

BRITISH CHEMICAL ABSTRACTS

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

DECEMBER, 1937.

Spectrum of doubly excited helium. F. P. BUNNY (Physical Rev., 1937, [ii], 52, 452—453; cf. Kiang, A., 1936, 1437).—Attempts with a special electron-impact discharge tube, giving a conc. 1000 ma. beam of 300—500 v. electrons through purified He at approx. 0.01 mm. Hg, to observe the spectrum of doubly excited He gave negative results. Experimental and theoretical implications are discussed. N. M. B.

Excitation and ionisation in active nitrogen. G. CARO and U. STILLE (Z. Physik, 1937, 107, 396—408).—N afterglow spectra photographed from sealed discharge tubes show no negative bands or higher members of the first positive group. It is suggested that Kaplan's observation of these in such spectra (A., 1935, 907) is due to excitation of long-lived mol. ions resulting from the discharge. Conditions for the excitation, and an estimate of the life period of such ions, are given. L. G. G.

Relative intensities and transition probabilities of the orange neon lines. M. GARBUNY (Z. Physik, 1937, 107, 362—368).—From measurements on the positive column Ne glow, conclusions are drawn as to the relative transition probabilities. L. G. G.

Stark effect with magnesium lines. H. ECKARTH (Z. Physik, 1937, 107, 182—191).—A method for observation of the Stark effect with fields up to 690 kv. per cm. is described. The Mg π line, λ 4481, and several members of the sharp and diffuse subordinate series in the triplet system, are influenced by the electric field. A limit for the existence of the excited state is shown by individual terms of the diffuse singlet and triplet subordinate series. H. C. G.

g Factors of rare gas terms. K. LÖRINCZI (Z. Physik, 1937, 107, 177—179).—The discrepancy between the observed Zeeman effect and the g formula for the p^5p configuration as given in the literature is due to an error in calculation. After correction, reasonable agreement is found for numerous A, Kr, and Xe terms. H. C. G.

Extreme ultra-violet spectra of scandium VI and scandium VII and other elements isoelectronic with phosphorus I and sulphur I. P. G. KRUGER and H. S. PATTIN (Physical Rev., 1937, [ii], 52, 621—625; cf. A., 1937, I, 485).—The spectra of Sc, Ti, V, and Cr were photographed in the range 80—700 Å. with a large grazing incidence vac. spectrograph. Ion multiplets are identified with the aid of the irregular doublet law and const. second difference law. In the S I sequence, multiplet

data and calc. term vals. obtained through the identification of intercombination lines are given; in the P I sequence multiplet data only were obtained.

N. M. B.

Band spectrum of As₂. G. D. KINZER and G. M. ALMY (Physical Rev., 1936, [ii], 49, 880; cf. A., 1936, 1039).—This spectrum has been extended to 7000 Å. Two new systems of bands, D and E, have been observed. L. S. T.

Emission and absorption band spectra of selenium. R. K. ASUNDI and Y. P. PARTI (Proc. Indian Acad. Sci., 1937, 6, A, 207—228; cf. A., 1930, 1075; 1936, 654).— $\lambda\lambda$ and intensities of emission bands in the range 3800—5875 Å. are tabulated; the bands show very irregular spacing of the vibrational levels. The energy of dissociation of the ground state is 2.7 ± 0.2 e.v. The observed bands are classified on the basis of two systems having a common initial level which is probably $^3\Sigma^-$; the ground level is $^3\Sigma^-$, the third level possibly being a singlet level due to unexcited atoms, and analogous to $^1\Sigma^+$ in O₂. The absorption bands reported by Moraczewska (A., 1930, 830) are probably due to SeO₂.

A. J. E. W.

Ground state of the Se₂ molecule. S. S. BHATNAGAR, H. LESSHEIM, and M. L. KHANNA (Proc. Indian Acad. Sci., 1937, 6, A, 155—157).—A detailed account of work already noted (A., 1937, I, 504).

Nuclear spin of rhodium. L. SIBAIYA (Proc. Indian Acad. Sci., 1937, 6, A, 229—231).—Measurements of the hyperfine structure of the Rh spectrum at 3434.9 Å. indicate that the nuclear spin of ¹⁰³Rh is $\frac{1}{2}$, the atom possessing a small positive magnetic moment. A. J. E. W.

Spark spectra of iodine in the extreme ultra-violet. L. BLOCH, E. BLOCH, and N. FELICI (J. Phys. Radium, 1937, [vii], 8, 355—362; cf. A., 1935, 271; 1936, 916).— $\lambda\lambda$ and intensities of 445 lines in the range 1000—190 Å. are recorded. Three groups of lines are observed, these probably corresponding with I II, I III, and I IV—I VII, respectively. The two fundamental lines $^1S_0 - ^1P_1$ and $^1S_0 - ^3D_1$ of I VIII have been observed, completing the isoelectronic series Pd I . . . Te VII, I VIII. 12 new lines attributed to I II are in accord with Lacroute's classification.

A. J. E. W.

Third spectrum of cerium (Ce III). H. N. RUSSELL, R. B. KING, and R. J. LANG (Physical Rev., 1937, [ii], 52, 456—466).—Data and identifications for 33 triplet and singlet terms involving 294

lines, mainly of $\lambda > 2000$ A., are tabulated and discussed. N. M. B.

Spectrum of neutral samarium, Sm I. W. ALBERTSON (Physical Rev., 1937, [ii], 52, 644—647; cf. A., 1935, 556).—Newly identified terms and energy states are given and data and classifications of lines are tabulated. The approx. ionisation potential of Sm I is 5.6 v. N. M. B.

Stepwise fluorescence in mercury-nitrogen mixtures. 3650 line. L. A. TURNER (Physical Rev., 1937, [ii], 52, 632—637).—A series of experiments by Wood and Gaviola showed that when Hg vapour is illuminated by light from a Hg arc and N₂ is added in increasing amounts the concn. of atoms in the ³P₂ state, as shown by intensity changes in λ 3650, passes through a min. An explanation involving excitation of atoms in the ³P₁ state by vibrating N₂ mols. is discussed. The results obtained when a filter of Br vapour is used indicate a transfer of excited Hg atoms from one to another ³D state on collision with N₂. N. M. B.

Light yield in the electron impact glow of thallium vapour. G. STROHMEIER (Z. Physik., 1937, 107, 409—413).—Apparatus for electron impact in Tl vapour is described, and from the resulting spectra excitation functions are derived. It is shown, contrary to all similar work, that the ground state whence the excitation proceeds corresponds with a P term and not an S term. L. G. G.

Excitation and emission of limits of the atomic continuous spectra. H. BARTELS (Z. Physik, 1937, 107, 424).—A correction to earlier work (A., 1937, I, 386). L. G. G.

Faraday effect near isolated band lines. T. CARROLL (Physical Rev., 1936, [ii], 49, 887). L. S. T.

Diffraction pattern due to an absorbing prism. R. C. SPENCER (J. Opt. Soc. Amer., 1937, 27, 318—322).—Mathematical. An equation is derived to take account of the transition of Fraunhofer bands with zero to infinite absorption by the prism. The resolving power of an absorbing prism and application to X-rays are considered. N. M. B.

Equivalent electrons and their spectroscopic terms. C. L. B. SHUDEMAN (J. Franklin Inst., 1937, 224, 501—518).—A simpler method than that of Russell (A., 1927, 705) for the calculation of spectral terms which arise from combinations of equiv. electrons, and capable of yielding the more complicated results for equiv. *g*, *h*, and *i* electrons, is given. A. J. M.

Monochromatic solar observations in the light of the helium line 5876. M. WALDMEIER (Naturwiss., 1937, 25, 715).—Observations, with the spectrohelioscope, with the He 5876 line show bright spots, and two types of dark spots, one without, the other with, the Doppler effect. Comparison is made with the H _{α} spectroheliogram. A. J. M.

Monochromatic images of the sun obtained on the spectroheliograph with the infra-red helium line λ 10,830, the violet line H _{ϵ} of hydrogen, and the infra-red lines λ 10,938 and λ 10,049 of the

same element. L. D'AZAMBUJA and (MME.) L. D'AZAMBUJA (Compt. rend., 1937, 205, 554—556).—The spectroheliograms are described and discussed and the origin of the lines is considered. A. J. E. W.

Solar radiation between 2000 and 3000 A. K. O. KIBPENHEUER (Naturwiss., 1937, 25, 669).—In contradiction to previous observations (Meyer *et al.*, Nature, 1934, 134, 535) no radiation between 2000 and 2800 A. could be detected on the summit of the Jungfrau in July and August. The shortest detectable λ of solar radiation is approx. 2845 A. A. J. M.

Shape of the Compton line for helium and molecular hydrogen. B. HICKS (Physical Rev., 1937, [ii], 52, 436—442).—Mathematical. By using variation functions which take into consideration the instantaneous interaction of the electrons, momentum distribution functions and intensity distributions in the Compton lines are computed for He and H₂, neglecting small relativity and binding corrections. N. M. B.

Direct spectrum of the structure and shift of the Compton line with helium gas as the scatterer. J. W. M. DU MOND and H. A. KIRKPATRICK (Physical Rev., 1937, [ii], 52, 419—436).—The characteristic K lines from a Mo target X-ray tube were scattered almost directly backwards by He at 14 atm., and the scattered radiation was resolved with a Cauchois focussing curved quartz-crystal spectrograph on a curved photographic film after 2059 hr. exposure. The structure and breadth of the modified line of this, the first direct spectrum obtained of radiation scattered by a gas, are in good agreement with the predictions of Du Mond's theory regarding the modified line as broadened by the Doppler effect of the momentum of the electrons in the scatterer. The slight defect in the shift (cf. Ross, A., 1934, 1282) caused by the momentum imparted to the atom in the ejection of the recoil electron is verified. Previous investigations on the structure and shift of modified scattered radiation are critically reviewed. N. M. B.

Variation of the atomic structure factor of nickel with X-ray wave-length. W. P. JESSE (Physical Rev., 1937, [ii], 52, 443—451; cf. A., 1936, 655).—X-Ray measurements made with a vac. ionisation spectrometer on powdered Ni to determine the variation of the at. structure factor in the region of the K absorption edge, $\lambda = 1.4839$ A., over the range 0.560—2.74 A., using powdered NaCl and LiF as comparison substances, show that the experimental dispersion curve for the at. structure factor, based on the difference between measured structure factor vals. on the long and short λ side of the K absorption edge, does not agree in shape with the theoretical curve, except approx. at longer λ . N. M. B.

Electronic specific heat and X-ray absorption of metals, and some other properties related to electron bands. H. JONES and N. F. MOTT (Proc. Roy. Soc., 1937, A, 162, 49—62).—A theoretical investigation for metals having closed *d* shells shows that the linear term in the expression for electronic sp. heat is $>$ that given by the free electron theory.

