 1937, **33**, 485—501).—Mathematical. The frequency of the normal vibrations and the vibration spectrum are worked out for a one-dimensional chain. The quasi-elastic binding forces previously used by Born and Karman are replaced by the real forces comprising the electrical interaction of the charges and the repulsive forces. The method also applies in principle to the three-dimensional lattice. The vibration spectrum obtained agrees fairly well with that of the Born-Karman model if the binding const. is adjusted to give the same density of low-frequency modes. The calculations are of importance in connexion with the thermal and optical properties of lattices. J. A. D.

Empty lattice test of the cellular method in solids. W. SHOCKLEY (*Physical Rev.*, 1937, [ii], **52**, 866—872).—Mathematical. The method is accurate in the first Brillouin zone but may be in error by a factor 2 in the second; hence calculations of occupied levels in Li and Na are probably good, but for Cu, Ca, diamond, LiF, and NaCl are liable to errors. Calculations of excited states are subject to considerable error. N. M. B.

Energy and screening constants of the hydrogen molecule. C. A. COULSON (*Trans. Faraday Soc.*, 1937, **33**, 1479—1492; cf. *A.*, 1935, 810).—Mathematical. The mol. orbital and electron-pair treatments of the ground state of the H_2 mol. are almost equally valid. F. L. U.

Valency-bond treatment of the oxygen molecule. G. W. WHELAND (*Trans. Faraday Soc.*, 1937, **33**, 1499—1502).—Mathematical. F. L. U.

Rotational energy of methane. A. W. MAUE (*Ann. Physik*, 1937, [v], **30**, 555—576).—Theoretical. The rotational energies of CH_4 , CH_3D , CH_2D_2 , CHD_3 , and CD_4 are calc. CH_4 and CD_4 exist in three, and the other methanes in two, forms separated by forbidden transitions. The difference in the temp. increase of rotational energy in the compounds cannot be entirely explained by their differing moments of inertia. The gases with dissimilar substituents reach the point of half saturation of rotational energy at lower temp. than mols. with similar substituent atoms, when allowance has been

made for difference in moment of inertia. The rotational energy at equilibrium, when the transition barriers are removed, and the entropy of the gases at low temp. in the region of vanishing rotational energy are calc. O. D. S.

Critical potentials of molecules. J. SAVARD (*Rev. Fac. Sci. Istanbul*, 1937, **2**, 235—259).—The ionisation potential of CO and the resonance potentials corresponding with the addition of two spectral terms have been determined by electronic bombardment methods. The data are consistent with a val. 8.8 v. for the dissociation energy of CO. Crit. potentials 13.5, 16, and 19.1 v. correspond with the formation of ions CO^+ , ${}^2\Sigma_g^+$; CO^+ , ${}^2\Pi$; and CO^+ , ${}^2\Sigma_u^+$, respectively. C. R. H.

Effective cross-section of non-spherical particles. F. EIRICH and R. SIMHA (*Z. physikal. Chem.*, 1937, **180**, 447—463).—The mean free path and the collision cross-sectional area have been calc. for a gas consisting of rigid ellipsoidal mols. under such conditions that the mean free path is large compared with the mol. dimensions. The results agree, on the whole, with existing experimental data for the viscosity of gaseous paraffins. The possibility of calculating the axial ratio of a coiled-up mol. formed from a chain having internal mobility is discussed. R. C.

Interaction of molecules in anisotropic liquids. W. KAST and W. MATER (*Physica*, 1937, **4**, 957—962; cf. *A.*, 1937, I, 293).—A discussion of current theories. F. L. U.

Theory of the fission rules on the basis of alternations of bond strength, electron density, and spin. O. SCHMIDT (*Z. Elektrochem.*, 1937, **43**, 853—858).—Considerations of the distribution of electron density and spin in chains of atoms having one, two, and three electrons lead to an interpretation of observed results on the splitting of hydrocarbon chains (cf. *A.*, 1936, 1228). F. J. G.

Anisotropy of van der Waals forces. J. H. DE BOER and G. HELLER (*Physica*, 1937, **4**, 1045—1057).—Mol. orientation by van der Waals forces is determined by (1) an additive effect whereby each mol. tends to surround itself closely with as many neighbours as possible and (2) anisotropy of the polarisability, in consequence of which the polar axes of the mols. tend to be collinear with the direction of attraction. An attempt is made to calculate the relative magnitude of the two effects, and it is inferred that an approach to a collinear orientation is to be expected only with diat. mols. or mols. of high polarisability. F. L. U.

London-van der Waals attraction between spherical particles. H. C. HAMAKER (*Physica*, 1937, **4**, 1058—1072).—Mathematical. The interaction between two spherical particles is computed. It is shown that when both are immersed in a liquid the London-van der Waals forces should generally give rise to an attraction. F. L. U.

Method for distinguishing between different contributions to van der Waals forces. A. J. STAVERMAN (*Physica*, 1937, **4**, 1141—1154; cf. *A.*, 1937, I, 507).—A general method is given for dis-

tinguishing the contributions of dispersion, induction, and orientation to the total cohesive forces.

F. L. U.

Cohesive forces of liquids with simple molecules and the so-called law of Stefan. A. T. VAN URK (*Physica*, 1937, 4, 1025—1033).—It is shown both experimentally and theoretically that the work required to transfer a mol. from the interior of a liquid to the surface is $\frac{1}{2}$ of its internal heat of vaporisation, except for H_2 , for which the ratio is 0.4.

F. L. U.

Molecular interactions and their influence on polarisability. A. MICHELS, J. DE BOER, and A. BIJL (*Physica*, 1937, 4, 981—994).—Mathematical.

F. L. U.

Parachor of NO_2F . D. G. HILL and L. A. BIGELOW (*J. Amer. Chem. Soc.*, 1937, 59, 2127—2128).—The surface tension of NO_2F is 21.5 ± 0.2 dynes per cm. at -64.1° and 23.4 ± 0.2 at -80.4° ; the calc. parachor is 111. The structure of NO_2F is discussed.

E. S. H.

Twenty-fifth anniversary of the Laue diagram. F. LAVES (*Naturwiss.*, 1937, 25, 705—708, 721—733).—A review dealing with the theory and applications of the X-ray interference method. Particular reference is made to the determination of ionic and at. radii in crystals, and its dependence on the type of binding.

A. J. M.

Theory of the use of more than two successive X-ray crystal reflexions to obtain increased resolving power. J. W. M. DUMOND (*Physical Rev.*, 1937, [ii], 52, 872—883).—The extended scope discussed may bring the study of the asymmetric diffraction patterns predicted by the theory of Prins within the range of experimental investigation.

N. M. B.

Generalisation of the notation for the double-crystal X-ray spectrometer. S. K. ALLISON (*Physical Rev.*, 1937, [iii], 52, 884—885).—A discussion of the Allison-Williams notation and a comparison with that of DuMond (cf. preceding abstract).

N. M. B.

Structure of thin oriented metal films deposited by vaporisation. O. RÜDIGER (*Ann. Physik*, 1937, [v], 30, 505—526; cf. Brück, A., 1936, 784).—The structure of films of Ag, Au, and Pd deposited by vaporisation on mica, calcite, fluorite, natural quartz surfaces, and polished quartz and Cu is described. For each metal-surface pair a characteristic temp. was observed above which the films were oriented. Orientation is at first confined to the surface but at higher temp. extends throughout the layer. Complete orientation was never observed on quartz surfaces.

O. D. S.

X-Ray study of the crystallisation of vitreous selenium. J. A. PRINS and W. DEKEYSER (*Physica*, 1937, 4, 900—908).—Amorphous Se, stretched at 60 — 70° , shows a fibre diagram in transmission, the fibre axis being the hexagonal axis. In reflexion photographs this appears only after tempering above 73° . The results are discussed in respect to the theory of a continuous transition from the glassy to the crystal state.

K. S.

Grain orientation in rolled magnesium alloys. J. C. McDONALD (*Physical Rev.*, 1937, [ii], 52, 886—887).—Simple preferred orientation independent of the element added or of the treatment is found for additions up to 4%. Addition of traces of Ca to these alloys or to Mg causes double orientation, which, unlike the case of Zn, cannot be due to twinning but appears to be associated with the reported presence of insol. Mg_2Ca .

N. M. B.

Crystal growth in wires of nickel and tungsten. J. A. DARBYSHIRE (*Phil. Mag.*, 1937, [vii], 24, 1001—1012).—Crystal growth in Ni and W wires used as heaters in valves has been investigated by means of X-rays. The chief cause of aggregation in Ni wires is too high a temp. during activation and pumping, followed by slow growth during the life of the heater. Ni-Mg (0.48%) alloy is more brittle than pure Ni, but after 1000 hr. running shows no aggregation. W does not begin to aggregate up to 2500° , and exhibits no aggregation during processing with Al_2O_3 , activation, ageing, or in continuous life test. Heaters which failed on intermittent life test showed considerable aggregation.

F. J. L.

Preferred orientation of the crystallites of electrodeposited hexagonal chromium. W. A. WOOD (*Phil. Mag.*, 1937, [vii], 24, 772—776; cf. A., 1931, 1358).—An X-ray examination of hexagonal electrodeposited Cr shows that the crystallites tend to lie with the hexagonal axis perpendicular to the plane of the deposit. The same structure persists with the deposit on Cu, Ni, brass, and Fe, cleaned or uncleaned, and appears to be an intrinsic property of Cr.

K. S.

Debye-Scherrer diagrams of germanium between 20° and 1100° K. H. NITKA (*Physikal. Z.*, 1937, 38, 896—901).—Debye-Scherrer diagrams of Ge between 20° and 1100° K. indicate no allotropic transformation within this range, in spite of observed anomalies in resistance, thermo-electric power, sp. heat, and compressibility. The lattice is of the diamond type, like that of grey Sn and Si in the same periodic group. The anomalies are probably due to a transformation of a higher order.

A. J. M.

Crystal structure of $CaMg_2$. H. WITTE (*Naturwiss.*, 1937, 25, 795).— $CaMg_2$ has the same type of crystal structure as $MgZn_2$ (C14 type), and occurs in long hexagonal prisms. X-Ray diagrams show that Ca takes the place of Mg of $MgZn_2$, and Mg that of the Zn. Lattice constns. are a 6.22, c 10.10 Å. Phases with the $MgZn_2$ structure also occur in the system Ca-Ag-Al.

A. J. M.

Crystal structure of manganese diselenide and manganese ditelluride. N. ELLIOTT (*J. Amer. Chem. Soc.*, 1937, 59, 1958—1962).— $MnSe_2$ and $MnTe_2$ have the pyrites type of structure, with a_0 6.417 ± 0.005 and 6.943 ± 0.002 Å., respectively, and u 0.393 ± 0.001 and 0.386 ± 0.002 , respectively. The results suggest that in this type of structure the Mn-X bonds (X = S, Se, or Te) are either ionic or resonate between ionic and covalent types, the latter involving 4d orbitals from the Mn atom. The results are supported by the magnetic susceptibilities

of MnS_2 , CoS_2 , and NiS_2 (A., 1935, 1197); which indicate that Co and Ni probably form d^2sp^3 bonds in these compounds. J. W. S.

Crystal structure of compounds of the rare earths with metalloids of the fifth group. IV. Compounds of neodymium. A. LANDELLI and E. BOTTI (Atti R. Accad. Lincei, 1937, [vi], 25, 638—640; cf. A., 1937, I, 401).—X-Ray measurements show that NdN, NdP, NdAs, and NdSb have a NaCl type lattice with a 5.141, 5.826, 5.958, and 6.309 Å, respectively. O. J. W.

Metals and alloys. XXIII. Constitution of phosphides, arsenides, antimonides, and bismuthides of lithium, sodium, and potassium. G. BRAUER and E. ZINTL (Z. physikal. Chem., 1937, B, 37, 323—352; cf. A., 1937, I, 296).— Li_3As , α - Li_3Sb , Li_3P , Na_3Bi , Na_3Sb , Na_3As , Na_3P , K_3Bi , K_3Sb , and K_3As all have the same kind of lattice (the " Na_3As type"). The unit cell is hexagonal, and contains 6 alkali-metal atoms (M) and 2 atoms of the other metal (X). The space-group is D_{6h}^2 , and the X atoms form a hexagonal spherical packing with the M atoms in the largest interstices. There is also a cubic (β) form of Li_3Sb , which has the same lattice as Li_3Bi . These are all valency compounds and may be regarded as compounds of M' with X''' ions. The radius of the sphere of action of a given anion increases towards a limit with increasing size of the cation. The morphotropic transition of Li_3Br through Na_3As to Li_3N structures seems to agree approx. with the vals. of the radius ratio of the ions. The Na_3As lattice is approx. anti-isomorphous with that of tysonite. Solid solutions of Na_3As in Na_2Se have been obtained. R. C.

Crystal chemistry of nitrates of univalent cations. III. C. FINBAK, O. HASSEL, and L. C. STRÖMME (Z. physikal. Chem., 1937, B, 37, 468—471; cf. A., 1937, I, 603).—The crystal structures and geometrical relations of the alkali nitrates are reviewed. The structure of the high-temp. trigonal form of RbNO_3 has been determined. R. C.

Crystal structure and the magnetic anisotropy of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$. K. S. KRISHNAN and A. MOOKHERJI (Nature, 1937, 140, 896—897).—Magnetic data (cf. A., 1937, I, 20) confirm the structure proposed (A., 1934, 1296) from an X-ray investigation. L. S. T.

Crystal structure of ammonium trihydrogen paraperiodate, $(\text{NH}_4)_2\text{H}_3\text{IO}_6$. L. HELMHOLZ (J. Amer. Chem. Soc., 1937, 59, 2036—2039).—The crystal structure of this compound confirms the above formula. The $\text{H}_3\text{IO}_6''$ group has an octahedral arrangement of the O atoms around the I atom, probably distorted by H bonds. The I—O distance is 1.93 ± 0.03 Å. Each O atom has one O neighbour from other octahedra at 2.60 Å. and two O neighbours at 3.02 Å. The shorter distance is attributed to the existence of a H-bond. J. W. S.

Crystal structure and cement chemistry. Stereochemistry of crystalline compounds in Portland cements. E. BRANDENBERGER (Schweiz. Arch. angew. Wiss., 1936, 2, 45—58; Chem. Zentr., 1936, i, 3886—3887).—The 3 CaO mols. in Ca_3 silicate

are especially loosely bound and are readily split off by H_2O . The ultimate degradation product is SiO_2 . Structural relationships between the silicates and aluminates are discussed. $\text{Ca}_3\text{Al}_2(\text{OH})_2$ forms cubic crystals (a 12.56 Å.; 8 mols. in unit cube; probable space-group O_h^{10} — $Ia3d$). $\text{Ca}_3\text{Al}_2\text{Si}_3\text{O}_{12}$ has in its structure a SiO_4 — AlO_6 chain, with Ca added as secondary cations. The compound $\text{Sr}_3\text{Al}_2(\text{OH})_2$ also exists. H. J. E.

Constitution of the poly-acids. J. S. ANDERSON (Nature, 1937, 140, 850).—A possible structure for 6-poly-acids such as the 6-molybdoperoiodates is suggested from consideration of at. radii. Discrepancies between X-ray and physico-chemical evidence may be due to hydrolysis in solution. L. S. T.

X-Ray diffraction patterns of organic liquids. S. TANAKA and Z. MURO (Proc. Phys. Math. Soc. Japan, 1935, 17, 548—555).—Diffraction ring radii and spacings are given for two-component equal-proportion mixtures of a no. of heterocyclic compounds and monosaccharides. The spacings for mixtures lie between those of the pure compounds. Cyclic compounds with long side-chains give diffuse halos and those without long side-chains sharp halos. Chain compounds and compounds with atoms of high at. no. give diffuse halos. Ordinary isomerides are distinguishable, but optical isomerides are not. CH. ABS. (e)

Assignment of indices to X-ray fibre diagrams of cellulose derivatives with the fibre period 15 Å. J. GUNDERMANN (Z. physikal. Chem., 1937, B, 37, 387—398).—The dimensions of the unit cells have been determined. With one exception, all the X-ray diagrams can be assigned to a trigonal or pseudo-trigonal lattice, and probably all have the same space-group, C_3^2 or C_3^3 . The structure of these substances is therefore based on an array of threefold screw axes all parallel to the fibre axis. R. C.

Highly polymerised compounds. CLXXI. Microscopic examination of synthetic substances of high mol. wt. H. STAUDINGER, M. STAUDINGER, and E. SAUTER (Z. physikal. Chem., 1937, B, 37, 403—420).—A fibre of eupolyethylene oxide of degree of polymerisation >1000 consists of fibrillæ, but the absence of a line lattice spectrum in the X-ray fibre diagram shows the diameter of the fibrillæ to be >100 Å.; the existence of finer fibrillæ is precluded by the relatively high mobility of the mols., which would permit thickening. In cellulose under pressure and tension there is defibrillation into sub-microscopic or mol. dimensions. Under pressure single crystals of β -polyoxymethylene (I) split up longitudinally into fibrillæ of min. diameter 0.2 μ ., without any sign of transverse structure. 60% H_2SO_4 causes slight swelling, followed by defibrillation, the polyoxymethylene chains being attacked laterally by the acid. Aq. NaOH, however, produces periodic transverse striations on the crystals, supposedly due to fission at the terminal OH of the polyoxymethylene dihydrate chains. The similarity in behaviour between (I) and cellulose suggests a similarity in fibre structure, and it is inferred that the

properties of these fibres are a result of their consisting of macromols., and not of a micellar structure.

R. C.

What electrons can tell us about metals. C. J. DAVISSON (J. Appl. Physics, 1937, 8, 391—397).—A review of methods and results. R. C. M.

Irrational interference phenomena on the penetration of small crystals by fast electrons. F. KIRCHNER and O. RÜDIGER (Ann. Physik, 1937, [v], 30, 609—615; cf. Kirchner and Lassen, A., 1934, 1451).—It is deduced from further experiments that the thin vac.-deposited metallic films which show irrational interference are oriented with cubic planes parallel to the underlayer. Laue's theory (cf. A., 1937, I, 351) is therefore inapplicable. O. D. S.

Irrational interference points. M. VON LAUE (Ann. Physik, 1937, [v], 30, 616—618).—The deductions of Kirchner and Rüdiger (cf. preceding abstract) are criticised. O. D. S.

Irrational interference points. F. KIRCHNER (Ann. Physik, 1937, [v], 30, 619—620).—A reply to von Laue (cf. preceding abstract). O. D. S.

Single and multiple scattering of moderately fast cathode rays by metal foil. E. KRUPPKE (Ann. Physik, 1937, [v], 30, 577—592).—The angular distribution between 0° and 50° of scattered electrons produced from a beam of 40 to 70 kv. velocity by Ni and Al foils, 3 to 10×10^{-6} cm. and 1 to 6×10^{-4} cm. thick, respectively, has been determined. At small thicknesses and high electron speeds vals. agree with the theoretical curve for single scattering calc. from the Rutherford formula. At large thicknesses and low speeds vals. agree with the curve for multiple scattering calc. from the Gauss theory of errors. A correction to Wentzel's criterion for single scattering (cf. Ann. Physik, 1922, [iv], 69, 341) is made. O. D. S.

Diffraction of β -rays. S. C. CURRAN (Phil. Mag. 1937, [vii], 24, 953—964).— β -Rays obtained from Ra-D + E + F in equilibrium are diffracted by thin Al and Au foil. The diameter of the (200) diffraction ring is measured with a Geiger counter and is in good agreement with that calc. by the de Broglie relation. Ra-D + E + F gives rise to a continuous β -ray spectrum, with a single intensity max. at $H_p = 2100$, and there is no γ -radiation. F. J. L.

Structure of the hydrides of boron. III. Borine carbonyl and borine trimethylamine. S. H. BAUER (J. Amer. Chem. Soc., 1937, 59, 1804—1812; cf. A., 1937, I, 119, 397).—Electron diffraction measurements on the vapour indicate that in BH_3CO the B, C, and O atoms are arranged linearly, with the H atoms completing the tetrahedron around the B atom. The interat. distances are H—B 1.20, B—C 1.57, and C—O 1.13, all ± 0.03 Å. In BH_3NMe_3 the distances are B—N 1.62 ± 0.15 Å. and N—C 1.53 ± 0.06 Å. The electronic structures and the great difference in stability of the compounds are discussed. J. W. S.

Electron diffraction studies of cuprous oxide. L. H. GERMER (Physical Rev., 1937, [ii], 52, 959—967; cf. A., 1936, 1451).—Abnormal diffraction patterns due mainly to the unusual smoothness of

the etched surfaces and to resulting refractive effects are discussed. A new cubic structure of cell edge 8.35 Å., produced by HNO_3 or KCN etch, but not by H_2SO_4 or aq. NH_3 , is reported. N. M. B.

Interatomic distances of the alkali halide molecules by electron diffraction. L. R. MAXWELL, S. B. HENDRICKS, and V. M. MOSLEY (Physical Rev., 1937, [ii], 52, 968—972).—Nuclear distances were obtained for the Na, K, Rb, and Cs halides from visual measurements of interference in electron diffraction photographs given by mol. beams when the salts were heated to approx. 1200° . Distances for Na, K, and Rb halides were 10% less, and for Cs halides 14% less, than in the corresponding crystal lattices. N. M. B.

Diffraction of electrons by cadmium iodide. G. I. FINCH and H. WILMAN (Trans. Faraday Soc., 1937, 33, 1435—1448).—Photographs and measurements of electron diffraction patterns of built-up films of cryst. CdI_2 are given. The c-axial length is double that assigned by Bozorth, and is independent of crystal thickness. The electron diffraction intensity distribution agrees with that required by Hassel's at. co-ordinates. Kirchner's explanation of the elliptic banded effects is confirmed and extended. F. L. Ü.

Molecular structures of boron trimethyl, trifluoride, trichloride, and tribromide. Covalent radius of boron. H. A. LÉVY and L. O. BROCKWAY (J. Amer. Chem. Soc., 1937, 59, 2085—2092).—Electron-diffraction investigations show that the mols. are planar and have the interat. distances: B—C 1.56 ± 0.02 , B—F 1.30 ± 0.02 , B—Cl 1.73 ± 0.02 , B—Br 1.87 ± 0.02 Å. These and other published data confirm the val. 0.89 Å. for the single-linking radius of B surrounded by an octet of electrons and 0.79 Å. for B with only 6 electrons. E. S. H.

Electron-diffraction investigation of higher aliphatic halides. J. A. A. KETELAAR and K. J. PALMER (J. Amer. Chem. Soc., 1937, 59, 2470).—Electron-diffraction figures of ω -dibromodecane, -dibromopentane, and -di-iodobutane show only a few diffuse rings and much background. This result is ascribed to the intramol. action of van der Waals forces, which causes the chains to take up bent configurations. E. S. H.

Electron-diffraction investigation of seven chlorobenzenes. L. O. BROCKWAY and K. J. PALMER (J. Amer. Chem. Soc., 1937, 59, 2181—2189).—The interat. distances in C_6Cl_6 , 1 : 3 : 5- $\text{C}_6\text{H}_3\text{Cl}_3$, *o*-, *m*-, and *p*- $\text{C}_6\text{H}_4\text{Cl}_2$, PhCl, and 1 : 2 : 4 : 5- $\text{C}_6\text{H}_2\text{Cl}_4$ have been determined and are discussed. The C—Cl distance decreases to about 1.70 compared with 1.76 Å. for chloromethanes and the C—C distance may increase by 0.02 Å. E. S. H.

Electron-optical images of vapour streams by the dark field method. H. BOERSCH (Z. Physik, 1937, 107, 493—496).—The broadening of a stream of CCl_4 vapour injected into a vac. is studied by the dark field method with an electron microscope. L. G. G.

Volume magnetostriction of iron and nickel. J. L. SNOEK (Physica, 1937, 4, 853—862).—Dilatometric measurements are recorded. K. S.

Magnetic properties of single crystals of silicon-iron. H. J. WILLIAMS (Physical Rev., 1937, [ii], 52, 747—751).—The magnetisation curves for the (100), (110), and (111) directions of Fe-3.85% Si single crystals were obtained from specimens cut in the form of hollow parallelograms so that the sides of each specimen were parallel to the tetragonal, digonal, or trigonal axes, respectively, thus avoiding errors due to demagnetising fields. Considerable anisotropy at low magnetisations was found. The (100) specimen after careful annealing showed a max. permeability of 1.38×10^6 . Magnetic anisotropy consts. were obtained. N. M. B.

Variation of initial permeability with direction in single crystals of silicon-iron. H. J. WILLIAMS (Physical Rev., 1937, [ii], 52, 1004—1005).—Permeability-flux density curves for specimens cut as hollow parallelograms to form closed magnetic circuits (no demagnetising factor) were obtained for 5—100 gauss. Extrapolation to zero flux density gives initial permeabilities 6000, 3100, and 1900 for the (100), (110), and (111) directions, respectively, in the approx. ratio 6 : 3 : 2 in agreement with theory. N. M. B.

Diffraction patterns of silicon-iron crystals oscillating magnetostrictively. G. W. FOX and H. T. HURLEY (Physical Rev., 1937, [ii], 52, 1077).—Laue photographs for thin Si-Fe strips containing large single crystals when the strips were oscillated magnetostrictively indicated that magnetostriction oscillation acts similarly to piezoelectric oscillation and gives slightly more intense patterns. N. M. B.

Magnetic properties of some solid solutions. I. Effect of magnetisation at a high temperature and of crystallisation on the course of the thermomagnetic curves. II. Solid solutions of iron oxides. III. Ferrous sulphide and its solid solutions. A. MICHEL (Ann. Chim., 1937, [xi], 8, 317—342, 343—378, 379—423).—I. Anomalies in the variation of the intensity of magnetisation (I) with temp. in α -Fe₂O₃, Ba, Sr, Pb, and Ni ferrites, and pyrrhotine, are discussed. The anomalies consist in general of a sudden increase in I on first heating the specimen ("high-temp. magnetisation"), and a large remanent magnetism on cooling. The governing factor in these effects is the magnetic hardness of the specimen, which is affected by heat-treatment. Demagnetisation is caused by heating the specimen to at least 50° below the Curie point. Annealing at high temp. removes the anomalies, but decreases the chemical reactivity of the specimen. The effects are varied by crystallisation of the specimen, and in the case of non-cubic crystals, by their orientation.

II. Variations of the magnetic properties of Fe oxides with the method of prep. are due to the formation of solid solutions involving Fe₃O₄ and α - and γ -Fe₂O₃. γ -Fe₂O₃ is unstable at low temp., giving α -Fe₂O₃; in a vac. it dissociates to Fe₃O₄ and O₂. γ -Fe₂O₃ can, however, be stabilised by addition of ferrites in solid solution. The Curie point of γ -Fe₂O₃, extrapolated from vals. for the stabilised solid solutions, is 675° (α -Fe₂O₃, 675° also). Part of the stabilising ferrite can be removed from solution without immediate change of the Curie point or cryst.

parameters. These changes occur on annealing the specimen. The O₂ pressure of γ -Fe₂O₃ decreases on formation of solid solutions.

III. FeS forms two types of solid solution; the FeS type is formed with metals and low contents of non-metals, and shows a Curie point and weak ferromagnetism; the pyrrhotine type, formed with higher contents of non-metals, is ferromagnetic and exhibits an allotropic change. The Debye-Scherrer diagrams for both types are identical. The magnetic properties and the solubility limits are discussed.

A. J. E. W.

Oxide film on aluminium and its photometric test. R. TOMII and Y. MIYAKAWA (J. Electrochem. Assoc. Japan, 1935, 3, 232—242).—The reflectivity of Al₂O₃ films formed under various conditions was measured with a photo-electric cell. The min. reflectivity was obtained on electrolysis in 2% H₂C₂O₄ at 15°, in 1% H₂CrO₄ at 30°, or in 5.5% Na₂B₄O₇ at 50°, using c.d. of 8.3, 3.3, and 0.6 ma. per sq. cm., respectively. CH. ABS. (c)

Transformations of manganese. H. YOSHISAKI (Sci. Rep. Tôhoku, 1937, [i], 26, 182—189).—The points of transformation in Mn have been measured by the differential thermal, dilatometric, and buoyancy methods and occur at 706°, 1087°, and 1150°. The m.p. is 1254°. F. J. L.

Thermal transitions in ammonium compounds. H. P. KLUG and W. W. JOHNSON (J. Amer. Chem. Soc., 1937, 59, 2061—2063).—From heating and cooling curves NH₄ compounds have been shown to have transitions at the following temp.: NH₄Cl -30.54±0.10°, NH₄Br -38.12±0.10°, NH₄I -41.65±0.20°, (NH₄)₂SO₄ -49.71±0.20°, (NH₄)₃AsO₃ -56.02±0.01°, (NH₄)₂Cr₂O₇ -2.40±0.20°, and NH₄H₂PO₄ 18.9±2.5°. These transitions are attributable to rotation of the NH₄⁺ ion. The transition of NH₄Br appears to have a fine structure, possibly due to inception of rotation in one axis prior to rotation in the other axes. No transitions are observed with (NH₄)₂CrO₄, NH₄ borate, (NH₄)₂CO₃, NH₄NO₃, (NH₄)₂C₂O₄, (NH₄)₂S₂O₈, (NH₄)₂HPO₄, or NH₄ tartrate. J. W. S.

Conductivity of gases at high pressures. J. CLAY, G. VAN KLEEF, and M. A. VAN TIJN (Physica, 1937, 4, 766). K. S.

[Electrical] conductivity of pure gases at high pressures. J. CLAY and G. VAN KLEEF (Proc. K. Akad. Wetensch. Amsterdam, 1937, 40, 663—667).—Measurements of the ionisation by γ -rays of Ne and Xe at 65—100 atm. pressure are recorded. Using a high potential gradient at these pressures, measurable conductivity was observed in He, Ne, Kr, Xe, and N₂ without γ - or cosmic-ray bombardment, the effect showing a large dependence on temp. At 4000 v. per cm. Xe has conductivity 3.2×10^{-18} amp. per v. A. J. E. W.

Conductivity of univalent metals. J. BARDEEN (Physical Rev., 1937, [ii], 52, 688—697).—Mathematical. N. M. B.

(A) Influence of a magnetic field and of temperature on the electrical resistance of gallium single crystals. (B) Change of resistance of

single crystals of gallium in a magnetic field. W. J. DE HAAS and J. W. BLOM (*Physica*, 1937, **4**, 767—777, 778—790; cf. *A.*, 1934, 588).—(A) A method for distinguishing the two shorter axes in Ga crystals by the increase in resistance in a magnetic field (11,800—22,300 gauss), at temp. between 14° and 273° K., is described. The sp. resistance of gallium at 0° C. is $5.27 \times 10^{-5} \Omega$ per cm.

(B) The dependence of the resistance increase on field strength (600—22,300 gauss) and temp. (10—80° K.) is given. K. S.

Measurement of the variation of the specific resistance of platinum with the thickness of the wire, as a contribution to the knowledge of mean free paths of conduction electrons. H. REUTER (*Ann. Physik*, 1937, [v], **30**, 494—504).—The sp. resistance of Pt wires at temp. from -150° to 0° is inversely \propto the thickness of the wire for thicknesses from 15.7 to 202 μ . Calc. vals. of the resistance at infinite thickness agree with the accepted vals. for Pt. The mean free path of the conduction electrons is calc. from the Nordheim formula for the increase of resistance by limitation of free path in thin wires; at 0° $\lambda_0 = 3.7 \mu$. Interpretation of the effect on the hypothesis of a badly conducting shell leads to the conclusion that the thickness of the shell is a function of temp. It is, therefore, more probable that such a shell is identical with the region where the free path of the electrons is limited by the proximity of the surface rather than formed by impurities. From the calc. thickness of the shell a mean free path $\lambda_0 = 1.62 \mu$ is obtained. O. D. S.