The high sp. heat of Ni, Pd, Pt, and Ta is attributed to an incomplete *d* shell. The density of states in the *d* band is calc. and magnetic susceptibilities, high-temp. resistance, and thermoelectric power for body-centred cubic transition metals are discussed. The fine structure of long- λ X-ray absorption bands is considered.

G. D. P.

Ionisation potentials of H₂, N₂, CH₄, and H₂O. L. G. SMITH and W. BLEAKNEY (Physical Rev., 1936, [ii], 49, 883).—Mass-spectrographic measurements of the min. energies of electrons to produce ions of H₂⁺, N₂⁺, and H₂O⁺ give the vals. 15.37, 15.57, and 12.59 v. (all ± 0.05 v.), respectively. In CH₄, ions of H₃⁺ are formed in addition to those of CH₄⁺, CH₃⁺, CH₂⁺, CH⁺, C⁺, H⁺, and H₂⁺. The ionisation potential of CH₄⁺ is 12.72 v., and the appearance potentials of H⁺, H₂⁺, and H₃⁺ are 22.7, 27.8, and 26.0 v., respectively.

L. S. T.

Effect of temperature on photo-electric emission. R. J. CASHMAN (Physical Rev., 1937, [ii], 52, 512—518).—Mathematical. From a survey of existing theories and data it is concluded that experimental results can be fitted to a T^2 law provided v_0 is regarded as a function of temp., and this leads to an accurate method of determining the temp. coeff. of v_0 giving good agreement with thermionic data.

N. M. B.

Detection of glow emission of single electrons by means of a proportional double amplifying device. E. H. WINKLER (Z. Physik, 1937, 107, 235—250).—By means of a two-stage potential drop amplifier and electrometer, the commencement and temp.-dependence of electron emission from Pt wire was measured. With an "amplification factor" of 200,000 and an electrometer sensitivity of 50,000 electrons per sq. mm., single electron emission may be detected. Commencement of electron emission at 509° from Pt wire 0.1 mm. thick occurs with a current of 3.88×10^{-20} amp. per sq. cm. and the emission potential for Pt is 4.3 v. Richardson's law is confirmed in the region of single electrons.

L. G. G.

Diamagnetism of an electron gas. A. PAPAETROU (Z. Physik, 1937, 107, 387—392).—Conclusions drawn from earlier work (A., 1937, I, 404) are incorrect. The magnetic behaviour of an electron gas in weak fields remains normal.

L. G. G.

Fluctuation phenomena in the passage of high-energy electrons through lead. W. H. FURRY (Physical Rev., 1937, [ii], 52, 569—581).—Mathematical. The fluctuations in size of showers produced by single electrons or photons and the fluctuations in energy loss of electrons are considered.

N. M. B.

Visual observations on the Malter effect. L. R. KOLLER and R. P. JOHNSON (Physical Rev., 1937, [ii], 52, 519—523).—The thin film field emission (cf. Malter, A., 1936, 540) from Al₂O₃ films on Al was investigated by coating the film with fine willemite dust and observing the behaviour of the primary beam, and by forming an electron image of the surface by means of the Malter current from it. The behaviour of the films while exhibiting the Malter effect is described and discussed.

N. M. B.

Calculation of the penetration of electrons of a few million volts. I. S. FRANCHETTI (Atti R. Accad. Lincei, 1937, [vi], 25, 468—474).—Theoretical.

O. J. W.

Secondary production of electrons in the corona discharge at low pressures. W. CHRISTOPH (Ann. Physik, 1937, [v], 30, 446—466).—Photo-electric measurements of the light emitted by a corona discharge in H₂ and air show that the no. of emitted quanta \propto the ratio of the current and the gas pressure. Direct measurements of the ionisation produced by this light have been made by means of a counter tube. For H₂ and air at 50 mm. pressure the photo-current produced by light from the discharge is, at a min. estimate, 1% of the total current. Allowing for the increase by collision, it is calc. that 50% of the total current has its origin in photoionisation. Mean absorption coeffs. for the emitted light for H₂ and air at 760 mm. are 27.6 cm.⁻¹ and 53.5 cm.⁻¹, respectively. A method of measuring the frequency of discharges in the counting tube up to 2.5×10^3 per sec. is described; it depends on the measurement of the time interval between application of the potential and establishment of the discharge.

O. D. S.

Angular distribution of photo-electrons from the K shell. F. F. H. EGGLESTON and L. H. MARTIN (Proc. Roy. Soc., 1937, A, 162, 95—110).—The angular distribution of X-ray photo-electrons from the K shell of A is studied by means of the Wilson expansion chamber. The distribution curves, bipartition angles, and asymmetries of electrons with energies of 14.2, 46.8, and 88.2 e.kv. are in agreement with the predictions of wave mechanics.

G. D. P.

Dimension relations for electron motion in alternating fields. II. E. BRÜCHE and A. RECKNAGEL (Z. tech. Physik, 1937, 18, 139—140; cf. *ibid.*, 1936, 17, 241).

O. D. S.

Ionisation of mercury vapour by positive potassium ions. R. N. VARNEY, M. E. GARDNER, and A. C. COLE (Physical Rev., 1937, [ii], 52, 526—527).—Using a balanced space charge method of improved sensitivity for detecting ionisation (cf. A., 1935, 556), no ionisation of Hg vapour by K ions of energies up to 300 e.v. was detected, although ionisation by Na ions has been found (cf. A., 1936, 1171).

N. M. B.

Mass-spectrographic examination of nitrogen hydrides. K. SCHÄFER and R. CONRAD (Z. Physik, 1937, 107, 393—395).—Ions produced in canal-ray tubes in NH₃, N₂H₄, and mixtures of N₂ + H₂ were examined by the parabola method. Normal exposure times show the presence of N⁺ ($m = 14$), NH⁺ and NH⁻ ($m = 15$), NH₂⁺ and NH₂⁻ ($m = 16$), NH₃⁺ ($m = 17$), and N₂⁺ ($m = 28$). Strong overexposure reveals lines of $m = 18, 29$, and 30. These and the non-appearance of negative ions ($m = 14, 17$, and 28) are variously explained. Results are in accord with those of Taylor (A., 1935, 801).

L. G. G.

Negative atomic hydrogen and deuterium ions. P. F. DARBY and W. H. BENNETT (Physical Rev., 1936, [ii], 49, 881—882).—The source of negative at. H ions previously reported (A., 1936, 263) has been improved and simplified by the introduction of Hg

vapour and the use of a transverse magnetic field. Using 50% D₂O, only 0.6 as much negative D as negative H was obtained.
L. S. T.

Destruction of electron space charges by positive ion rays. R. KIENZLE (Ann. Physik, 1937, [v], 30, 401—419).—The destruction of a negative space charge by a directed beam of positive ions of velocity from 100 to 1250 v. has been investigated. The effect increases with increasing space charge density and with increasing ion velocity. With increasing no. of positive ions the effect increases to a saturation val. determined by the original val. of the space charge. The influence of the direction of the ionic beam has been investigated. Results indicate that the effect is, at least in part, due to the change in the potential distribution by the presence of the positive ions. Kingdon's theory (Physical Rev., 1923, 21, 408) is not applicable to positive ions of the high velocities used.
O. D. S.

Velocity analysis by means of the Stern-Gerlach effect. V. W. COHEN and A. ELLETT (Physical Rev., 1937, [ii], 52, 502—508).—A method permitting a study of the velocity distribution in a mol. beam and of the behaviour of the field gradient as a function of position is applied to a beam of alkali atoms and shows that with low v.p. in the oven the Maxwell distribution law is obeyed, but at oven pressures such that the mean free path is \ll the width of the oven slit a departure sets in.
N. M. B.

Velocity analysis of potassium atoms scattered by magnesium oxide. A. ELLETT and V. W. COHEN (Physical Rev., 1937, [ii], 52, 509—512).—A beam of K atoms was scattered by a MgO crystal and the magnetic velocity analyser (cf. preceding abstract) was used to determine the velocity distribution of the scattered atoms. The velocity spectrum agrees with that calc. from a Maxwell distribution characteristic of the crystal for a crystal temp. varied over a wide range. There is no evidence of specular reflexion or of diffraction but only of random or cosine scattering. The process appears to be one of adsorption and re-evaporation.
N. M. B.

Magnetic moment of the proton. I. ESTERMANN, O. C. SIMPSON, and O. STERN (Physical Rev., 1937, [ii], 52, 535—545).—The magnetic moment of the proton, measured by the method of magnetic deflexion of mol. beams employing H₂ and HD, was 2.46 nuclear magnetons, accurate to $\pm 3\%$.
N. M. B.

At. wt. of phosphorus. O. HÖNIGSCHMID (Naturwiss., 1937, 25, 670—671).—Nephelometric determination of the ratio POCl₃ : 3Ag gives 30.978 for the at. wt. of P, in agreement with the mass-spectrographic val.
A. J. M.

At. wt. of neodymium. O. HÖNIGSCHMID (Naturwiss., 1937, 25, 701).—Analysis of NdCl₃ gives the val. 144.27 for the at. wt. of Nd, in exact agreement with the International val., and disagreeing with Aston's mass-spectrographic val. of 143.5.
A. J. M.

Abundance ratio of the isotopes in natural or isotopically separated carbon. A. R. BROSI and

W. D. HARKINS (Physical Rev., 1937, [ii], 52, 472—474).—The relative intensity of the (1, 0) band heads of the ¹²C¹²C and ¹²C¹³C mols. in the Swan system of the C₂ spectrum, measured by a photographic spectrophotometric method, is 0.0217 ± 0.0009 , giving a val. of 92.2 ± 3.7 for the ¹²C/¹³C abundance ratio in good agreement with the val. 91.6 ± 2.2 obtained from mass-spectrographic data (cf. Vaughan, A., 1936, 400).
N. M. B.

The row of increasing at. wts. and the periodic law. A. V. GROSSE (J. Chem. Educ., 1937, 14, 433—444).—The arithmetic mean of the at. wts. of all at. species of an element is used instead of the at. wt. for the exact formulation of the periodic law. The anomalies associated with A, Co, Te, and Th then disappear.
L. S. T.

Second report of the Committee on Atoms of the International Union of Chemistry. F. W. ASTON, N. BOHR, O. HAHN, W. D. HARKINS, and G. URBAIN (Paris, 1937, 19 pp.).—The International Table of stable isotopes has been revised for the 1937 edition as a result of data taken from nine papers.

Tritium or triterium? K. C. BAILEY (Nature, 1937, 140, 590).—The name that corresponds with deuterium is "tritium." "Triterium" should not be used.
L. S. T.

Distribution of the lifetimes of radioelements. M. E. NAHMIAS (Physical Rev., 1937, [ii], 52, 666; cf. A., 1937, I, 340).—Plottings of additional data support a Gaussian-like distribution of lifetimes, and results, examined mathematically, confirm this view.
N. M. B.