Electrical conductivity of single crystals of tungsten at low temperatures in a strong transverse and longitudinal magnetic field. E. JUSTI and H. SCHEFFERS (*Physikal. Z.*, 1937, **38**, 891—896).—Previous work (*A.*, 1936, 1452) on the increase of resistance of single crystals of W in a transverse magnetic field at low temp. has been extended to fields of 35 kilogauss. Under these conditions the magnetic energy of the free electrons is $<$ the thermal energy and the resistance increases to about 10^6 times the ideal resistance without reaching a saturation val. The anisotropy factor is independent of field strength and temp. The longitudinal effect is small, being within the experimental error. The results do not agree with the assumption of a perfectly free, isotropic, electron gas. A. J. M.

Electrical resistance and magnetic susceptibility of palladium wires charged with deuterium. A. SIEVERTS and W. DANZ (*Z. physikal. Chem.*, 1937, **B**, **38**, 61—71).—D increases the resistance of Pd more than H, the max. relative increase being 0.92 for D (for PdD_{0.66}) and 0.69 for H (for PdH_{0.79}). The resistance-concn. curve for Pd-D alloys is convex to the concn. axis. Equiv. amounts of D and H depress the magnetic susceptibility of Pd by equal amounts. R. C.

Magnetic behaviour of superconductors carrying a current on transition to the superconducting state. K. STEINER (*Physikal. Z.*, 1937, **38**, 880—887).—The effect of the passage of an electric current through a superconductor on its magnetic

properties at the threshold of transition to or from the superconducting state has been investigated for a single crystal of Sn, polycryst. Sn, Zn-Cd, and In. If the current is flowing, a magnetisation of the superconductor occurs before passing into the superconducting state, the magnetisation having the same direction as the field produced by the current. It increases with the current strength, and changes sign when the current is reversed. The direction of the magnetisation is independent of the direction of the resultant field when an external magnetic field is superimposed, and the phenomenon is observed when a compensating field is applied to counteract the field due to the current itself. A. J. M.

Connexion between magnetic induction and superconduction. J. STARK, K. STEINER, and H. SCHOENECK (*Physikal. Z.*, 1937, **38**, 887—891).—The time taken for the occurrence of paramagnetic and diamagnetic induction in two hollow cylinders of polycryst. Sn on transition to the superconducting state has been compared. The magnetic behaviour of normal conductors (single crystal of Au, polycryst. W) was also investigated at temp. $< 4^\circ$ K., in order to discover whether the great change in magnetic induction suffered by superconductors is peculiar to this class of substances. No such change was observed with normal conductors. A. J. M.

Threshold values of superconductors of small dimensions. R. B. PONTIUS (*Phil. Mag.*, 1937, [vii], **24**, 787—796; cf. *A.*, 1937, I, 451).—The effect of depth of penetration on the threshold val. of a Pb wire superconductor was examined. K. S.

Superconductors in alternating magnetic fields. D. SHOENBERG (*Proc. Camb. Phil. Soc.*, 1937, **33**, 559—576).—Magnetic properties are studied by measuring the change in self-inductance of a coil when specimens are introduced in the presence of a magnetic field. The method is applied to observe the variations in magnetic properties of a superconductor with the frequency of an applied a.c. field. The effects of size, nature of the specimen, and amplitude of the a.c. field are studied while the specimen is maintained in the transitional or intermediate state. J. A. D.

“Overshoot phenomenon” in superconductivity. A. D. MISENER (*Proc. Camb. Phil. Soc.*, 1937, **33**, 583—585).—The “overshoot phenomenon” described by Silsbee (cf. Scott and Brickwedde, *A.*, 1937, I, 292) is apparently due to local fluctuation of temp. at the surface of their specimen caused by its particular form and mounting. J. A. D.

Superconductivity. F. LONDON (*Physical Rev.*, 1937, [ii], **52**, 886).—A criticism of Wick (cf. *A.*, 1937, I, 606). N. M. B.

Quantum theory of interatomic currents in aromatic compounds. F. LONDON (*J. Phys. Radium*, 1937, [vii], **8**, 397—409).—Anomalous diamagnetic anisotropy in aromatic compounds may be explained by a system of interat. currents in the mol. It is shown that such currents cannot occur in saturated compounds. C₆H₆, C₁₀H₈, anthracene, Ph₂, pyrene, and phenanthrene are considered in

detail, and the calc. vals. of the diamagnetic anisotropy are in accord with experimental vals.

A. J. E. W.

Moment and molecular field of ferromagnetics. L. NÉEL (Ann. Physique, 1937, [xi], 8, 237—308; cf. A., 1936, 420, 555, 668, 671, 1188).—A comprehensive presentation of a general theory of vol. anomalies, variation of interaction energy with distance between atoms, variation of molecular field with temp., and the differences of ferromagnetic and paramagnetic moments of metals and alloys. Calc. results are in good agreement with available experimental data.

N. M. B.

Dia- and para-magnetism of metallic mixed crystals. V. Behaviour of dissolved cobalt and rhodium. E. HILDEBRAND (Ann. Physik, 1937, [v], 30, 593—608; cf. Vogt, A., 1937, I, 352).—The susceptibility from -190° to 640° of the following series of mixed crystals has been measured: Au-Co from 0.3 to 3.4 at.-% Co, Cu-Co from 0.1 to 0.5 at.-% Co, and Pt-Rh from 9 to 32 at.-% Rh. Susceptibilities are calc. assuming that those of the two components are additive. Weiss' law is obeyed for Co in all cases. The magnetic moment of Co is independent of concn. but differs for the two solvents: Au-Co μ_B , 4.6, Θ , between -160° and -250° ; Cu-Co μ_B , 5.4, Θ , between -860° and -1020° . A max. of susceptibility was observed in the Pt-Rh series at 25 at.-% Rh and is interpreted. Up to 25 at.-% Rh, Pt behaves as a neutral ground metal. Weiss' law is obeyed for Rh only at the lowest concn. and vals. μ_B , 1.9, Θ , -90° are obtained. The solubilities of Co in Au and Cu below 500° are <0.37 and 0.12% by wt., respectively, and $<$ previously recorded vals.

O. D. S.

Atomic susceptibility of bivalent copper. S. S. BHATNAGAR, H. LESSHEIM, and M. L. KHANNA (J. Indian Chem. Soc., 1937, 14, 445—448).—The susceptibility of several Cu⁺⁺ compounds has been determined. The results show that there is no difference in the magnetic state of the Cu atom in simple or complex compounds.

E. S. H.

Magnetic properties of vanadium ammonium alum. J. VAN DER HANDEL and A. SIEBERT (Physica, 1937, 4, 871—878).—Susceptibility measurements varying from 730 to 1909×10^{-6} for $V NH_4$ alum, at temp. between 1.465° and $297.4^{\circ} K.$, are described and discussed.

K. S.

Magnetic anisotropy of rare-earth sulphates and the asymmetry of their crystalline fields. K. S. KRISHNAN and A. MOOKHERJI (Nature, 1937, 140, 549).—The vals. given for the magnetic anisotropy of the octahydrated sulphates of Pr, Nd, Sm, and Er do not support the conclusion of Spedding *et al.* (A., 1937, I, 216, 349, 393) that the fields acting on the M^{III} ions in these crystals are cubic in symmetry.

L. S. T.

Magnetic susceptibility of the CH_2 group in combination. J. FARQUHARSON and M. V. C. SASTRI (Trans. Faraday Soc., 1937, 33, 1472—1474).—The val. of χ_{mol} for $\cdot CH_2\cdot$, calc. from data for saturated fatty acids, is $-11.64 \pm 0.026 \times 10^{-6}$.

F. L. U.

Effect of ring-closure on magnetic susceptibility. J. FARQUHARSON and M. V. C. SASTRI (Trans. Faraday Soc., 1937, 33, 1474—1478).—From measurements on 3-, 4-, 5-, and 6-membered C rings and the related open-chain compounds, constitutive correcting consts. for the rings are evaluated. These differ from the vals. given by Pascal. The effect of ring closure is a fall in diamagnetism except in the 5-ring. The necessity for correcting consts. is considered to be due to changes in the χ of the C atom in rings of different size.

F. L. U.

Permanent thermo-electric currents in metallic conductors and the thermodynamic basis. F. ODONE (Nuovo Cim., 1936, 13, 11—15; Chem. Zentr., 1936, i, 3800).

H. J. E.

Thermomagnetic properties of ferric oxide. R. CHEVALLIER and Z. E. BÉGUI (Bull. Soc. chim., 1937, [v], 4, 1735—1742).—Pure α - Fe_2O_3 , prepared in different ways, has a magnetic susceptibility in the ferromagnetic region (20°) of 20 — 100×10^{-6} , but when traces of alkaline impurities are present the val. may reach 1000 — 2000×10^{-6} . In the paramagnetic region (720°) the susceptibility of 25 specimens of Fe_2O_3 from different sources is approx. 20×10^{-6} , independently of the state at low temp. and of the presence of traces of impurities.

E. S. H.

Determination of the relaxation time for the vibrational energy of carbon dioxide. A. VAN ITERBEEK and P. MARIËNS (Nature, 1937, 140, 850—851).—Measurements at 16.6° and -31.0° of the absorption of sound in CO_2 give relaxation times at 1 atm. of 8.3×10^{-6} and 13.3×10^{-6} sec., respectively (cf. A., 1937, I, 504). Impurities \sim a few parts per 1000 have a marked effect.

L. S. T.

Aligning action of sound fields on non-spherical particles. R. POHLMAN (Z. Physik, 1937, 107, 497—508).—A mathematical analysis of the motion of disc-shaped particles under the influence of stationary supersonic waves. An observable alignment of the particles can be produced only by very weak sound fields.

H. C. G.

Periodicity in the appearance of supersonic waves. F. HIEDEMANN and E. SCHREUER (Z. Physik, 1937, 107, 463—473).—The theories of Nath and of Nomoto regarding the interference phenomena observed when a system of stationary supersonic waves is illuminated with parallel light are discussed in relation to Winkelmann's investigation of an analogous phenomenon with an optical lattice. A diagrammatic illustration of the phenomenon is given.

H. C. G.

Ultrasonic interferometry for liquid media. F. E. FOX (Physical Rev., 1937, [ii], 52, 973—981).—Mathematical. Theory is discussed and measurements with H_2O are reported.

N. M. B.

Mechanism of luminescence in liquids under ultrasonic treatment. V. L. LEVSHIN and S. N. RSHEVKIN (Compt. rend. Acad. Sci. U.R.S.S., 1937, 16, 399—404).—The intensity of the luminescence of H_2O and aq. solutions under the action of ultrasonic vibration decreases with rising temp. and disappears at about 50° . Traces of most salts have little

effect, but NaHCO_3 causes quenching, as does saturation with CO_2 . This is interpreted as confirming that the luminescence is due to formation in the liquid of cavities filled with H_2O vapour, which is excited under the influence of p.d. produced when the liquid is disrupted or the cavities destroyed. The luminescence of hydrazide solutions increases with amplitude of vibration but disappears in very violent vibrations.

J. W. S.

Effect of intense sound on metallic melts. I. Preliminary experiments. G. SCHMID and L. EHRET (*Z. Elektrochem.*, 1937, **43**, 869—874).—Apparatus for studying the effect of intense high-frequency sound vibrations on metallic melts is described. Sb, Cd, duralumin, and silumin after solidification while exposed to the vibrations show a marked increase in fineness of structure, with corresponding changes in mechanical properties. Sb solidifies without the usual supercooling; the cooling curves of the other metals are unaffected. The vibrations enable Pb to be dispersed in Al.

F. J. G.

M.p. of silicon. F. HOFFMANN and A. SCHULZE (*Physikal. Z.*, 1937, **38**, 901—905).—The m.p. of Si (99.89%) determined by a thermo-electric and by an optical-pyrometric method, is $1410 \pm 2^\circ$. Commercial Si (98%) melts about 2° lower.

A. J. M.

Measurements of the atomic heat of aluminium from 1.1° to 20° K. J. A. KOK and W. H. KEESOM (*Physica*, 1937, **4**, 835—842).—Transition from superconductive to nonsuperconductive state occurs at 1.13° K. The at. heat is given by $C_v = D(419/T) + 0.0003484T$ g.-cal./degree mol.; below 1.13° K., C_v increases sharply.

K. S.

Phase equilibria in hydrocarbon systems. XX. Isobaric heat capacity of gaseous propane, *n*-butane, isobutane, and *n*-pentane. B. H. SAGE, D. C. WEBSTER, and W. N. LACEY (*Ind. Eng. Chem.*, 1937, **29**, 1309—1314; cf. *A.*, 1937, **I**, 413).—The vals. of C_p for these gases have been determined at 70 — 340° F. and 760 mm., and the data for zero pressure deduced.

J. W. S.

Specific heats of solids due to molecular rotations. T. S. CHANG (*Proc. Camb. Phil. Soc.*, 1937, **33**, 524—533).—Mathematical. The methods recently used in the treatment of the order-disorder transitions in alloys (cf. *A.*, 1935, 1192) are applied to calculate the change in sp. heat due to mol. rotation in solids. Rotation of the mols. occurs above a certain crit. temp., resembling the crit. ordering temp. in alloys, and gives rise to a sudden discontinuity in the val. of the sp. heat. Previous calculations made by Fowler (cf. *A.*, 1935, 683) using the Bragg-Williams type of approximation are now repeated using Bethe's method. The agreement with experiment is still poor.

J. A. D.

Transitions in solid mono- and tetra-deuteromethane. Entropy relations of monodeuteromethane CH_3D and of deuterium hydride HD. K. CLUSIUS, L. POPP, and A. FRANK (*Physica*, 1937, **4**, 1105—1116; cf. *A.*, 1937, **I**, 505).—Work previously published is summarised.

F. L. U.

Data of state of normal and para-hydrogen from the b.p. to 55° K. E. A. LONG and O. L. I. BROWN (*J. Amer. Chem. Soc.*, 1937, **59**, 1922—1924).—Comparison of the P - V - T relations of normal and p - H_2 at 21 — 56° K. reveals no essential difference in behaviour.

J. W. S.

Liquid helium temperatures. I. B.p. of helium. II. Vapour pressure curve of liquid helium. G. SCHMIDT and W. H. KEESOM (*Physica*, 1937, **4**, 963—970, 971—977).—I. Redetermination of the normal b.p. of He gives 4.216° K. The apparatus is described.

II. New measurements on the v.p. of He between 0 and 76 cm. give temp. slightly higher than those calc. by the formulæ which form the basis of the 1932 temp. scale. A table of differences is given. The λ -point is at $p = 3.83$ cm. Hg. $T = 2.186^\circ$ K. ± 0.002 .

F. L. U.

Pressure, volume, temperature properties of nitrogen at high density. I. Results obtained with a weight piezometer. II. Piston displacement method. M. BENEDICT (*J. Amer. Chem. Soc.*, 1937, **59**, 2224—2233, 2233—2242).—I. Apparatus and procedure for the gravimetric determination of gas d is described. Results are recorded for N_2 at -100° to -183° and 100 — 1250 atm., and at 0° and 1550 atm. An equation of state, which fits these and other published data, is derived. The Joule-Thomson inversion curve for N_2 has been calc. from the equation of state and found to agree with the experimental curve of Roebuck and Osterberg.

II. The vol. changes of N_2 have been measured by the displacement of a gas-tight piston fitted to a cylinder containing N_2 . Sp. vols. have been determined at 980—5800 atm. and from -175° to 200° , with a probable error of 0.24%. An equation of state has been fitted to the data, and derived thermal data have been obtained from it.

E. S. H.

Vapour pressure and dissociation of tungsten hexachloride in the gas phase. A. A. VERNON (*J. Amer. Chem. Soc.*, 1937, **59**, 1832—1833).—Over the temp. range 25 — 150° the v.p. (p) of WCl_6 is given by $\log p = 3.1 - 1198/T$. The equilibrium consts. at 1087° , 1227° , 1327° , and 1727° indicate that the heat of dissociation is about 9000 g.-cal. per mol.

J. W. S.

Vapour tensions of certain substances in the interval 0—50 atm. D. N. TARASENKOV and V. P. AFINOGENOV (*J. Phys. Chem. Russ.*, 1937, **9**, 889—900).—The v.p. of the following substances are determined: H_2O (118 — 237° , 2 — 41.7 kg. per sq. cm.), C_6H_6 (91 — 288° , 1.53 — 48.2 kg.), EtBr (48 — 226° , 1.53 — 49.9 kg.); EtOH (96 — 220° , 2.13 — 46.1 kg.); Ph_2O (267 — 447° ; 1.23 — 17.9 kg.); Ph_2 (260 — 402° ; 1.23 — 11.4 kg.); C_{10}H_8 (233 — 434° , 1.48 — 27.1 kg.); SbCl_3 (235 — 480° ; 1.53 — 41.0 kg.); and 72 — 231° , 1.2 — 756 mm.); AlBr_3 (271 — 482° , 1.53 — 19.7 kg.); and BiCl_3 (245 — 446° , 3 — 750 mm.).

E. R.

Symmetrical diethyl sulphite. F. ISHIKAWA and C. TANIBE (*Bull. Inst. Phys. Chem. Res. Japan*, 1937, **16**, 1318—1322).—The v.p. (0 — 158°) is given by $\log_{10} P$ (mm.) = $-2253.92/T + 1.75 \log T - 0.001794T + 4.272492$. The calc. heats of evapor-

ation are 10,623 g.-cal. at 25° and 10,294 at the b.p. The b.p. is -119.8°. The vals. of Trouton const., Ramsay-Shields const., and parachor are discussed in relation to mol. association. Et₂SO₃ is a normal liquid. E. S. H.

More precise formulation of fundamental concepts of thermodynamics. K. A. PUTILOV (Bull. Acad. Sci. U.R.S.S., 1937, Sér. Chim., 701—714).—It is suggested that thermometry and the theory of the equation of state should be based on the principle that if a body is heated or cooled one or more variables of state in addition to the temp. change. Thermodynamically the only possible forms of energy transfer are heat and work. Work is a macrophysical form of energy transfer, whilst heat is a complex of microphysical processes. A process occurring in an isolated system may be defined as irreversible if any process resulting solely in the restoration of the system to its original state is impossible. The definition of an equilibrium process is discussed. R. C.

Equation of state of gases and critical phenomena. J. E. LENNARD-JONES (Physica, 1937, 4, 941—956).—The potential energy of mols. at a separation r is conveniently represented as the sum of attraction and repulsion terms $\lambda r^{-n} - \mu r^{-m}$. The properties of this function are discussed, and vals. of λ and μ are given for several gases when $n = 12$, $m = 6$. An equation of state for high pressures is derived by classical statistical methods and used to calculate the Boyle temp., b.p., crit. temp., and heat of sublimation of a no. of gases. Appreciable divergence between observed and calc. vals. is found only with the lightest gases, for which agreement is not to be expected. F. L. U.

Quantum theory of the non-ideal gas. II. Behaviour at low temperatures. E. BETH and G. E. UHLENBECK (Physica, 1937, 4, 915—924; cf. A., 1936, 1191).—Mathematical. F. L. U.

General extension of Boltzmann's method to van der Waals gases. L. WALDMANN (Physica, 1937, 4, 1117—1132).—Mathematical. F. L. U.

Statistical mechanics of condensing systems. M. BORN (Physica, 1937, 4, 1034—1044).—Mathematical. The treatment adopted by Mayer and Ackermann (J. Chem. Physics, 1937, 5, 67, 75) is improved and simplified. F. L. U.

Theory of condensation. B. KAHN and G. E. UHLENBECK (Physica, 1937, 4, 1155—1156).—Comments on a paper by Mayer (J. Chem. Physics, 1937, 5, 67). F. L. U.

Thermal conductivity of superconductors in a magnetic field. K. MENDELSSOHN and R. B. PONTIUS (Phil. Mag., 1937, [vii], 24, 777—787).—The change of the thermal conductivity of a superconductor in a transverse magnetic field (4.2 k., 0—1500 gauss) in the case of Pb is similar to the change in the electric conductivity; a Pb-Bi alloy shows a hysteresis effect. K. S.

Researches on heat conduction by rarified gases. III. Thermal accommodation coefficient of helium, neon, and hydrogen at 12—20° K. W. H. KEESOM and G. SCHMIDT (Physica,

1937, 4, 828—834; cf. A., 1937, I, 72).—The thermal accommodation coefficients $a_{1,\infty}$ for He, Ne, and H₂ at 12—20° K. are given. $a_{1,\infty} = 1.00$ for $T \ll T_{crit.}$, even when the glass surface is covered with an adsorbed unimol. layer. Knudsen's formula for mol. heat transfer is valid. K. S.

Influence of magnetic fields on the heat conductivity of gases. IV. Investigations on mixtures of oxygen with diamagnetic gases. H. SENTLEBEN and J. PIETZNER (Ann. Physik, 1937, [v], 30, 541—554; cf. A., 1936, 1191).—The effect of magnetic fields on the heat conductivity of O₂ is decreased by the addition of diamagnetic gases. The effect is approx. \propto the partial pressure of O₂, showing that the influence of magnetic field is effective in collisions both between an O₂ and a diamagnetic gas mol. and between two O₂ mols. The influence of the effective cross-section and of the mol. wt. of the added gas is calc. and for gases of mol. wt. close to that of O₂ agrees with experimental vals. For heavier and lighter gases agreement is obtained when it is assumed that the effect of magnetic field in collision between two O₂ mols. is $>$ that in collision between an O₂ and a diamagnetic gas mol. O. D. S.

Thermal conductivity of pure iron. D. HATTORI (Sci. Rep. Tôhoku, 1937, [i], 26, 190—205).—An apparatus for measuring the thermal conductivity of Fe and steel over a range of temp. is described. The thermal conductivity of Armco steel is measured between 30° and 700° and varies from 0.167 to 0.09 g.-cal. per °C. cm. sec. From these results the most probable val. for the thermal conductivity of pure Fe at 30° is calc. to be 0.172—0.175 g.-cal. per °C. cm. sec. F. J. L.

Accommodation coefficients of the noble gases and the specific heat of tungsten. W. C. MICHELS (Physical Rev., 1937, [ii], 52, 1067—1073).—A semi-classical treatment of the thermal accommodation coeffs. for monat. gases against solid surfaces is developed on the basis of Compton's sp. heat theory. Application to the data of Roberts (cf. A., 1934, 6) is satisfactory if the heats of adsorption of He and Ne on W are taken as 50 and 278 g.-cal. per g.-atom, respectively. The Compton characteristic temp. of W is 148° K., indicating that the excess sp. heat of W above the classical val. is partly due to anharmonic terms in the potential energy of the at. oscillators. N. M. B.

Viscosity of air. W. V. HOUSTON (Physical Rev., 1937, [ii], 52, 751—757).—Using the rotating-cylinder apparatus, remeasurements of η and re-determination of all consts. were made. The val. of η at 22° is 1.8243 ± 0.0045 c.g.s. units; this raises the oil drop val. of e to 4.796×10^{-10} e.s.u. New corrections are discussed. N. M. B.

Fluorine at low temperatures. V. Viscosity of fluorine gas. E. KANDA (Bull. Chem. Soc. Japan, 1937, 12, 463—468).—By measuring the decrement of the oscillation-rotation of a disc, the η of F₂ has been determined between -186° and 0°, and the vals. have been used to calculate the diameter of the mol., 3.02 Å., the mean free path, 9.12×10^{-6} cm., and the Sutherland const., 129. C. R. H.

Effect of similarity of particles on gas kinetic quantities with application to nuclear spins. O. HALPERN and E. GWATHMEY (Physical Rev., 1937, [ii], 52, 944—951).—Mathematical. Theory is developed and applied in detail to the determination of the coeff. of η and thermal conductivity of ortho- and para- H_2 . In favourable cases (Ne) the nuclear spins of isotopes can be determined from η . N. M. B.

Mobilities of ions in a series of liquid hydrocarbons and their relation to viscosity. I. ADAMCZEWSKI (Ann. Physique, 1937, [xi], 8, 309—359).—Using an improved high-precision Langevin method, measurements were made of the mobilities of ions formed by X-rays in the five hydrocarbons C_5H_{12} — C_9H_{20} . Three types of ion exist in each liquid: two positive, of relative mobility 3:1, and one negative of intermediate mobility. The limiting mobilities of the slowest ion in C_9H_{20} and the fastest in C_5H_{12} are 0.78×10^{-4} and 12.01×10^{-4} , diminishing uniformly with increase of η . An analysis of the variation of mobility u with η gives $u = A\eta^{-3/2}$ where A is a coeff. characteristic of each ion. With the help of Stokes' law this leads to an ionic radius $\propto \sqrt{\eta}$. N. M. B.

Influence of temperature and specific volume on viscosity of liquids. W. R. VAN WIJK and W. A. SEEDER (Physica, 1937, 4, 1073—1088).—Experimental formulæ proposed to express the η - θ relation for liquids are discussed theoretically, and it is shown that formulæ in which the temp. is assumed to affect η only by influencing the sp. vol. are applicable to non-configurational liquids, whilst those in which a direct influence is assumed are applicable to liquids possessing internal structure. A formula is given which is applicable to measurements under atm. and higher pressures and which shows the difference between the two classes of liquids. F. L. U.

Experimental development of thermal diffusion. T. L. IBBS (Physica, 1937, 4, 1133—1140).—A historical summary. F. L. U.

Determination of specific gravity and refractive index of aqueous solutions of β -chloroethyl alcohol. J. MATEJKA and B. JELINEK (J. Chim. phys., 1937, 34, 611—614).—Data are recorded for the complete range of solutions at 20°. $n \propto$ concn., but a slight deviation from linearity at medium concns. is observed for d . E. S. H.

Specific heats of aqueous solutions of carbamide from 2° to 40° and the apparent molal heat capacity of carbamide. F. T. GUCKER, jun., and F. D. AYRES (J. Amer. Chem. Soc., 1937, 59, 2152—2155).—Sp. heats are recorded for the range from 0.1M to a nearly saturated solution. The apparent mol. heat capacity changes less with concn. than does that of a 1:1 electrolyte. Equations connecting these properties with concn. have been derived. E. S. H.

Viscosities of solutions of chlorides in certain solvents. F. E. DOLAN and H. T. BRISCOE (J. Physical Chem., 1937, 41, 1129—1138).—The increase of η produced by the addition of chlorides to EtOH is in the order: $NiCl_2 > AlCl_3 > CoCl_2 > CuCl_2 > FeCl_3 > CdCl_2 > SnCl_4 > HgCl_2$; the increase is

$>$ the corresponding increase in aq. solutions. $AlCl_3$ increases η for EtOH- H_2O mixtures. Vals. of η for EtOH- CCl_4 , $HgCl_2$ -AcOH, and $SnCl_4$ -EtOAc mixtures are recorded and the applicability of the equation of Jones and Dole (A., 1929, 1395) is considered.

F. R. G.

Viscosity in concentrated solution. R. HOUWINK (Österr. Chem.-Ztg., 1937, 40, 472—475).—Formulæ connecting η for viscous solutions with concn. are compared, special reference being made to cellulose nitrate, viscose, rubber, polystyrene, and synthetic resin solutions. J. W. S.

Optical behaviour of dissolved ions and its significance for structure of solutions of electrolytes. VI. Interaction between ions and solvent molecules, and structure of water-alcohol mixtures. G. KORTÜM (Z. physikal. Chem., 1937, B, 38, 1—22; cf. A., 1937, I, 77).—Largely a more detailed account of work already described (*ibid.*, 61). The physical properties of EtOH- H_2O mixtures suggest that at low concns. EtOH is present as a mol. dispersion in H_2O , whilst at higher concns. the degree of dispersity is smaller and mol. swarms of EtOH may be present. R. C.

Electronic structure of alloys. J. C. SLATER (J. Appl. Physics, 1937, 8, 385—390).—Theoretical. On the assumption that the 3*d* electrons in Fe, Co, and Ni are completely magnetised, the magnetic moments of the respective atoms should be 2.7, 1.7, and 0.6, which correspond with the no. of unfilled spaces in the 3*d* group. The relation is shown to hold also for Ni-Cu, Ni-Zn, Ni-Co, Fe-Ni, Fe-Co, Fe-V, and Fe-Cr alloys. R. C. M.

Alloys of gallium with magnesium. N. A. PUSHIN and O. D. MICIĆ (Z. anorg. Chem., 1937, 234, 229—232).—The system Ga-Mg has been studied by means of cooling curves. There are four compounds, $MgGa_2$, $MgGa$, Mg_2Ga , and Mg_5Ga_2 . F. J. G.

Alloys of gallium with aluminium. N. A. PUSHIN and O. D. MICIĆ (Z. anorg. Chem., 1937, 234, 233—234).—The results of Jenckel (A., 1935, 291) have been completely confirmed and the earlier results of Pushin and Stajić (A., 1933, 118) are therefore incorrect. F. J. G.

Solid solutions, their latent energy, and their lattice constant. J. CICHOCKI (J. Phys. Radium, 1937, [vii], 8, 391—396; cf. A., 1937, I, 138).—Solutions of Zn, Ga, and Ge in Cu, and of Cd, In, Sb, and Sn in Ag, are discussed. The degree of perturbation caused by substitution of a solute atom in the solvent lattice is evaluated using Mott's formula, and the vol. of the solute atom deduced. Formulæ have been derived for the lattice const. and for the "latent energy," from which the m.p. depression can be calc. An analogous treatment of interstitial solute atoms is given; in cases such as Cu-Zn the proportion of such atoms is negligible. A. J. E. W.

Widmanstätten structure. IX. The Mg - Mg_2Sn and Pb - Sb systems. G. DERGE, A. R. KOMMEL and R. F. MEHL (Amer. Inst. Min. Met. Eng. Tech. Publ. 820, 1937, 12 pp.; Met. Tech., 1937, 4, No. 6).— Mg_2Sn with a CaF_2 type of lattice

separates from the close-packed hexagonal Mg matrix with three different orientation relationships: (a) $[111] \parallel [00\cdot1]$ and $[110] \parallel [10\cdot0]$; (b) $[110] \parallel [00\cdot1]$ and $[110] \parallel [10\cdot0]$; (c) $[111] \parallel [00\cdot1]$ and $[110] \parallel [11\cdot0]$. On cooling from 560° , plates form parallel to the $[00\cdot1]$, $[10\cdot1]$, and $[10\cdot2]$ planes of the matrix; quenching and ageing at 250° forms plates on the $[00\cdot1]$ planes only. The different pptn. mechanisms are related to the shearing processes which operate at the heat-treating temp. Rhombohedral Pb ppts. face-centred cubic Pb as plates parallel to the $[111]$ planes of Pb as expressed by the relation $[111] \text{ Pb} \parallel [001] \text{ Sb}$ and $[110] \text{ Pb} \parallel [100] \text{ Sb}$. R. B. C.

Constitution of the metallic phases NaZn_{13} , KZn_{13} , and KCd_{13} . E. ZINTL and W. HAUCKE (Naturwiss., 1937, 25, 717).—Extraction of Na-Zn alloys with liquid NH_3 gives NaZn_{13} with cubic structure and a 12.27 Å. For KZn_{13} and KCd_{13} the vals. of a are 12.36 and 13.77 Å., respectively. A. J. M.

Mixed crystal series MgCu_2 - MgNiZn and MgZn_2 - MgCuAl . W. DÖRING (Metallwirts., 1935, 14, 918—919; Chem. Zentr., 1936, i, 3974).—Cu in MgCu_2 and Zn in MgZn_2 can be replaced in all proportions by NiZn and CuAl, respectively. Lattice measurements for these mixed crystals are recorded. H. J. E.

Isomorphism of the ternary compounds $\text{Mn}_3\text{Zn}_3\text{Al}_2$ and Mg_4CuAl_6 . F. LAVES, K. LÖHBERG and H. WITTE (Metallwirts., 1935, 14, 793—794; Chem. Zentr., 1936, i, 3797).—X-Ray and micrographic data are discussed. $\text{Mn}_3\text{Zn}_3\text{Al}_2$ and Mg_4CuAl_6 form cubic face-centred crystals (a 14.16 ± 0.03 and 14.25 ± 0.03 Å., respectively; 161 atoms in unit cell in each case). H. J. E.

Dependence on composition of the critical ordering temperature in alloys. C. E. EASTHOPE (Proc. Camb. Phil. Soc., 1937, 33, 502—517).—Mathematical. The statistical method of Bethe (cf. A., 1935, 1192) is applied to alloys having superlattices of the AB and AB_3 types. It is assumed that at any temp. the alloy is in a single phase. The theoretical relation between the max. val. of the crit. temp. and the composition indicates that for alloys of the AB type, the max. should occur when $[A] = [B]$ as found by experiment. For alloys of the type AB_3 the crit. temp. should have a max. when $[A] > \frac{1}{4}$. This result is not in agreement with experiment. Both results agree, however, with the calculations of Bragg and Williams (cf. A., 1934, 954), who made use of a simplified relationship between the configurational energy and the degree of ordering. J. A. D.

Incomplete solubility of liquid iodine in carbon tetrachloride. J. H. HILDEBRAND (J. Amer. Chem. Soc., 1937, 59, 2083—2085).—I and CCl_4 form a liquid-liquid system having a crit. solution temp. 160.5° . The relation between the solubilities of I in the solid and liquid states is discussed. E. S. H.

Solubility of cellulose and of its ethers. S. PAFKOV, F. ROGOVIN, and V. KARGIN (J. Phys. Chem. Russ., 1937, 9, 156—157).—In contact with certain other liquids complete miscibility is found to

occur below and above certain temp.; between these the miscibility is limited and two layers are formed. E. R.

Solubility in ternary systems. J. S. KAZARNOVSKI (J. Phys. Chem. Russ., 1937, 9, 25—31).—The solubility of a non-volatile component in a mixture of two volatile solvents has been calc. for the system $\text{NaCl} + \text{H}_2\text{O} + \text{NH}_3$. E. R.

Fluorine at low temperatures. III. Dissolution of chlorine in liquid fluorine. S. AOYAMA and E. KANDA. **IV. Separation of fluorine from oxygen by adsorption and rectification.** E. KANDA (Bull. Chem. Soc. Japan, 1937, 12, 455—457, 458—462).—III. A saturated solution of Cl_2 in liquid F_2 at -195° contains 1.04% Cl_2 .

IV. O_2 is adsorbed by C in greater quantity than F_2 . After five adsorptions at -180° a mixture containing 96% F_2 and 3.7% O_2 was refined to 99.4% F_2 and 0.4% O_2 . Rectification of liquid mixtures of F_2 and O_2 yielded a liquid containing 99% F_2 . C. R. H.

Theory of diffusion in solids. J. E. DORN and O. E. HARDER (Amer. Inst. Min. Met. Eng., Tech. Publ. 836, 1937, 19 pp.; Met. Tech., 1937, 4, No. 6).—A theory of diffusion in metals is developed which takes account of the lattice structure. It affords an interpretation of the relations between the energy of loosening of an atom and the m.p. and of diffusibility and solubility. Equations relating to interstitial and substitutional diffusion are given. Applications of the theory are discussed. R. B. C.

Statistics of hydrogen-palladium system. J. R. LACHER (Proc. Camb. Phil. Soc., 1937, 33, 518—523).—Theoretical. The statistical theory of Peierls and Bethe is applied to solutions of H_2 in Pd. The dissociation of H_2 mols. and the existence of excited vibrational states of the absorbed atoms are taken into account. The results are compared with previous calculations in which the Bragg-Williams type of approximation was used. The theoretical isotherms at 160° and 295° are compared with experimental data. J. A. D.

Solubility of deuterium and hydrogen in solid palladium. III. A. SIEVERTS and W. DANZ (Z. physikal. Chem., 1937, B, 38, 46—60; cf. A., 1937, I, 75).—The isobars for the solubility of D_2 and H_2 in Pd-black at 20— 350° and 740 mm. and the isotherms at 80— 300° up to 1150 mm. have been determined. The curves for the two gases are similar in form, and within certain limits the solubility \propto (pressure) $^{\frac{1}{2}}$. The ratio (n) of the solubility of D_2 to that of H_2 under the same conditions is always < 1 , the val. at room temp. being 0.96 and at 200° 0.60. In the system Pd- H_2 the transition from the α -phase, which dissolves H_2 and D_2 only sparingly, to the β -phase, which takes up much more H_2 and D_2 , occurs on the isobars at higher temp. and on the isotherms at lower pressures than in the system Pd- D_2 . From an equimol. mixture of H_2 and D_2 at 100° under 1 atm. Pd sorbs H_2 preferentially. R. C.

Manganese and hydrogen. A. SIEVERTS and H. MORITZ (Z. physikal. Chem., 1937, 180, 249—263).—The solubility, s , of H_2 in Mn, which has been

measured at 20—1320° at pressures, p , up to 1 atm., is \gg that in Cr, Fe, Ni, or Co. The solubility isobar for 760 mm. shows the existence of three transition points for solid Mn (cf. A., 1936, 1455). At a given temp. s for α - or β -Mn $\propto \sqrt{p}$. The temp. coeffs. of s for β -, β' -, γ -, and molten Mn are positive, but the solubility curve for α -Mn has a min. At the m.p. s for molten Mn is \gg for the solid γ -phase. R. C.

Solubility of noble metals and high pressure.
II. Dissolution of gold in cyanides at high air pressures. **III. Influence of temperature and concentration of potassium cyanide on the rate of dissolution of gold at high air pressures.** V. G. TRONEV and S. M. BONDIN (Compt. rend. Acad. Sci. U.R.S.S., 1937, 16, 281—284, 313—316).—II. The rate of dissolution of Au in aq. KCN increases with increasing pressure of air up to 50 atm., but is not affected by further increases at 18°. At 50° the rate of dissolution increases steadily up to 70 atm. In N_2 the rate is very small and almost independent of pressure. The results indicate that there is an optimal $[O_2]$ below which diffusion of O_2 is the controlling factor.

III. At high pressures (50 atm.) there is a sufficient $[O_2]$ to eliminate effects due to variation of this factor and under these conditions the rate of dissolution increases continuously with rising temp. The effect of varying $[KCN]$ is the same as at 1 atm. F. J. G.

Solubilities of cupric sulphate and strontium chloride in deuterium water. F. T. MILES and A. W. C. MENZIES (J. Amer. Chem. Soc., 1937, 59, 2392—2395).—Solubility data for $CuSO_4$ at 2·7—110° and for $SrCl_2$ at 0—145° in 98·1% D_2O are recorded. The transition points $CuSO_4 \cdot 5D_2O \rightarrow CuSO_4 \cdot 3D_2O$ $96 \cdot 2 \pm 0 \cdot 2^\circ$, $SrCl_2 \cdot 6D_2O \rightarrow SrCl_2 \cdot 2D_2O$ $56 \cdot 4 \pm 0 \cdot 2^\circ$, and $SrCl_2 \cdot 2D_2O \rightarrow SrCl_2 \cdot D_2O$ $128 \cdot 5 \pm 0 \cdot 5^\circ$ have been determined and compared with the vals. for the corresponding hydrates. E. S. H.

Composition of the liquid phase in aqueous systems containing strong electrolytes of higher valency types as solid phases. G. ÅKERLÖF (J. Physical Chem., 1937, 41, 1053—1076).—Solubilities at 25° are recorded for $Ba(NO_3)_2$ -NaBr, - $BaBr_2$, - $BaCl_2$, - $Ba(OH)_2$, - $FeCl_3$, - $NaNO_3$, - $Al(NO_3)_3$, and - $Th(NO_3)_4$, $NaNO_3$ - $Al(NO_3)_3$, KCl - $FeCl_3$, and $K_3Fe(CN)_6$ - KCl . The composition of these and a no. of other systems can be expressed by the author's equation (A., 1934, 490). F. R. G.

Solubility curves of the systems carbon tetrachloride- n -alkyl acids-water at 25°. H. A. SMITH and M. BERMAN (J. Amer. Chem. Soc., 1937, 59, 2390—2391).—Solubility data are recorded for the ternary systems involving straight-chain acids with 1—7 C. With increasing chain length the mutual solubility increases at first, but later decreases. The max. occurs with $EtCO_2H$. E. S. H.

Salting-out of molecular benzoic acid in aqueous salt solutions at 35°. G. M. GOELLER and A. OSOL (J. Amer. Chem. Soc., 1937, 59, 2132—2134).—The solubility of $BzOH$ in aq. $LiCl$, $NaCl$, $NaBr$, KCl , KBr , NaI , KI , and $BaCl_2$ has been determined, and the mol. solubility and salting-out const. have been calc. for each concn. of salt. The

vals. are compared with published data for 25° and 18°. E. S. H.

Salting-out by complex cobalt salts. P. P. KOZAKEVITSCH and R. S. JANKELEVITSCH (J. Phys. Chem. Russ., 1937, 9, 113—122).—The salting-out effect of complex Co ions was investigated by measuring their influence on the miscibility of H_2O and $PhOH$. Increase in the size of the cation by the introduction of neutral mols. into the complex decreases the salting-out capacity, but exchange of NH_3 for H_2O in the complex is without effect. E. R.

Experimental tests of recent theories descriptive of the salting-out effect. P. S. ALBRIGHT (J. Amer. Chem. Soc., 1937, 59, 2098—2104).—Dielectric consts. for aq. $COMe_2$, NH_2Ph , Et_2O , glycerol, glycine, and $CO(NH_2)_2$, and d vals. for aq. $COMe_2$, NH_2Ph , glycine, and $CO(NH_2)_2$ have been determined. From the data and the Debye theory of salting-out, the limiting slopes of the solubility curves for the non-electrolyte solutes have been calc. as a function of salt concn. The calc. solubilities agree well with those observed in the more dil. solutions, confirming the essential correctness of the Debye theory. E. S. H.

Periodic structures; Liesegang phenomenon in agar gels. M. F. TABOURY and J. BERNUCHON (Bull. Soc. chim., 1937, [v], 4, 1857—1866).—The influence of electrolyte impurities on the formation of Liesegang rings in agar is discussed; the formation of Ag_2CrO_4 rings is favoured by the presence of Br^- and inhibited by SO_4^{2-} . The "density" of the rings is independent of $[K_2Cr_2O_7]$ and hardly affected by $[KBr]$ in the gel. The law of Jablczynski relating the distances successive rings is confirmed. E. S. H.

Periodic structures; Liesegang phenomenon in starch paste. M. F. TABOURY and L. TOURNAT (Bull. Soc. chim., 1937, [v], 4, 1866—1876).— Ag_2CrO_4 rings are not formed when $AgNO_3$ diffuses into starch paste containing $K_2Cr_2O_7$, but rings appear when KBr is added to the gel. Periodic structures are produced when $CuSO_4$ diffuses into starch paste containing K_2CrO_4 . The law of Jablczynski does not appear to be valid in this case. White light and the presence of PO_4^{3-} inhibit the formation of the structures. E. S. H.

Periodic structures; Liesegang phenomenon in agar. Action of light. M. F. TABOURY and M. BELLOT (Bull. Soc. chim., 1937, [v], 4, 1876—1884).—When the gel containing $K_2Cr_2O_7$ and KBr is illuminated with light from an electric lamp for a short time before causing $AgNO_3$ to diffuse into the gel in the dark, the formation of rings is favoured; when the illumination is prolonged the formation of rings is inhibited. E. S. H.

Periodic formation of layers in the crystallisation of aqueous solutions of nickel sulphate, cupric chloride and sulphate. P. F. MICHALEV (J. Phys. Chem. Russ., 1937, 9, 157). E. R.

Periodic crystallisation of copper sulphate on filter-paper. P. F. MICHALEV (J. Phys. Chem. Russ., 1937, 9, 159). E. R.

Adsorption of hydrogen by supported nickel poisoned with carbon monoxide. C. W. GRIFFIN (J. Amer. Chem. Soc., 1937, 59, 2431—2434).—Adsorption measurements at 0° show that very small amounts of CO cause increased adsorption of H₂. With larger amounts of CO a small low-pressure increase in H₂ adsorption is found, although at higher pressures there is a considerable decrease. Larger amounts of CO decrease the rate of adsorption. It is probable that some, but not all, of the active Ni centres are able to adsorb H₂ as a second layer above the CO. E. S. H.

Activated adsorption of oxygen by molybdenum films. J. H. DE BOER and H. H. KRAAK (Rec. trav. chim., 1937, 56, 1103—1110).—The oxidation of Mo has been followed by measuring the change in electrical resistance of a film of Mo (which has adsorbed O₂ at -185°) when the temp. is raised in vac. In the series Cs, Mo, C, the activation energy of oxidation increases as the interat. distance decreases. E. S. H.

Gas adsorption in electric fields. O. BLÜH (Z. Physik, 1937, 107, 369—381).—Mixtures of H₂ + CO₂ and H₂ + SO₂ in approx. equal proportions were streamed slowly through a vessel containing an Al multi-plate condenser across which fields up to 22,000 v. per cm. were established. The relative concn. of H₂ in the gas mixtures before and after streaming were measured simultaneously by means of a differential catharometer. It is shown that unimol. layers of CO₂ and SO₂ are formed on Al and adsorption is not selective to dipolar and quadrupolar mols. L. G. G.

Adsorptive properties of silica gels in relation to their porosity. M. V. POLJAKOV, L. P. KULECHOVA, and I. E. NEIMARK (J. Phys. Chem. Russ., 1937, 9, 100—112).—Gels have been prepared by drying in air, C₆H₆, PhMe, and xylene atm. The adsorption of org. vapours during the formation of the gel determines the character of its porosity. The smallest pores are obtained by drying at the higher temp. E. R.

Adsorption of chain molecules. E. BRODA and H. MARK (Z. physikal. Chem., 1937, 180, 392—402).—The dependence of adsorption equilibria on the chain length of the adsorbed mols. is discussed on the basis of both the kinetic and quantum-mechanical theories. The determining factor is the change in phase vol. caused by a reduction in the no. of degrees of freedom; the heats of adsorption and the consequent effects of temp. change are deduced. J. W. S.

Reversible and irreversible phenomena in the adsorption of vapours by surfaces of salts exposed to vapours. C. J. DIPPEL (Chem. Weekblad, 1937, 34, 676—677; cf. A., 1933, 457).—The author's work on the adsorption of Cs and I by CaF₂ is reviewed and discussed. D. R. D.

Adsorption of oleic acid and sodium oleate in flotation of heavy spar. W. PETERSEN (Kolloid-Z., 1937, 81, 212—222).—The adsorption of oleic acid (I) by the solids during froth flotation of BaSO₄ has been studied by determining separately the effect

on the γ of H₂O, pulp, and froth. There is complete parallelism between the quantity of (I) adsorbed by the concentrate and the % of BaSO₄ floated. For a given amount (I) added to H₂O, the lowering of γ is greatest when the degree of dispersion is highest, and when solid is present the adsorbed quantity is a max. under these conditions. The highest efficiency was shown by emulsions of (I) in H₂O produced by ultrasonic waves, and by pouring a 1% solution in EtOH into H₂O. 10 and 50% solutions gave coarser emulsions, and the lowest efficiency was shown by the last-named and by an emulsion made by ordinary mechanical mixing. Similar results were obtained with 1% solutions of Na oleate when these were <2 days old. F. L. U.

Adsorption and wettability of solid surfaces. D. H. BANGHAM and R. I. RAZOUK (Trans. Faraday Soc., 1937, 33, 1459—1463).—The work done when a solid and liquid are pulled apart is largely determined by the properties of the adsorbed phase formed from the saturated vapour, and hence is to be distinguished from the "work of adhesion" as commonly understood. The heat of immersional wetting is given by $F_L - T \frac{dF_L}{dT}$ (F_L = lowering of surface energy on immersion) and is to be distinguished from the total heat of adsorption at saturation. F. L. U.

Method of capillary analysis for following the adsorption of surface-active substances by the particles of a hydrosol. A. BOUTARIC and (MLLE.) G. BELLOT (Bull. Soc. chim., 1937, [v], 4, 1899—1907).—The adsorption of saponin by the particles of sols of As₂S₃, Fe(OH)₃, and clay, respectively, has been studied by measuring the change of surface tension with time. The influence of concn. and size of the particles in As₂S₃ sols has been examined. Even after flocculation a progressive decrease of adsorbent power for a period of about 15 days is observed; this seems to be connected with a progressive increase in size of the flocculated particles. The masses of As₂S₃, Fe(OH)₃, and clay particles required for the adsorption of 1 g. of saponin under the experimental conditions, and the masses of As₂S₃ and clay particles required for 1 g. of serum-albumin, have been evaluated. E. S. H.

Theory of surface tension of electrolytes. J. W. BELTON (Trans. Faraday Soc., 1937, 33, 1449—1454; cf. A., 1937, I, 307).—The no. of non-electrolyte mols. present in the surface layer of a solution containing ions is shown to be related to the permanent moment and, to a smaller extent, to the polarisability of the mols. by an expression which, when substituted for Γ in the Gibbs adsorption equation, yields vals. of $d\gamma/dc$ which are in substantial agreement with experiment for solutions of NaCl and KCl. The theory also accounts for the behaviour of non-aq. salt solutions, and is in qual. agreement with the behaviour of ternary solutions. The relative sizes of Li, Na, and K ions calc. from adsorption data agree with those derived from transport measurements. F. L. U.

Surface tension of aqueous soap solutions as a function of hydrogen-ion (p_H) and salt concentration. I. Sodium laurate and sodium nonoate. F. A. LONG, G. C. NUTTING, and W. D. HAR-

KINS (J. Amer. Chem. Soc., 1937, 59, 2197—2203).—The surface tension is relatively high in basic and low in neutral aq. Na laurate and nonoate, supporting the view that the long-chain paraffin ions and the oppositely charged ions are adsorbed from strongly basic solutions while the surface-active acid is adsorbed more strongly from slightly basic or neutral solutions. Addition of neutral salts lowers markedly the surface tension, particularly in basic solutions. The effect is related to the concn. of the electrolyte, but not to the ionic strength. E. S. H.

Change of surface tension with time. W. N. BOND and H. O. PULO (Phil. Mag., 1937, [vii], 24, 864—887).—The surface tension of H₂O and aq. solutions of NaCl, K₂CO₃, soap, thymol, *p*-toluidine, butyl, amyl, *n*-hexyl, and *n*-heptyl alcohols has been measured by means of the moving liquid sheet method and also by the oscillating jet method. For pure liquids γ attains its final state in <0.005 sec. The surface layer in aq. solutions is initially pure H₂O but ultimately it contains an excess (or deficit) of solute. The rate of change of concn. (and change in γ) is initially infinite but subsequently depends on the rate of diffusion of the solute from inside the liquid to the surface layer. The time for γ to pass halfway to its final val. is obtained and agrees with that obtained from theoretical considerations. F. J. L.

Interfacial tension between an aqueous solution and a solution of sapamine in a hydrocarbon. A. BOUTARIC and (MLLE.) M. BRETON (Bull. Soc. chim., 1937, [v], 4, 1793—1800).—The influence of the concn. of sapamine (in C₆H₆) and of buffer mixtures (in H₂O) on the interfacial tension between the liquid phases has been determined. This depends on the buffer mixture, but in all cases increases rapidly with rising p_H up to about p_H 7, after which it remains nearly const., with a tendency to decrease. With dil. acids (0.001—0.0001N-HCl, -H₂SO₄, or -HNO₃) the instantaneous interfacial tension increases with increasing dilution and decreases with time. In a medium of known constitution, the interfacial tension against sapamine in C₆H₆ can be used to calculate the p_H . Reference is made to the influence of ions other than H⁺, especially in biological phenomena. E. S. H.

Stability of a surface of contact between two phases. L. GAY (J. Chim. phys., 1937, 34, 598—610).—Theoretical. Additions and corrections to a previous theory are made (A., 1936, 1064). E. S. H.

Adsorbed moisture films on the surface of glazed porcelain. F. W. JOHNSON (Phil. Mag., 1937, [vii], 24, 797—807).—Films giving rise to continuous leakage consist of two components, one represented by an adsorbed and the other by a surface solution. The equilibrium relations are independent of voltage stress and temp. K. S.

Effect of dissolved salts on insoluble monolayers. I. LANGMUIR and V. J. SCHAEFER (J. Amer. Chem. Soc., 1937, 59, 2400—2414).—Apparatus and technique for the determination of the adsorption of salts from aq. solution by a surface monolayer of an insol. substance are described. Vals. of η for stearic

acid and Ba stearate monolayers on H₂O at varying p_H are recorded; the vals. show progressive changes due to adsorption of impurities. Effects on monoskims of stearic acid due to adsorption from H₂O containing 0.0005 p.p.m. of Al⁺⁺⁺ or 0.003 p.p.m. of Cu⁺⁺ are described. Procedure for the visual observation of the influence of very low concns. of impurities in H₂O on the crumple pattern and crystallised monoskim of stearic acid monolayers are described. Equations for the rate of diffusion of dissolved substances through H₂O to an insol. monolayer on the surface are given, and a method for greatly accelerating the rate of arrival at the surface is described. E. S. H.

Unimolecular layers. D. G. DERVICHIAN (Ann. Physique, 1937, [xi], 8, 361—466).—The author's results are summarised and compared with those of other investigators. J. W. S.

Monolayers of porphyrins and related compounds. A. E. ALEXANDER (J.C.S., 1937, 1813—1816).—Chlorophyll-*a* (I) and -*b* (II), hæmin, Mg naphthalocyanine, Mg and Fe phthalocyanines, protoporphyrin, bilirubin, mesoporphyrin Me₂ ester, and hæmatoporphyrin (III) have been examined in the form of monolayers on aq. substrates. With the exception of (I), (II), and (III), the compounds appear to form very unstable condensed films with conjugated ring systems vertically oriented and close-packed. (I) and (II) give liquid-expanded films which by increase of pressure are condensed to the close-packed form with the dihydroporphin rings vertically oriented. The (III) mols. lie flat on the surface, forming a vapour-expanded type of film. The data are discussed with reference to the constitutions of the compounds. C. R. H.

Wetting of charcoal and nature of the adsorbed phase formed from saturated vapours. D. H. BANGHAM and R. I. RAZOUK (Trans. Faraday Soc., 1937, 33, 1463—1472; cf. A., 1935, 29).—Blocks of wood C having a pore vol. of 2.6 c.c. per g., suspended with the pore axes vertical in saturated vapours of H₂O, MeOH, C₆H₆, and CCl₄, adsorb vapour, but do not condense liquid in the pores. When, after this adsorption has occurred, the blocks are lowered so as to touch the liquid, the latter rises at a speed which indicates that the wetting angle is > 0° for C₆H₆ and CCl₄, and \geq 0° for MeOH and H₂O, until the pores are filled. Vapour-free C, on the contrary, absorbs liquid MeOH rapidly and violently. It is concluded that films adsorbed from vapour cannot act as condensation nuclei for the bulk liquids. A new derivation of two-dimensional equations of state for adsorbed films on solids is given. F. L. U.

Wetting of filaments by molten metals. M. A. COUNTRYMAN (J. Appl. Physics, 1937, 8, 432—433).—Ni filaments are wetted perfectly by Ag and Au, and Pt filaments by Al and Cu; Mo filaments are wetted by Al, Ni, and Pt, but not by Ag, Au, or Cu; Ta filaments by Al and Ni, but not by Au, Cu, or Ag, and filaments of W by Al, Ni, and Pt, but not by Ag, Au, or Cu. R. C. M.

Capillary systems. XIX. (4) Permeability of channelled and latticed capillary systems

for liquids and gases. E. MANEGOLD (Kolloid-Z., 1937, 81, 164—179; cf. A., 1937, I, 612).—The subject is treated systematically and theoretically.

F. L. U.

Permeability of the reed membrane. I. Dynamics for non-electrolytes. B. STEHLIK (Coll. Czech. Chem. Comm., 1937, 9, 434—456).—Chiefly theoretical. The initial rate of passage of solvent through permeable membranes \propto the concn. of the solution; it is also \propto the difference in permeability between solvent and solute. The time for attainment of the max. pressure is independent of the concn.

J. S. A.

Diffusion of lithium ions through quartz in an electric field. P. M. HARRIS and C. E. WARING (J. Physical Chem., 1937, 41, 1077—1085).—Measurable transport of Li⁺ through a quartz diaphragm occurs at 5 to 125 v.; the current is given by $Se^{-W/RT}$, where S is a collision factor and W a work factor which approaches a const. val. at the higher voltages (cf. Jost, A., 1934, 11).

F. R. G.

Spreading of insoluble films produced by a soluble substance. K. ARIYAMA (J. Physical Chem., 1937, 41, 1139—1146).—The spreading rate of H₂O-sol. nigrosine on tap-H₂O is given by $dm/dt = Bm^{1-k/2}$ (m is mass per sq. cm. of the film). The shape of the particle and the shape and surface area of the vessel have an undetermined effect. The solid film formed on alum solutions has a thickness of 6.87×10^{-6} cm. $\pm 10\%$ and $n = 1.75$. Films formed on distilled H₂O are less stable and tend to dissolve.

F. R. G.

Pressure correction of sedimentation equilibria. C. DRUCKER (Z. physikal. Chem., 1937, 180, 378—382).—Correction terms are derived for reducing the data for sedimentation equilibria to ordinary pressures. For HgCl₂ the correction lies within the limits of experimental error.

J. W. S.

Theory of osmotic pressure. A. THIEL (Z. physikal. Chem., 1937, 180, 314—316).—A reply to Wohl (A., 1937, I, 459).

R. C.

Cryoscopic studies of solutions in 1 : 4-dioxan. F. H. GETMAN (Rec. trav. chim., 1937, 56, 1025—1033).—The f.p. of solutions of various org. compounds, mainly alcohols, in 1 : 4-dioxan have been determined and the corresponding mol. depressions calc. Progressive association of solute with increasing concn. is observed. EtOH and BuⁿOH are solvated in dil. and associated in conc. solutions; these solutes, when dissolved in other solvents of higher dielectric const., show no solvation even in dil. solution. The association factors of typical solutes in dioxan vary linearly with the concn.

E. S. H.

Molecular solution volumes of optical isomerides. W. H. BANKS (J.C.S., 1937 1857—1858).—The slight differences observed by Patterson and Lambertson (cf. A., 1937, I, 513) between the mol. solution vol. of the isomerides of Bu ^{β} tartrate are considered to be of the same order as errors arising from temp. uncertainties.

C. R. H.

Viscosity of aqueous solutions of electrolytes. III. Concentration anomalies of specific ionic viscosities. H. TOLLERT (Z. physikal. Chem.,

1937, 180, 383—391; cf. A., 1935, 443; 1936, 27).—The sp. ionic viscosities ($\eta_{sp.}$) of H⁺, Na⁺, K⁺, OH⁻, and Cl⁻ have been calc. for 20° and 25° and for concns. 10^{-4} — $1N$. $\eta_{sp.}$ for OH⁻ and H⁺ show inflexions between $0.5 \times 10^{-2}N$ and $2 \times 10^{-2}N$, but outside this range it varies linearly with the concn. Other ions also show inflexion points in this range at 20°; these become more pronounced and shift towards lower concn. at 25°. The anomalies are attributed to free H₂O and not to solutes, and it is shown that positive changes in η are anomalous, and negative changes normal.

J. W. S.

Dielectric constants of solutions of amphoteric electrolytes. III. Anomalous dispersion in the wave-length range 50—100 cm. H. LINHART (Z. physikal. Chem., 1937, B, 38, 23—45; cf. A., 1935, 166).—In the above λ range the dielectric const., ϵ , of aq. solutions of various amphoteric electrolytes falls with λ , but attains at about 60 cm. a const. val. which is $>$ the ϵ of the solvent. With some, a further decline sets in at a lower λ . An interpretation of the results in terms of Malsch's theory (A., 1937, I, 65) is suggested. According to this the solutions contain groups of zwitterions, which also contain H₂O dipoles, linking them together. In the falling part of the dispersion curve the solvate layer of the zwitterions and the "structure" of the solution are preserved, because the relaxation period of the structure is $<$ that of hydrated groups. At a certain frequency of the alternating field, the movement of the structure around the zwitterion fails to keep pace with the period of the field and the zwitterions now turn freely and the flat part of the dispersion curve is reached. The existence of this flat part is inexplicable if rigid association of the dipoles is assumed. In the subsequent further fall the frequency of the field may be supposed to correspond with the relaxation period of the naked zwitterion.

R. C.

Osmotic method for determining particle weight of colloidal solutions. W. OSTWALD (Kolloid-Z., 1937, 81, 195—199).—Contrary to the opinions of Duclaux and of Dobry, these authors' results (cf. following abstract) are in accord with modern theories of osmotic pressure. Examples are given.

F. L. U.

Mol. wt. and viscosity of high polymerides. A. DOBRY (Kolloid-Z., 1937, 81, 190—195).—A summary of work previously published (A., 1934, 958; 1935, 291, 445, 466; 1936, 28, 1459).

F. L. U.

Shape, structure, and solidity of the aggregates of non-spherical colloidal particles. W. HELLER (J. Physical Chem., 1937, 41, 1041—1052).—Non-spherical Fe₂O₃ particles form oblong aggregates, the degree of regularity decreasing with the rate of coagulation and the no. of primary particles. Changes due to ageing are irregular.

F. R. G.

Influence of time and of electrolytes on the viscosity of colloidal solutions of arsenious sulphide. A. BOUTARIC and (Mlle.) S. THÉVENET (Compt. rend., 1937, 205, 862—863).— η for As₂S₃ sols containing 50—60 g. per litre decreases from the time of prep. to a limiting val., the rate of decrease

at 9—70° increasing with temp. With increasing concn. of electrolyte the limiting val. rises and is reached at lower concn. It also increases with the valency of the cation. For K salts the anion appears to have little influence, except in the case of KOH and K_3PO_4 , for which η decreases continuously with increasing concn. owing to dissolution of the micelles.

R. S. B.

Double refraction in colloid solutions. H. W. FARWELL (J. Appl. Physics, 1937, 8, 416—417).—Sols of V_2O_5 and benzopurpurin show considerable double refraction between crossed nicols, apparently of the streaming type, caused by convection currents. When the sols are contained in a thermostat, any slight mechanical disturbance sets up double refraction, which persists for a considerable time.

R. C. M.

Electrochemistry of platinum sols. II. Nature of the electric conductivity of sols. N. A. BACH and A. A. RAKOV (J. Phys. Chem. Russ., 1937, 9, 18—24).—Sols were prepared by dispersing Pt by an a.c. arc in H_2 , O_2 , and air, and bubbling the gas through H_2O . The conductivity κ was measured and the contribution κ_s due to the sol (as distinct from that of the intermicellar liquid) was determined by coagulating the sol by freezing. For sols prepared in H_2 κ_s increases with concn., up to 75% of κ . These sols consist of Pt particles and H^+ ions, the latter forming the outer part of the double layer. Conditions are more complicated for sols prepared in O_2 .

E. R.

Dielectric measurements with hydrophilic colloids. II. Bridge method of measuring dielectric constants of conducting liquids. P. J. DENEKAMP and H. R. KRUYT (Kolloid-Z., 1937, 81, 151—164).—A detailed description is given (cf. A., 1937, I, 615).

F. L. U.

Aërosols (dusts, smokes, and mists). W. L. H. MOLL (Kolloid-Z., 1937, 81, 225—234).—A review of recent work.

Applicability of the Mie effect in determining particle size of white aërosols, especially when coarsely dispersed. H. ENGELHARD and H. FRIESS (Kolloid-Z., 1937, 81, 129—143).—The spatial distribution of the light diffracted by spherical non-conducting particles has been measured with fogs of Et_2 sebacate and $(C_6H_4Me)_3PO_4$ containing particles of known size. The results are compared with those calc. according to Mie's theory for spheres with radius 70—1400 μ . The Mie effect can be usefully employed to determine particle sizes between the limits 50 and 500—600 μ , but the diffraction curves give no information about the degree of heterogeneity of the aërosols.

F. L. U.

Disperse gases. III. Bubble size and time of ascent. W. LUCHSINGER (Kolloid-Z., 1937, 81, 180—182; cf. A., 1937, I, 460).—The time of ascent of air bubbles through 140 cm. of H_2O decreases with increase of vol. of the bubbles from 0.00018 c.c., and reaches a min. at 0.004 c.c., beyond which it increases slowly and tends to a const. val. (max. size studied = 0.062 c.c.). The diminished rate of ascent of the larger bubbles is associated with marked

D (A., I.)

deformation and a change in the character of the motion.