Fourth radioactive family with at. wts. $4n + 1$. L. GROSCHEV (Uspech. Fiz. Nauk. U.S.S.R., 1935, 15, 931—932).—A review.
CH. ABS. (e)

Present position (June 1, 1937) of the theory of β -decay. G. GAMOW (Physikal. Z., 1937, 38, 800—814).—A review.

Compton effect with γ -rays. R. S. SHANKLAND (Physical Rev., 1937, [ii], 52, 414—418).—Results of investigations of the Compton effect using Geiger-Müller counters are summarised. No time lag as great as 10^{-4} sec. can exist in the Compton scattering process. The angular relationship given by the photon theory is verified to within $\pm 20^\circ$.
N. M. B.

γ -Radiation from lithium and fluorine bombarded with protons. E. R. GAERTNER and H. R. CRANE (Physical Rev., 1937, [ii], 52, 582—591; cf. A., 1937, I, 108).—In view of disagreement between the results given by recoil electrons and pairs, the recoil electrons ejected from a 2-mm. C scatterer by the γ -radiation from Li + ¹H were investigated and indicate lines of energies 17, 14.5, 11.5 and possibly 8.5 m.e.v. Pairs ejected from the same scatterer are attributed mainly to the 17 m.e.v. line. Recoil electrons ejected from a 1.5-mm. C scatterer by the γ -radiation from F + ¹H indicate lines of energies 5.7 and 4 m.e.v. Pairs produced by internal conversion of the same radiation indicate the same two lines. The cross-section for this effect is in good agreement with theory.
N. M. B.

Emission of electrons from substances of varying thickness and atomic number by means of hard γ -rays. E. CARLSEN (*Naturwiss.*, 1937, **25**, 700—701).—Repetition of earlier work (Workman, A., 1933, 762; Gueben *et al.*, *ibid.*, 762) shows that it was partly invalidated by the natural activity of the walls of the ionisation chamber. γ -Rays from Ra were filtered through 12 mm. and 50 mm. of Pb, respectively, and Al, Cu, Sn, and Pb were used as secondary filters. For equiv. metal thicknesses the absorption is approx. the same in Cu, Sn, and Pb, but is smaller for the hard than for the soft γ -rays. Al absorbed in both cases more strongly than the other metals. The max. of the absorption curves are smaller for hard γ -rays than for soft, the more so the greater is the at. no. A. J. M.

Resonance levels of the two ^{80}Br isomerides. R. FLEISCHMANN (*Z. Physik*, 1937, **107**, 205—209).—The energies of the resonance neutrons produced from the isomeric nuclei ^{80}Br ($t = 18$ min.) and ^{80}Br ($t = 4.2$ hr.) have been measured by absorption in B and found to be identical within limits of experimental error. H. C. G.

Scattering of slow neutrons. M. GOLDBABER and G. H. BRIGGS (*Proc. Roy. Soc.*, 1937, **A**, **162**, 127—143).—Improved methods for measuring total and scattering cross-sections of the elements are described. Total cross-sections for a few and scattering cross-sections for most of the elements are tabulated. The scattering of slow neutrons by H in H_2O or paraffin mols. is the same. Elements heavier than H do not slow down medium-velocity neutrons appreciably. An upper limit, 10^{-27} cm., is given for the cross-section for scattering of slow neutrons by electrons. G. D. P.

Low-temperature neutrons. W. F. LIBBY and E. A. LONG (*Physical Rev.*, 1937, [ii], **52**, 592—603; cf. A., 1936, 1314).—Experiments are described which indicate that hydrogenous substances (paraffin, $n\text{-C}_7\text{H}_{16}$, C_2H_6 , CH_4 , H_2O , NH_3 , and H_2) so cold that nearly all the mols. are in the ground state can cool only those neutrons having kinetic energies great enough to excite the mols. to their first state, the probability of energy loss to a liquid or crystal is small, and, for hydrocarbons, the limiting temp. for cooling neutrons decreases with increase in length of the hydrocarbon chain. A neutron thermometer, using the absorption by B, was tested and approx. calibrated. N. M. B.

Inelastic scattering of fast neutrons. G. T. SEABORG, G. E. GIBSON, and D. C. GRAHAME (*Physical Rev.*, 1937, [ii], **52**, 408—414).—Evidence is presented that the soft γ -rays produced when fast neutrons bombard various substances are due to a process of inelastic scattering. Measurements on absorption, inelastic scattering, and slowing of fast neutrons in C, Al, S, CCl_4 , Fe, Cu, Cd, and Pb are given. N. M. B.

Disintegration of boron by deuterons. W. E. STEPHENS and T. W. BONNER (*Physical Rev.*, 1937, [ii], **52**, 527).—The presence of 13-m.v. neutrons when B is bombarded with 0.9-m.v. deuterons in He is

confirmed (cf. A., 1936, 1174), indicating that 13-m.v. neutrons do make elastic collisions with He nuclei. N. M. B.

Addition processes with fast protons. W. GENTNER (*Z. Physik*, 1937, **107**, 354—361).—From coincidence measurements on secondary electrons from γ -rays produced by the bombardment of Li, B, F, Na, and Al with protons up to 600 e.k.v. energy, the quantum energies and positions of resonance of the γ -rays are obtained. The mechanism of proton addition is discussed. L. G. G.

Disintegration of lithium by deuterons. J. H. WILLIAMS, W. G. SHEPHERD, and R. O. HAXBY (*Physical Rev.*, 1937, [ii], **52**, 390—396; cf. Rumbaugh, A., 1937, I, 5).—The disintegrations studied in the deuteron energy range 100—250 kv. were: (1) ${}^7_3\text{Li} + {}^2_1\text{H} \rightarrow {}^4_2\text{He} + {}^4_2\text{He} + \frac{1}{2}n + Q_1$, (2) ${}^7_3\text{Li} + {}^2_1\text{H} \rightarrow {}^4_2\text{He} + {}^4_2\text{He} + Q_2$, (3a) ${}^7_3\text{Li} + {}^2_1\text{H} \rightarrow {}^7_3\text{Li} + {}^1_1\text{H} + Q_{3a}$, (3b) ${}^7_3\text{Li} + {}^2_1\text{H} \rightarrow {}^7_3\text{Li} + {}^1_1\text{H} + Q_{3b}$; ${}^7_3\text{Li} \rightarrow {}^7_3\text{Li} + h\nu$, (4) ${}^7_3\text{Li} + {}^2_1\text{H} \rightarrow {}^4_2\text{He} + {}^4_2\text{He} + Q_4$. Efficiency curves for (1), (2), and (3a) are regular. The Oppenheimer-Phillips process (cf. A., 1935, 1296) is not applicable to (3a). The relative yield of (3b) to (3a) rises with increasing deuteron energy. The return of the excited Li nucleus in (3b) to its normal state is shown by the emission of a γ -ray of 400 kv. energy as determined by absorption measurements. The existence of a homogeneous group of particles from (4) indicates the instability of ${}^5\text{He}$, which has a mean life of approx. 6×10^{-20} sec., and is unstable by 0.93 m.e.v., disintegrating into an α -particle and a neutron. Abs. yields for the five disintegrations are given for a deuteron energy of 212 kv. N. M. B.

β -Ray spectra of ${}^8\text{Li}$ and ${}^{12}\text{B}$. D. S. BAYLEY and H. R. CRANE (*Physical Rev.*, 1937, [ii], **52**, 604—609).—The use of strict criteria in track selection leads to the val. 12.0 ± 0.6 m.e.v. for the upper limits of both spectra. There is evidence that the protons emitted during the formation of ${}^8\text{Li}$ have nearly zero energy, and at least 1 m.e.v. in the case of ${}^{12}\text{B}$. Comparisons of results with those predicted by the Konopinski-Uhlenbeck and Fermi theories in conjunction with α -particle distribution data are discussed. N. M. B.

Long period positron activity: ${}^{22}\text{Na}$. L. J. LASLETT (*Physical Rev.*, 1937, [ii], **52**, 529—530).—Bombardment of Mg with 5.2-m.e.v. deuterons gave rise to a long-period radioactivity ascribed to ${}^{22}\text{Na}$ (half-life 3.0 ± 0.2 years). Absorption measurements on the positrons emitted agree with those for F under α -particle bombardment. The positron momentum distribution investigated with a H_2 -filled cloud-chamber in a magnetic field gave an upper limit corresponding with 0.58 ± 0.03 m.e.v. N. M. B.

New radioactive isotope of potassium. H. WALKER (*Physical Rev.*, 1937, [ii], **52**, 663; cf. A., 1937, I, 213).—Pure Ca or $\text{Ca}(\text{OH})_2$ irradiated with high-energy neutrons from a Li target bombarded with 14 ma. deuterons gave activities of half-life 12.5 hr. and 18 ± 1 min., chemically identified as K isotopes and attributed to ${}^{42}\text{K}$ (12.5 hr.) and to ${}^{43,44}\text{K}$ (18 min.) formed thus: ${}^{43,44}\text{Ca} + n^1 \rightarrow {}^{43,44}\text{K}$; ${}^{43,44}\text{K} \rightarrow {}^{43,44}\text{Ca} + e^-$. N. M. B.

β -Ray spectrum of ^{56}Mn . R. H. BACON, E. N. GRISEWOOD, and C. W. VAN DER MERWE (Physical Rev., 1937, [ii], 52, 668).—Measurements of the β -ray spectrum of ^{56}Mn excited by bombarding NaMnO_4 solution with neutrons from a Ra-Be source confirm the results of Brown (cf. A., 1936, 1441) rather than those of Gaertner (cf. *ibid.*, 918).

N. M. B.

Radioactive isotopes of indium. L. J. LAWSON and J. M. CORK (Physical Rev., 1937, [ii], 52, 531—535).—Assignments of the seven radioactive periods known to exist were established by bombarding In with slow neutrons, deuterons, and very fast neutrons, and by bombarding Cd with deuterons. Assignments are: ^{116}In (54 min. and 13 sec.), ^{114}In (4.1 hr. and 50 days), ^{111}In (20 min.), ^{112}In (72 sec.), ^{117}In (2.3 hr.). β -Ray energy limits are approx. 2.15 m.e.v. for the 50-day period and 1.75 m.e.v. for the 20-min. positive period.

N. M. B.

Detection of α -particles in the disintegration of thorium. A. BRAUN, P. PREISWERK, and P. SCHERRER (Nature, 1937, 140, 682).—Bombardment of Th by neutrons from a Ra-Be source gives α -particles of energy $>9 \times 10^6$ e.v. They are ascribed to the change $^{232}\text{Th} \rightarrow ^{228}\text{Ra}$.