F. L. U.

Stability of foams. I. Kinetics of the syneresis of foams. K. N. ARBUZOV and B. N. GREBENSCHTSCHIKOV (J. Phys. Chem. Russ., 1937, 9, 32—42).—Foams have been prepared by filtering saponin sol through a Schott filter, and the velocity of syneresis was determined by measuring the vol. of the liquid formed.

E. R.

Influence of ultrasonic waves on colloid solubility. III. Peptisation of carbon in ethyl ether. N. SATA (Kolloid-Z., 1937, 81, 182—187; cf. A., 1937, I, 238).—In attempts to disperse C in H_2O and 10 org. liquids by means of ultrasonic waves, only in Et_2O was a stable suspension obtained. H_2O is necessary, but it is immaterial whether it is contained in the C or the Et_2O . Ostwald's "solid-phase" rule is followed. The quantity of H_2O needed for peptisation corresponds approx. with the solubility of H_2O in Et_2O .

F. L. U.

State of cellulose in solution. T. LIESER (Kolloid-Z., 1937, 81, 234—241).—A review.

Study of molecular compounds of cellulose by determining the apparent specific volume and by X-ray measurement of the unit cell of swollen cellulose. I. SAKURADA and S. OKAMURA (Kolloid-Z., 1937, 81, 199—208).—An expression is derived relating the wt. of H_2O or aq. solution taken up by 1 g. of cellulose with the experimentally determined d of the swollen cellulose and of the liquid used, and the vol. of the unit cell of the former as found by X-ray measurements. These quantities have been determined for cellulose swollen in H_2O , aq. NaOH, N_2H_4 , HNO_3 , and $HClO_4$, and the following compositions are deduced:

H_2O -cellulose (cf. A., 1937, I, 80), $C_6H_{10}O_5 \cdot H_2O$;
Na-cellulose-I, $C_6H_{10}O_5 \cdot NaOH \cdot 3H_2O$;
Na-cellulose-II, $C_6H_{10}O_5 \cdot NaOH \cdot H_2O$;
Na-cellulose-IV, $C_6H_{10}O_5 \cdot 0.3NaOH \cdot H_2O$;
hydrazine-cellulose, $C_6H_{10}O_5 \cdot N_2H_4 \cdot H_2O$;
Knecht's compound, $C_6H_{10}O_5 \cdot HNO_3 \cdot H_2O$;
perchloric acid cellulose, $2C_6H_{10}O_5 \cdot HClO_4 \cdot 2H_2O$.

F. L. U.

Mechanism of deformation and fine structure of cellulose hydrate. I. Relation between swelling anisotropy and mechanism of deformation in hydrocellulose gels. P. H. HERMANS (Kolloid-Z., 1937, 81, 143—150).—Attention is directed to the importance of measurements of the anisotropy of swelling in affording information about the orientation of cellulose crystallites. Mathematical relations are established between the anisotropy of swelling and the extent of mechanical deformation of an initially isotropic cellulose gel on the assumptions (a) that the crystallites are joined end to end and (b) that they form a three-dimensional network. Experimental results are in accord with (b).

F. L. U.

X-Ray diffraction patterns of sol, gel, and total rubber when stretched, and when crystallised by freezing and from solutions. G. L. CLARK, E. WOLTHUIS, and W. H. SMITH (J. Res. Nat. Bur. Stand., 1937, 19, 479—491).—Sol rubber, when stretched at room temp., affords no evidence of the

crystal fibre pattern characteristic of total rubber even at 1000% elongation. Gel rubber shows the pattern at elongations >100%, but exposure to air in the unvulcanised condition and the removal of antioxidants results in the disappearance of crystal interference effects even at 400% elongation. After vulcanisation, sol rubber at elongations >400% and gel rubber at elongations <250% show slight crystal interferences. A large interplanar spacing of 54 Å., found in unstretched gel, is absent in the sol. Within experimental error, frozen sol, gel, and total rubbers give rise to similar patterns. The pattern of gel, crystallised from Et₂O, is similar to the patterns of stretched and frozen rubber. Evidence for the crystalline nature of sol deposited from Et₂O has also been obtained. C. R. H.

Isothermal and reversible variation in absorption in thixotropic sols. W. HELLER and (MLLE.) G. QUIMFE (Compt. rend., 1937, 205, 857—859; cf. A., 1936, 795).—The variation with time of the absorption coeff. of a goethite sol has been measured for λ 6200 Å. at 22.7°. R. S. B.

Soils. XXI. Fixation of silicic radicals by soil clays. J. CLARENS and J. LACROIX (Bull. Soc. chim., 1937, [v], 4, 1916—1920).—When clays are treated with alkaline silicates, a certain amount of SiO₂ is fixed in such a way that it is not removed by subsequent treatment with dil. HCl. The amount fixed is available for the fixation of other bases [e.g., Ba(OH)₂] and can thus be determined. E. S. H.

Fluctuations of composition in a system of molecules in chemical equilibrium. F. G. DONNAN, E. TELLER, and B. TOPLEY (Phil. Mag., 1937, [vii], 24, 981—1001).—Consideration is given to the fluctuations in an enclosed vol. and in an "open" vol. (small vol. forming part of a larger closed system of the same sort) containing mols. in chemical equilibrium at const. temp. F. J. L.

Degree of ionisation of binary electrolytes and the hydration of their ions. B. H. VAN RUYVEN (Rec. trav. chim., 1937, 56, 1111—1132).—A crit. review of published work. E. S. H.

Dissociation constants of alkyl-substituted benzoic and phenylacetic acids. J. W. BAKER, J. F. J. DIPPY, and J. E. PAGE (J.C.S., 1937, 1774—1779).—Recorded vals. of $K \times 10^5$ at 25° are: *p*-C₆H₄Et·CO₂H, 4.43; *p*-C₆H₄Pr^o·CO₂H, 4.43; *p*-C₆H₄Bu^o·CO₂H, 3.98; *p*-C₆H₄Et·CH₂·CO₂H, 4.24; *p*-C₆H₄Pr^o·CH₂·CO₂H, 4.06; *p*-C₆H₄Bu^o·CH₂·CO₂H, 3.82. It is suggested that these and earlier data for BzOH, CH₂Ph·CO₂H, and the *p*-Me-substituted acids are not inconsistent with the postulates regarding the electron-release capacity of alkyl groups and that the small differences in the *K* vals. may be due to differing heat capacity and entropy effects. On the other hand, the partial inversion found in the benzoic series can, it is thought, be explained on the Baker-Nathan theory. C. R. H.

Determination of dissociation constants of ammonium hydroxide and water from buffer capacity. S. KILPI (Z. physikal. Chem., 1937, 180, 464—474).—The dissociation const. of NH₄OH in alkali chloride and NaOAc solutions has been

obtained by measuring the buffer capacity. From measurements of the buffer capacity of NH₄OAc solutions, the vals. of the ionic product for H₂O in aq. KCl and NaCl solutions have been derived. R. C.

Physical chemistry of amino-acids, peptides, and related substances. IX. Dissociation constants of amino-acid derivatives. M. ZIEF and J. T. EDSALL (J. Amer. Chem. Soc., 1937, 59, 2245—2248; cf. A., 1933, 781).—Dissociation consts. have been determined using the formula $pK' = p_H + \log [(a - [H'])/(b + [H'])]$, where *a* is the stoichiometric concn. of the acidic form of the mol. studied and *b* that of the conjugate basic form. The vals. obtained for *pK'* are: hydantoic acid 3.80, glycylglycinehydantoic acid 3.54, acetylglycine 3.60, chloroacetylglycine 3.37, formylglycine 3.42, *N*-carbethoxyglycine 3.65, hydantoin 9.12, 5 : 5-dimethylhydantoin 9.19, glycineamide 7.93, *O*-methylisocarbamide hydrochloride 9.72. The influence of the peptide linking on the dissociation is discussed. E. S. H.

Salt action on the ionisation of acetic acid and hydrolysis of the acetate ion. H. S. HARNED and F. C. HICKEY (J. Amer. Chem. Soc., 1937, 59, 2303—2304).—The ionisation of AcOH in aq. LiCl, KCl, and BaCl₂ at 25° has been calc. from e.m.f. measurements of the cells H₂|AcOH(*M*), MCl_{*n*}(*m*)|AgCl—Ag. Combining the results with data derived from the cells H₂|MOH(*m*₀), MCl_{*n*}(*m*₀)|AgCl—Ag, the salt effect on the reaction OAc' + H₂O \rightleftharpoons AcOH + OH' has been determined. The concn. term $m_{\text{AcOH}}m_{\text{OH}}/m_{\text{OAc}}$ in the salt solutions has been evaluated; its variation with salt concn. is large in LiCl and BaCl₂ solutions. E. S. H.

Ionic activity coefficient product and ionisation of water in uni-univalent halide solutions: a numerical summary. H. S. HARNED and M. A. COOK (J. Amer. Chem. Soc., 1937, 59, 2304—2305).—Equations and numerical parameters relating to H₂O in solutions of K, Na, and Li chlorides and bromides over wide temp. ranges at at. concns. > 3M are derived. E. S. H.

Electrolyte action with acetic acid. II. Ionic activity coefficients in aqueous ammonium and alkali chloride solutions. S. KILPI and A. MERETOJA (Z. physikal. Chem., 1937, 180, 264—280).—Ionic activity coeffs., *f*, for AcOH in the above solutions at 18° and 25° have been calc. from measurements of H₂ electrode potentials and the dissociation consts. previously determined (A., 1937, I, 516). Interpolation formulæ for the calculation of *f* have been derived. The activity of undissociated AcOH increases with the salt concn. A solution 0.1N in respect of KCl and AcOH is a convenient reference solution for *p*_H measurements. R. C.

Thermodynamics of aqueous hydrochloric acid-hydrobromic acid mixtures at constant total molality. B. B. OWEN and T. F. COOKE, jun. (J. Amer. Chem. Soc., 1937, 59, 2277—2279).—The Ag—AgBr electrode gives reproducible results in aq. HBr—HCl over a 7-fold change in relative concn. The activity coeff. of HBr in presence of HCl at 0—45° is given by $-\log \gamma_{\text{HBr(HCl)}} = \log m + 1/2 \log x + (E - E_0)/2k$, where *m* is the total molality, *E*₀ the e.m.f. of the cell containing HBr at unit activity, and *k* = 0.0019844*T*. The rate of variation of

log γ for HCl in the mixtures is of the same order of magnitude, but of opposite sign; its temp. coeff. is also negative.

E. S. H.

Thermodynamics of aqueous potassium chloride-lithium chloride mixtures at constant total molalities. B. B. OWEN and T. F. COOKE, jun. (J. Amer. Chem. Soc., 1937, 59, 2273—2276).—The variation of the v.p. of solutions containing varying amounts of LiCl and KCl at a const. total molality (1, 2, or 3M) has been determined at 25° by the isopiestic method. The osmotic coeff. is a quadratic function of the relative composition.

E. S. H.

Thermodynamic properties of solutions of amino-acids and related substances. II. Activity of aliphatic amino-acids in aqueous solution at 25°. P. K. SMITH and E. R. B. SMITH (J. Biol. Chem., 1937, 121, 607—613; cf. A., 1937, I, 136).—The osmotic and activity coeffs. of *dl*-alanine, *dl*- α -amino-*n*-butyric, *dl*- α -amino-*n*-valeric, and α -amino-*isobutyric* acids, and *dl*-valine have been determined at 25° by an isopiestic method with sucrose as reference substance.

J. W. S.

Determination of the activities of electrolytes by the ultracentrifuge. C. DRUCKER (Z. physikal. Chem., 1937, 180, 359—377).—The sedimentation equilibria in aq. KI, KIO₃, NaIO₃, LiIO₃, CsIO₃, HIO₃, AgClO₄, TiClO₄, Ti₂SO₄, CdSO₄, CdI₂, KCl₃, and KHgCl₃ have been determined by the ultracentrifuge method of Pedersen (A., 1934, 1170). The calc. activity gradients are compared with the concn. distribution indicated by e.m.f. and f.p. depression measurements.

J. W. S.

Complex formation of ferric ions with chloride ions. M. MÖLLER (J. Physical Chem., 1937, 41, 1123—1128).—It is assumed that aq. FeCl₃ contains [Fe(H₂O)₆]⁺⁺⁺ and [Fe(H₂O)₅Cl]⁺⁺ and from potential measurements at 25° for Pt|(FeCl₂ + FeCl₃ + HCl) against a KCl-Hg₂Cl₂ electrode, it is estimated that $[\text{Fe}(\text{H}_2\text{O})_5\text{Cl}]^{++}/[\text{Fe}(\text{H}_2\text{O})_6]^{+++}[\text{Cl}^-] = 4.1$.

F. R. G.

Equilibria in solutions of cadmium and zinc oxalates. W. J. CLAYTON and W. C. VOSBURGH (J. Amer. Chem. Soc., 1937, 59, 2414—2421).—The solubility products of Cd and Zn oxalates, derived from e.m.f. measurements for the cell Cd(Ag)|CdC₂O₄ (sat.), K₂C₂O₄, KHC₂O₄, quinhydrone|Pt and the corresponding Zn cell, are 2.78×10^{-8} and 2.47×10^{-9} , respectively, at 25°. The solubilities of Cd and Zn oxalates in H₂O, in aq. CdSO₄ or ZnSO₄, and in aq. K₂C₂O₄ have been determined at 25°. The ionisation consts. are: CdC₂O₄ 3.0×10^{-4} , ZnC₂O₄ 2.1×10^{-5} at 25°. The solutions contain only small amounts of Cd(C₂O₄)₂^{''} or Zn(C₂O₄)₂^{''}; the instability const. of these complex ions has been calc.

E. S. H.

Equilibrium of the semiquinone of phenanthrene-3-sulphonate with its dimeric compound. L. MICHAELIS and E. S. FETCHER, jun. (J. Amer. Chem. Soc., 1937, 59, 2460—2467).—Equilibrium exists between 4 forms of the dye: (a) the oxidised, (b) the reduced, (c) the intermediate semiquinone radical, (d) the intermediate valency-saturated dimeric compound of the radical. The existence of the dimeride is favoured by increasing the total concn. of

the dye. In alkaline solution the main intermediate form is the radical, especially at low concns.; in acid solution the radical exists only in extremely small amounts. The dimeric form is scarce when the total concn. of dye is low, but may increase considerably at high concns. Increase of alkalinity increases the total amount of intermediate forms and also the fraction of this which is in the form of a radical. The equilibrium consts. for semiquinone formation, dimeride formation, and dimerisation have been evaluated for acid and alkaline solutions.

E. S. H.

Photo-electric extinction measurements on alkaline phenolphthalein solutions. S. BODFORSS and I. LEDEN (Z. anorg. Chem., 1937, 234, 239—252).—Using apparatus previously described (A., 1935, 722) it is found that Beer's law holds for the red phenolphthalein solutions over a 20-fold range of concn. The kinetics and equilibrium in the reaction $\text{CO}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{C}(\text{C}_6\text{H}_4 \cdot \text{O}) \cdot \text{C}_6\text{H}_4 \cdot \text{O}' + \text{OH}' \rightleftharpoons \text{CO}_2 \cdot \text{C}_6\text{H}_4 \cdot \text{C}(\text{OH})(\text{C}_6\text{H}_4 \cdot \text{O})_2$ have also been studied. Both the velocity coeffs. and the equilibrium const. are markedly influenced by neutral salts, and there is a small sp. influence of the various cations. EtOH shifts the equilibrium to the left.

F. J. G.

Transition temperature of gypsum to anhydrite. A. E. HILL (J. Amer. Chem. Soc., 1937, 59, 2242—2244).—The solubility of CaSO₄ in H₂O has been determined at 35°, 45°, and 65°. Comparison with published data for CaSO₄·2H₂O shows that the transition temp. is about 45°.

E. S. H.

Thermal dissociation of higher sulphides of tin. J. I. GERASIMOV, E. V. KRUGLOVA, and N. D. ROZENBLUM (J. Gen. Chem. Russ., 1937, 7, 1520—1524).—SnS₂ dissociates at >650° to form Sn₂S₃, which gives Sn₄S₅ at 700° and SnS at 800°. The so-called intermediate sulphides are in reality solid solutions of the above three sulphides.

R. T.

Anhydrous chlorides of chromium. H. A. DOERNER (U.S. Bur. Mines, Tech. Paper 577, 1937, 51 pp.).—The prep. of pure anhyd. CrCl₂ and CrCl₃ is described. V.p. of CrCl₂ and equilibrium concns. in the reaction $\text{CrCl}_2 + \text{H}_2 = \text{Cr} + 2\text{HCl}$ have been determined. V.p. and dissociation pressures of CrCl₃ are complicated by the formation of CrCl₄ (not isolated). Equilibrium concns. for the reaction $2\text{CrCl}_3 + \text{Cl}_2 = 2\text{CrCl}_4$ are given, and employed to calculate partial pressures of CrCl₃. All the data are treated thermodynamically, and tables of thermodynamic consts. are given.

F. L. U.

Chemical equilibrium between uni- and bi-valent copper ions in presence of metallic copper. C. T. KAWASSIADIS (Praktika, 1935, 10, 391—399; Chem. Zentr., 1936, i, 3988).—Equilibrium data for the reaction $\text{Cu} + \text{CuSO}_4 = \text{Cu}_2\text{SO}_4$ at 50—200° in presence of H₂O are recorded. Rise in temp. favours the formation of Cu₂SO₄.

H. J. E.

Furfurylidene- and benzylidene-phenolsystems and their fusion diagrams. V. V. TSHELINCEV (Compt. rend. Acad. Sci. U.R.S.S., 1937, 16, 347—350; cf. A., 1936, 1241).—Curves are recorded for mixtures of mono- and di-furfurylidene- and -benzylidene-acetone with *o*-, *m*-, and *p*-C₆H₄(OH)₂. Maxima occur with colour change at simple mol.

compositions which indicate the new phenol-ketone complexes: [X.4A], [X.2A], [X.2B], [X.B], [2X.B], where $X = C_6H_4(OH)_2$, $A = R \cdot CH : CH \cdot COMe$, $B = (R \cdot CH : CH)_2CO$. These org. complexes are explained by quadrivalency in the ketonic O. I. McA.

System lithium sulphate, cadmium sulphate, and water at 30°. H. PARKS, M. PATTERSON, and W. C. VOSBURGH (J. Amer. Chem. Soc., 1937, 59, 2141—2142).—Solubility data are recorded. There is no evidence of the existence of a double salt. E. S. H.

Calcium arsenates. Three-component system calcium oxide-arsenic oxide-water. O. A. NELSON and M. M. HARING (J. Amer. Chem. Soc., 1937, 59, 2216—2223).—Equilibria at 62° have been determined and the solid phases examined by microscopical and X-ray methods. The existence of $CaHAsO_4$, $Ca_5H_2(AsO_4)_4 \cdot 5H_2O$, $Ca_3(AsO_4)_2 \cdot 2H_2O$, and $4CaO \cdot As_2O_5 \cdot xH_2O$, but not the reported $10CaO \cdot 3As_2O_5 \cdot 4H_2O$, has been established. E. S. H.

Heterogeneous equilibria in aqueous solutions of the sodium salts of the vanadic acids at 30°. S. J. KIEHL and E. J. MANFREDO (J. Amer. Chem. Soc., 1937, 59, 2118—2126).—The system $V_2O_5 - Na_2O - H_2O$ at 30° has been studied. The solid phases stable in contact with solution at 30° are: $NaOH \cdot H_2O$, $Na_3VO_4 \cdot 2.5H_2O$, $Na_3VO_4 \cdot 7H_2O$, $Na_3VO_4 \cdot 12H_2O$, $Na_4V_2O_5 \cdot 18H_2O$, $NaVO_3 \cdot 2H_2O$, $Na_4V_6O_{17} \cdot 12H_2O$, and V_2O_5 . Convenient apparatus for sampling and determining the d of a liquid phase is described. E. S. H.

Reciprocal salt-pair $(NH_4)_2SO_4 + 2KCl \rightleftharpoons K_2SO_4 + 2NH_4Cl$ in water and in ammonia-water at 25°. A. E. HILL and C. M. LOUCKS (J. Amer. Chem. Soc., 1937, 59, 2094—2098).—Solubility data are recorded. The solid phases are solid solutions of $NH_4Cl + >2.5\%$ of KCl , $KCl + >16.6\%$ of NH_4Cl , and $K_2SO_4 + (NH_4)_2SO_4$ in all ratios. E. S. H.

Formation of an organic ternary molecular compound. I. System antipyrine-quinol-pyrocatechol. K. HRYNAKOWSKI and F. ADAMANIS (Bull. Soc. chim., 1917, [v], 4, 1815—1825).—A ternary compound is not formed in this system, although 4 binary compounds have been recognised. The system has 6 eutectic points; the corresponding temp. and compositions have been determined. E. S. H.

Sign and symbol of heat of reaction. H. J. S. SAND (Nature, 1937, 140, 809—810).—Certain recommendations of the report of the Joint Committee of the Chemical, Faraday, and Physical Societies on symbols and conventions are criticised. L. S. T.

Thermochemistry of perchloric acid and perchlorates. C. F. GOODEVE and A. E. L. MARSH (J.C.S., 1937, 1816—1819).—The heat of reaction of Cl_2O_7 with excess of H_2O is -50.0 ± 0.5 kg.-cal. per g.-mol. of Cl_2O_7 . There is no evidence for the formation of a stable $Cl_2O_7 \cdot H_2O$. The slow rate of dissolution of Cl_2O_7 in H_2O suggests a limited solubility of $HClO_4$ in Cl_2O_7 . From the heats of dissolution and formation of Cl_2O_7 , the calc. heat of formation of aq. $HClO_4$ is -31.6_5 kg.-cal. Calc. heats of formation

of cryst. salts are: $NaClO_4$, -93.0 ; $KClO_4$, -104.4 ; NH_4ClO_4 , -70.2 ; $Ba(ClO_4)_2$, -194.3 kg.-cal.

C. R. H.

Heats of ionisation of water, ammonium hydroxide, carbonic, phosphoric, and sulphuric acids. Variation of ionisation constants with temperature and the entropy change with ionisation. K. S. PITZER (J. Amer. Chem. Soc., 1937, 59, 2365—2371).—The recorded heats of ionisation at 25° are: H_2O , $13,358 - 50.0(t - 25) + 0.15 \times (t - 25)^2$; NH_4OH , 865 ± 30 ; H_2CO_3 , 1843 ± 60 ; HCO_3' , 3500 ± 60 ; H_3PO_4 , -1880 ± 80 ; H_2PO_4' , 800 ± 80 ; HPO_4'' , 3500 ± 500 ; HSO_4' , -5200 ± 500 g.-cal. per mol. Consideration of the changes in heat content, free energy, entropy, and heat capacity with ionisation for 16 weak acids shows that for all first ionisations ΔS^0 is approx. -22 g.-cal. per mol. and ΔC_p approx. -40 g.-cal. per mol. From these generalisations a formula is developed, which gives the approx. ionisation const. over a range of temp. when a single experimental val. is known: $\log K = \text{const.}/T + 53.78 - 20 \log T$. If several vals. are available, the form $\log K = A + B/T + 20 \log T$ may be used. E. S. H.

Hydrazine: heats of dissolution of hydrazine and hydrazine hydrate at 25°. V. C. BUSHNELL, A. M. HUGHES, and E. C. GILBERT (J. Amer. Chem. Soc., 1937, 59, 2142—2144).—Sp. heats of aq. $N_2H_4 \cdot H_2O$ at 25° are recorded. The heat of dissolution of $N_2H_4 \cdot H_2O$ is -2098 g.-cal.; that of N_2H_4 is -3895 g.-cal. E. S. H.

Thermal data. VII. Heats of combustion of seven amino-acids. H. M. HUFFMAN, S. W. FOX, and E. L. ELLIS. VIII. Heat capacities, entropies, and free energies of amino-acids. H. M. HUFFMAN and E. L. ELLIS (J. Amer. Chem. Soc., 1937, 59, 2144—2150, 2150—2152; cf. A., 1936, 1341).—VII. Data recorded are: *dl*-alanine 386.55 ± 0.14 ; *d*-arginine 893.48 ± 0.30 , glycine 232.57 ± 0.10 , *d*-leucine 856.01 ± 0.21 , *l*-leucine 855.98 ± 0.20 , *dl*-leucine 855.23 ± 0.21 , *l*-tyrosine 1058.34 ± 0.37 kg.-cal. per mol.

VIII. Heat capacities of *dl*-alanine, *d*-arginine, *dl*-leucine, and *l*-tyrosine have been determined over the range 90—298° K. The entropies at 298.1° K. are 31.6, 49.5, 59.9, and 53.0, respectively, and the corresponding free energies are $-89,440$, $-84,610$, $-58,490$, and $-97,750$ g.-cal. per mol. E. S. H.

Thermodynamics in hydrocarbon research. C. L. THOMAS, G. EGLOFF, and J. C. MORRELL (Ind. Eng. Chem., 1937, 29, 1260—1267).—The differences between thermodynamic data calc. from the heat capacities at low temp. and those calc. from infrared and Raman spectral data are discussed. From recent data it is deduced that the standard free energies of formation of straight-chain hydrocarbons C_nH_{2n+2} are given by $\Delta G_f^0 = -10,550 - 5890n + 25.2nT - 2.2T$ g.-cal. per mol., when $n > 1$, and those of olefines of the form $C_{n-2}H_{2n-3} \cdot CH : CH_2$ by $\Delta G_f^0 = 20,321 - 5835n - 33.26T + 24.52nT$ g.-cal. per mol., when $n > 2$. From the latter expression it is inferred that such olefines should be interconvertible in presence of catalysts at 611° K. with zero standard free energy change. Data for 42 hydrocarbons are

recorded and possibilities of reaction at various temp. discussed. J. W. S.

Electrical conductances of standard potassium chloride solutions throughout the temperature range 0—25°. R. W. BREMNER and T. G. THOMPSON (J. Amer. Chem. Soc., 1937, 59, 2372—2374).—Results for 0.1 and 0.01 "demal" standard KCl solutions at 5°, 10°, 15°, and 20° are recorded. The accuracy is 0.001—0.01%. An equation which fits these and other published data has been derived; it predicts a point of inflexion in each temp.-conductance curve. E. S. H.

Conductivity of hydrochloric and phosphoric acid in presence and absence of hydrogen sulphide. H. JABECZYŃSKA-JĘDRZEJEWSKA and J. GROYECKA (Rocz. Chem., 1937, 17, 392—397).—The conductivity of aq. HCl or H₃PO₄ falls with increasing [H₂S], probably owing to the reaction H₂S + H⁺ → [H₃S]⁺. R. T.

Conductance of salts in H₂O—D₂O mixtures. J. P. CHITTM and V. K. LA MER (J. Amer. Chem. Soc., 1937, 59, 2425—2430).—Equiv. conductances of approx. 0.02N-LiCl, -NaCl, and -KOAc in H₂O—D₂O mixtures have been determined at 25.0°. The mobilities of the ions in D₂O have been calc. In passing from H₂O to D₂O the transference no. of Li⁺ decreases by about 2%; the other ions are less affected. The influence of η on conductance has been examined. The stoichiometric dissociation const. of AcOH in D₂O has been derived. The temp. coeff. of equiv. conductance of NaCl solutions in D₂O is > in H₂O at 25—45°. E. S. H.

Effect of viscosity on ionic mobilities. D. BELCHER (Nature, 1937, 140, 810).—The influence of increasing [PhOH] on the equiv. conductance of 10⁻⁴N-HCl at 25° has been determined. For [PhOH] up to 0.3N, the equiv. conductance \propto the relative fluidity of the PhOH solution. The bearing of this result on the interpretation of dissociation consts. is discussed. L. S. T.

Electrochemical behaviour of rhodium. IV. Transport and p_H measurements in hydrochloric acid and aqueous solutions of rhodium trichloride. G. GRUBE and H. AUTENRIETH (Z. Elektrochem., 1937, 43, 880—886).—On electrolysis of solutions of RhCl₃ containing HCl, Rh migrates to the anode, the migration being greatest when there are from two to three mols. of HCl per mol. of RhCl₃. These solutions contain complex acids such as H₂RhCl₅ or H₃RhCl₆, but the complex anion is partly dissociated into Rh⁺⁺⁺ and Cl⁻. On evaporation of a solution of RhCl₃ in conc. HCl a compound H₂RhCl₅·4H₂O is obtained. In aq. solutions of RhCl₃ the amount of Rh migrating to the cathode is \ll that which would correspond with simple ionisation. In such a solution a complex acid such as H₃[RhCl₅(OH)₃] is formed, a view which is supported by p_H measurements. In 2.71M-RhCl₃ [H⁺] = 0.975N. F. J. G.

Electrochemical study of the ternary system AlCl₃-NaCl-PhNO₂. A. M. RUBAN (J. Gen. Chem. Russ., 1937, 7, 1419—1426).—Conductivity in the system increases parallel with [NaCl], whilst with

increasing [AlCl₃] it passes through a max. Na is deposited at the cathode. R. T.

Potential of the normal and the decinormal calomel electrodes at temperatures ranging from 12.5° to 91°. H. T. S. BRITTON and G. WELFORD (J.C.S., 1937, 1846—1848).—Data for 12.5°, 25°, 34°, 53°, 63°, 75°, and 91° are recorded. C. R. H.

Temperature coefficient of the standard silver electrode. Entropy of silver ion. J. J. LINGANE and W. D. LARSON (J. Amer. Chem. Soc., 1937, 59, 2271—2273).—The temp. coeff. of the theoretical cell Ag|Ag'(a = 1)|H'(a = 1)|H₂(1 atm.), derived from measurements of the temp. coeffs. of cells of the type Pt|quinhydrone(s), HClO₄(C₁)|HClO₄(C₁), AgNO₃(C₂)|Ag (where C₁ \gg C₂), is +0.967 \pm 0.004 mv. per degree at 25°. The calc. standard entropy of Ag⁺ at 25° is 16.7 g.-cal. per degree per mol. E. S. H.

Measurement of the molal ferric-ferrous electrode potential. W. C. SCHUMB, M. S. SHERRILL, and S. B. SWEETSER (J. Amer. Chem. Soc., 1937, 59, 2360—2365).—The molal Fe⁺⁺⁺-Fe⁺⁺ electrode potential, derived from e.m.f. measurements of the cell Pt, H₂|HClO₄(c₁), Fe(ClO₄)₃(c₃), HClO₄(c₁), Fe(ClO₄)₂(c₂)|Pt, is -0.7701 v. The formal Fe⁺⁺⁺-Fe⁺⁺ electrode potentials for Fe(ClO₄)₃-Fe(ClO₄)₂ mixtures in aq. HClO₄ for ionic strengths of 0.1 to 1.0 are recorded; over the ionic strength range 0.5—1.0 the val. is -0.741 v. A method for the determination of free acid in presence of Fe⁺⁺⁺ and Fe⁺⁺ is described. E. S. H.

Electrode potential of thin films of zinc on platinum. D. P. MELLOR and H. MULHALL (J. Proc. Roy. Soc. New South Wales, 1937, 70, 332—337).—Experiments have been made to determine the min. thickness of Zn which must be deposited on Pt in order that the electrode may have the same potential as massive Zn. The cell Zn|ZnSO₄|Pt was short-circuited until the e.m.f. fell to 0.05 v. and the amount of Zn deposited was determined. The thickness of the layer is found to depend on the nature of the electrolyte and the rate of deposition of the metal. The results are discussed in relation to the nature of the Pt surface, and the effect of alloying of the Zn with the Pt substrate. A. J. M.

Nature of the glass electrode potential. III. Cause of the asymmetry potential of the glass electrode. H. YOSHIMURA (Bull. Chem. Soc. Japan, 1937, 12, 443—452).—The asymmetry potential approaches zero when the H₂ electrode functions of both surfaces of the electrode membrane approach each other. With a bulb membrane the electrode function is generally less on the convex than on the concave surface, and the positive pole of the asymmetry potential is generally on the convex side. With increasing thickness of the membrane, the magnitude of the asymmetry potential and the difference between the electrode functions decrease. The subject is discussed mathematically. C. R. H.