L. S. T.

Nuclear transformations produced in copper by α -particle bombardment. W. B. MANN (Physical Rev., 1937, [ii], 52, 405—407).—Bombardment of Cu by 11-m.e.v. α -particles gives rise to activities of half-life 1.10 ± 0.05 and 9.2 ± 0.2 hr., belonging, respectively, to ^{68}Ga and ^{66}Ga , both positron active. Absorption measurements gave vals. of 1.8 and 3.1 m.e.v., respectively, for the max. energies of the short- and long-period positrons, but measurements of the positron tracks photographed in a cloud-chamber gave corresponding vals. of 1.9 and 3.9 m.e.v. The excitation function for α -particles and Cu was investigated.

N. M. B.

Radioactive isotopes of scandium from calcium and potassium by α -particle bombardment. H. WALKE (Physical Rev., 1937, [ii], 52, 400—404; cf. A., 1937, I, 213).— ^{43}Sc was separated chemically from Ca; the half-life is 4.0 ± 0.1 hr. There was no evidence of ^{46}Sc or ^{47}Sc . ^{42}Sc (4.1 ± 0.1 hr.) and ^{44}Sc (52 ± 3 hr.) were isolated from K. Decay curves are given. Cloud-chamber studies of the positrons emitted by ^{43}Sc and ^{42}Sc show that the upper limits of the two spectra are 1.3(8) and 1.6(3) m.e.v., respectively.

N. M. B.

Absorption of high-energy electrons. II. J. J. TURIN and H. R. CRANE (Physical Rev., 1937, [ii], 52, 610—613; cf. A., 1937, I, 487).—Cloud-chamber measurements of the energy loss of electrons in passing through Pb and C absorbers are extended up to 11 m.e.v. by using β -rays from ^8Li . The vals. of the average energy loss for Pb are $>50\%$ $>$ those predicted by the Bethe-Heitler theory; this discrepancy is discussed and partly explained to increase agreement to within 30%. Results for C are in good agreement with theory.

N. M. B.

Transmutations with possible emission of negative protons. M. E. NAHMIA (Physical Rev., 1937, [ii], 52, 525; cf. A., 1937, I, 340).—Attempts

to detect ^{11}C and ^{27}Si (radio elements the existence of which would support the possibility of a negative proton) after bombardment of B and Al with fast neutrons were unsuccessful.

N. M. B.

Variations of cosmic ray intensity during magnetic storms. C. STÖRMER (Nature, 1937, 140, 549—550).—The interrelationship observed (A., 1937, I, 546) was predicted by the author.

L. S. T.

Ultra-radiation and active solar processes. J. ZIRKLER (Naturwiss., 1937, 25, 715).—Increase in the intensity of ultra-radiation was observed when H_2 eruptions occurred on the sun, and when sun-spots passed through the central meridian of the sun.

A. J. M.

Electrodynamic force equation in its bearing on evidence for the existence of a new cosmic-ray particle. W. F. G. SWANN (Physical Rev., 1937, [ii], 52, 387—390).—Mathematical.

N. M. B.

Cosmic-ray measurements with a small ionisation chamber. I. Variation with altitude and latitude of the total ionisation for various shields. R. T. YOUNG, jun., and J. C. STREET. II. Comparison of small bursts at different altitudes and their variations with thickness of shield. R. T. YOUNG, jun. (Physical Rev., 1937, [ii], 52, 552—559, 559—564).—I. Latitude ionisation ratios, northern: equatorial, for shielding thicknesses up to 19.4 cm. of Pb at altitudes corresponding with 76, 51, and 45 cm. Hg are independent of shield at each elevation. The latitude ratios are 1.16, 1.27, and 1.30, respectively. A comparison of the contributions to ionisation by penetrating and secondary radiation in relation to vertical rays and showers is made.

II. Data for comparisons of frequencies of occurrence of various sized bursts at different altitudes agree, for the smallest burst-groups, with counter measurements on showers, and, for the largest bursts, with ionisation chamber data. The max. of burst production-absorption curves shift to greater Pb thicknesses with increasing burst size.

N. M. B.

Disintegration processes by cosmic rays with the simultaneous emission of several heavy particles. M. BLAU and H. WAMBACHER (Nature, 1937, 140, 585).—The long-range ionisation tracks observed to start from a common focus in the emulsion of a photographic plate which had been exposed to cosmic radiation for 5 months at an altitude of 2300 m. are considered to have been produced by disintegration of an atom, probably of Ag or Br, in the emulsion by a cosmic ray.

L. S. T.

Production of showers by heavy particles. L. LANDAU and G. RUMER (Nature, 1937, 140, 682).—The limiting val. which the frequency of ionising showers at sea-level and under the earth reaches in a Pb layer of increasing thickness is explained by irradiation with heavy particles that easily penetrate the Pb. A formula for the probability that a shower produced by a photon emitted by a heavy particle emerges from a layer of sufficient thickness is given.

L. S. T.

Shower production (A) under thick layers of various materials, (B) in various materials. K. Z. MORGAN and W. M. NIELSEN (Physical Rev., 1937, [ii], 52, 564—567, 568—569).—(A) From observations by Geiger-Müller counters on showers from Pb and Fe over a wide thickness range, data for Pb-Fe and Fe-Pb transition curves are given. Results are in qual. agreement with the multiplicative theory of cosmic-ray shower origin with the assumption of the generation of additional shower producing radiation in the lower layers of material.

(B) Increases of counting rate due to shower production by layers of equal at. density of Cu, Sn, and Pb vary as a power of the at. no. slightly but significantly $>$ the second. N. M. B.

Geometrical model of the atomic nucleus. W. WEFELMEIER (Z. Physik, 1937, 107, 332—346).—An extension of earlier work (A., 1937, I, 492).

L. G. G.

Theory of scattering of protons by protons. (SR) A. EDDINGTON (Proc. Roy. Soc., 1937, A, 162, 155—174).—A system consisting of an electron and a proton is neutral and there is no electric interaction between the system and the rest of the universe. For two protons this interaction cannot be neglected, and when account is taken of it an extra energy term appears in the wave equations defining a potential well. The consts. of the well are in agreement with those observed. The investigation provides a foundation for the theory of at. nuclei. It is suggested that the magnitude of the potential well should not vary much for different nuclei, but that its intensity should be approx. \propto the at. no. As the potential is gravitational, not electrical, the energy of a neutron is nearly the same as that of a proton. G. D. P.

Binding forces between elementary nuclear particles. E. A. HYLLEAAS (Z. Physik, 1937, 107, 258—272).—Theoretical. The ground state of ^3H , ^3He , and ^4He is considered. L. G. G.

Saturation property of nuclear forces. E. FEENBERG (Physical Rev., 1937, [ii], 52, 667—668; cf. A., 1937, I, 341).—Mathematical. N. M. B.

Comparison of proton-proton and proton-neutron interactions. G. BREIT and J. R. STEHN (Physical Rev., 1937, [ii], 52, 396—399).—A comparison based on the data of Tuve (cf. A., 1937, I, 5) and Amaldi (cf. *ibid.*, 58). The singlet *S* level of D is discussed. N. M. B.

Relativistic effects for the deuteron. S. SHARE and G. BREIT (Physical Rev., 1937, [ii], 52, 546—551; cf. A., 1937, I, 214).—Mathematical. N. M. B.

Some multiple processes between electrons, positrons, and light quanta. B. KOCKEL (Z. Physik, 1937, 107, 153—176).—Theoretical. Action cross-sections for processes between electrons, positrons, and light quanta in which two light quanta participate are compared with similar processes in which three light quanta are involved. L. G. G.

Calculation of the time interval *T* between two successive collisions of an electron with the molecules of the ionosphere. T. V. IONESCU (Compt. rend., 1937, 205, 569—571).—Vals. calc.

on the basis of the author's theory (cf. *ibid.*, 363) are in agreement with experimental and wave-mechanical vals. A. J. E. W.

Determination of *e/m* for an electron by a new deflexion method. II. F. G. DUNNINGTON (Physical Rev., 1937, [ii], 52, 475—501).—A detailed development of a preliminary report (cf. A., 1933, 444). The final val. as free as possible from experimental and subjective errors is $(1.7597 \pm 0.0004) \times 10^7$ e.m.u., but is about 1.25 parts in $10^3 >$ that found in recent spectroscopic determinations. The present most probable val. based on the work of investigators in the last 10 years is $(1.7584 \pm 0.0003) \times 10^7$ e.m.u. N. M. B.

Ratio *e/m* for primary β -rays from radium-*E*. C. T. ZAHN and A. H. SPEES (Physical Rev., 1937, [ii], 52, 524—525).—Investigations using a reversed Bucherer type method show that the assumption of β -particles of mass $>$ for normal electrons, as recently suggested by cloud-chamber experiments, is untenable. N. M. B.

Multiplet structure in a crystalline electric field of cubic symmetry. G. J. KYNCH (Trans. Faraday Soc., 1937, 33, 1402—1418).—Theoretical. *J*-levels for rare-earth ions are given, and some general theorems of matrix elements of crystal potential energies are proved. H. J. E.

Application of the virial theorem to approximate molecular and metallic eigenfunctions. J. O. HIRSCHFELDER and J. F. KINCAID (Physical Rev., 1937, [ii], 52, 658—661).—Mathematical. A simple method of modifying the approx. charge distributions to satisfy the virial theorem is developed. N. M. B.

New method for the production of light sources of constant energy in the visible spectrum. M. VON ARDENNE (Z. Physik, 1937, 107, 414—419).—When Ag-activated Zn-CdS phosphors differing only in CdS content are irradiated with cathode rays or ultra-violet light, the resultant fluorescence spectrum maxima are of const. abs. intensity. A commercial tube is described with a four-component fluorescing plate which gives rise to a const.-intensity spectrum over the range 6800—4300 Å. and of which the four intensity maxima are equally distributed along the range of λ . The range may be extended by means of a fifth component to 3700 Å. and the tube can be used in any common cathode-ray tube exciting circuit. L. G. G.

Rotational quantum numbers in single *Q* branches. L. A. TURNER and W. T. HARRIS (Physical Rev., 1937, [ii], 52, 630—631).—An improved graphical method, applicable to a single band, for determining rotational quantum numbers and rotational consts. of *Q* branches is given. N. M. B.

New band system of the C_2 molecule. J. G. FOX and G. HERZBERG (Physical Rev., 1937, [ii], 52, 638—643).—Analyses are tabulated for the 0—3, 0—4, 0—5, and 0—6 bands at 2855, 2987, 3129, and 3283 Å. of a new C_2 band system. The lower state $^3\Pi$ is the same as for the Swan bands; the upper is a new $^3\Pi_2$ state. Rotational and vibrational consts. are calc. or corr., and the electron configuration is

discussed. Some other bands (unanalysed), probably due to C_2 , are given. N. M. B.

Some new magnesium hydride bands. A. GUNTSCH (Z. Physik, 1937, 107, 420—424).—The $2\Pi^* \rightarrow 2\Sigma$ transition of the 1—0 band is discussed. Consts. for a no. of new bands are given, some of which are ascribed to unknown states of the mol. L. G. G.

Ultra-violet bands of magnesium hydride. L. A. TURNER and W. T. HARRIS (Physical Rev., 1937, [ii], 52, 626—630).—From a detailed study and extension of the $2\Pi^* \rightarrow 2\Sigma$ system of MgH, vals. of consts. of the $2\Pi^*$ state are obtained. Assignments of K vals. in the MgH and MgD bands are corr., and difficulties in the interpretation of the λ 2348 band of MgH and the λ 2360 band of MgD are discussed. N. M. B.

Transfer of rotational energy in molecular collisions. II. Exchange of energy in collisions between unexcited HgH and N_2 molecules. F. RIEKE (J. Chem. Physics, 1937, 5, 831—835; cf. A., 1936, 1176).—The influence of primary light on the intensity distribution in the HgH 4017 band excited by sensitised fluorescence in the mixture $Hg + H_2 + N_2$ indicates a very slow exchange of vibrational energy in collisions between N_2 and HgH mols. in their normal electronic states. Additional experiments rule out other causes, such as self-reversal and reactions involving high-energy Hg atoms formed by stepwise excitation. W. R. A.

Cameron bands ($3\Pi \rightarrow 1\Sigma$) of carbon monoxide. L. GERÖ, G. HERZBERG, and R. SCHMID (Physical Rev., 1937, [ii], 52, 467—471).—The 0—0 and 1—0 Cameron bands of CO were investigated in absorption with high dispersion and data for the lines of three P , three Q , and three R branches observed for each band are tabulated. Vals. of consts. are calc. The upper state of the third positive group of CO is $3\Sigma^+$. The electronic excitation energy of the $a^3\Pi$ level is 48,473.7 cm.⁻¹ N. M. B.

Absorption spectrum of F_2O_2 . P. H. BRODERSEN, P. FRISCH, and H. J. SCHUMACHER (Z. physikal. Chem., 1937, B, 37, 25—29).—Between 2000 and 10,000 Å. the spectrum is a slightly undulating continuum. Absorption begins at about 5900 Å. and the extinction coeff. increases with falling λ . R. C.

Ultra-violet absorption spectrum of nitrogen dioxide. A. IONESCU (J. Phys. Radium, 1937, [vii], 8, 369—374; cf. A., 1932, 1187).—A rotational analysis of the band at 2491 Å. is given; the band is attributed to a transition in which a change of electric moment occurs along the O atom axis. The dissymmetry of the mol. is small. The N—O interat. distance in the unexcited mol. is approx. 1 Å., the valency angle being 107°; in the excited mol. the vals. are 2.15 Å. and 87°. Vals. of I for the unexcited and excited mols. are given. A. J. E. W.

Spin doubling in 2Σ states of AlO. M. K. SEN (Indian J. Physics, 1937, 11, 251—281).—The rotational structure of the (1,0) (0,0) (0,1) (2,1) (1,1) and (1,2) bands of AlO in the system $2\Sigma \rightarrow 2\Sigma$, λ 4100—5700 have been analysed. Spin doubling in both the upper and lower states is found. F. J. L.

Spectra of silicon fluoride. T. YUASA (Sci. Rep. Tokyo Bunrika Daigaku, 1937, 3, A, 195—203).

—Data are tabulated for three new band systems of SiF: 3839—3293, 3365—3198, both degraded towards the red, and 3413—3244 Å., degraded towards the violet. For the first-mentioned system a vibrational analysis is given; the ground state is probably the fundamental level of SiF. Consts. are evaluated. N. M. B.

Ultra-violet band systems of (A) GeCl and GeBr, (B) germanium monoxide. W. JEVONS, L. A. BASHFORD, and H. V. A. BRISCOE. (C) **Ultra-violet band systems of SnBr and SiBr.** W. JEVONS and L. A. BASHFORD (Proc. Physical Soc., 1937, 49, 532—542, 543—553, 554—567).—(A) Data are given for band systems developed in the ranges λ 3202—2847, and 3260—2946 for GeCl and GeBr, respectively, in heavy-current tube-discharges through continuous flows of $GeCl_4$ and $GeBr_4$ vapours. Each consists of two subsystems of bands degraded towards shorter λ , and expressions for the heads are found. Electronic intervals δv_e , upper state energies (system-origins) v_e , and vibrational coeffs. ω_e and $x_e\omega_e$ for both electronic states are compared with those of band systems of other monohalides of the same group. With increasing at. no. and mass of either atom the expected trend is observed in each case: an increase in δv_e , and decreases in v_e , ω_e , and $x_e\omega_e$, except for δv_e in SiBr and the Pb monohalides; the apparent anomalies are discussed.

(B) Measurements reported for the GeO band system by Shaw (cf. A., 1937, I, 110) are extended over the range λ 3319—2441 in an uncondensed discharge through a mixture of $GeCl_4$ vapour and O_2 flowing continuously through the discharge tube. Data for 32 bands are given, and an expression for the heads is found. The system is attributed to ^{74}GeO , and measurements for some heads probably due to ^{72}GeO and ^{70}GeO are recorded. Data are compared with those for band systems of other monoxides and monosulphides of the same group, and observed decreases of v_e , ω_e , and $x_e\omega_e$ with increasing at. no. or mass of either atom are shown graphically.

(C) The ultra-violet systems of SnBr and SiBr developed in heavy-current tube-discharges through continuous flows of $SnBr_4$ and $SiBr_4$ vapours were investigated in relation to those of other monohalides of the same group. SnBr has two systems: at λ 3428—3021, degraded towards the further ultra-violet, and at λ 3709—4255, degraded towards the red. Data and analyses are tabulated, and expressions for the heads are found. Miescher's analysis (cf. *ibid.*, 392) of the SiBr system is modified to include a few hitherto unobserved band-heads, and in analogy to the SiCl and GeBr systems. N. M. B.

Absorption spectra of some carbon and tin halides in the vapour state. Y. P. PARTI and R. SAMUEL (Proc. Physical Soc., 1937, 49, 568—586).—The absorption spectra of the vapours of $SnCl_2$, $SnBr_4$, and of mols. of the types CX_4 , CHX_3 , and CH_2X_2 ($X = Cl, Br, I$) were investigated. The no. of max. and their energy differences and a comparison of the beginnings of the various absorption regions with thermochemical data indicate that the first

process of photo-dissociation corresponds with $MX_4 \rightarrow MX_2(1\Sigma) + 2X$; the further absorption regions are due to one or two excited halogen atoms.

N. M. B.

Absorption spectra of monosulphides of alkaline-earth elements and their latent heats of vaporisation. L. S. MATHUR (Proc. Roy. Soc., 1937, A, 162, 83—94).—An experimental investigation shows that SrS and BaS have two, CaS one, region of absorption. The latent heats are calc. from the long- λ limits of the first continuous absorption.

G. D. P.

Absorption spectrum of $Tm_2(SO_4)_3 \cdot 8H_2O$. H. A. BETHE and F. H. SPEDDING (Physical Rev., 1937, [ii], 52, 454—455).—Calculations support the view that the absorption spectra of rare-earth salts are due exclusively to transitions within the 4f shell (cf. Freed, A., 1937, I, 110).

N. M. B.

Absorption spectrum of iodine molecules adsorbed on salts. N. B. BARAKAN (J. Phys. Chem. Russ., 1937, 9, 364—375).—TI, Cs, K, Na, and NaCl were used. λ varied between 200 and 600 $m\mu$. The spectrum of CsI + I resembles that of CsI₃.

J. J. B.

Absorption spectrum of an atomic solution of tellurium in sulphuric acid. Z. V. BOIZOVA and K. V. BUTKOV (J. Phys. Chem. Russ., 1937, 9, 553—558).—The extinction coeff. has been measured between 260 and 620 $m\mu$. There is a max. at 520 and a min. at 390 $m\mu$. Beer's law is followed.

J. J. B.

Light absorption and its significance for chemical questions. H. FROMHERZ (Z. Electrochem., 1937, 43, 791—796).—A lecture. The laws of light absorption are stated and the application of absorption measurements to some determinations of concn. and constitution explained.

J. W. S.

Optical interaction of chromophores in the same molecule. W. AUMÜLLER, H. FROMHERZ, and C. O. STROTHER (Z. physikal. Chem., 1937, B, 37, 30—36).—Measurements of the extinction coeffs. of solutions of aliphatic dibromides and di-iodides have shown that the absorption of a mol. with two chromophores separated by at least one CH_2 is the sum of the effects due to the chromophores separately. If the chromophores are attached to adjacent C atoms or the same C atom the absorption is intensified and shifted towards the red, and this effect becomes more pronounced if the H adjacent to the chromophores are replaced by alkyl, irrespective of the nature of the latter. It appears that the interaction of chromophores does not depend on their ability to form a conjugated system of double linkings, but rather on their sp. properties, such as polarisation.

R. C.

Absorption spectrum of formic acid in the vacuum ultra-violet. W. C. PRICE and W. M. EVANS (Proc. Roy. Soc., 1937, A, 162, 110—119).—A no. of discrete absorption bands in the region below 1550 Å. is observed. The vibrational structure is discussed and the bands are attributed to the excitation of electrons in the carbonyl O atoms.

G. D. P.

Absorption spectrum of diacetylene in the near ultra-violet. II. S. C. WOO and T. C. CHU (J. Chem. Physics, 1937, 5, 786—791; cf. A., 1935, 1299).—Using an apparatus of high dispersion the spectrum of $(CH_3C)_2$ consists of sharp, narrow, closely-spaced bands in the region 2970—2650 Å., whilst below 2650 Å. the bands are more diffuse but with a comparatively simpler gross structure. Normal vibrations and symmetry properties of the mol. are discussed and frequencies of ≈ 2100 and 1900 cm^{-1} are assigned respectively to the totally symmetrical and the anti-symmetrical longitudinal frequencies of the C:C linkings in the excited state. W. R. A.

Absorption spectrum and molecular structure.

I. Aromatic amines. S. KATO and F. SOMENO (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1937, 33, 209—230).—The intense diffuse band system of NH_3 and the NH_2 group in the region 1900—2400 Å. is attributed to excitation of the normal [Za_1] to the lowest excited state of a $2p(z)$ electron of the N atom. From comparisons of the spectra of NH_2Ph , C_6H_5 , PhMe, and PhOH it is concluded that the pairing of $2p(z)$ electrons is not destroyed by the effect of strong interaction with the orbitals of the Ph radical, but the electron configuration is unstabilised or their symmetry deformed. The conclusions are used to explain the formation of NH_4 salts and are applied to the interpretation of the spectra of more complicated aromatic amines.

J. W. S.

Organic photochemistry. VI. Spectro- and photo-chemical study of the colour sensitiser of dialkylaminoarylpolymermethinecycloammonium.

S. YOSHIMURA and S. SAKURAI (Bull. Inst. Phys. Chem. Res. Japan, 1937, 16, 1071—1098).—The absorption max. in the tetramethine series occurs at λ 500 Å. > for the dimethine series, whilst the sensitising max. for the former is about 680 Å. > for the latter.