Calculation of the normal potential of the non-metal. I. UHARA (J. Physical Chem., 1937, 41, 1117—1121).—Relative vals. of the normal

potentials of F, Cl, Br, I, and O are deduced by the author's method (A., 1936, 799). F. R. G.

Electromotive behaviour of bismuth elements. T. KURENNIEMI (Ann. Acad. Sci. fenn., 1935, A, 44, No. 5, 5—68; Chem. Zentr., 1936, i, 3978).—Measurements for the cell $\text{Bi}|\text{Bi}_2\text{O}_3$ dissolved in $\text{HCl}|\text{Hg}_2\text{Cl}_2|$ Hg and for the corresponding bromide cell are recorded. H. J. E.

Theory of limiting currents. II. Limiting currents of cells without and with an indifferent electrolyte. D. MACGILLAVRY (Rec. trav. chim., 1937, 56, 1039—1046; cf. A., 1937, I, 620).—Theoretical. Formulae for the limiting currents of cells with one electrolyte, and for the depression caused by adding an excess of indifferent electrolytes, are derived and compared with published data. The large depression of the limiting currents at the dropping electrode is explained. E. S. H.

Thermo-galvanic cells. D. RĂDULESCU and F. BĂRBULESCU (Bull. Soc. Chim. România, 1936, 18, 137—150).—Measurements of E for a no. of cells consisting of two identical electrode systems at different temp. show that the solution pressure P in the Nernst equation varies only slightly with temp., but depends to a greater extent on the concn. of the ions in solution. This is considered to be evidence against the view that P may be regarded as an osmotic pressure acting at the electrode surface. Vals. of p , η , and κ at 0—80° for M- and 0.1M- CuSO_4 , $-\text{ZnSO}_4$, $-\text{AgNO}_3$, $-\text{Co}(\text{NO}_3)_2$, and $-\text{KAl}(\text{SO}_4)_2$ are tabulated. A. J. E. W.

Standardisation of some buffer solutions at elevated temperatures. H. T. S. BRITTON and G. WELFORD (J.C.S., 1937, 1848—1852).— p_{H} vals. at 12.5°, 25°, 34°, 53°, 63°, 75°, and 91° are recorded for the neutralisation of Britton-Robinson universal buffer, and of its constituents, viz., 0.2N-citric acid, 0.2N- KH_2PO_4 , 0.2N- H_2BO_3 , and 0.03N-diethylbarbituric acid, by the addition of NaOH. The p_{H} vals. of the universal buffer vary little with temp. below p_{H} 6, but higher vals. decrease with rise of temp. C. R. H.

Polarographic studies with dropping mercury cathode. VI. Simultaneous polarisation of both electrodes. V. MAJER (Coll. Czech. Chem. Comm., 1937, 9, 457—464).—The influence of the electrolyte and of the presence of O_2 on the variations in anodic and cathodic potential accompanying changes in applied voltage are discussed. J. S. A.

Cathodal polarisation in electro-deposition of metals from aqueous solutions. A. LEVIN and O. ESSIN (J. Gen. Chem. Russ., 1937, 7, 1478—1487).—The potential-c.d. curves for electrolysis of CuSO_4 in $\text{HCO}\cdot\text{NH}_2$, or of AgNO_3 in $\text{C}_5\text{H}_5\text{N}$, suggest chemical polarisation, whilst concn. polarisation only is found in the electrolysis of CuCl in $\text{HCO}\cdot\text{NH}_2$ or of ZnCl_2 or ZnI_2 in $\text{C}_5\text{H}_5\text{N}$. R. T.

Cathodic polarisation in the deposition of zinc from zincate solutions. O. ESSIN and T. BEKLEMISHEVA (J. Phys. Chem. Russ., 1937, 9, 145—155).—Cathodic potential (E)-c.d. curves have been determined for solutions of ZnO in KOH and a formula derived for the calculation of concn. polarisation η_{κ} .

The sum of the equilibrium potential E_0 and the chemical polarisation (overvoltage) η_{x} is calc. by subtracting η_{κ} from E . $E_0 + \eta_{\text{x}}$ changes rapidly with c.d., thus indicating that η_{x} is $\neq 0$. The overvoltage is of the type explained by slow discharge of ions. E. R.

Polarisation in the deposition of alkali metals on mercury cathodes. O. ESSIN, M. LOSCHKAREV, and K. SORIJSKI (J. Phys. Chem. Russ., 1937, 9, 132—144).—Cathode potential-c.d. curves have been determined (a) with a Hg-jet electrode, and (b) with a stationary Hg electrode and a mixer. In both cases the polarisation is a function of c.d. and the form of this function indicates that the polarisation is due to the slow diffusion of the alkali metal into Hg rather than to the slow discharge of ions. E. R.

Theory of many-electrode electrochemical systems and its application to corrosion problems. II. Three-electrode galvanic systems. N. D. TOMASCHOV (J. Phys. Chem. Russ., 1937, 9, 43—63).—A Cd electrode was immersed in an electrolyte between a Pt anode and a Zn cathode and connected to various parts of the external circuit. Direction and strength of the current in the intermediate electrode were determined in relation to its position in the liquid, to the resistances of the external circuit on both sides of the branching, and to the conditions of electrolysis. E. R.

The p_{H} of distilled water, and hydrolysis of ammonium sulphate, nitrate, chloride, and acetate. J. A. CRANSTON and H. F. BROWN (Trans. Faraday Soc., 1937, 33, 1455—1458; cf. A., 1937, I, 245).—The p_{H} of pure H_2O has been measured with a glass electrode and the results of Ellis and Kiehl (A., 1936, 38) are confirmed. The hydrolysis consts. of NH_4NO_3 and NH_4Cl , calc. from p_{H} vals. at dilutions from 0.1N, are 1.4×10^{-10} at 15°. $(\text{NH}_4)_2\text{SO}_4$ gives higher p_{H} vals. than the others at corresponding concns. The p_{H} of NH_4OAc is substantially unchanged by dilution. F. L. U.

Electron affinity of free radicals. XII. ΔF of addition of sodium to organic compounds by the potentiometric and analytical methods. N. B. KEEVIL (J. Amer. Chem. Soc., 1937, 59, 2104—2107; cf. A., 1936, 1205).—Determinations of the free energy of addition of Na to fluorenone, C_2Ph_4 , didiphenylenediphenylethane, and $\alpha\gamma$ -bisdiphenylene- β -phenylallyl have been made by the e.m.f. and analytical methods formerly described. Good agreement between the two sets of results is obtained. E. S. H.

Sugar alcohols. IX. Physicochemical study of the erythritan-boric acid complex. J. C. KRANTZ, jun., E. F. BECK, and C. J. CARR (J. Physical Chem., 1937, 41, 1087—1090; cf. A., 1936, 1463).—Increase of the erythritan : H_3BO_3 ratio diminishes the p_{H} whilst dilution of the complex has the opposite effect. Change of temp. is without influence. The val. of n in $\log (\text{H}_3\text{BO}_3 + n \log [\text{erythritan}]) + K = -2p_{\text{H}}$ is 1.3, which agrees, contrary to Böeseken, with the val. for fructose. F. R. G.

Determination of reaction velocity and velocity constants of bimolecular reactions. A. LOTTERI

(Annali Chim. Appl., 1937, 27, 439—444).—A theoretical derivation of the abs. val. of the velocity coeff. of a bimol. reaction, and the reaction velocity equation, expressing the yield as a function of time, is given.

L. A. O'N.

Extrapolation to zero decomposition. D. N. ANDREEVSKI (J. Phys. Chem. Russ., 1937, 9, 64—70).—A theoretical discussion of the method of identifying the primary products of a decomp. reaction by extrapolation to the beginning of the process.

E. R.

Chemical reactions as an intramolecular diffusion phenomenon. II. J. A. CHRISTIANSEN (Z. physikal. Chem., 1937, B, 37, 374—386; cf. A., 1936, 1072).—From an equation for the "internal activity" of an atom in a mol. the equation $k = [D/4\pi\sqrt{ab}]e^{-l/(a+b)}$ has been deduced for the velocity coeff. of a reaction. Here a , b , and l can be determined from the potential curve, $a \propto$ the temp. (K), T , and b may be some other function of T . The linear relation between frequency index and activation no. (cf. *ibid.*, 1204) may be explained by the present theory if it is assumed that the particle displaced in the reaction has an electric moment and that near the potential max. the field is so weak that the mean moment of the particle is given by Debye's equation.

R. C.

Effect of temperature on flame speed, and temperature gradient at flame front. H. SACHSSE (Z. physikal. Chem., 1937, 180, 305—313).—By measuring the height of the inner cone of a Bunsen flame the relation between the flame speed, v , in mixtures of O_2 with CH_4 , C_2H_6 , and C_3H_8 and the O_2 content and the temp., θ , at which the gas mixture is preheated has been studied. With rising θ , v increases only slowly, the rise being due solely to the approach of θ to the inflammation temp., θ_1 . The rate of the combustion reaction has no appreciable effect on v or on the temp. gradient at the flame front. Owing to the induction period preceding ignition, the observed θ_1 is the lower the more time is allowed for inflammation to occur.

R. C.

Thermal decomposition of dimethyl sulphite. R. C. WOOD and H. A. TAYLOR (J. Physical Chem., 1937, 41, 1091—1099).—Decomp. data over the range 360—390°/10—250 mm. indicate that the mechanism involves free radicals producing CH_4 , CO , SO_2 , H_2 , and Me_2SO_2 . No Me_2O could be detected. The activation energy of Me_2SO_3 is 55,000 g.-cal. It is suggested that Prinz (A., 1884, 1255) worked with $EtSO_2 \cdot OEt$, not $(EtO)_2SO$.

F. R. G.

Kinetics and mechanism of decomposition of hydrocarbons. V. Thermal decomposition of dodecane, $\beta\beta\delta$ -trimethylpentane, and $\beta\epsilon$ -dimethylhexane. A. I. DINTZES and C. I. KLABINA. **VI. Kinetics of decomposition of ethane at reduced pressures.** A. I. DINTZES, A. KVIATKOVSKI, A. D. STEPUCHOVITSCH, and A. V. FROST (J. Gen. Chem. Russ., 1937, 7, 1507—1514, 1754—1761).—V. The composition of the reaction products obtained by pyrolysis (500—570°) of $\beta\epsilon$ -dimethylhexane and $\beta\beta\delta$ -trimethylpentane is in good agreement with that expected on the basis of Rice's theory (A., 1931, 819),

whilst in the case of n - $C_{12}H_{26}$ more C_2H_4 and less CH_4 are produced than would follow from this theory.

VI. The rate of decomp. of C_2H_6 at 600° is inversely \propto pressure, at 1—60 mm. The velocity of decomp. falls progressively, probably owing to attainment of equilibrium conditions at >60 mm., and at <60 mm. owing to the inhibitive action of some unidentified reaction product. Addition of $CH_2:CHMe$, but not of C_2H_4 or n - C_4H_{10} , retards decomp. of C_2H_6 at >60 mm. and 612°.

R. T.

Mechanism of polymerisation reactions. H. MASH (Naturwiss., 1937, 25, 753—757).—A review.

Kinetics of polymerisation.—See A., II, 3.

Decomposition of hypochlorites. III. Kinetics of decomposition of aqueous hypochlorites in presence of ammonia. A. P. ZAKOSCHTSCHIKOV, R. G. NESHELSKAJA, and N. A. PICHUNOVA (J. Appl. Chem. Russ., 1937, 10, 1380—1402).—The rate of decomp. of $NaOCl$ in presence of aq. NH_3 is at a max. with 1 mol. of NH_3 per 2 mols. of $NaOCl$. The reaction is represented as $NH_4Cl + NaOCl \rightarrow NH_2Cl + NaCl + H_2O$; $NH_2Cl + NaOCl \rightarrow NHCl_2 + NaOH$; the alkalinity of the solution may thus rise during the process of activated bleaching. The temp. coeff. of the process is 1.93, as compared with 2.5 in absence of NH_3 ; the velocity of reaction rises with increasing p_H , to a greater extent in conc. than in dil. solutions of $NaOCl$.

R. T.

Oxidation of aqueous sulphite solutions. III. Mechanisms of sulphite oxidation. P. BAUMGARTEN and H. ERBE (Ber., 1937, 70, [B], 2235—2264; cf. A., 1936, 434).—The oxidation of aq. sulphite has been studied in the presence of substances capable of yielding stable compounds with the unstable intermediates. In addition to Cu^{II} salts (*loc. cit.*), KSO_4 , HSO_5 , H_2O_2 , and the electric current have been used for oxidation and C_5H_5N , $CO(NH_2)_2$, dioxan, and glycine as indicators; NH_3 , H_3BO_3 , alkali fluoride, and excess of sulphite are useful if used at high concn. All the indicators have pronouncedly co-ordinative, unsaturated character; saturated compounds (SO_4'' , PO_4''' , CO_3'') are ineffective. Three types of sulphite oxidation are distinguished. Cu^{II} salts and HSO_5 give characteristically 1-pyridiniumsulphonic acid (I) in addition to SO_4'' and S_2O_6'' ; $2Cu^{II} + C_5H_5N + SO_3'' \rightarrow 2Cu^+ + C_5H_5N^+ \cdot SO_3 \cdot O^-$ and $SO_3(O \cdot OH)O^- + C_5H_5N + SO_3'' \rightarrow C_5H_5N^+ \cdot SO_2 \cdot O^- + SO_4'' + OH^-$. Anodic oxidation and KSO_4 do not afford (I) but the yield of dithionate ($2SO_3'' - 2e \rightarrow S_2O_6''$ and $S_2O_8'' + 2SO_3'' \rightarrow S_2O_6'' + 2SO_4''$) is \gg in the absence of C_5H_5N under similar conditions. In addition SO_4'' is produced. Only with KSO_4 are 2- and 3-pyridylpyridinium salts (II) produced. These are produced incomparably more rapidly than from C_5H_5N and KSO_4 alone so that their production is intimately related to sulphite oxidation. With H_2O_2 , even in presence of C_5H_5N , SO_4'' is almost exclusively produced, the formation of (I) and (II) not being detectable. The presence of C_5H_5N causes no increase of S_2O_6'' . If oxidation is effected in presence of another indicator, anodic oxidation is accompanied by formation of a greatly increased amount of S_4O_6'' .

In presence of NH_3 anodic oxidation, HSO_4^- , or KSO_4^- , but not Cu^{II} salts, cause production of $\text{NH}_2\cdot\text{SO}_3\text{H}$; except in the case of anodic oxidation the yield of $\text{S}_2\text{O}_6^{--}$ does not exceed that observed in H_2O . Oxidation in alkaline solution of approx. const. $[\text{OH}^-]$ is a change of the second order but the determinations do not permit conclusions with regard to definite intermediate reactions. In explanation of the changes the production of monothionic ions (*A*) and isomonothionic ions (*B*) is assumed. The evidence of discharge of SO_3^- at S or O is regarded as dependent on the oxidising agent, *B* being intermediate when (I) is produced in presence of $\text{C}_5\text{H}_5\text{N}$ whereas *A* is prominent wherever $\text{S}_2\text{O}_6^{--}$ is the characteristic product. The probable reaction is $\text{C}_5\text{H}_5\text{N} + \text{A} \rightarrow \text{C}_5\text{H}_5\text{N} - \text{A} \rightarrow (+\text{A}) \text{S}_2\text{O}_6^{--} + \text{C}_5\text{H}_5\text{N}$. Analogous additive intermediates are assumed with $\text{CO}(\text{NH}_2)_2$, dioxan, glycine, H_3BO_3 , F^- , and SO_3^{--} . The failure of coordinatively unsaturated H_2O to give an enhanced yield of $\text{S}_2\text{O}_6^{--}$ is attributed to the presence of a mobile proton which renders isomerisation possible, so that contact with *A* causes removal of the superfluous charge with production of H_2SO_4 thus: $\text{H}_2\text{O} + \text{A} \rightarrow \text{H}_2\text{O} - \text{A} \rightarrow (+\text{A}) \text{H}_2\text{SO}_4 + \text{SO}_3^{--}$. The action of NH_3 is similar to that of H_2O for the same cause: $\text{NH}_3 + \text{A} \rightarrow \text{NH}_3 - \text{A} \rightarrow (+\text{A}) \text{NH}_2\cdot\text{SO}_3\text{H} + \text{SO}_3^{--}$. The production of $\text{NH}_2\cdot\text{SO}_3\text{H}$ by the anodic oxidation of SO_3^{--} solutions containing NH_3 is not accompanied by diminution of the $\text{S}_2\text{O}_6^{--}$ yield and is conditioned by the peculiar conditions of the experiment such as the located discharge of *A* at the surface of the electrode. The production of (II) is explained: $\text{S}_2\text{O}_8^{--} + \text{SO}_3^{--} \rightarrow \text{SO}_4^{--} + \text{A} + \text{B}$ and $2\text{B} + 2\text{C}_5\text{H}_5\text{N} + \text{A} \rightarrow \text{HSO}_4^- + [\text{C}_5\text{H}_5\text{N}\cdot\text{C}_5\text{H}_5\text{N}] + \text{SO}_4^{--} + \text{SO}_3^{--}$, and as concurrence reaction, $\text{B} + \text{SO}_3^{--} \rightarrow \text{SO}_4^{--} + \text{A}$. In alkaline solution SO_4^{--} can be used in the discharge of OH^- which can then react: $\text{OH}^- + \text{SO}_3^{--} \rightarrow \text{OH}^- + \text{A}$. Oxidation by H_2O_2 leading rapidly to the almost exclusive formation of SO_4^{--} is unaffected by the presence of $\text{C}_5\text{H}_5\text{N}$ or similar indicators and can therefore take place only to a completely subordinate extent through intermediates of the type described above. The main process is in all probability an immediate transference of O from H_2O_2 to SO_3^{--} , thus: $\text{H}_2\text{O}_2 + \text{SO}_3^{--} \rightarrow \text{SO}_4^{--} + \text{H}_2\text{O}$.

(A.) $\begin{array}{c} \cdot\cdot \\ \cdot\text{O} \\ \cdot\cdot \\ \cdot\text{O}:\text{S} \\ \cdot\cdot \\ \cdot\text{O} \\ \cdot\cdot \end{array}$ (B.) $\begin{array}{c} \cdot\cdot \\ \cdot\text{O} \\ \cdot\cdot \\ \cdot\text{O}:\text{S}:\text{O} \\ \cdot\cdot \\ \cdot\text{O} \\ \cdot\cdot \end{array}$

Steric factor in reactions in solution. W. BRENSCHEDE (Z. physikal. Chem., 1937, 180, 403—404; cf. A., 1937, I, 522).—Polemical against Hückel (*ibid.*, 86, 622).

Kinetics of addition of HOCl to double linkings. IV. HOCl and Δ^{β} -butene- $\alpha\delta$ -diol. E. A. SCHILOV and N. P. KANJAEV (J. Phys. Chem. Russ., 1937, 9, 123—131).—The addition of HOCl to Δ^{β} -butene- $\alpha\delta$ -diol in aq. solution at 0° is a second-order reaction in respect to HOCl. It is catalysed by HCl. In presence of alkali the reaction $\propto [\text{HOCl}][\text{OCl}^-]$.

Oxidation velocities of alkenes with peracetic acid. J. BÖESEKEN and J. STURMAN (Rec. trav. chim., 1937, 56, 1034—1038).—The rates of re-

action of several alkenes and cyclenes with AcO_2H in AcOH solution have been measured at different temp. The vals. of *E* and *B* in the Arrhenius equation $\log k = -(E/2303RT) + B$ have been calc. The reaction coeff. increases considerably as H on the unsaturated C atoms is replaced by alkyl groups; this is ascribed to the fall in the *E* vals. In the cyclic compounds the *B* vals. also fall. E. S. H.

Effect of polar groups on esterification velocities of substituted benzoic acids. R. J. HARTMAN and A. M. BORDERS (J. Amer. Chem. Soc., 1937, 59, 2107—2112).—The velocity of reaction of several substituted benzoic acids with MeOH in presence of H^+ has been determined. The effect of substituent polar groups is to increase the velocity by displacement of electrons towards the CO_2 group. The vals. of $\log k$ for the esterification agree with those predicted by Hammett's equation (A., 1937, I, 142). The non-exponential factor of the Arrhenius equation as well as the activation energy increases on passing from the rapidly to the slowly esterified acids. E. S. H.

Kinetics of the production of anthraquinone compounds from benzoylbenzoic acid derivatives.—See A., 1937, II, 507.

Stepwise mechanism of the hydrolysis of dissolved polyoxymethylene dimethyl ethers.—See A., II, 4.

Absorption of carbon dioxide. D. H. KILLEFER (Ind. Eng. Chem., 1937, 29, 1293).—The rate of absorption of CO_2 by aq. Na_2CO_3 is greatly accelerated by the presence of small amounts of CH_2O , MeOH, EtOH, Pr^iOH , soap, PhOH, Na lactate, Na alkyl sulphates, and $\text{N}(\text{C}_2\text{H}_4\text{-OH})_3$. It is inferred that the usual slowness of absorption is due to surface tension rather than to viscosity effects. J. W. S.

Kinetics of luminescence of white phosphorus. K. JABŁCZYŃSKI and H. JABŁCZYŃSKA-JĘDRZEJEWSKA (Rocz. Chem., 1937, 17, 431—435).—The velocity coeff. of extinction of the luminescence of white P is $k = (\log Q_0/Q)/t$ where Q_0 and Q are respectively the intensity of luminescence initially and at time *t*. The effect is due to formation of a protective oxide film on the P surface. R. T.

Velocity of dissolution of lead in acids. I. G. TEDESCHI (Atti R. Accad. Lincei, 1937, [vi], 25, 641—647).—Spongy Pb dissolves in 2—8N- H_2SO_4 with a velocity $\propto [\text{H}_2\text{SO}_4]^2$. The temp. coeff. of the reaction is 1.85. O. J. W.

Influence of transitional states on the rate of formation of cobalt spinel from the solid oxides. J. A. HEDVALL and L. LEFFLER (Z. anorg. Chem., 1937, 234, 235—238).—The increased reactivity of solids during the transition between two cryst. forms is exemplified by the reaction $\text{CoO} + \text{Al}_2\text{O}_3 = \text{CoO}\cdot\text{Al}_2\text{O}_3$. With Al_2O_3 which has been dried at 800° there are sudden increases in reaction rate at about 900° and 1000° corresponding with the formation of the γ - and α - Al_2O_3 lattices, respectively. If, however, the Al_2O_3 has been ignited at 1100° these effects are not found. If Co_3O_4 is used instead of CoO the reaction rate is greater owing to the formation of "nascent" CoO, and particularly when the oxides are heated in N_2 instead of O_2 . F. J. G.

Influence of magnetic transformations on the speed of formation of ferrites. H. FORESTIER and R. LILLE (Compt. rend., 1937, 205, 848—850).—Mixtures of Fe_2O_3 and various co-pptd. oxides were heated for 0.5 hr. at 400—850°, and the variation in magnetisation was studied at room temp. The curves of magnetisation against temp. show a max. at 675°, indicating an increase in the speed of formation of ferrites in the neighbourhood of the Curie point of Fe_2O_3 . Further max. appear: $\text{Fe}_2\text{O}_3, \text{NiO}$ 590°, $\text{Fe}_2\text{O}_3, \text{BaO}$ 460°, $\text{Fe}_2\text{O}_3, \text{PbO}$ 465°, $\text{Fe}_2\text{O}_3, \text{CuO}$ 460°, and $\text{Fe}_2\text{O}_3, \text{SrO}$ 480°. R. S. B.

Combustion of detonation of solid explosives.—See B., 1937, 1411.

Deuterium in catalytic and photochemical researches. H. S. TAYLOR (J. Chim. phys., 1937, 34, 529—535).—A summary of published work, with particular reference to the reactions of D_2 with hydrocarbons. E. S. H.

Reduction of peroxysulphate by manganous ion and by hydrazine with silver ion as catalyst. A. O. DEKKER, H. A. LÉVY, and D. M. YOST (J. Amer. Chem. Soc., 1937, 59, 2129—2131).—The reactions are: (1) $\text{S}_2\text{O}_8^{2-} + \text{Mn}^{2+} + 2\text{H}_2\text{O} = 2\text{SO}_4^{2-} + \text{MnO}_2 + 4\text{H}^+$, (2) $2\text{S}_2\text{O}_8^{2-} + \text{N}_2\text{H}_5^+ = 4\text{SO}_4^{2-} + \text{N}_2 + 5\text{H}^+$. The rate $\propto [\text{S}_2\text{O}_8^{2-}]$ and $[\text{Ag}^+]$ and is independent of $[\text{Mn}^{2+}]$ or $[\text{N}_2\text{H}_5^+]$. The sp. reaction rates for Mn^{2+} and N_2H_5^+ differ but little. The mechanism suggested involves the oxidation of Ag^+ to Ag^{2+} by means of $\text{S}_2\text{O}_8^{2-}$, followed by rapid reaction between Mn^{2+} or N_2H_5^+ and Ag^{2+} , forming Ag^+ . The effect of the ionic strength on the rate of each reaction is in qual. agreement with predictions from Brönsted's theory. E. S. H.

Oxidation of phenols by ozone in aqueous solution and in sulphuric acid solutions of various concentrations, in presence of manganese sulphate. L. I. KASCHTANOV and O. N. OLESCHTSCHUK (J. Gen. Chem. Russ., 1937, 7, 1413—1416).—The oxidation of PhOH by O_3 in H_2O is not a chain reaction. The velocity of oxidation $\propto [\text{H}_2\text{SO}_4]$ of the solution. The reaction is catalysed by MnSO_4 . R. T.

Catalytic action of copper oxide in the combustion of hydrogen. G. TEDESCHI (Gazzetta, 1937, 67, 609—611).—A reply to a criticism by van Cleave and Rideal (A., 1937, I, 315). O. J. W.

Stability of solutions of trivalent niobium in sulphuric acid. S. J. KIEHL, R. L. FOX, and H. B. HARDT (J. Amer. Chem. Soc., 1937, 59, 2395—2399).—The extent of the reaction $\text{Nb}^{III} + 2\text{H}^+ \rightleftharpoons \text{Nb}^V + \text{H}_2$ has been determined by measuring $[\text{Nb}^{III}]$ at different time intervals; the catalytic influence of Pt-black has been determined by measuring the increase of pressure at const. vol. Unidentified blue crystals were observed in conc. solutions of $[\text{Nb}^{III}]$ in 3M- and 6M- H_2SO_4 . Red crystals appearing during the reduction of 6—9M- H_2SO_4 saturated with Nb_2O_5 and KHSO_4 are tentatively assigned the empirical formulæ $4\text{K}_2\text{O}, 2\text{Nb}_2\text{O}_5, \text{Nb}_2\text{O}_5, 12\text{H}_2\text{SO}_4, 12\text{H}_2\text{O}$ and $4\text{K}_2\text{O}, 2\text{Nb}_2\text{O}_5, \text{Nb}_2\text{O}_5, 13\text{H}_2\text{SO}_4, 16\text{H}_2\text{O}$. E. S. H.

Action of hydrogen fluoride on vanadium-barium catalysts for oxidation of sulphur dioxide.—See B., 1937, 1335.

Preparation of oxide catalysts by deposition of aerosols. II. Intermediate compounds in the catalytic oxidation of carbon monoxide on ferric oxide. K. IVANOV and N. KOBOSSEV (J. Phys. Chem. Russ., 1937, 9, 1—17).—The reaction $2\text{CO} + \text{O}_2 = 2\text{CO}_2$ is of zero order on a Fe_2O_3 aerosol at 400°, and of the first order at 500—550°. It is of the first order on ordinary Fe_2O_3 powders at all temp. The activation energy is the same in both cases (8.15 kg.-cal.). Strong sorption of CO (up to 1.3 mols. per mol. of Fe_2O_3) occurs during the reaction. The activation energy of sorption is 4.45 kg.-cal. on the Fe_2O_3 powder and 2.04 kg.-cal. on the aerosol. Results can be explained by the assumption of the existence of intermediate compounds $(\text{Fe}_x\text{O}_y)(\text{CO})_z$, with $x : y > 2 : 3$. E. R.

Catalytic dehydration of ethyl alcohol by alumina. II. W. A. ALEXANDER, W. R. HORN, and L. A. MUNRO (Canad. J. Res., 1937, 15, B, 438—446; cf. A., 1935, 1210).—At 450° 100% of C_2H_4 is produced and is not affected by the H_2O content of the Al_2O_3 , but at 318° the max. of 25% C_2H_4 corresponds with an optimum H_2O content of 1%, whilst the optimum H_2O content (5%) for formation of Et_2O is independent of temp. The effect of ageing the catalyst also exhibits a max. F. R. G.

Autoxidation of monolayers. I. Mechanism of autoxidation of maleic anhydride- β -eläostearin. G. GEE and E. K. RIDEAL. II. Catalysts and inhibitors. G. GEE (J. Chem. Physics, 1937, 5, 794—801, 801—807).—I. Monolayers of maleic anhydride- β -eläostearin (I) on 0.01N- H_2SO_4 or -HCl spontaneously undergo a series of reactions identifiable with the normal process of drying of an oil, autoxidation being followed by polymerisation of the oxidation product (A., 1935, 1080; 1936, 434). The autoxidation of the double linking remote from the glyceride residue is now considered and the effects of pressure and temp. over a wide range of p_{H} are investigated. It is shown that the substrate is involved in the oxidation and that p_{H} has a profound effect. The effective oxidising agent is thus shown to contain no element except O or H and a free radical mechanism involving HO_2 and O_2' is postulated. The kinetics of the proposed mechanism are given and abs. vals. of such constns. as can be determined are consistent with the physical picture of the process.

II. The rate of oxidation of (I) is accelerated by the addition of CoSO_4 and increases progressively as the $[\text{Co}]$ increases. With other metals more complicated results are obtained. Addition of pro- and anti-oxygens to the substrate gave complex results; the behaviour of quinol has been studied in detail. The catalytic effect depends on the p_{H} of the substrate. Results are discussed in the light of the free radical mechanism postulated above and a semi-quant. treatment, which accounts satisfactorily for the principal features of the results, has been developed. W. R. A.

Negative catalysts in the hydrogenation of fatty oils.—See B., 1937, 1366.

Catalytic hydrogenation of oils.—See B., 1937, 1297.

Dominant processes in electrolytic separation of hydrogen on active palladium and platinum electrodes. L. KANDLER, C. A. KNORR, and C. SCHWITZER (*Z. physikal. Chem.*, 1937, **180**, 281—304).—Partly an amplification of a previous paper (A., 1936, 1343). If the electrode is sufficiently active, the rate of the electrode process as a whole is, even in strongly alkaline solution, determined by the rate of diffusion of mol. H_2 . It has been deduced theoretically and confirmed experimentally that the electrode potential is given by $E = -0.029 \log [(AF + I)/AF]$, where I is the c.d. and AF the amount of H_2 diffusing to the electrode per sec. The electrode is probably able to remove protons, not only from H_3O^+ ions, but also from H_2O , an analogous process possibly constituting the mechanism of the passage of current through dielectric liquids. R. C.

Platinum electrode as catalyst for the activation of hydrogen. II. M. CALVIN and H. E. DYAS (*Trans. Faraday Soc.*, 1937, **33**, 1492—1495).—Further experiments confirming conclusions previously published (A., 1936, 1212) are described. F. L. U.

Anodic formation of chlorine dioxide in the electrolysis of perchloric acid. G. GRUBE and K. H. MAYER (*Z. Elektrochem.*, 1937, **43**, 859—863).—When conc. solutions of $HClO_4$ are electrolysed at high c.d. more O_2 is liberated at the anode than corresponds with $2ClO_4^- + H_2O = 2HClO_4 + 0.5O_2 + 2e^-$. ClO_2 and $HClO_3$ are also formed at the anode. The phenomena agree quantitatively with the view that a part of the discharged ClO_4^- ion breaks up into ClO_2 and O_2 , whilst a part of the ClO_2 is then oxidised electrolytically to $HClO_3$. F. J. G.

Discharge of alkali metals during electrolysis of carnallite.—See B., 1937, 1358.

Silver oxide positive of the alkaline accumulator.—See B., 1937, 1362.