J. W. S.

Absorption of R_1-R_1 systems. Spectra of Δ^1 -*p*-menthen-3-one, *p*-xyloquinone, thujone, cyclohexanone, menthone, cyclopentanone, and cyclohexene. H. MOHLER and H. LOHR (Helv. Chim. Acta, 1937, 20, 1183—1188; cf. A., 1937, I, 217, 393).—Data are recorded for the absorption spectra of solutions in C_6H_{14} . The effects of the positions of the double linkings are discussed.

J. W. S.

Optical absorption of porphyrins. XII. Metal complexes. A. STERN and M. DEŽELIĆ (Z. physikal. Chem., 1937, 180, 131—138; cf. A., 1937, I, 442).—The absorption spectra of metal complex salts of mesoporphyrin-IX Me₂ ester in the visible vary considerably, the differences being related to the state of combination of the metal atoms.

R. C.

Chemical war materials. V. Discussion of the absorption bands of $\beta\beta'$ -dichlorodiethyl sulphide. H. MOHLER (Helv. Chim. Acta, 1937, 20, 1188—1192; cf. A., 1937, I, 217).—The absorption spectra of $(OH \cdot CH_2 \cdot CH_2)_2S$, Et_2S , thiophen, $(CH_2Cl \cdot CH_2)_2SO$, $(CH_2Cl \cdot CH_2)_2SO_2$, and diethylene disulphide have been investigated in the region 2000—3000 Å. The results suggest that the selective

absorption of $(\text{CH}_2\text{Cl}\cdot\text{CH}_2)_2\text{S}$ is attributable to excitation of the electrons of the S atom.

J. W. S.

Ice, liquid water, and its solution in dioxan in the near infra-red. G. BOSSCHIETER and J. ERRERA (Compt. rend., 1937, 205, 560—562; cf. A., 1937, I, 495).—Transmission curves for the ν range 2700—3700 cm^{-1} are given. H_2O gives a min. at 3400 cm^{-1} , attributed to H linkings between adjacent mols., and an inflexion at 3250 cm^{-1} . Ice gives a min. at 3250 cm^{-1} , probably due to H linkings in the crystal lattice, and inflexions at 3350 and 3150 cm^{-1} . H_2O in dioxan gives a band system at 3530 cm^{-1} ascribed to H linkings between dioxan and H_2O mols.

A. J. E. W.

Optical absorption of solutions of coloured inorganic salts in the near infra-red. T. DREISCH and W. TROMMER (Z. physikal. Chem., 1937, B, 37, 37—59).—All the Cu salts examined, except $\text{Cu}(\text{OAc})_2$, had the same form of absorption curve and the same was true of the Ni salts, but the absorption max. of the amino-salts were displaced towards the blue compared with those of the aquo-salts and the absorption was more intense. Hexo-aquocobaltous salts (I) have a band with fine structure at 1.23 μ , irrespective of the anion. Aq. and EtOH solutions of $(\text{NH}_4)_2\text{Co}(\text{CNS})_4$ have a band at 1.23 μ , but the absorption intensity is \gg for (I). Mixed solutions of Co^{II} halides with the corresponding halogen acids have an absorption max. between 0.6 and 0.85 μ . and between 1.5 and 2.5 μ .; the position and intensity vary with the halogen. Complex Co^{III} salts absorb in the visible at about 5000 \AA ., but not in the infra-red. The results are consistent with the theory that in the solid and dissolved blue compounds of Co the Co atom is surrounded by four atoms or groups and in the red compounds by six. Two new bands at 1.8 and 2.15 μ . have been observed for NH_4^+ . The absorption max. of H_2O at 0.98 and 1.46 μ . have been resolved into max. at 0.98 and 1.01, and 1.445 and 1.468 μ ., respectively.

R. C.

Infra-red spectrum of tetradeuteroethylene. G. B. B. M. SUTHERLAND and G. K. T. KONN (Nature, 1937, 140, 644—645).—Four more of the twelve fundamental frequencies of C_2D_4 have been identified from a study of the infra-red spectrum.

L. S. T.

Two bands in the infra-red spectrum of formaldehyde. E. S. EBERS and H. H. NEILSEN (J. Chem. Physics, 1937, 5, 822—827).— CH_2O vapour has been examined between 1 μ . and 15 μ .; regions of intense absorption occur near 3.5, 5.7, 6.7 μ ., and from 7.5 to 10 μ .. Exploration of the region 7.5—10 μ . with a grating spectrometer has revealed two bands, rather intense and overlapping, which appear to arise from oscillations of the electric moment perpendicular to the axis of symmetry. Consideration of their features indicates that they are oscillations at right angles to each other and are ν_5 and ν_6 in Sutherland and Dennison's notation (A., 1935, 569). Their centres are at 1278 and 1165 cm^{-1} . The anomalous spacing of the principal rotation lines is attributed to interaction between rotation and the two oscillations which are only slightly anisotropic.

W. R. A.

Geometrical structure of the CH_3N_3 molecule. E. BLUM and H. VERLEGER (Physikal. Z., 1937, 38, 776).—The rotation-vibration spectrum of CH_3N_3 has been photographed in the infra-red. It is concluded that the structure of the CH_3N_3 mol. is symmetrical, with the four atoms C-N-N-N in a straight line (cf. A., 1933, 1222).

A. J. M.

Infra-red absorption spectra of the stereoisomerides of cystine.—See A., II, 488.

Raman spectrum of sulphur dioxide in different states. H. GERDING and W. J. NIJVELD (Rec. trav. chim., 1937, 56, 968—982).—Details are given of results previously recorded (A., 1936, 359). Only small displacements of the Raman lines are observed in SO_2 - SO_3 and SO_2 - CCl_4 mixtures, and the spectra are approx. the superposed spectra of the components.

J. W. S.

Intensity of Raman lines due to intermolecular oscillations. (A) S. C. SIRKAR. (B) C. S. VENKATESWARAN (Current Sci., 1937, 6, 92—93, 93).—(A) Contrary to Venkateswaran (A., 1937, I, 496) the new lines in the vicinity of the Rayleigh line observed in solid compounds are due to intermol. (cf. *ibid.*, 282) and not to lattice oscillations, comparison with diamond not being relevant because the whole crystal behaves as a single mol.

(B) As the lines are depolarised they cannot be due to intermol. oscillations of polymerides. The experimental data are contradictory.

F. R. G.

Raman effect in sulphonitric mixtures. J. CHÉDIN (Ann. Chim., 1937, [xi], 8, 243—315).—A comprehensive report of available results and of investigations previously announced (cf. A., 1936, 9, 279, 649; 1937, I, 112).

N. M. B.

Raman spectra of the compounds POCl_3 , PSCl_3 , $\text{PO}(\text{OMe})_3$, and $\text{PS}(\text{OMe})_3$. A. SIMON and G. SCHULZE (Naturwiss., 1937, 25, 669).—The Raman spectra of compounds of the type POX_3 and PSX_3 were determined and compared with that of H_3PO_4 . If the latter has the form $\text{PO}(\text{OH})_3$ the Raman spectra of $\text{PO}(\text{OMe})_3$ and $\text{PS}(\text{OMe})_3$ should be similar to that of the acid. The spectra of both esters are, however, much more complex than that of H_3PO_4 , indicating a lesser degree of symmetry of the mol. The symmetry of the esters is also < that of POCl_3 or PSCl_3 .

A. J. M.

Raman spectra of inorganic compounds. O. REDLICH, T. KURZ, and W. STRICKS (Monatsh., 1937, 71, 1—5).—Raman spectra of H_2SnBr_6 , MgSnBr_6 , H_2SeCl_6 , SbCl_5 , AsBr_3 , and NaH_2PO_2 have been investigated. In aq. solution SnBr_6^{2-} is not octahedral, but of lower symmetry, probably D_{4h} . The existence of SeCl_6^{2-} is confirmed. NaH_2PO_2 gives 6 lines and shows the expected H frequencies.

E. S. H.

Hexaco-ordination of tellurium, molybdenum, and tungsten. J. GUPTA (Nature, 1937, 140, 685).—The Raman spectra of aq. H_2TeO_4 , NH_4 and K molybdates, Na and K tungstates show only three lines in each case (data given), and their characteristics indicate that these substances at room temp. exist as octahedral units, two O being co-ordinated

to the central atoms from the two H_2O mols. of hydration. L. S. T.

Free rotation in the oxalate group and the resonance bond of carboxyl. J. GUPTA (Indian J. Physics, 1937, 11, 231—233).—The Raman spectra of solid $(\text{NH}_4)_2\text{C}_2\text{O}_4$ and $\text{K}_2\text{C}_2\text{O}_4$ and in aq. solution have been examined. There is free rotation about the C-C bond of the oxalate group in solution, and assuming the O-C-O angle to be 129° the C-O bond is calc. to be 1.30 Å. F. J. L.

Constitution of oxonium compounds. Raman spectra of acid additive compounds of simple aliphatic alcohols and ethers. G. BRIEGLEB and W. LAUPPE (Z. physikal. Chem., 1937, B, 37, 260—284).—A detailed account of investigations the principal results of which have already been recorded (A., 1937, I, 497). R. C.

Raman effect of some aliphatic monoximes. M. MILONE (Gazzetta, 1937, 67, 527—529).—Measurements of the Raman spectra of some aliphatic monoximes show that they are true oximino-compounds and do not exist in tautomeric forms. O. J. W.

Lines attributed to a possible pyrrolenine form in the Raman spectrum of pyrrole. G. B. BONINO and R. MANZONI-ANSIDEI (Atti R. Accad. Lincei, 1937, [vi], 25, 489—493; cf. A., 1937, I, 10).—The existence of a pyrrolenine form of $\text{C}_4\text{H}_5\text{N}$ (cf. A., 1936, 546) is not confirmed by Raman spectrum measurements. O. J. W.

Raman spectrum of N-deuteropyrrole. G. B. BONINO and R. MANZONI-ANSIDEI (Atti R. Accad. Lincei, 1937, [vi], 25, 494—497; cf. A., 1937, I, 10).—The Raman spectra of $\text{C}_4\text{H}_5\text{N}$ and of $\text{C}_4\text{H}_4\text{ND}$ are compared. The results confirm the existence of a form of $\text{C}_4\text{H}_5\text{N}$ in which the direction of the N-H linking is not coplanar with the plane of the ring. O. J. W.

Molecular symmetry of pyrrole. G. B. BONINO (Atti R. Accad. Lincei, 1937, [vi], 25, 502—508; cf. A., 1937, I, 283).—Possible symmetry types of $\text{C}_4\text{H}_5\text{N}$ and of $\text{C}_4\text{H}_4\text{S}$ are discussed. O. J. W.