Electrodeposition of copper on aluminium after preliminary chemical oxidation.—See B., 1937, 1359.

Formation of complexes in some salt melts. G. WIRTHS (*Z. Elektrochem.*, 1937, **34**, 486—491).—Electrolysis of fused $PbCl_2$ (alone and mixed with KCl) containing Th-B in a divided cell with a capillary between the two compartments and determinations of the radioactivity of the contents of the two compartments after several hr. indicated that no complex $PbCl_4^{2-}$ or $PbCl_3^-$ anions are formed in pure $PbCl_2$ but that such occur in KCl- $PbCl_2$ mixtures to an extent which is the greater the higher is the % of KCl in the mixture. The cathode yield of Cd when the metal is electrolysed under a bath of molten $CdCl_2$ saturated with Cd is always $>100\%$ calc. on Cd^{2+} ; the existence of Cd_2Cl_2 in the metal is, therefore, inferred. A. R. P.

Behaviour of lead in nickel-plating baths.—See B., 1937, 1358.

Electrolyses with alternating current and tin electrodes in alkaline medium. E. VALLESI

(*Annali Chim. Appl.*, 1937, **27**, 157—164).—The electrolysis of 0.2—4.0N-NaOH solutions with a.c. (50 cycles per sec.) and Sn electrodes has been studied. At room temp. and with concns. $> N$ a black deposit of Sn is formed on the electrodes, no H_2 is evolved, and Sn is dissolved as stannate. At higher temp. and with concns. $< N$ the Sn deposit is non-adherent and is dissolved as stannite with evolution of H_2 .

O. J. W.

Electrodeposition of tin.—See B., 1937, 1358.

Action of a dark electric discharge on a mixture of nitric oxide and hydrogen. Production of ammonia. C. ZENGHELIS and K. EVANGELIDIS (*Praktika*, 1935, **10**, 208—212; *Chem. Zentr.*, 1936, i, 3789; cf. A., 1935, 176).—Formation of NH_3 was a max. (65 vol. %) at low pressures, high c.d., and in the range 14—153°. N_2H_4 and NH_2OH were not detected. The NH_3 yield is lowered by a large excess of H_2 . H. J. E.

Photochemical reactions. G. K. ROLLEFSON (*Z. physikal. Chem.*, 1937, **B**, **37**, 472—473).—A reply to criticisms (A., 1936, 1228; 1937, I, 91) of mechanisms suggested by the author for the formation of $COCl_2$ and the bromination of C_2H_2 . R. C.

Photochemical studies. XXV. Direct photochemical decomposition of nitrous oxide. W. A. NOYES, jun. (*J. Chem. Physics*, 1937, **5**, 807—812).—The no. of mols. of gas uncondensed by liquid air, produced from N_2O per quantum adsorbed in the presence and absence of Hg vapour, indicates partial primary decomp. into N_2 and O, but formation of NO and N cannot be definitely excluded. The mechanism involves the subsequent reactions $O + N_2O = 2NO$ and $O + O = O_2$. Weakness of the absorption suggests possible formation of N_2 and O in their normal electronic states. W. R. A.

Topography of the latent photographic image. A. KEMPF (*Z. wiss. Phot.*, 1937, **36**, 235—250).—The distribution of the latent image in the interior of a AgBr grain was investigated for a specially prepared large- and uniform-grained emulsion. The surface of the grains (size and no. measured at each stage under the microscope) was treated alternately with a solvent for Ag [$0.1N-(NH_4)_2S_2O_8$] to remove the latent image in the surface exposed, and with a AgBr solvent (1% $Na_2S_2O_3 + 1\%$ KBr, + 5 c.c. of 10% NaOH per 100 c.c. of the solution of the first two) to remove a suitably thick layer from the grain. The latent image in the surface layer at each stage was determined by development and measurement of the density of blackening, and also by determination of Ag; these methods all led to closely similar results. The original exposure of the emulsion was made with visible light (40-watt lamp) and also by X-rays. Results show that the rate of fall in concn. of the latent image from the outside to the interior of the AgBr grain is slow, although it is greater near the surface than further in the interior; the rate of fall is considerably less in the case of the X-ray image. With physical development, whereby Ag nuclei remaining after each stage of AgBr dissolution will be developed, thus leaving the same amount of developable centres, a stepped curve is to be expected, and is obtained, in

place of the smooth curve. It is noted that the latent X-ray image is much more resistant to Ag solvent than the ordinary-light image. It is thus proved that the latent image is distributed throughout the grain; such fall as occurs in the interior is attributed to a real reduction in nucleus formation. Light absorption cannot occur in the case of X-rays. With ordinary light, absorption may also contribute to the decreasing concn. Ordinary development reduces only the exterior layer of the grains. J. L.

Effect of concentration on the production of the latent photographic image by hydrogen peroxide. M. W. JONES and J. M. BLAIR (J. Chem. Physics, 1937, 5, 835—836).—Examination of data obtained concerning the latent image produced by various concns. of H_2O_2 suggests that initially there is a net reaction of second order and indicates an optimum concn. for production of max. density.

W. R. A.

Mass and distribution of photolytic silver in silver bromide-gelatin emulsions of different grain size. III. Mass and distribution of photolytic silver in films without nitrite. W. MEIDINGER (Physikal. Z., 1937, 38, 905—919; cf. B., 1937, 151; A., 1937, I, 626).—The amount of photolytic Ag formed by a given amount of radiation depends on grain size, being for the larger-grained > for the smaller-grained emulsions. The max. quantities of Ag deposited at const. intensity of radiation are smaller for small-grained emulsions. The amount of Ag formed is for damp films > for dry ones, and there is a variation in the amount of Ag deposited with temp. of film during exposure. The addition of an acceptor for the Br eliminated increases the photo-efficiency 60 times. The effect depends on the concn. of the acceptor, which also decides the effectiveness of the acceptor in reducing solarisation. The photolytic Ag may be divided into inner and surface Ag. The amount of surface Ag increases linearly with exposure, whilst the curve of inner Ag reaches a limit. There is no connexion between the mass of photolytic Ag and solarisation. A. J. M.

Photochemical transformations of methane, ethane, propane, and n-butane. III. W. KEMULA and A. DYDUSZYŃSKI (Rocz. Chem., 1937, 17, 423—430).—The effect of ultra-violet illumination of the gaseous hydrocarbons is as follows: $CH_4 \rightarrow CH_3 \cdot + H_2$; $2CH_3 \cdot \rightarrow C_2H_4 \rightarrow$ polymerides; $C_nH_{2n+2} \rightarrow C_nH_{2n} + H_2$; $C_nH_{2n} \rightarrow$ polymerides.

R. T.

Photochemical oxidation of trichloroethylene to dichloroacetyl chloride sensitised by chlorine. K. L. MÜLLER and H. J. SCHUMACHER (Z. physikal. Chem., 1937, B, 37, 365—373; cf. A., 1937, I, 370).—In light of λ 436 m μ , a yield of $CHCl_2 \cdot COCl$ > 95% results: $C_2HCl_3 + 0.5O_2 = CHCl_2 \cdot COCl$. The rate \propto the intensity of absorbed light, is independent of $[C_2HCl_3]$ and $[O_2]$, and has the temp. coeff. ~ 1.12 . At 95° the quantum yield is ~ 40 . The formation of a peroxide, $C_2HCl_4O_2$, is probably an essential step in the chain mechanism. A side reaction is $C_2HCl_3 + 1.5O_2 = CO_2 + HCl + COCl_2$.

R. C.

Photochemical decomposition of aliphatic alcohols in aqueous solution. L. FARKAS and Y.

HIRSHBERG (J. Amer. Chem. Soc., 1937, 59, 2450—2453).—Under the action of light from a Hg arc, aq. MeOH, EtOH, and PrⁿOH decompose yielding H_2 and the corresponding aldehyde; the aldehyde is partly decomposed in a subsequent photochemical reaction. The quantum yield for the decomp. of EtOH is 0.8. PrⁿOH yields H_2 and $COMe_2$, which is further decomposed in a subsequent reaction.

E. S. H.

Photolysis of aliphatic aldehydes. V. Acraldehyde. F. E. BLACET, G. H. FIELDING, and J. G. ROOF (J. Amer. Chem. Soc., 1937, 59, 2375—2379; cf. A., 1936, 437).—A correlation between photochemical polymerisation and the absorption spectrum has been found. Between λ 3660 and 3130 (sharp-banded absorption) the quantum yield Φ_p is < 0.5; at λ 3020 (very diffuse absorption) $\Phi_p = 1.0$; at λ 2804 (border between banded and continuous absorption) $\Phi_p = 10$; at λ 2654 and 2537 (continuous region) $\Phi_p = 19$. The large quantum yields are explained by a mechanism involving free radicals. An induction period in polymerisation has been observed.

E. S. H.

Photochemical decomposition of aliphatic aldehydes in aqueous solutions. Y. HIRSHBERG and L. FARKAS (J. Amer. Chem. Soc., 1937, 59, 2453—2457).—The decomp. of aq. CH_2O (I), MeCHO (II), acetaldol (III), crotonaldehyde (IV), and EtCHO (V) under the influence of light from the Hg arc has been investigated. (III) is formed from MeCHO according to $2MeCHO = OH \cdot CHMe \cdot CH_2 \cdot CHO$, and it is suggested that the formation of an aldehyde mol. with free valencies is the photochemical primary process. The quantum yield (no. of aldehyde mols. disappearing per absorbed quantum) is 0.5 for (I), 2.5 for (II), $\ll 1$ for (IV), and 1.8 for (V). E. S. H.

Photo-oxidation of acetone vapour. P. FUGASSI (J. Amer. Chem. Soc., 1937, 59, 2092—2093).—The quantum yield of the photo-oxidation of $COMe_2$ vapour at 25° using λ 3130 Å. is 0.24. Assuming that 1 mol. of O_2 reacts with 1 mol. of $COMe_2$, the quantum yield for the oxidation of $COMe_2$ = that for its decomp. A similar oxidation reaction of $COMe_2$ occurs in the electrical discharge.

E. S. H.

Free radicals in solution. D. H. HEY and W. A. WATERS (Nature, 1937, 140, 934—935).—The close similarity between the properties of free alkyl radicals produced photochemically in solution (A., 1937, I, 471) and those of the free aryl radicals formed by the decomp. of diazo-hydroxides etc. (A., 1937, II, 97) is discussed.

L. S. T.

Photosynthesis of carbohydrates in vitro. E. C. C. BALY (Nature, 1937, 140, 930).—Carbohydrates are photosynthesised when a surface of NiO coated with an adsorbed layer of hydrated CO_2 is irradiated with white light. The two successive photochemical reactions are: $4NiO \cdot CO_2 \cdot H_2O + h\nu_1 = 2Ni_2O_3 \cdot CHOH$ and $2Ni_2O_3 \cdot CHOH + h\nu_2 = 2Ni_2O_3 + CHOH$, where $h\nu_1$ is a quantum of blue light ($\lambda = 4000$ Å.) and $h\nu_2$ one of red light ($\lambda = 6400$ Å.), and CHOH is a mol. of activated formaldehyde which polymerises on the surface to a carbohydrate. These processes are followed by the dark

reaction $2\text{Ni}_2\text{O}_3 = 4\text{NiO} + \text{O}_2$. The first product of photosynthesis is a complex carbohydrate which is unstable and polymerises or condenses to a more complex carbohydrate. This is stable in solution, and is not hydrolysed by acid or by diastase. It appears to be the hitherto unknown parent of a starch. The essential for success is a surface of a true cryst. lattice of NiO, and all failures to achieve photosynthesis have been due to the dispersion of the Ni compound by alkali. L. S. T.

Becquerel effect and photochemical reactivity of coloured organic molecules. (MLLE.) C. STORA (J. Chim. phys., 1937, **34**, 536—597; cf. A., 1935, 429, 586, 682).—A general review and discussion. The effect is caused by the photochemical reaction between the photo-sensitive substance and the surrounding medium. In the case of oxidised mols. in equilibrium with their reduction products the effect depends on the lability of the oxidation-reduction equilibrium. The mechanism is discussed.

E. S. H.

Effect of the simultaneous action of radiations of different frequencies on the bromination of cinnamic acid and stilbene. J. C. GHOSH, S. K. BHATTACHARYYA, and M. L. N. MURTHI (J. Indian Chem. Soc., 1937, **14**, 452—462).—The velocities of reaction in CCl_4 have been determined iodometrically at 31° under the simultaneous influence of two radiations of different λ selected from 546, 436, and 406 m μ . The combined effect of two radiations is always $<$ the sum of the two individual effects, and the velocity coeff. for monochromatic radiation \propto the square root of the intensity of the absorbed radiation.

E. S. H.

Long life of excited organic molecules, exemplified by the rubrene oxidation. H. GAFFRON (Z. physikal. Chem., 1937, **B**, **37**, 437—461).—Data supporting the theory of the oxidation previously advanced (A., 1933, 1214) are recorded. In the photo-oxidation of rubrene (I) in C_6H_6 solution the quantum yield, γ , rises rapidly with concn., c , to a limit of 1. The effect of the O_2 pressure, p , on γ is negligible when c is large and considerable when c is small. γ is not affected by the intensity or λ of the absorbed radiation. Contrary to Koblitz and Schumacher's findings (A., 1937, **I**, 255) γ for high c does not converge continuously to zero as p falls, but when the O_2 is used up γ abruptly falls from a large val. to zero. The high val. of γ for small p can be explained only by supposing that there is in addition to the ordinary short-lived active form of (I) an activated form which is comparatively long-lived, and during its life every collision leads to reaction. Evidence of the presence of two active forms of (I) is also afforded by the observation that if c is large and a foreign colouring matter is present as sensitiser, γ is independent of p , whereas if c is small and a considerable amount of a foreign acceptor is present γ falls with p . In dil. solution (I) transports O.

R. C.

Oxidation of rubrene in light. H. J. SCHUMACHER (Z. physikal. Chem., 1937, **B**, **37**, 462—467).—Comments on Gaffron's paper (cf. preceding abstract).

R. C.

Differential aëration as a factor in the localisation of corrosion.—See B., 1937, 1355.

Corrosion of metals.—See B., 1937, 1355.

Rôle of diffusion in the oxidation of copper and iron. L. CZERSKI (Rocz. Chem., 1937, **17**, 436—443).—Oxidation of Cu in air at 950° consists initially of the processes $\text{Cu} \rightarrow \text{Cu}_2\text{O} \rightarrow \text{CuO}$; the surface layer of CuO is relatively impermeable to O_2 , so that dissociation of CuO to Cu_2O and O or O_2 takes place. At the same time Cu diffuses outwards from the metal surface to the oxide layer, and undergoes oxidation at the boundary of the CuO layer; this process is responsible for the oxidation of the bulk of the metal. Analogous results are found for Fe.

R. T.

Displacement of gold from chloride solutions by hydrogen at high pressures. V. G. TRONEV (Compt. rend. Acad. Sci. U.R.S.S., 1937, **16**, 317—320).— H_2 at 1 atm. reduces HAuCl_4 (0.02N) to Au^{I} at first, and a ppt. of Au appears only after an induction period of about 1 hr. In presence of an excess of NaCl this is increased to several hr. Complete pptn. of the Au is not possible. At 100 atm. without stirring Au is pptd. very slowly, but the rate of reaction increases rapidly with increasing speed of stirring, whilst at a given speed of stirring the rate of reaction increases with increasing pressure. Excess of HCl causes a decrease in the rate of reaction. With rising temp. the rate of reaction increases only slightly from 18° to 50° , but much rapidly from 50° to 75° .

F. J. G.

Chemical and electrochemical factors in the attack of acids on metals. Acid corrosion of magnesium and aluminium. A. QUARTAROLI and O. BELFIORI (Gazzetta, 1937, **67**, 565—573; cf. A., 1937, **I**, 250).—The action of aq. solutions of acids on Mg and on Al is compared. With Mg the metal is attacked mainly by H_2O and by mols. of undissociated acid, whereas with Al the action is mainly due to H^+ . The action on pure Al of N-HCl containing small amounts of H_2O_2 is ascribed to the formation of a spongy, loosely adherent oxide film, which disturbs the polarised Al surface and allows it to be attacked by H^+ .

O. J. W.

Crystallisation of calcium fluoride from the fused state. E. V. ZECHOVITZER (J. Phys. Chem. Russ., 1937, **9**, 88—99).— CaF_2 was fused in ZrO_2 crucibles. The largest single crystals obtained were < 5 mm. No transparent agglomerations could be obtained by re-melting. One of the main causes of failure was the decomp. of CaF_2 with the formation of $\approx 3\%$ of CaO.

E. R.

Action of bromine on mercuric oxide. M. LEMARCHANDS and P. PIERRON (Bull. Soc. chim., 1937, [v], **4**, 1773—1783).—The first product is HgOBr_2 , which decomposes to form HgBr and either $\text{Hg}(\text{BrO}_3)_2$ or $\text{Hg}(\text{BrO})_2$ according to the conditions.

E. S. H.

Action of mercury on solutions of potassium chromate and dichromate. R. PARIS (Bull. Soc. chim., 1937, [v], **4**, 1803—1811).—Hg remains almost unchanged in aq. $\text{K}_2\text{C}_2\text{O}_4$, but the reaction $2\text{K}_2\text{CrO}_4 + 6\text{Hg} + 5\text{H}_2\text{O} = 3\text{Hg}_2\text{O} + 2\text{Cr}(\text{OH})_3 +$

4KOH occurs slowly. Hg slowly transforms neutral aq. $K_2Cr_2O_7$ into K_2CrO_4 and $H_2Cr_2O_7$; in presence of HCl, Cr^{+++} is formed quantitatively, whilst with H_2SO_4 or HNO_3 Hg_2CrO_4 is formed; in presence of AcOH slow but quant. reduction to Cr^{+++} occurs.

E. S. H.

Mercury infection of aluminium. A. QUARTAROLI and O. BELFIORI (Gazzetta, 1937, 67, 557—565). The action of N-HCl and of N- HNO_3 on Al, with and without previous deposition of traces of Hg on the Al, has been studied. The results are used to obtain information regarding the state of the Al_2O_3 film on the Al surface. A freshly formed film completely covers the Al surface and renders it passive towards HCl even after treatment with a dil. $HgCl_2$ solution. An ordinary Al surface, which is covered with a more or less aged film, when treated with dil. $HgCl_2$ solution, is rapidly attacked by N-HCl.

O. J. W.

Structure, energy content, and other properties of active substances. XXII. Size of the primary particles, secondary structure, and energy content of various active γ -aluminium oxides. R. FRICKE, F. NIEMANN, and C. FEICHTNER (Ber., 1937, 70, [B], 2318—2330).—Differences in the energy content amounting to nearly 4 kg.-cal. per g.-mol. of Al_2O_3 are observed between the various active conditions of γ - Al_2O_3 obtained by heating at 500—800° $Al(OH)_3$ pptd. from hot solution (very finely-divided böhmite). It is shown röntgenographically that these differences are not due to differences in the lattice const. or to lattice distortions. The primary particles of all specimens are very small and diminish as the energy content increases. The phenomena resemble closely those observed with γ - Fe_2O_3 . The relationship is linear between energy content and primary particle size (or extent of mol.-surface calc. on the assumption of cubical particles). Primary particle size therefore here determines the energy content. The slope of the graph indicates a total surface energy of 560 ergs per sq. cm. for γ - Al_2O_3 ; this no. is a lower limit. Investigation of the preps. by Hahn's emanation method using radiothorium gives for the initial hydroxide a max. emanatory power ($EmV = 58\%$); the emanatory power of the oxides produced therefrom diminishes as the temp. is raised and the duration of heating is prolonged. The "surfaces" reckoned from the EmV vals. are somewhat < those calc. from the size of the primary particles and have no clear relationship to the energy content of the specimens. The results obtained explain the great suitability of γ - Al_2O_3 as catalyst and catalyst carrier. It is remarkable that after comparatively drastic ignition (6 hr. at 800°) the primary particles are still very small (40 Å.) and the EmV very considerable (33%). This prep. is considered to have an energy content about 5.5 kg.-cal. per mol. > that of the form poorest in energy. The hygroscopicity of γ - Al_2O_3 is also explained; this persists after ignition at 1000° and disappears when γ - Al_2O_3 passes into α - Al_2O_3 above 1100°.

H. W.

Corrosion probability [for aluminium].—See B., 1937, 1357.

Preparation of aluminium silicofluoride. V. SHTSCHERBAKOVA (J. Appl. Chem. Russ., 1937, 10,

1403—1404).— $Al_2(SiF_6)_3$ is prepared from $Al(OH)_3$, $HF-H_2SiF_6$, and SiO_2 gel.

R. T.

Compounds of gallium. II. P. NEOGI and S. K. NANDI (J. Indian Chem. Soc., 1937, 14, 492—494; cf. A., 1936, 1217).— $GaPO_4 \cdot 3H_2O$ has been obtained by (a) dissolution of $Ga(OH)_3$ in H_3PO_4 or (b) interaction of aq. $Ga(NO_3)_3$ and Na_2HPO_4 ; $Ga(ClO_3)_3 \cdot H_2O$ by double decomp. of aq. $Ga_2(SO_4)_3$ and $Ba(ClO_3)_2$; $Ga(IO_3)_3 \cdot 2H_2O$ by adding HIO_3 to a solution of Ga in HNO_3 ; $Ga(IO_3)_3 \cdot Ga_2O_3 \cdot 3H_2O$ by mixing aq. $NaIO_3$ and $Ga(NO_3)_3$. Ga bromate is unstable; it has been prepared in solution, but not isolated.

E. S. H.

Thallium sulphides, selenides, and tellurides.

I. Thallium selenides. A. BARONI (Atti R. Accad. Lincei, 1937, [vi], 25, 621—625).—The f.p. curve and X-ray examination of the system Tl - Se show that only the compounds Tl_2Se_3 and Tl_2Se exist.

O. J. W.

Chemical investigations of silicates. VI. Behaviour of enstatite, $MgSiO_3$, towards melting chlorides of bivalent metals. E. THILO (Ber., 1937, 70, [B], 2267—2272).—Exchange occurs when enstatite (I) is heated in N_2 in absence of O_2 with the molten chloride of the requisite bivalent metal, the sequence of decreasing readiness being Co^{++} , Mn^{++} , Cu^{++} , Fe^{++} , and Ni^{++} . No reaction occurs with $ZnCl_2$ or $CdCl_2$. The Debye diagrams of the products are identical with that of (I). In general reaction occurs less readily with (I) than with the metasilicate derived from talc. If O_2 is present, orthosilicates sol. in HCl are produced.

H. W.

Affinity. LXXV. Sulphides of titanium. W. BILTZ and P. EHRLICH [with K. MEISEL] (Z. anorg. Chem., 1937, 234, 97—116).—The system Ti - S has been investigated röntgenographically and (in part) tensimetrically. In addition to the known mono-, sesqui-, and di-sulphides a trisulphide and one or more subsulphides exist. TiS_3 is prepared by heating Ti or a lower sulphide with S and removing excess in vac. It resembles graphite and has $d^{20} 3.22$, heat of formation 4 kg.-cal. per g.-mol. It is sol. in hot H_2SO_4 whilst hot HNO_3 yields TiO_2 . TiS_2 and Ti_2S_3 are the upper limits of homogeneous ranges which extend down to $TiS_{1.7}$ and $TiS_{1.1}$, respectively. At high temp. the range of solid solutions extends from TiS_2 to $TiS_{1.48}$. Preps. having the ratio $S:Ti < 1 > 0.25$ do not show the lines of TiS or of Ti ; they differ from TiS in being readily attacked by HCl, yielding H_2S , and at approx. 1000° they give sublimes consisting of violet and silvery-white crystals. In TiS_3 , TiS_2 , Ti_2S_3 , TiS , and " $TiS_{0.5}$ " the at. vols. of S are 11, 12, 11, 9, and 6, respectively.

F. J. G.

Preparation and properties of the higher oxides of lead. G. L. CLARK, N. C. SCHIELTZ, and T. T. QUIRKE (J. Amer. Chem. Soc., 1937, 59, 2305—2308).—The products of heating PbO_2 , $NaOH$, and H_2O in a pressure bomb under different conditions have been identified by X-ray analysis as Pb_2O_3 and Pb_3O_8 . Large single crystals may be obtained. At higher temp. Pb_3O_4 is produced. A Pb - Na - O compound of undetermined composition is reported.

E. S. H.

Efficiency at 90° of phosphorus pentoxide as a desiccant. D. A. LACOSS and A. W. C. MENZIES (J. Amer. Chem. Soc., 1937, 59, 2471—2472).—The efficiency at 90° = that at room temp. E. S. H.

Metaphosphoric acid derived from Graham's salt. (MME.) R. SALIH (Bull. Soc. chim., 1937, [v], 4, 1724—1726).—The complexity of Na metaphosphates varies with the method of prep. When Graham's salt is pptd. by Pb⁺⁺ it undergoes a modification of structure, yielding a product which is identical with that obtained from Na₆(PO₃)₆·10H₂O.

E. S. H.

Individuality of phosphorus nitrides P₃N₅, P₄N₆, (PN)_n, and their modes of hydrolysis. I. General. II. Experimental. H. MOUREU and G. WETROFF (Bull. Soc. chim., 1937, [v], 4, 1839—1850, 1850—1857).—I. Published work is reviewed. The possibility of the existence of PN(OH)₂ is discussed.

II. The products of hydrolysis by H₂O in sealed tubes have been identified by chemical and X-ray analysis. P₃N₅ yields (NH₄)₂HPO₄ and NH₄H₂PO₄; (PN)_n gives initially NH₄H₂PO₃, which is subsequently converted into NH₄H₂PO₄ and H₂; P₂N₆ yields (NH₄)₂HPO₄, NH₄H₂PO₄, NH₄H₂PO₃, and H₂.

E. S. H.

Combined action of heat and hydrogen on alkaline-earth arsenates. H. GUÉRIN (Bull. Soc. chim., 1937, [v], 4, 1885—1895; cf. A., 1937, I, 92).—Reduction of arsenate to arsenite occurs at 350° for Ca, 400° for Sr, and 450° for Ba; decomp. of arsenite to oxide occurs at 350° for Ca, 600° for Sr, 700° for Ba; arsenide is formed only with Ba.

E. S. H.

Pharmaceutically important arsenic compounds. II.—See A., 1937, II, 491.

Exchange reactions with radio-sulphur. H. H. VOGEL and W. F. LIBBY (J. Amer. Chem. Soc., 1937, 59, 2474).—Exchange of S and radio-S occurs between S'' and S₂O₃'', but not between S'' and SO₄'' or SO₃'' and SO₄''. E. S. H.

Oxidation of aqueous sulphide solutions by hypochlorites. A. R. CHOPPIN and L. C. FAULKENBERRY (J. Amer. Chem. Soc., 1937, 59, 2203—2207).—The end-products of the reaction are S and SO₄'', which are formed in quantities depending on the concns. of the reagents, the temp., and *p_H*. High [NaOCl] and rising temp. increase the proportion of SO₄''. A min. in the production of SO₄'' occurs at *p_H* 10. E. S. H.

Behaviour of thiosulphate and the formation of higher polythionic acids in fuming hydrochloric acid. J. JANICKIS (Z. anorg. Chem., 1937, 234, 193—223).—The nature of the clear solution which is obtained when aq. Na₂S₂O₃ is dropped into fuming HCl (A., 1924, ii, 104) has been investigated. The views of Bassett and Durrant (A., 1927, 843) as to the nature of the substance present in acidified thiosulphate solutions which reduces methylene-blue are criticised, and it is suggested that this substance is H₂S₂O₃. A method for quant. analysis of the solution has been worked out, and the results indicate that it contains H₂S₂O₃, SO₂, higher polythionic acids, and a little H₂S. At 0° it deposits no S for some 8 hr.,

and during this time its composition changes continuously, [H₂S₂O₃] decreasing and [SO₂] increasing, while the no. of mols. of polythionic acids passes through a min. and their average S content through a max. corresponding approx. with H₂S₁₄O₆. Even after 24 hr., when quite turbid, the solution still contains H₂S₂O₃. The results are interpreted as follows: at the moment of prep. H₂S₅O₆ is formed according to H₂S₂O₃ + H₂O ⇌ 2H₂SO₂ and H₂SO₂ + 2HS₂O₃' → S₅O₆' + 2H₂O, whilst the formation of H₂S is due to 3H₂SO₂ ⇌ H₂S₂O₂ + SO₂ + 2H₂O and H₂S₂O₂ → SO₂ + H₂S. Subsequently the following reactions occur: S_nO₆' + H₂S₂O₃ → S_{n+1}O₆' + SO₂ + H₂O; 2S_nO₆' + 4H⁺ → (2n - 5)S + 5SO₂ + 2H₂O; S_nO₆' + S → S_{n+1}O₆'; 5H₂S₂O₃ → 2H₂S₅O₆ + 3H₂O; S₅O₆' + S₅O₆' → S_{5+a}O₆' + S_{n-a}O₆'. The stability of the solution is due to the fact that the direct decomp. to S + SO₂ is a property not of undissociated H₂S₂O₃ but of the ion HS₂O₃'.

F. J. G.

Sulphur selenium protochloride. Fractional distillation index and surface tension of mixtures of sulphur with selenium protochloride, Se₂Cl₂. A. BARONI (Atti R. Accad. Lincei, 1937, [vi], 25, 719—723; cf. A., 1933, 241).—By the fractional distillation of mixtures of S and Se₂Cl₂, previously heated for 6 hr. in a sealed tube at 200°, an orange liquid, SSeCl₂, b.p. 68°/20 mm., has been isolated. Evidence for the existence of this compound has also been obtained from measurements of *n* and *γ* for S—Se₂Cl₂ mixtures at various temp. SSeCl₂ has *n*_D²⁰ 1.7234, *d*₄²⁰ 2.1502; it is more stable than SeSCL₂ and probably has the structure S:Se:Cl₂. O. J. W.

Preparation of chromium fluoride. V. SHTSCHERBAKOVA (J. Appl. Chem. Russ., 1937, 10, 1405—1406).—CrO₃ is dissolved in a 10% excess of HF, a 20% excess of C is added, and the mixture is heated at 80°, when the reaction 2CrO₃ + 6HF + 3C → 2CrF₃ + 3CO₂ takes place. R. T.

Preparation of 12-molybdophosphoric acid. S. L. MALOWAN (Z. anal. Chem., 1937, 111, 7—10).—(NH₄)₃PO₄·12MoO₃ is heated to incipient redness, forming a blue-black substance of the apparent composition 8MoO₂·16MoO₃·P₂O₅. This is dissolved in 3% aq. H₂O₂, acidified with HNO₃, and evaporated, giving pure, alkali-free molybdophosphoric acid.

J. S. A.

Resistance of metals to hydrofluosilicic acid.—See B., 1937, 1356.

Affinity. LXXVI. Tensimetric analysis of the higher phosphides of manganese. W. BILTZ and F. WIECHMANN [with K. MEISEL] (Z. anorg. Chem., 1937, 234, 117—129).—The highest compound is a triphosphide, MnP₃, *d* 4.26. MnP₃ takes up excess of P into solid solution, but MnP₃ and MnP form an almost ideal two-phase system. There are no indications of the existence of MnP₂ (A., 1914, ii, 273). F. J. G.

Pentaiodorhenic acid. W. BILTZ [with F. W. WRIGGE, E. PRANGE, and G. LANGE] (Z. anorg. Chem., 1937, 234, 142—149).—When K₂ReI₆ in 20% H₂SO₄ is shaken with Et₂O all of the Re and 5/6 of the I, but none of the K, pass into the

upper layer. In this ethereal solution the Re is quadrivalent, so that the equation is $K_2ReI_6 + H_2SO_4 = (K_2SO_4 + HI) aq. + HRe^{VI}_5$ (in Et_2O). The reaction is sp. for K_2ReI_6 ; with the Cl and Br compounds little or no Re is absorbed by Et_2O . A definite solid compound of Re and I could not be isolated.

F. J. G.

Physico-chemical nature of oxides of nickel. D. P. BOGATZKI (J. Gen. Chem. Russ., 1937, 7, 1397—1402).—The composition of oxides of Ni prepared by heating $Ni(NO_3)_2$ varies according to the temp., from NiO at $>1100^\circ$ through a series of solid solutions to NiO_2 at 500° . The X-ray diagrams of the oxides Ni_3O_4 and Ni_2O_3 differ from that of NiO only in their larger space lattice const., suggesting that these are solid solutions of NiO in NiO_2 .

R. T.

Compounds of platinum with unsaturated hydrocarbons of the ethylene series. A. D. GELMAN (Compt. rend. Acad. Sci. U.R.S.S., 1937, 16, 351—354; cf. A., 1937, II, 54).—Replacing Cl by Br, or C_2H_4 by propylene, isobutylene, or styrene, prep. and properties are given for further members of the complex type: $[C_2H_4 X PtCl_2]$ where $X = NH_3$ or C_5H_5N . As with the chlorides, *trans*-forms are obtained from Zeise type salts, *cis*- from Coss type. $[C_2H_4 X PtCl_2]$ with KBr yield the bromides. The olefines are inter-replaceable, showing residual affinities in the order $C_3H_6 > C_2H_4 > C_3H_8$ or C_4H_8 (cf. A., 1936, 1098). $[C_2H_4 NH_3 PtCl_2]$ when boiled with HCl yields Coss' salt, showing elimination of C_2H_4 to be the primary reaction. The results confirm the *trans*-influence in the inner shell of the unsaturated mols.

I. McA.

Designation of capabilities of quantitative methods of determination. A. SCHLEICHER (Z. anal. Chem., 1937, 111, 3—7; cf. Reichel, A., 1937, I, 528).—An alternative method of expressing the precision and applicability of analytical methods is discussed.

J. S. A.

Technique of spectral analysis. W. GERLACH and W. ROLLWAGEN (Metallwirts., 1937, 16, 1083—1094).—Recent progress in qual. and quant. spectral analysis is reviewed.

C. E. H.

Direct photo-electric determination of elements in the flame. J. HEYES (Angew. Chem., 1937, 50, 871—874).—The flame spectra of the elements to be determined are excited under standardised conditions, using a Lundegårdh atomiser. Suitable lines are isolated by means of a monochromator, and their intensity is measured directly with a photo-electric cell. At low concns., the photo-electric current directly \propto the concn. of the element concerned.

J. S. A.

Comparative p_H measurements with the hydrogen and glass electrodes. K. SCHWABE [with W. GRAUPNER] (Z. Elektrochem., 1937, 43, 874—879).—Comparisons of the glass electrode (SiO_2 72, CaO 6, Na_2O 22%) with the H_2 electrode in solutions of a no. of partly neutralised acids over the p_H range 1 to 10 show that they agree within the experimental error except in the case of $CCl_3 \cdot CO_2H$, where large divergences, which may be attributed to catalytic hydrogenation, are found.

F. J. G.

p_H measurements with the glass electrode. G. HAUGAARD (J. Soc. Leather Trades Chem., 1937, 21, 582—586).—The glass electrode and a sensitive, low-capacity potentiometer are very trustworthy and accurate to approx. 0.02 p_H . A suitable modified vac.-tube potentiometer is described (cf. A., 1937, I, 567).

D. W.

Two new colour indicators from β -naphthylamine.—See A., 1937, II, 494.

Use of naphthol compounds as fluorescent indicators. M. DÉRIBÉRE (Ann. Chim. Analyt., 1937, [iii], 19, 262—263).—The fluorescent properties of numerous naphthols, naphtholsulphonic acids, and their derivatives are recorded and the compounds proposed for use as indicators.

J. S. A.

Acridine-orange and brilliant-diazole-yellow as fluorescent indicators. M. DÉRIBÉRE (Ann. Chim. Analyt., 1937, [iii], 19, 290—291; cf. A., 1933, 1132).—Commercial samples of acridine-orange exhibit a brick-red and the pure material a yellow-green fluorescence at p_H 8—10.5. The fluorescence of diazole-yellow changes from green to yellow-green with increase in concn. There is no fluorescence below p_H 7.5, or in the presence of oxidising agents.

J. L. D.

Modified distillation method for [the determination of] moisture. H. N. CALDERWOOD and R. J. PRICHOWSKI (Ind. Eng. Chem. [Anal.], 1937, 9, 520).—In the Dean-Stark method (B., 1920, 438) with xylene as the immiscible liquid, the introduction of a few drops of EtOH removes H_2O adhering to the inner wall of the condenser tube, and thus increases the accuracy of the method. The EtOH should be added only after dehydration of the sample is complete and should not be used as an indicator to show when this is the case. Rates and periods of boiling are specified.

L. S. T.

Microchemical detection of halogen. F. HALLA and F. RITTER (Mikrochim. Acta, 1937, 1, 365).—One drop of the test solution is heated with 2—4 drops of fuming HNO_3 in the usual form of apparatus, and the liberated halogen, halogen acid, or $NOCl$ absorbed by a drop of acid $AgNO_3$ solution. The limiting sensitivity is $<10^{-6}$ g.

L. S. T.

Determination of chlorides and bromides. L. A. REBER and W. M. McNABB (Ind. Eng. Chem. [Anal.], 1937, 9, 529).—0.1N- $AgNO_3$ is added to the Cl' or Br' solution in presence of dil. HNO_3 , the coagulated halide is filtered off, and the combined filtrate and washings are titrated with 0.1N-KI using starch and $Ce^{IV} NH_4$ sulphate solution as indicator. The results agree with those obtained by the Volhard and gravimetric methods. I' can be similarly determined, filtration of the pptd. AgI being unnecessary. When the iodide is titrated with $AgNO_3$ the endpoint appears too soon, probably owing to adsorption of I' by the AgI .

L. S. T.

Determination of bromates in chlorates by Junck's method. I, II. F. TARADOIRE (Bull. Soc. chim., 1937, [v], 4, 1759—1771, 1771—1773).—I. The applicability of Junck's method has been investigated, with special reference to the action of

atm. O_2 and light, the presence of Cu and Fe, and the influence of the nature and amount of acid used.

II. Results of analysis are reported.

E. S. H.

Determination of micro-quantities of iodine.

J. F. REITH and C. P. VAN DIJK (Biochem. J., 1937, 31, 2128—2135).—New methods have been tested. A rapid and trustworthy method based on extraction of I' from salt mixtures by EtOH (cf. Hamilton, A., 1936, 1351) is described. The reduction of IO_3' in alkaline solution by N_2H_4 also gave good results. No detectable IO_3' is formed on heating a mixture of I', NO_3' , and CO_3'' . Small amounts of org. material (e.g., 50 mg.) can be destroyed with practically no loss of I' by heating with $NaNO_3$. J. N. A.

Dioxan as a reagent for detection and determination of small amounts of iodide. Application to the detection of iodide in iodised salt. A. SAIFER and J. HUGHES (J. Biol. Chem., 1937, 121, 801—802; cf. A., 1937, I, 260).—A correction.

J. W. S.

Determination of iodine in organic medicaments.—See B., 1937, 1406.

Stability of potassium iodate volumetric solutions. S. M. BERMAN (J. Assoc. Off. Agric. Chem., 1937, 20, 590—592).—Solutions prepared as suggested (*ibid.*, 57) and standardised by As_2O_3 show no appreciable loss of stability in 20 months, and the method is therefore suggested as a tentative standard. J. G.

Determination of fluorine. J. J. T. GRAHAM (J. Assoc. Off. Agric. Chem., 1937, 20, 392—394).—The Willard-Winter method (A.O.A.C. Methods of Analysis, 1935, 19(b), 46) gives low results in presence of large amounts of Al and SiO_3'' . In such cases the $PbFCl$ method is applied. E. C. S.

Determination of fluorine by peroxidised titanium method. D. DAHLE (J. Assoc. Off. Agric. Chem., 1937, 20, 505—516).—Use is made of the inhibitory action of Al salts on the bleaching by F of peroxidised Ti to eliminate errors due to variation in p_H or to adventitious colours, aq. $Al(NO_3)_3$ being added to an aliquot part of the solution of F which is to be analysed. The colours developed are determined by the use of a neutral wedge photometer (cf. Clifford and Wichmann, A., 1936, 443) and compared with those developed in standard solutions of F. The interference by other ions when this procedure is used is negligible unless present in amounts \gg those tolerated in any other method of determination of F. E. C. S.

Volumetric micro-determination of 0.01N-sulphate solutions with sodium rhodizonate as indicator. E. ABRAHAMCZIK and F. BLÜMEL (Mikrochim. Acta, 1937, 1, 354—364).—The red colour of Ba rhodizonate (I) is discharged in acid solution owing to decomp. of the liberated rhodizonic acid, and although (I) is stable in neutral solution the colour change from red to yellow in the titration of an aq. Ba salt with aq. SO_4'' and Na rhodizonate as indicator is not sharp. When buffered to p_H 3 by citrate and HCl and diluted with 3 vols. of MeOH, 0.01N-BaCl₂ can be satisfactorily titrated with 0.01N-

$(NH_4)_2SO_4$, but not the SO_4'' with the Ba solution. The method has been applied to the determination of S in org. elementary analysis, and to the titration of HSO_4' and free H_2SO_4 solutions. Interfering cations are removed from SO_4'' solutions by adsorption with zeolite. L. S. T.

Determination of total reducible sulphur in caustic soda.—See B., 1937, 1333.

Rapid determination of sulphide sulphur.—See B., 1937, 1335.

Microchemical detection of selenium. F. FEIGL and V. DEMANT (Mikrochim. Acta, 1937, 1, 322—325).— SeO_3'' in 2N-HCl gives first a red and then a reddish-violet colour with 1% $NPh_2 \cdot NH_2$ in glacial AcOH; limiting sensitivity 0.05×10^{-6} g. SeO_2 . Se, selenides, and SeO_4'' are first converted into SeO_3' . IO_3' , ClO_3' , MnO_4' , etc. and peroxides must be destroyed by warming with HCl, whilst Fe''' , Cu'' , tungstates, and molybdates are converted into complex oxalates by boiling with HCl + $H_2C_2O_4$. TeO_3'' and TeO_4'' give no reaction, and 0.001% Se can be detected in 20 mg. of S or Te. Sulphides and Se minerals are attacked by heating with conc. HCl and perhydrol. L. S. T.

Determination of selenium. Z. SHIBATA (Sci. Rep. Tôhoku, 1937, [I], 26, 248—252).—The determination of Se by pptn. with SO_2 , and iodometric titration after addition of KI, is described.

F. J. L.

Determination of phosphoric acid in superphosphate and phosphorite meal.—See B., 1937, 1334.

Semi-micro-methods for the rapid colorimetric determination of arsenic. F. GAUDY and M. P. ANTOLA (Anal. Asoc. Quím. Argentina, 1937, 25, 76—80).—Material containing 0.1—1 mg. of As is evaporated with HNO_3 and H_2SO_4 to a colourless residue, and then reduced with $N_2H_4 \cdot H_2SO_4$, the product being treated with HCl, 1% gelatin, and finally a saturated solution of H_2S . As is determined by colorimetric comparison with standard solutions. Bi, Sn, Cu, and Fe must be removed before the final pptn. The effect of varying the amount of gelatin is recorded. The method is suitable for rapid commercial analyses. F. R. G.

Volumetric determination of arsenic, anti-mony, and bismuth with potassium iodide. L. FAUCHON and L. VIGNOLI (J. Pharm. Chim., 1937, [viii], 26, 337—341; cf. A., 1937, I, 478).—The vol. of a standard solution of a Bi salt in HNO_3 or 10% H_2SO_4 required to produce a yellow colour with KI is compared with that of the unknown, the Bi content of which is calc. Sb and As can be determined similarly in 25% and 40% H_2SO_4 , respectively. J. L. D.

Determination of silicic acid in substances soluble in acids. W. VAN TONGEREN (Chem. Weekblad, 1937, 34, 774—777).—A comparative examination of the HCl, HNO_3 , $HClO_4$, NH_4Cl -HCl, and NH_4NO_3 - HNO_3 methods for separating SiO_2 from sol. silicates shows that the last gives the most trustworthy results and the smallest degree of contamination of the SiO_2 , which is due in this case

almost entirely to TiO_2 . In the preferred method 1 g. of finely powdered sample is intimately mixed with 1 g. of NH_4NO_3 in a small Jena glass beaker covered with a watch-glass. 5 c.c. of HNO_3 (d 1.4) are added, and the mixture is warmed on the water-bath for 0.5 hr. with stirring. The SiO_2 is then collected in a folded paper containing a small wad of macerated paper in the bottom of the cone, washed with 100—125 c.c. of hot 5% HNO_3 containing a few drops of H_2O_2 , ignited in Pt, and weighed. The residue is treated with HF and SiO_2 determined by difference. S. C.

Determination of silicon in steels.—See B., 1937, 1351.

Rapid determination of inert gas content of nitrogen.—See B., 1937, 1335.

Micro-reaction for lithium. I. M. KORENMAN and M. M. FURSINA (J. Appl. Chem. Russ., 1937, 10, 1494—1495).—A drop each of solution, of 15% $(\text{CH}_2)_6\text{N}_4$, and of 15% $\text{K}_3\text{Fe}(\text{CN})_6$ are mixed; characteristic octahedra form in presence of $\leq 6 \times 10^{-8}$ g. Li. Mg, Na, Rb, and Cs do not interfere. R. T.

Micro-reactions for caesium and rubidium. I. M. KORENMAN and G. J. JAGNIATINSKAJA (J. Appl. Chem. Russ., 1937, 10, 1496—1499).—A drop of solution is evaporated to dryness on a slide, and a drop each of saturated aq. $\text{K}_3\text{Fe}(\text{CN})_6$ and $\text{Pb}(\text{OAc})_2$ are placed on the residue; characteristic micro-crystals of $\text{Cs}_3\text{Fe}(\text{CN})_6$, $\text{Pb}(\text{OAc})_2$ are formed (6×10^{-7} g. Cs). Cs (6×10^{-8} g.) or Rb (3×10^{-6} g.) is detected microscopically by placing a granule of KBiI_4 in a drop of solution, when hexagonal crystals form within 15 min.; a similar, more sensitive reaction is obtained by substituting Sb for Bi in the reagent. Alternatively, Cs (3×10^{-8} g.) or Rb (1.5×10^{-7} g.) is detected as characteristic crystals of $\text{Cs}_2\text{AuPdCl}_7$ or $\text{Rb}_2\text{AuPdCl}_7$. K, Na, Li, and Mg do not interfere with the above reactions, except in very great excess. R. T.

Determination of lime in cement etc.—See B., 1937, 1343.

Investigation of several metals with a single reagent. M. SOARES (Rev. Chim. pura appl., 1937, [iii], 12, 1—11).—A review of the use of $\text{SH}\cdot\text{CH}_2\cdot\text{CO}_2\text{H}$ in the detection and determination of heavy metals. F. R. G.

Quantitative mineralogical X-ray analysis. T. N. AGAFONOVA (Compt. rend. Acad. Sci. U.R.S.S., 1937, 16, 367—369).—Relative intensity ratio $I_A(hkl)/I_B(mno)$ —% composition curves determined by photometry of suitable pairs of lines in X-ray powder photographs of binary A-B mixtures, are applied to determine the % of component A in a mixture, by adding a known % of a standard B (Fe, Al, NaCl) and recording I_A/I_B for the same line-pairs. Curves are given for the binary mixtures apatite-Al; MnO_2 - Mn_2O_3 . Without special precautions, some components are claimed to be determinable to <1%. I. MCA.

Determination of lead in presence of other metals. C. MAHR and H. OHLE (Z. anorg. Chem., 1937, 234, 224—228).—Pb can be separated from other metals by pptn. from HNO_3 solution with $\text{CS}(\text{NH}_2)_2$ at 0° as $2\text{Pb}(\text{NO}_3)_2, 11\text{CS}(\text{NH}_2)_2$. The ppt. E (A., I.)

can be dissolved in hot H_2O and Pb determined by the usual methods. F. J. G.

Determination of lead in motor fuel.—See B., 1937, 1298.

Application of mercurimetry to the determination of thallium. J. TRTILEK (Z. anal. Chem., 1937, 111, 10—14).—Tl is pptd. by adding a measured excess of KI. TlI is filtered off, and the excess of KI is titrated back with standard $\text{Hg}(\text{NO}_3)_2$, using diphenylcarbazone as indicator. J. S. A.

Use of micro-analytical methods in rock analysis. F. HECHT (Z. anal. Chem., 1937, 110, 385—401).—The micro-analytical determination of elements present in traces (0.01—0.02%) in rocks is reviewed. Cu may be determined colorimetrically with $\text{NET}_2\cdot\text{CS}_2\cdot\text{Na}$, or gravimetrically by pptn. with 5:7-dibromo-8-hydroxyquinoline (I). The SiO_2 is removed from the rock by fuming with HF + H_2SO_4 . The residue is dissolved in H_2O and Cu is pptd. with H_2S at room temp. The ppt. is dissolved in HCl + HNO_3 , and Cu pptd. with (I). Mn, Zn, Ni, and Co are pptd. with H_2S from the ammoniacal solution after removing Fe, Al, etc. as basic acetates. Mn and Zn are separated by Hillebrand's method, and Zn is pptd. with 8-hydroxyquinoline in presence of much NH_4OAc . Org. compounds in the filtrate are destroyed by treatment with HCl + HNO_3 , and then with H_2O_2 + HNO_3 . Mn is pptd. by treatment with $\text{Br}\cdot\text{H}_2\text{O}$ + NH_3 , and the ppt. is ignited to Mn_2O_4 at 1000° . The sulphides are dissolved in HCl + HNO_3 and evaporated down with HCl. Pt and Cu are pptd. in HCl solution with H_2S . Ni in a portion of the filtrate is pptd. with dimethylglyoxime; Co is pptd. with 1:2- $\text{NO}\cdot\text{C}_{10}\text{H}_6\cdot\text{OH}$ and ignited to Co_3O_4 . Ca co-pptd. with Mg is determined by dissolving the $\text{Mg}_2\text{P}_2\text{O}_7$ in dil. H_2SO_4 , and adding 9—10 parts of EtOH. The CaSO_4 is collected, dissolved in HCl, and pptd. with $\text{H}_2\text{C}_2\text{O}_4$. The CaC_2O_4 is ignited at 1000° , and reconverted into CaSO_4 . Sr is determined after extracting the nitrates with EtOH + Et_2O , by fuming down with H_2SO_4 , and collecting SrSO_4 formed. Ba is determined in a separate sample which is fused with Na_2CO_3 + NaNO_3 . The melt is extracted with H_2O , and the insol. portion is treated with H_2SO_4 . The residue is treated with HF + H_2SO_4 , leaving Ba and Sr (+Ca) as sulphates. These are brought into HCl solution by fusion with Na_2CO_3 , and Ba is pptd. as BaSO_4 . Rare earths are pptd. with Fe and Ti by means of KOH, from the sample used for determining Ba, and are obtained as insol. fluorides on evaporating with HF. The rare earths are finally converted into the oxalates, by double pptn., and are ignited to the oxides. Total S is determined in the H_2O extract from the Na_2CO_3 - NaNO_3 fusion, and is pptd. as BaSO_4 . Cl is determined in the H_2O extract after fusion with Cl-free Na_2CO_3 . J. S. A.

Electrolytic analysis of white and yellow metal alloys.—See B., 1937, 1353.

Determination of mercurous chloride and total mercury in mercury ores.—See B., 1937, 1354.

Colour reactions of rare-earth elements with alkaloids and polyhydric phenols. IV. Colour

reactions of cerium, lanthanum, thorium, thallium, and elements of the third analytical group with morphine salts. F. M. SCHEMJAKIN and V. A. VOLKOVA (J. Gen. Chem. Russ., 1937, 7, 1553—1556).— Ce^{IV} in aq. NH_3 gives a brown ppt. with morphine hydrochloride (I) ($< 10^{-5}$ g. Ce per ml.); pptn. proceeds periodically, giving well-defined Liesegang rings. Th, La, and group III cations do not interfere. Ti^{III} gives a yellow ppt. with (I), but not with brucine.

R. T.

Quantitative spectroscopic determination of neodymium and praseodymium in minerals. S. A. BOROVIK and T. A. BUROVA (Compt. rend. Acad. Sci. U.R.S.S., 1937, 16, 311—312).—The rare earths and Th, after separation of other metals, are made up to a 1% solution and Pr and Nd determined by adjusting the thickness of a layer of a standard solution to equal brightness of the lines 5270—5207 Å. for Nd and 4879 Å. for Pr.

F. J. G.

Purity tests in assaying by means of spot tests.—See B., 1937, 1355.

Precipitation of basic gallium sulphate by means of carbamide. II. Separation and determination of gallium. H. H. WILLARD and H. C. FOGG (J. Amer. Chem. Soc., 1937, 59, 2422—2424; cf. A., 1937, I, 473).—Ga is pptd. quantitatively as basic sulphate when aq. $\text{Ga}_2(\text{SO}_4)_3$ containing $\text{CO}(\text{NH}_2)_2$ is heated until p_{H} 4—5.5 is reached. Ga can be separated from Zn and Mn, and within certain limits from Ca, by this process. Al, Cr, and Fe interfere.

E. S. H.

Determination of manganese in silicate rocks. O. HACKL (Z. anal. Chem., 1937, 110, 401—406; cf. A., 1936, 813).—Previously published specifications are supplemented.

J. S. A.

Determination of manganese in sea-water. V. KRASNOVA (J. Gen. Chem. Russ., 1937, 7, 1417—1418).—Minor modifications of Schmidt's method (B., 1928, 110) are suggested.

R. T.

Spectrographic determinations on cast iron.—See B., 1937, 1348.

Gravimetric determination of chromic acid as lead chromate. D. TSCHAVDAROV and N. TSCHAVDAROVA (Z. anal. Chem., 1937, 110, 348—354).— $\text{CrO}_4^{''}$ may be pptd. as PbCrO_4 from solutions approx. 0.1—0.2N in HNO_3 ; the ppt. is dried at 160—180°. High results may be obtained in the presence of HCl; most cations do not interfere.

J. S. A.

Preservation of ammonium molybdate reagent. S. SAITÔ (Sci. Rep. Tôhoku, 1937, [i], 26, 253—260).—The usual solution of NH_4 molybdate (75 g. per l. of 3N- HNO_3) is highly supersaturated with respect to $\text{MoO}_3 \cdot 2\text{H}_2\text{O}$, which separates as a yellow ppt. on keeping the reagent. The rate of crystal growth is small and the solution can often be preserved for some time, but the most stable solution contains 25 g. per l. in 5N- HNO_3 . The effect of heat and light on the formation of the ppt. is small.

F. J. L.

Determination of tungstates. E. CARRIÈRE and R. BERKEM (Bull. Soc. chim., 1937, [v], 4, 1907—

1912).—Existing procedures have been critically examined. Minor modifications are suggested.

E. S. H.

Determination of uranium, thorium, and lead in thucholite. O. B. MUENCH (J. Amer. Chem. Soc., 1937, 59, 2269—2270).—The Pb-U ratio is 0.038, whence it is estimated that the approx. age of the mineral is 278×10^6 years.

E. S. H.

Iodometric determination of tin. M. HEGEDÜS (Z. anal. Chem., 1937, 110, 338—348).—The Sn, in HCl solution, is reduced completely to Sn^{II} by addition of Zn + a little Cd, air being first displaced by CO_2 . When the Zn and Cd have dissolved, a HCl solution containing a weighed excess of KBrO_3 + 10 parts of KI is added, and the excess of I is titrated back with $\text{Na}_2\text{S}_2\text{O}_3$. In presence of Pb, the original solution is first treated with an excess of Na_2SO_4 ; 10 parts of Pb do not interfere with the determination of Sn.

J. S. A.

Reduction of iron with metallic tin. R. RINNE (Z. anal. Chem., 1937, 111, 1—3).— Fe^{III} in HCl solution may be reduced to Fe^{II} by heating with Sn. The solution is decanted from undissolved metal, HgCl_2 is added, and Fe is titrated as usual. The method has advantages over the use of the Zn reductor.

J. S. A.

Drop reaction for titanium. M. V. GAPTSCHENKO and O. G. SCHEINTZIS (J. Gen. Chem. Russ., 1937, 7, 1427—1428).—A drop of solution is placed on filter-paper saturated with tannin, followed by a drop of 20% antipyrin; a red spot forms in presence of $< 2 \times 10^{-7}$ g. Ti. The colorations given by Fe, U, or V, but not by Ti or Mo, are discharged by 20% H_2SO_4 . Cr, Al, Co, Ni, Mn, Zn, Hg, Pb, Cu, Cd, Bi, and Zr do not interfere.

R. T.

Fractional reaction for zirconium and the precipitation of amorphous precipitates. N. A. TANANAEV (J. Appl. Chem. Russ., 1937, 10, 1514—1520).—Polemical, in reply to Alimarin (A., 1936, 1354; 1937, I, 259).

R. T.

Organic reagents capable of application to mineral analysis. 2 : 3 : 7-Trihydroxy-9-methyl-6-fluorone, special reagent for antimony cations. P. WENGER, R. DUCKERT, and C. P. BLANCPAIN (Helv. Chim. Acta, 1937, 20, 1427—1445; cf. A., 1937, I, 330).—Among the elements of group VIII the ions of Fe and Os react with 1 : 2 : 3-(I), 1 : 2 : 4-(II), and 1 : 3 : 5- $\text{C}_6\text{H}_3(\text{OH})_3$ (III) but (III) reacts only with Fe^{III} and Os^{III} . In group V each isomeride appears to confine its reactions to a special region, (I) giving ppts. with Sb^{III} and Bi^{III} , (II) giving unexpected changes depending on experimental conditions, and (III) giving colorations with As^{III} , Sb^{III} , and Sb^{IV} . In group IV there is no resemblance between the reactions of the three isomerides, (I) giving ppts. with Ce^{III} , Ti^{III} , and Ti^{IV} , (II) yielding no reactions apart from a fugitive colour with Ce^{III} , with which (III) gives a ppt. (I) gives reactions with TiO_3' , SnO_2'' , $\text{Ta}_6\text{O}_{19}''''''$, and S'' , (II) with IO_3' , and (III) with NO_2' and BrO_3' . (I) only yields a ppt. with Sb but under the same conditions Bi also reacts. (I), (II), and (III) cannot be regarded as sp. reagents for Sb ions. With 2 : 3 : 7-trihydroxy-9-methyl-6-fluorone the ions of Fe and Os

give colorations whilst the cations Ti^{+++} , Ce^{++++} , Ge^{++++} , V^{+++} , As^{+++} , Sb^{+++} , Bi^{+++} , Mo^{++++} , W^{++++} , and V^{++++} give well-defined ppts. the colour of which varies between red-orange and red-brown. The production of these ppts. depends greatly on the acidity of the solution so that at p_H 4 the reagent may be regarded as sp. for Sb. Its use in the analysis of salts and alloys in macro- and micro-analytical practice is described in detail. Quantitatively difficulties are met in filtering the pptd. Sb complex and in freeing it from excess of the reagent by washing. H. W.

Determination of bismuth in medicines.—See B., 1937, 1406.

Determination of gold and silver by recovery of minute amounts from solution. W. E. CALDWELL and K. N. McLEOD (Ind. Eng. Chem. [Anal.], 1937, 9, 530—532).—Details for the recovery of small amounts of Au and Ag from large vols. of liquid by collection with pptd. Hg-HgCl, cupellation, and parting with HNO_3 are given. The best reducing agent for producing the Hg-HgCl ppt. from aq. $HgCl_2$ is $Mg + HCl$ or H_2SO_4 . Good recovery of Au and Ag is also obtained by the addition of aq. NH_3 followed by aq. $HgNO_3$, when the Hg- $Hg(NH_2)NO_3$ ppt. collects these metals as it settles through the solution. The data given show that 0.01 mg. of Au or 1.0 mg. of Ag is recoverable from 40 litres of H_2O . The method has been applied to the control testing for Ag content in sterilised H_2O , and to the analysis of sea- and mine- H_2O and ore leach solutions for Au. L. S. T.

Microchemistry of the precious-metal elements. H. J. FRASER (Amer. Min., 1937, 22, 1016—1034).—Reactions of Pt, Pd, Rh, Ru, Ir, Os, and Au with benzidine, $CS(NH_2)_2$, dimethylglyoxime, dimethylaminobenzylidenerhodanine, C_5H_5N , HBr, K Hg^{II} thiocyanate, $(NH_4)_2Cr_2O_7$, KI, NH_4Cl , and CsCl in the formation of cryst. ppts. examined under the microscope are described, together with the interferences that may be produced by one metal in presence of another. The mineralogy of these metals and the solubilities of their minerals in acids are discussed. The tests considered to be the most satisfactory for the identification of these metals in minerals are selected. L. S. T.

Analysis of platinum metals: silver assay bead.—See B., 1937, 1355.

Determination of osmium in a lead assay button.—See B., 1937, 1355.

Determination of specific heats by an eddy-current method. I. Theoretical. R. M. DAVIES and W. J. THOMAS. II. Experimental. W. J. THOMAS and R. M. DAVIES (Phil. Mag., 1937, [vii], 24, 600—633, 713—744).—I. The sp. heats of metals and alloys, in cylindrical or sheet form, may be determined from a knowledge of the heating effect due to eddy currents produced by an alternating magnetic field. The necessary relationships are deduced.

II. A procedure for the determination of sp. heats is described. The sp. heats of Ni, Al, Cu, Fe, Sb, Bi, several alloys, and H_2O at 20° are given, with a max. error of 0.6%.

Precision thermostat, independent of surrounding temperature. B. JELINEK (Bull. Soc. chim., 1937, [v], 4, 1811—1813).—With the regulator described it is possible to maintain the temp. of 45 litres of H_2O within about 0.001° for several days.

E. S. H.

Spectro-analytical investigations with an interrupted arc of limited arc length. J. VAN CALKER (Z. anorg. Chem., 1937, 234, 179—188).—The advantages of limiting the arc length in an interrupted arc are discussed, and circuits for such an arc are considered. The effect of the sign of the electrodes on the spectrum is discussed. Almost all metals are more easily detected if the upper (pointed) electrode is the cathode, but As, P, La, and Li are more easily observed if it is made the anode. The variation of potential in a high-frequency self-maintaining interrupted arc without moving electrodes is compared with that of the ordinary rotating-electrode interrupted arc by an oscillograph method.

A. J. M.

Two spectrometers for X-ray analysis. W. F. DE JONG (Nature, 1937, 140, 768).

L. S. T.

Spectroscopic method for kinetic study of rapid chemical reactions. K. G. STERN and D. DUBOIS (J. Biol. Chem., 1937, 121, 573—587).—An apparatus for recording the speed of fast reactions without intervention of electric or photo-electric instruments is described. The time of mixing when a solution of methylene-blue was injected into H_2O was 0.008 to 0.027 sec. Dissociation of human oxyhaemoglobin at p_H 8.6 and 28.5° was complete after approx. 0.08 to 0.12 sec. The rates of union of ferrihaemoglobin with H_2O_2 , $EtCO_2H$, HCN, and HF at p_H 5.3 and $26—27^\circ$, and of catalase with the last three at p_H 6.9 and $26—28^\circ$, have been determined.

J. N. A.

Mirror spectrograph of the observatory of the University of Leipzig. W. LOHMANN (Z. Instrumkde., 1937, 57, 124—129).—Apparatus is described.

O. D. S.

Auto-collimating quartz spectrograph with long focal length. W. HERRMANN (Z. Instrumkde., 1937, 57, 21—24).—Apparatus is described.

O. D. S.

Infra-red spectrometer making double use of the prism. W. DAHLKE (Z. Instrumkde., 1937, 57, 18—20).—Apparatus previously used (cf. A., 1936, 1318) is described.

O. D. S.

(A) Methods of recording in infra-red spectroscopy. (B) Apparatus for measuring spectrograms. S. FAHRENTOLZ (Z. tech. Physik, 1936, 17, 67—68, 68—69; Chem. Zentr., 1936, i, 3871).