Structure of benzene. X. Intensities of the Raman lines in benzene and hexadeuterobenzene. R. C. LORD, jun., and E. TELLER (J.C.S., 1937, 1728—1737; cf. A., 1936, 1322).—The quite irregular changes in the intensities of Raman lines and infrared absorption bands on isotopic substitution of D for H in C_6H_6 are explained on a theory which is developed and quantitatively illustrated with respect to the Raman lines. To calculate the intensity changes it is necessary to consider collectively the dynamically inter-related vibrations of a symmetry class and also any rotations belonging to that class because these rotations, as well as the vibrations, can change the dipole moment vector and the polarisability tensor on which respectively absorption and scattering depend. The intensity changes for several symmetry classes have been considered. Calc. intensities agree well with experimental vals. W. R. A.

Phosphorescence of zinc sulphide. E. BAUR (Helv. Chim. Acta, 1937, 20, 878; cf. A., 1937, I, 626).—It is suggested that the phosphorescence of Sidot

blende is due to the decomp., in light, into Zn and S, the latter associating with ZnS during the illumination, but subsequently reacting again with the scattered Zn atoms to re-form ZnS, with emission of the phosphorescent radiation. J. W. S.

Fluorescence efficiencies of solutions of hydrocarbons. E. J. BOWEN and J. W. SAWTELL (Trans. Faraday Soc., 1937, 33, 1425—1429).—Fluorescence efficiencies of solutions of C_6H_6 , C_{10}H_8 , anthracene, phenanthrene, CHPh_3 , and fluorene in EtOH and C_6H_{14} have been measured for λ 2540—3665 Å., using a photo-cell combined with an "integrating screen." This provided a uniform λ sensitivity over the necessary range. H. J. E.

Triboluminescence of certain natural crystals and synthetically prepared materials. (Miss) F. G. WICK (J. Opt. Soc. Amer., 1937, 27, 275—285).—Factors that may be concerned in the emission of triboluminescence are: (a) emission closely resembling phosphorescence and low-temp. thermoluminescence, coming from unstable excited centres activated by exposure to Ra, X-rays, or cathode rays; (b) emission characteristic of the material itself and dependent only on breaking or crushing, due to stable heat-resistant centres; (c) emission due to an electric discharge. For fluorites, synthetic materials containing CaF_2 , and the rare earths, triboluminescence is due to (a), (b), and (c), separately or together; for materials heated in the blast it is due to (b) and (c), and for those ground under liquids, in addition, it is due to (b); for sphalerite and willemite and for artificial substances showing scintillations it is due to (b) and (c); for Mg, Cd, and Na sulphates containing 1% MnSO_4 and for $\text{CaCO}_3 + 1\%$ MnCO_3 (all synthetic) and for $\text{CaF}_2 + \text{Mn}$ and $\text{CaSO}_4 + \text{Mn}$, it is due to (a). Materials showing marked triboluminescence contain traces of impurities serving as activators. The intensity of triboluminescence is affected by heat-treatment. In many cases the spectrum of triboluminescence is identical with that of phosphorescence or low-temp. thermoluminescence excited by Ra. Substances which may be activated to relatively high-temp., persistent thermoluminescence or that due to exposure to Ra, cathode rays, or X-rays show triboluminescence. N. M. B.

Photo-expansion of bromine. W. SMITH, M. RITCHIE, and E. B. LUDLAM (J.C.S., 1937, 1680—1690).—The photo-expansion of Br has been investigated and an equation is developed which connects photo-expansion, thermal conductivity, total pressure, and light absorbed. In general, the addition of foreign gases facilitated the homogeneous recombination of Br atoms and increased the photo-expansion. The triple collision process is promoted by $\text{CO}_2 > \text{O}_2 > \text{N}_2 > \text{H}_2 > \text{A}$. The influence of Br pressure on the thermal conductivity and the effect of adding small amounts of H_2O vapour to the carefully dried system have also been studied. W. R. A.

Contact potentials. (A) Condensation of potassium and sodium on tungsten. R. C. L. BOSWORTH and E. K. RIDEAL. **(B) Evaporation of sodium films.** R. C. L. BOSWORTH (Proc. Roy.

Soc., 1937, A, 162, 1—31, 31—49).—(A) The experimental conditions to be satisfied in order to obtain satisfactory measurements of contact potentials by studying the infra-saturation currents in a thermionic tube are discussed. Films of Na and K condensed on W are examined and from the observed contact potentials the dipole moments of the adions are calc. The dipole moments decrease with increasing film concn. The adsorption of H on a surface partly covered with K is studied. A complete covering of H, K, or O or a mixed film precludes further adsorption of H; on a partly covered surface H may be adsorbed until a complete composite surface is formed. Investigation of the condensation of Na on W wire and ribbon shows that the latter has a much greater sp. surface than the former. Prolonged heating at high temp. increases the no. of Na atoms required to change the surface concn. by a specified amount. The v.p. of solid (285—370° K.) and of liquid (370—443° K.) Na is calc.

(B) An investigation of the evaporation of Na from W by means of measurements of contact potential shows that, on heating, an adion in the film may be excited to a higher energy level in which it is separated from the surface by a distance 0.5 Å. > the normal. Further heating produces evaporation. Spreading forces are calc.; they have a small negative temp. coeff. Consideration of the change of rate of evaporation with concn. leads to the conclusion that conc. films consist of a condensed and a diffuse phase. G. D. P.

Selective photo-effect in oxide cathodes with embedded metal atoms. R. FLEISCHER and H. PIETSCH (Z. Physik, 1937, 107, 322—331; cf. A., 1935, 808).—Red-sensitive semi-conducting photocells of the Cs—Cs₂O—Ag type, both vac. and gas-filled, show changes in selective max. with applied voltage. Up to about 2 v. the change is towards longer λ. Further increase in potential may cause retrogression of the max., which never falls behind the max. when v = 0. L. G. G.

Electrical and optical properties of semi-conductors. XIII. Measurements on cadmium, thallium, and tin oxides. G. BAUER (Ann. Physik, 1937, [v], 30, 433—445; cf. Baumbach and Wagner, A., 1933, 887; Meissner *et al.*, *ibid.*, 894).—Measurements have been made of the electrical conductivity, Hall const., thermoelectric effect, and infra-red absorption from 1 to 6 μ. of thin films of Cd, Tl, and Sn deposited on quartz or glass and oxidised by heating in O₂. The variation in these properties with the extent of oxidation is described. The compounds behave as electron excess conductors but show peculiarities. O. D. S.

Becquerel effect in galena. F. FISCHER, B. GUDDEN, and M. TREU (Z. Physik, 1937, 107, 200—204).—The photo-electric effect of PbS (from various sources) in contact with electrolytes is measured during illumination by an interrupted beam of white light. Synthetic and fused natural PbS show no effect. L. G. G.

Influence of contact resistance on the rectifying and photo-electric properties of barrier-layer

cells. J. ROULLEAU (Ann. Physique, 1937, [xi], 8, 153—236).—A general method is given for determining the resistance of the contact film assumed to exist between a metal and a semi-conductor, and this is shown to depend, in the case of metal—Cu₂O, on the temp., resistivity of the Cu₂O, and nature of, and time interval from, the treatment of the Cu₂O. A relation exists between the photo-electric effect and the rectifying effect; the anomalies of the temp. coeffs. of these effects are only apparent. There is evidence in the Becquerel effect of the superposition of electrochemical and contact film effects. Interpretations afforded by contemporary theories are not, in general, in accord with experimental results.

N. M. B.

Theory of metals according to the Thomas-Fermi method. B. MROWKA and A. RECKNAGEL (Physikal. Z., 1937, 38, 758—765).—The no. of conductivity electrons and emission work may be calc. on the basis of the Thomas-Fermi method, giving qual. agreement with experiment. A. J. M.

Conductivity of cuprous oxide. J. GUNDERMANN, K. HAUFFE, and C. WAGNER (Z. physikal. Chem., 1937, B, 37, 148—154).—The relation previously recorded (A., 1933, 887) between the sp. conductivity and the O₂ pressure has been confirmed at 900° over a wider pressure range. At very low pressures there is an indication of a change to electronic conduction, independent of the pressure (cf. A., 1936, 138). Under low pressures at 700° and 800° the conductivity varies irregularly. The decomp. pressures of Cu₂O have been calc. from existing e.m.f. data. R. C.

Conductivity of cupric oxide. J. GUNDERMANN and C. WAGNER (Z. physikal. Chem., 1937, B, 37, 157—160).—The conductivity at room temp. depends on the previous history and is the lower the higher was the temp. and the lower the O₂ pressure at the latest equilibration with the gas phase. R. C.

Dielectric strengths of CCl₂F₂-air and SO₂-air mixtures. C. M. HUDSON, L. E. HOISINGTON, and L. E. ROYT (Physical Rev., 1937, [ii], 52, 664—665; cf. A., 1937, I, 221).—Sparking potential-partial pressure curves for total pressures 14—100 lb. per sq. in. are given. The dielectric strengths of pure CCl₂F₂ and SO₂ are, respectively, 3.0 and 2.7 times as great as that of pure air. In the case of CCl₂F₂-air the dielectric strength > the sum of the dielectric strengths of the components. N. M. B.

Dielectric constant of titanium dioxide at low temperatures. H. BÜTTNER and J. ENGL (Z. tech. Physik, 1937, 18, 113—117).—The dielectric const. of powdered TiO₂, containing 1.4% SiO₂ and traces of Fe and of metals of the H₂S group, and ignited at 1380° to remove H₂O, has been measured at audio-frequencies and temp. from 0° to —180°. No anomalies dependent on temp. were observed. O. D. S.

Dispersion and absorption with ultra-short waves. (A) Dioxan-water mixtures as comparison liquids at high frequency. W. HACKEL and M. WIEN. (B) Dispersion and absorption of water in the infra-red and the Debye dipole

theory. G. HETTNER. (C) Reflexion and absorption determinations in water and alcohols with centimetre waves. A. ESAU and G. BAZ (Physikal. Z., 1937, 38, 767—770, 771—774, 774—775).—(A) Mixtures of dioxan and H₂O in different proportions enable liquids of dielectric const. 2.3—80 to be obtained. The high-frequency conductivity of dioxan-H₂O mixtures has been determined. In agreement with the Debye theory, the dipole conductivity for long $\lambda \propto \lambda^{-2}$. To increase the val. of such mixtures as comparison liquids for dielectric loss determinations electrolytes may be added.

(b) The variation of the optical consts. (n , and absorption coeff. $n\chi$) with λ has been determined for H₂O in the infra-red. There are marked deviations from Debye's dipole theory.

(c) The dispersion and absorption of H₂O, MeOH, and EtOH have been determined at λ 2.8—10 cm. Used in conjunction with previous results, the observations give for the transition λ , H₂O, 1.85 cm., MeOH, 12.8 cm., EtOH, 28.4 cm. These results agree with Debye's theory. A. J. M.