H. J. E.

Means of increasing light transmitted by disappearing-filament pyrometer of precision. V. H. STOTT (J. Sci. Instr., 1937, 14, 370—372).—The circular diaphragm adjacent to the eyepiece is replaced by a slit, set parallel to the filament.

J. S. A.

(A) Double grid valve in potentiometric analysis. (B) Potentiometric electrode and electrode-receptacle. R. VANOSI (Anal. Asoc. Quím.

Argentina, 1937, 25, 54—71, 72—75).—A description of apparatus (cf. Hiltner, A., 1933, 362). F. R. G.

Relative efficiency of various types of counter-tubes for hard γ -rays. K. BUCHMANN (Physikal. Z., 1937, 38, 817—824).—The efficiency of counter-tubes with walls of different materials (Pb, brass, Al) was investigated. For γ -rays from Th-C'' the efficiency was Pb 100, brass 78, Al 68. For hard Ra γ -rays, the ratio was Pb 100, brass 75, and for Ra γ -rays of approx. 0.6 M.e.v., Pb 100, brass 60. For Pb and brass an increase of 12—14% in efficiency can be achieved by roughening the inner surface of the tube. The optimum efficiency is obtained for Pb of thickness 0.65 mm. A. J. M.

Efficiency of counters and counter circuits. A. E. RUARK and F. E. BRAMMER (Physical Rev., 1937, [ii], 52, 885; cf. A., 1937, I, 582).—A correction. N. M. B.

Calculation of the grid temperature of electron tubes. S. WAGENER (Z. tech. Physik, 1937, 18, 270—280).—The method previously described (Heinze and Wagener, B, 1937, 987) is applied to calculate grid temp. in multi-electrode tubes from cathode temp. Calc. vals. agree within 4% with experimental vals. obtained with tubes of a normal industrial type. O. D. S.

Photo-electric cells for measurement in the visible spectrum. P. GÖRLICH and W. LANG (Z. Instrumkde., 1937, 57, 249—250; cf. A., 1936, 1223).—Photo-electric cells with combined Cs—Cs₂O—Ag and transparent Cs—Bi etc. cathodes have approx. uniform sensitivity throughout the visible spectrum. O. D. S.

Current stabiliser for electrolytic circuits. J. H. BRUCE and A. HICKLING (J. Sci. Instr., 1937, 14, 367—370).—A simple thermionic valve circuit is described. J. S. A.

Hydrogen peroxide electrode. K. KODAMA and T. ONIZUKA (J. Biochem. Japan, 1937, 25, 573—578).—The electrode (which appears to be of no practical val.) gives a relationship between potential (mv.) and p_H of $E = E_0 - 51.8p_H$. F. O. H.

Vacuum titration. T. THUNBERG (Skand. Arch. Physiol., 1935, 72, 291—294; Chem. Zentr., 1936, i, 4039).—A method of titrating from a burette into an evacuated vessel is described. It is suitable for determining ascorbic acid in juices. H. J. E.

Apparatus for the extraction of small quantities of liquid. H. K. BARRENSCHEEN (Mikrochim. Acta, 1937, 1, 319—321).—The apparatus described extracts from 1 to 20 (max.) c.c. L. S. T.

New laboratory apparatus and application of porous glass filters. P. H. PRAUSNITZ (Chim. e. l'Ind., 1937, 19, 569—574).—A description of laboratory apparatus made by the firm of Schott, Jena. O. J. W.

Laboratory circulating pump in glass. W. H. ALBRECHT (Chem. Fabr., 1937, 10, 470).—A rotary pump with a capacity of 4 l. of H₂O per min. and a lift of approx. 2 m. is described. The use of glass throughout renders the pump suitable for corrosive liquids and relatively high temp. A. K. G. T.

Economical air compressor. H. W. BEAMS, A. T. CASTEEL, and R. L. KING (Science, 1937, 86, 428).—The adaptation of a motor-car engine is described. L. S. T.

Calculation of surface tension from the measurement of sessile drops. A. W. PORTER (Phil. Mag., 1937, [vii], 24, 823).—The correction table (A., 1933, 250) is amended. K. S.

Simple, accurate film balance of the vertical type for biological and chemical work, and a theoretical and experimental comparison with the horizontal type. Tight packing of a monolayer of ions. W. D. HARKINS and T. F. ANDERSON (J. Amer. Chem. Soc., 1937, 59, 2189—2197).—The procedure involves the use of the Wilhelmy method for the determination of surface tension in a proper differential form, making use of the balance between the vertical pull of the surface tension directed downward and the vertical upward force of buoyancy of the liquid. Advantages of the apparatus are described. The mathematical theory of the "horizontal-pull" film balance is developed, and it is shown that the two types give essentially the same vals. of surface pressure with liquid or solid films. A study of the effect of Ca'' on films of stearic acid shows that Ca'' compresses the fatty acid ions of the film and eliminates the expanded region obtained without it. E. S. H.

Practical needle valve for vacuum apparatus. W. VON MEYEREN (Z. tech. Physik, 1937, 18, 281).—A reducing valve for gas inlet is described. O. D. S.

Study of gases. M. W. TRAVERS (J. Inst. Fuel, 1937, 11, 17—25).—The technique and some of the results of the author's experimental study of the thermal decomp. of C₂H₆, C₃H₈, and MeCHO are described (cf. A., 1935, 40; 1936, 309; 1937, I, 34). A. B. M.

Non-corrodible [glass] circulating device. K. A. FREEMAN and P. J. THOMPSON (Ind. Eng. Chem. [Anal.], 1937, 9, 532).—The apparatus described can be used for circulating liquids, as a sampling device for solutions or suspensions, and for circulating an electrolyte through a cell. L. S. T.

Piezometer ring. C. P. BAKER and A. J. KOMICH (Ind. Eng. Chem. [Anal.], 1937, 9, 533). L. S. T.

Determination of specific gravity. E. A. SIEBEL and A. E. KOTT (J. Assoc. Off. Agric. Chem., 1937, 20, 535—542).—In order to avoid the continual reweighing of the pycnometer necessitated by variation in atm. pressure and temp., a counterweight of vol. = that of the pycnometer is employed. A simplified method of calculation is described. E. C. S.

New capillary phenomenon and its use, especially for micro-manometric measurements. E. RÖBBELEN (Z. tech. Physik, 1936, 17, 95—98; Chem. Zentr., 1936, i, 4038). H. J. E.

Simple manometer for measuring low pressures. J. NIKLIBORC (Acta phys. polon., 1935, 4, 85—96; Chem. Zentr., 1936, i, 3870).—The damping of the vibration of a 4.5-mm. Ni-coated and

polished Fe plate suspended by a quartz fibre is measured. H. J. E.

Quartz manometer for the static measurement of vapour tensions of fused salts. W. JAHN-HELD and K. JELLINEK (*Z. Elektrochem.*, 1937, 43, 491—496).—Pb is used as manometer liquid for 330—800° and Ag for temp. above 960°; the construction and standardisation of the instrument are described. The results obtained for the vapour tension of PbCl₂ at 752—903° and for PbBr₂ at 772—880° were in close agreement with data found in the literature. A. R. P.

Highly polymerised compounds. CLX. Applicability of the Ostwald viscosimeter to the determination of high mol. wts. G. V. SCHULZ (*Z. Elektrochem.*, 1937, 43, 479—485).—In determining η for solutions of, e.g., cellulose nitrate in CMe₂ or polystyrene in PhMe the diameter and length of the capillary should be so adjusted that 0.5—1 c.c. of the solvent alone passes through in 100 sec. so as to reduce the Hagenbach correction to <1%. The results thus obtained are in good agreement with those obtained with the Ubbelohde viscosimeter. A. R. P.

Simple overflow viscosimeter and its use in determining the solvent power of organic liquids for cellulose esters. I. SAKURADA and N. SAITO (*Kolloid-Z.*, 1937, 81, 208—212).—The instrument is constructed so that, when successive additions are made to the liquid under examination, the lower level remains unchanged. F. L. U.

Sedimentation analysis. E. HOFFMANN (*Österr. Chem.-Ztg.*, 1937, 40, 476—479; cf. A., 1937, I, 374).—Methods of determining particle size in suspensions are discussed. The theory is developed for the method involving centrifuging for various times, followed by determination of the particle distribution at various levels. J. W. S.

Analytical measurements of ultracentrifugal sedimentation. A. TISELIUS, K. O. PEDERSEN, and T. SVEDBERG (*Nature*, 1937, 140, 848—849).—A new quant. procedure is described. The centrifuged solution is separated into two portions in a modified cell and from the change in the amount of the sedimenting component in the layers the sedimentation const. can be calc. The method is of special importance in the study of enzymes and antibodies. L. S. T.

Geochemistry.

Analysis of the sulphurous water of the "Pergoli" spring of Tabiano (Parma). G. ILLARI (*Annali Chim. Appl.*, 1937, 27, 444—456).—Chemical and physico-chemical analyses are given. The H₂O has a strong odour of H₂S, deposits S when kept in air, is radioactive, and contains chiefly Na⁺, Ca⁺⁺, Mg⁺⁺, Cl⁻, SO₄⁻⁻, HS⁻, and HCO₃⁻ ions, SiO₂, and dissolved H₂S and CO₂. L. A. O'N.

Thermal waters of the Ailet region (Eritrea). C. TOFFOLI (*Annali Chim. Appl.*, 1937, 27, 165—174).—Chemical and other properties are recorded. The waters are hyperthermal, soft, rich in SiO₂, radioactive, and contain mainly alkali H carbonates. O. J. W.

Thermal water of Ali-Hasa (Eritrea). C. TOFFOLI (*Annali Chim. Appl.*, 1937, 27, 175—178).—This H₂O is very similar to those described in the preceding abstract. O. J. W.

Carbonate mineral water from the air-port of Ciampino (Rome). M. TALENTI (*Annali Chim. Appl.*, 1937, 27, 207—209).—Chemical analyses and other data are recorded. O. J. W.

Enrichment of heavy water in glacial ice. A. EUCKEN and K. SCHÄFER (*Nachr. Ges. Wiss. Göttingen Math.-phys. Kl.*, III, 1935, 1, 137—146; *Chem. Zentr.*, 1936, i, 3961; cf. A., 1936, 1226).—Earlier results are confirmed and amplified. H. J. E.

Plantersville meteorite, Grimes County, Texas. J. T. LONSDALE (*Amer. Min.*, 1937, 22, 877—888).—The meteorite consists of hypersthene and a monoclinic pyroxene 40%, chrysolite 30%, metal 19%, troilite 5%, glass 5%, and traces of a brown spinel and chromite (?). Chemical analyses [F. A. GONYER]

of the metallic portion, the sol. silicates and sulphides, and the insol. silicates are given. The composite analysis is SiO₂ 35.87, Al₂O₃ 2.18, FeO 12.10, MgO 23.57, CaO 1.97, Na₂O 1.05, K₂O 0.12, P₂O₅ 0.05, Cr₂O₃ 0.03, MnO 0.18, TiO₂ none, NiO 0.01, CoO none, S 1.45, Fe 16.99, Ni 1.92, Co 0.06, Cu trace, P trace, total 97.55%. A spectrographic analysis [H. C. WILHELM] showed the presence of Ge and Ti in addition. L. S. T.

Labile equilibria in the field of crystallisation of astrakhanite. V. I. NIKOLAEV, E. E. BUROVAJA, and N. I. ROSTOV'TZEVA (*Bull. Acad. Sci. U.R.S.S., Sér. Chim.*, 1937, 681—695).—Crystallisation of astrakhanite takes place most readily from solutions saturated with respect to NaCl and MgSO₄ but with a low MgCl₂ content. R. T.

Occurrences of kaolinite deposited from solution. W. A. TARR and W. D. KELLER (*Amer. Min.*, 1937, 22, 933—935).—Three such occurrences in small, white crystals are reported from Oronogo, Missouri; Henley, Missouri; and Keokuk, Iowa. L. S. T.

Unusual occurrence of halite. K. SPIROFF (*Amer. Min.*, 1937, 22, 931—933).—Halite occurs as stalactites, stalagmites, and encrustations in the Quincy Mine, Hancock, Michigan. L. S. T.

Petrologic results of a study of the minerals from the Tertiary volcanic rocks of the San Juan Region, Colorado. E. S. LARSEN, J. IRVING, F. A. GONYER, and E. S. LARSEN 3rd. (*Amer. Min.*, 1937, 22, 889—905; cf. A., 1937, I, 102).—The occurrence, resorption, and conditions of formation of the amphiboles are described. Chemical analyses of three and optical properties of seven amphiboles from this

region are recorded. A similar study for biotite has been made. Chemical analyses and optical properties of four biotites from these lavas are recorded. Conditions favouring the formation of Fe_2O_3 -rich hornblende and biotite are probably represented by $2\text{FeO} + \text{H}_2\text{O} \rightleftharpoons \text{Fe}_2\text{O}_3 + 2\text{H}$. L. S. T.

Lopezite, a new mineral. M. C. BRANDY (Amer. Min., 1937, 22, 929—930).—Lopezite, α 1.714, β 1.732, γ 1.805, occurring at Maria Elena, near Tocopilla, has properties practically identical with those of artificial $\text{K}_2\text{Cr}_2\text{O}_7$. L. S. T.

Optical properties and chemical composition of glaucophane. H. W. V. WILLEMS (Proc. K. Akad. Wetensch. Amsterdam, 1937, 40, 720—724).—The approx. composition of a glaucophane can be predicted from its optical properties. A. J. E. W.

Rôle of physical chemistry in stratigraphic problems. G. R. MANSFIELD (Econ. Geol., 1937, 32, 533—549).—The need for the application of physico-chemical methods to the problems of stratigraphy is illustrated by a consideration of the phosphate beds and bedded cherts of the Phospharia formation in Idaho and of the K-bearing Salado halite in New Mexico and Texas. L. S. T.

Dynamic metamorphism of a pegmatite. J. L. LINDNER (J. Geol., 1937, 45, 558—563).—A soda-pegmatite on the east shore of the Herman Lake, Ontario, has been metamorphosed in part to a schist. Mineralogically, the chief difference has resulted from addition of chlorite. The chemical analyses recorded show additions of H_2O , MgO , and FeO , and losses of alkalis, CaO , Al_2O_3 , and SiO_2 . L. S. T.

Formation of laterite. D. W. BISHOP (Geol. Mag., 1937, 74, 442—444).—A discussion. L. S. T.

Composition and structure of stilpnomelane. J. W. GRUNER (Amer. Min., 1937, 22, 912—925).—Chemical analyses selected from the lit. and a new analysis of the mineral from Baern give the formula $(\text{OH})_{16}(\text{K}, \text{Na}, \text{Ca})_{0-2}(\text{Fe}, \text{Mg}, \text{Al})_{29}\text{Si}_{32}\text{O}_{93} \cdot 13\text{H}_2\text{O}$. Except for the state of oxidation of the Fe, chalcodite is the same chemically and structurally as stilpnomelane (I). Dehydration in a vac. shows that $\frac{1}{3}$ to $\frac{2}{5}$ of the total H_2O in (I) is present as OH. This is not given off below 500° . Dehydration is complete at 750° . The structure collapses completely between 600° and 650° . Fe is not oxidised during dehydration at the higher temp. X-Ray data give $d_{(001)}$ 12.07—12.18 Å, b_0 9.08—9.12 Å, a_0 5.23—5.27 Å. The structure probably consists of pyrophyllite-talc layers spaced 12.1 Å apart. The space between them contains ions of Fe, Mg, and K which cannot be accommodated in the layers. A corresponding no. of O or OH ions must be present between the layers. The result is a defect structure in which ions may occupy random positions. K is partly replaced by Tl when (I) is boiled in aq. TlNO_3 . (I) heated with 0.1N-HCl, but not with 0.03N-HCl, in Au-lined bombs at 300° changes to a true pyrophyllite structure. L. S. T.

Magnetic behaviour of the dolerite intrusions in the Karroo system and magnetic measure-

ments on the Witwatersrand. G. BEYER and R. KÜHNE (Metall u. Erz, 1937, 34, 471—475).

A. R. P.

Crystalline structure and decomposability of Greek bauxite. A. A. DELYANNIS and K. ALEXOPOULOS (Metall u. Erz, 1937, 34, 466—467).—The Al_2O_3 readily sol. in hot aq. NaOH is present as böhmite, whereas that insol. is present as diaspore.

A. R. P.

Mongolian magmas. G. W. BAIN (Bull. Geol. Soc. Amer., 1935, 46, 1745—1813).—The rocks are described, 46 analyses being recorded.

CH. ABS. (e)

Scheelite-leuchtenbergite vein in Paradise range, Nevada. P. F. KERR and E. CALLAGHAN (Bull. Geol. Soc. Amer., 1935, 46, 1957—1974).—It is believed that the scheelite is residual and that the original quartz matrix has been replaced by talc and leuchtenbergite due to hydrothermal action.

CH. ABS. (e)

Petrography and genesis of the Siwalik series [N. W. India]. P. D. KRYNINE (Amer. J. Sci., 1937, [v], 34, 422—446).—These fluvial sediments consist of (i) medium-grained sandstones and graywackes containing approx. 40% of quartz, 15% of feldspar, 6% of mica (mainly biotite), and 30—40% of metamorphic rock fragments, and (ii) fine-grained red mudstones, siltstones, and subordinate shales. Minerals present are recorded, and conditions of deposition discussed. The Murree sediments consist mainly of fine-grained brick-red or maroon sandstones containing a large proportion of schist fragments. L. S. T.

Graftonite from Greenwood, Maine. J. J. GLASS and J. J. FAHEY (Amer. Min., 1937, 22, 1035—1039).—Graftonite from Noyes Mountain, Greenwood, Maine has α 1.709, β 1.714, and γ 1.733. The chemical analysis [J. J. FAHEY] gives an isomorphous variation in the proportions of Fe, Mn, and Ca, but conforms to the established formula of $3(\text{Fe}, \text{Mn}, \text{Ca})\text{O} \cdot \text{P}_2\text{O}_5$. L. S. T.

Rare-alkali biotite from Kings Mountain, N. Carolina. F. L. HESS and R. E. STEVENS (Amer. Min., 1937, 22, 1040—1044).—Brown mica associated with a pegmatite at Ware farm, King's Mountain, N. Carolina, has Si 42.02, Al_2O_3 18.75, Cr_2O_3 n.d., Fe_2O_3 0.66, FeO 8.29, MnO 0.27, MgO 9.55, CaO 0.93, Li_2O 1.20, Na_2O 0.73, K_2O 8.54, Rb_2O 1.85, Cs_2O 0.47, H_2O 0.16, $\text{H}_2\text{O} + 2.44$, TiO_2 1.35, F 4.34, total 101.55, less O for F 1.83, total 99.72%. An analysis of biotite from near Tin Mountain, S. Dakota, is also recorded. L. S. T.

Contemporaneous crystallisation of beryl and albite versus replacement. B. M. SHAUB (Amer. Min., 1937, 22, 1045—1051).—The beryl-albite intergrowths occurring at the Golding-Keene, New Hampshire, and the Strickland Connecticut, feldspar mines show relationships that indicate a contemporaneous crystallisation and not an origin through processes of replacement. L. S. T.

Hilgardite, a new mineral species, from Choctaw Salt Dome, Louisiana. C. S. HURLBUT, jun., and R. E. TAYLOR (Amer. Min., 1937, 22, 1052—1057).—Hilgardite (I) is found associated with

anhydrite, danburite, boracite, etc. in the insol. residue from a brine well in this dome. (I), d 2.71, hardness 5, is monoclinic-domatic with $a:b:c$ 1.0147:1:0.5585, β 90° 00', colourless with a vitreous lustre, n_x 1.630, n_y 1.636, n_z 1.664. The analysis [F. A. GONYER] is CaO 34.41, B₂O₃ 49.18, H₂O 6.31, Cl 10.37, insol. 1.89, total 102.16, less O for Cl 2.34, total 99.82%, giving the formula Ca₈(B₂O₁₁)₃Cl₄·4H₂O. A Weissenberg study gives a_0 11.85, b_0 11.12, c_0 6.20 Å., vol. of unit cell 786 Å.³, and mol. wt. of unit cell 1290; space-group *Pc* or *Pm*. L. S. T.

Massive low-fluorine topaz from the Brewer Mine, S. Carolina. J. T. PARDEE, J. J. GLASS, and R. E. STEVENS (Amer. Min., 1937, 22, 1058—1064).—Topaz of a fine-grained chert-like character forms a large part of the Au-bearing lode at this mine. The large size and low F content make this deposit unique. The massive topaz has SiO₂ 33.00, Al₂O₃ 56.76, Fe₂O₃ trace, H₂O—0.04, H₂O+ 2.67, F 13.23, total 105.70, less O for F 5.57, total 100.13%, d^{25} 3.509±0.001, n 1.631, α 1.629, β 1.631, γ 1.638. The F and H₂O contents are the lowest and highest, respectively, on record. The uniformity in optical properties of the massive, granular, and disseminated topaz from different parts of the mine indicates a common origin. Previously existing rocks of the area apparently reacted with magmatic solutions rich in F, SiO₂, and sulphides, and deficient in alkalis, and were replaced by topaz, quartz, and small amounts of sulphides. L. S. T.

[Occurrences of] tellurium minerals in New Mexico. W. P. CRAWFORD (Amer. Min., 1937, 22, 1065—1069).—Descriptive. L. S. T.

Colour change and absorption of zircon from Mongka, Upper India. K. CHUDOBA and T. DREISCH (Zentr. Min., 1936, A, 65—79; Chem. Zentr., 1936, i, 3993; cf. A., 1937, I, 204).—The changes in infra-red spectrum show that the colour change is due to decomp. of Fe^{III} compounds. H. J. E.

Crystallisation of pyroxene and hornblende from artificial silicate melts. D. P. GRIGORIEV and H. W. ISKÜLL (Zentr. Min., 1936, A, 82—87; Chem. Zentr., 1936, i, 3993; cf. A., 1937, I, 204).—From a melt of CaF₂, MgO, and SiO₂ (1:1:2) pyroxene crystallises together with hornblende. H. J. E.

Mechanism of the dehydration of zeolites. W. O. MILLIGAN and H. B. WEISER (J. Physical Chem., 1937, 41, 1029—1040).—X-Ray diffraction study and dehydration isobars at 23.6 mm. obtained under conditions used previously (A., 1937, I, 527) show that scolecite is a trihydrate giving a dihydrate; natrolite a dihydrate giving a monohydrate; mesolite a mixture of these. In stilbite, heulandite, thomsonite, analcite, and chabazite the H₂O is bound by adsorption forces within the lattice channels. Hence the term "zeolitic water" has no special meaning. F. R. G.

Sedimentary and petrographic study of certain glacial drifts of Minnesota. F. C. KRUGER (Amer. J. Sci., 1937, [v], 34, 345—363).—The distributions of heavy minerals in the various drifts are tabulated. The Wisconsin Red drift is high in augite

and magnetite, whilst the Illinoian Red drift has abundant limonite. Garnet, hornblende, and apatite are prominent constituents of the Wisconsin Gray, Kansan Gray, and Iowan drifts; abundant micaceous minerals are also a characteristic. These drifts can be separated on the basis of their carbonate content (data for extraction with dil. HCl given). The amounts of sol. carbonates and the assemblage of heavy minerals are correlated with the origin of a drift. L. S. T.

Calcite from the Madonna del Carmine [hill] of Dorgali, [Sardinia]. C. LAURO (Atti R. Accad. Lincei, 1937, [vi], 26, 25—28).—A crystallographic description of the calcite crystals found in the basaltic lava. O. J. W.

A singular rock from the Baltoro glacier (Karakorum). I, II. P. COMUCCI (Atti R. Accad. Lincei, 1937, [vi], 25, 648—651, 734—738).—Three samples of a felspar from this source are described and their composition is given. O. J. W.

Microscopic study of goëthite and hæmatite in the brown iron ores of E. Texas. F. W. GALBRAITH (Amer. Min., 1937, 22, 1007—1015).—The Fe oxide minerals consist of approx. 80% of goëthite (I) and 20% of hæmatite (II). Lepidocrocite is absent. Quartz is the predominant impurity, but is not abundant. (I) and (II) are essentially contemporaneous; both appear to have been deposited at ordinary temp. and there has been little, if any, alteration of one into the other. L. S. T.

Chemical composition of the iron ores of the U.S.S.R. A. D. ARCHANGELSKI and E. V. KOPTSCHENOVA (Trans. Sci. Inst. Geol. Min. U.S.S.R., 1935, No. 11, 5—66).—Data for the distribution of P, Mn, Ti, V, As, Cr, Ni, Co, and Cu in sedimentary Fe ores are recorded and discussed. CH. ABS. (e)

Structure of Norwegian ores. M. MORTENSON (Tids. Kjemi, 1937, 17, 131—134).—The microcryst. structure of pyrites ores containing ZnS has been studied. The presence of magnetite indicates that the original magma contained an excess of Fe, which would tend to replace Zn in the Zn blende. This is confirmed by the difficulty of separating Zn by flotation in ores containing magnetite. M. H. M. A.

Morenosite from Val Malenco. A. CAVINATO (Atti R. Accad. Lincei, 1937, [vi], 25, 399—401).—The green incrustations on the serpentine masses in the Val Malenco appear to consist of an impure morenosite containing some Mg. O. J. W.

Formation of gneisses and granulites containing sillimanite in the French Massif Central. H. LONGCHAMBON (Compt. rend., 1937, 205, 567—569). A. J. E. W.

Cairnsmore of Fleet granite and its metamorphic aureole. C. I. GARDINER and S. H. REYNOLDS (Geol. Mag., 1937, 74, 289—300).—An analysis of a biotite- and of a muscovite-biotite-granite are given. L. S. T.

Anthophyllite-cordierite-granulites of the Lizard. C. E. TILLEY (Geol. Mag., 1937, 74, 300—309).—Petrological. L. S. T.

[Physical] disintegration of radioactive minerals. E. FØYEN (Tids. Kjemi, 1937, 17, 126).—Autoclaving of cleveite with H_2O for 6 hr. at 190° gives a disintegration product of the same composition as the original mineral, whereas bröggerite (12 hr. at 300°) gives a product rich in Pb and Fe, but containing no U, Th, or Ra. No dissolution occurred in either case. It is concluded that a high $UO_2:UO_3$ ratio favours decomp. M. H. M. A.

Determination of uranium, thorium, and lead in thucholite.—See A., I, 46.

Carbon dioxide accumulations in geologic structures.—See B., 1937, 1200.

New Vogtland wolframite deposit at Pechtelsgrün near Lengsfeld. F. WERNICKE and E. O. TEUSCHER (Z. deut. Geol. Ges., 1936, 88, 87—104; Chem. Zentr., 1936, i, 4275).—Geological and petrological characteristics of the deposit are discussed. J. S. A.

Origin of the Thüringian Bunter Sandstone. R. SÖFNER (Chem. Erde, 1937, 11, 420—444).—Origin and structure are discussed. L. S. T.

Attapulgitite. J. DE LAPPARENT (Z. Krist., 1937, 97, 237—239).—A reply to KERR (A., 1937, I, 484). Identity of attapulgitite (I) with montmorillonite (II) is refuted by thermal and dehydration curves, and by chemical, structural, and X-ray evidence. (I) has a mica, (II) a chlorite, structure. The long-spacing difference of 4 Å. is due to the brucite layer in (II) of Si surrounded by OH' which is destroyed at 300° . I. MCA.

Crystallography of brushite. P. TERPSTRA (Z. Krist., 1937, 97, 229—233).—The monoclinic cell of $CaHPO_4 \cdot 2H_2O$ contains 8 mols. and has a 10.3, b 15.4, c 6.4 Å., β $84^\circ 53'$; probable space-group C_2^2 ; d 2.326. Optical, goniometric, and X-ray measurements confirm the close analogy with the isomorphous gypsum (A., 1937, I, 17). The $PO_3:OH$ groups in brushite occupy the SO_4 positions in gypsum. P lies inside a distorted tetrahedron bearing O ions at its corners with H' at the middle of one edge, the PH' line forming a dyad axis. I. MCA.

Isomorphous kerolite-beidellite series in clay silicates. D. P. SERDIUTSCHENKO (Compt. rend. Acad. Sci. U.R.S.S., 1937, 16, 355—358).—Isomorphous exchange of $3MgO-Al_2O_3$ in the forms $3MgO \cdot 3SiO_2 \cdot 4.5H_2O-Al_2O_3 \cdot 3SiO_2 \cdot 5H_2O$ applied to published chemical analyses for the reddish soapy mineral from Montmorillon (France) shows that it consists of montmorillonites or of members of the kerolite-beidellite series. The higher SiO_2 content of the similar mineral from Rhön basalts is due to isomorphous addition of montmorillonite. The results accord with the nature, formation, and X-ray analyses of the minerals. I. MCA.

Behaviour of montmorillonite on wetting. W. F. BRADLEY, R. E. GRIM, and G. L. CLARK (Z. Krist., 1937, 97, 216—222; cf. A., 1936, 1450; 1937, I, 17).—A Wyoming bentonite (montmorillonite) of stated air-dried composition is grained to 0.05—0.1 μ . and X-rayed in oriented sheets at various

humidities, the H_2O content being determined by ignition. Swelling is not continuous. The (001) spectra indicate five definite hydrates $P, 6nH_2O$ ($n = 0-4$, $P =$ pyrophyllite) of cell heights 9.6, 12.4, 15.4, 18.4, 21.4 Å., respectively. A structure is assigned in which the 2 H_2O of P occur as OH associated with the terminal Al_2O_3 octahedra, and the 6 H_2O enter successively as hexagonally-packed layers, 3Å. thick, between the internal O layers; it explains the (001) spacings and intensities, especially the marked line at about 3.1 Å., and provides a mechanism in layer mobility for easy base exchange. I. MCA.

Carbonate-apatites. Structure of francolite. J. W. GRUNER and D. MCCONNELL (Z. Krist., 1937, 97, 208—215; cf. A., 1934, 157).—Chemical analyses, and indexed spacings of estimated intensity from a powder X-radiogram, are listed for francolite, the hexagonal unit cell of which has a 9.34 ± 0.01 , c 6.88 ± 0.01 Å., $d_{pyk} = 3.147$. Assuming the Mehmel fluorapatite structure, at. exchange is discussed. The C ion cannot occupy the F positions. As CO_3 , some C replaces Ca, contrapolarisation by adjoining P ions expanding the CO_3 radical; as CO_4 , the main part replaces P, decreasing the positive charges sufficiently to permit replacement of O by OH and excess F. The carbonate-apatite group structure is thus: $[Ca(F,Cl,OH)](Ca,C)_4[(P,C)(O,OH,F)_4]_3$. I. MCA.

Photolytic neutralised elements of fluorite. J. HOFFMANN (Chem. Erde, 1937, 11, 368—374).—White fluorite from Fürstenberg when exposed to Ra became blue and this colour disappeared in a few sec. on exposure to light. The coloured material, powdered in the dark, gave an alkaline reaction. Prepared CaF_2 did not show this effect. The colour is due to free Ca atoms, and not to Ce oxides. Dark violet fluorite from deposits containing U minerals is strongly alkaline. Differences in odour noticed when this material is powdered are due to F_2 , HF, and O_3 (the last two formed by the action of F_2 on traces of H_2O). L. J. S.

Pneumatolytic and hydrothermal alteration and synthesis of silicates. G. W. MOREY and E. INGERSON (Econ. Geol., 1937, 32, 607—761 Suppl.).—A review. Available data relating to hydrothermal and pneumatolytic syntheses of silicates are assembled. An annotated bibliography is given. L. S. T.

Sedimentary petrography of the Upper Pleistocene and Lower Pleistocene of the middle Upper Rhine plain. K. H. SINDOWSKI (Z. deut. Geol. Ges., 1937, 89, 409—418).—Heavy mineral analyses are recorded and discussed. L. S. T.

Carotene (provitamin-A) in sapropel. B. K. KLIMOV and E. I. KAZAKOV (Compt. rend. Acad. Sci. U.R.S.S., 1937, 16, 321—323).—Marsh sapropels contain from 10 to 20 mg. of carotene per 100 g. of dry substance. Lake sapropels contain smaller amounts. F. J. G.

Germanium and gallium in coal ash and flue dust.—See B., 1937, 1291.