Absorption bands in polar substances at very high radio-frequencies. I, II. L. CAVALLARO (Atti. R. Accad. Lincei, 1937, [vi], 25, 382—387, 509—515).—I. The theory of the absorption of high-frequency radiation by polar substances is reviewed.

II. The absorption of Bu^oOH and Bu^oOH at -40° to 60° in the region $\lambda = 5-22$ m. has been measured. The results agree with those of Mizushima (A., 1926, 1082). O. J. W.

Dielectric constant of isopropyl alcohol vapour. J. D. STRANATHAN (J. Chem. Physics, 1937, 5, 828—830).—Measurements of the dielectric const. at 12 different temp. between 26.8° and 190.4°, and at several different v.p. for each temp., yield 1.682 ± 0.007 D. for the electric moment of Pr^oOH.

W. R. A.

Determination of the electric dipole moment of the two tautomeric forms of ethyl acetoacetate. M. BEYAERT (Natuurwetensch. Tijds., 1937, 19, 197—213).—From measurements of ϵ of CH₂Ac·CO₂Et in CS₂ solution at room temp. and at -80° the val. of μ is 2.04 and 3.22 D. for the enol and keto-forms at -80° and 18.2°, respectively. S. C.

Molecular polarisation and dipole moments of *o*-, *p*-, and *m*-dimethylcyclohexane. G. M. PANTSCHENKOV and V. F. ORESCHKO (J. Phys. Chem. Russ., 1937, 9, 704—712).—A method for measuring dielectric consts. to 1 part in 10⁵ is described. Mol. polarisations are measured in C₆H₆ solutions. They decrease linearly with concn. The dipole moments are zero for all three compounds. All C atoms in cyclohexane and in its Me₂ derivatives are thus situated at centres of regular tetrahedra. E. R.

Molecular volumes and expansivities of liquid normal hydrogen and parahydrogen. R. B. SCOTT and F. G. BRICKWEDDE (J. Res. Nat. Bur. Stand., 1937, 19, 237—248).—The mol. vols. at saturation between 14° and 20.4° K. are, for normal H₂ 24.747 - 0.08005T + 0.012716T², and for *p*-H₂ 24.902 - 0.0888T + 0.013104T². The change in mol. vol. in passing from *o*- to *p*-H₂ is opposite in direction

to the change observed for other substances in passing between the states of mol. rotation and non-rotation.

F. L. U.

Relation between refraction data and reactivity of halogenated methane derivatives. J. M. STEVELS (Trans. Faraday Soc., 1937, 33, 1381—1390).—Vals. of d and μ are recorded for the various liquid halogenated CH₄ derivatives. Vals. for the bond refractions are calc. and correlated with the reactivity of these CH₄ derivatives (e.g., their reactions with at. H and Na). H. J. E.

Constitution of potassium cyanide and selenocyanate. Refractometric investigation. G. SPACU and E. POPPER (Z. physikal. Chem., 1937, 180, 154—156).—The mol. refraction indicates that both have the nitrile structure (cf. A., 1937, I, 10).

R. C.

One-electron rotatory power. E. U. CONDON, W. ALTAR, and H. EYRING (J. Chem. Physics, 1937, 5, 753—775).—Mathematical. A single electron moving in a force field, which has neither planes nor centre of symmetry, can give rise to optical rotatory power in a medium containing mols. of this type. This effect is called one-electron rotatory power and is in sharp contrast to older theories involving coupled oscillator models. The model is adapted to a consideration of the rotatory power of CHPhMe·O·NO and *sec*-BuOH. The general quantum-mechanical theory of circular dichroism is developed and Kuhn's anisotropy factor is quantum-mechanically defined; the contribution of spins to optical rotation is considered. Experiments of Schwab *et al.* (A., 1934, 1076) on the catalytic dehydration of BuOH on active quartz are discussed and kinetic arguments are advanced to show how the relative configurations of quartz and BuOH may be inferred from such data. The relation of one-electron rotatory power to known dipole moment and solvent effects on rotatory power is briefly discussed. W. R. A.

Dependence of the Kerr electro-optic effect on temperature for carbon disulphide and Halowax oil. A. A. ZUEHLKE and L. R. INGERSOLL (J. Opt. Soc. Amer., 1937, 27, 314—317; cf. A., 1933, 1104).—The Kerr dispersion of CS₂ is independent of temp. for -100° to 20° and a range of $\lambda\lambda$, and this independence is probably general. The temp. variation of the Kerr effect for CS₂ at low temp. and Halowax at high temp. is not well represented by the Langevin-Born theory. Measurements of dielectric const. are tabulated for CS₂ over -110° to 20° and for Halowax over 20—140°; the curve for CS₂ shows an abrupt increase of slope at -92°.

N. M. B.

Chemical properties of the rare gases. B. A. NIKITIN (Nature, 1937, 140, 643).—A, like Rn (A., 1936, 676), is held by SO₂·6H₂O (I), and can be transferred quantitatively from the gas phase into the crystals. Ne is also taken up by crystals of (I), but less easily than A. Only traces of He are taken up under similar conditions. Ne thus forms Ne·6H₂O isomorphous with (I). The different stabilities of these hydrates make it possible chemically to separate A and Rn from He and Ne, and Rn from A.



The chemical properties of A are nearer to those of Rn than to Ne. L. S. T.

Structure of inorganic peroxides. V. I. KASATOTSHKIN (J. Phys. Chem. Russ., 1937, 9, 932—934).—Arguments against Kazarnovski's peroxide formula $H\cdot O\cdot O\cdot H$, and for the alternative formula $H_2\cdot O\cdot O$, with a "mol." O_2 , are advanced. E. R.

Constitution of aurous compounds: gold mirrors. C. S. GIBSON (Nature, 1937, 140, 583).—A discussion. The 2-covalency of Au in its aurous compounds is emphasised. The aurous like the auric ion appears to be incapable of existence. L. S. T.

Co-ordination numbers eight. W. G. PENNEY and J. S. ANDERSON (Trans. Faraday Soc., 1937, 33, 1363—1368).—Complexes are formed by Zr, Ru, Ce, Hf, Os, and Th which have a characteristic group of 24 valency electrons. The complexes formed by Mo and W have groups of 25 and 26 valency electrons, respectively. These facts are shown to be predictable from the theory of mol. orbitals. H. J. E.

Constitution of Erdmann's salt. I. B. C. RAY (J. Indian Chem. Soc., 1937, 14, 440—443).—Chemical and spectroscopic evidence is adduced which supports the view that Erdmann's salt possesses a *cis*- NO_2 -*trans*- NH_3 configuration. F. L. U.

Homeomerism, the identity of physico-chemical characteristics of substances of different composition. G. URBAIN (Bull. Soc. chim., 1937, [v], 4, 1612—1621).—A lecture.

Association coefficients and their variation as a function of temperature. P. GUARESCHI (Atti R. Accad. Lincei, 1937, [vi], 25, 516—518).—An expression for the variation of the coeff. of association of liquids with temp. is derived; it agrees well with the experimental data. O. J. W.

Interaction in molecules between rotation and slightly anisotropic oscillations. H. H. NIELSEN (J. Chem. Physics, 1937, 5, 818—822).—Mathematical. The interaction between rotation and oscillation in two-dimensional slightly anisotropic mols. is discussed quantum-mechanically, considering only rotations about an axis normal to the plane of oscillation together with its effect on the intensities and spacing of the rotational lines of the spectrum. Expressions are derived for the energies of the mol. in the normal and upper states. W. R. A.

Bond force constants and vibrational frequencies of some hydrocarbons. G. GLOCKLER and F. T. WALL (J. Chem. Physics, 1937, 5, 813—817).—Vibrational frequencies of $CMe\cdot CH$, $(CMe)_2$, C_2H_2 , $(CH_2\cdot C)$, C_2H_6 , and CH_4 have been calc. by setting up and solving the appropriate secular equations for valency force systems. Apart from CH_4 , for which both non-degenerate and degenerate frequencies are calc., only non-degenerate frequencies are considered. Five force consts. are used and it is assumed that these remain const. irrespective of the mol. in which the bond occurs. It is also assumed that the bending consts. for the $H-C-H$ and $H-C-C$ angles are the same. These five force consts. are adequate to set up potential energy functions for each of the

29 frequencies considered. Calc. vals. are in fairly good agreement with experimental vals. both for liquids and gases. Slightly different vals. for the five force consts. are used for the two states of aggregation and the force consts. for gases are $>$ those for liquids except for the $C-C$ bond.

W. R. A.

Theory of unsaturated and aromatic compounds. E. HÜCKEL (Z. Elektrochem., 1937, 43, 827—849; cf. A., 1937, II, 450).—The properties of free radicals and the reactivities of unsaturated compounds are discussed theoretically, and various published theories are considered. J. W. S.

Systematics of band-spectral constants. I. Calculation of fundamental vibration frequencies of non-hydride di-atoms (XY type) of symmetrical molecular groups. C. H. D. CLARK. **II. Interrelation of fundamental vibration frequencies of symmetrical di-atoms (XX type) in the same molecular group.** C. H. D. CLARK and C. W. SCAIFE. **III. Simple modification of Mutayama's relation connecting the ground state frequencies of di-atoms XX in the same groups.** C. H. D. CLARK (Trans. Faraday Soc., 1937, 33, 1390—1394, 1394—1398, 1398—1401; cf. A., 1937, I, 215).—I. Theoretical. The validity of the relation $a^3 = 0.815bc^2$ is discussed, a , b , and c being fundamental vibration frequencies. II, III. Theoretical discussions. H. J. E.

Surface condensation of water vapour. N. FUKS (J. Phys. Chem. Russ., 1935, 6, 410—415; cf. A., 1935, 699).—Condensation on a completely wetted surface begins exactly at the dew point. On unwetted bodies (*e.g.*, paraffin) it begins after a supercooling of 0.015—0.002°, the drops appearing in repeated experiments at the same points on the surface. These centres are not all equally active. The Gibbs-Volmer theory can be tested only with very high supersaturations, when the effect of active points may be neglected. CH. ABS. (e)

Surface tension and structure of molecules. The parachor. P. CORRIEZ (J. Pharm. Chim., 1937, [viii], 26, 299—313).—A review.

Measurement of the surface tension of molten salts and metals at high temperatures. F. M. JAEGER (Chem. Weekblad, 1937, 34, 641—646).—A review. S. C.

Reduction of the fundamental laws of chemistry to a single proposition. F. MICHAUD (J. Chim. phys., 1937, 34, 507—516).—Mathematical treatment of the laws of combination by masses and vols. D. F. R.

Indexing of powder photographs. L. K. FREVEL (J. Appl. Physics, 1937, 8, 553—557).—By taking two successive exposures at const. temp. separated by about 150°, an easily measurable temp. shift which can be related to the anisotropy of a cryst. substance is obtained on a single film. Simplified means of indexing the crystallographic systems are discussed mathematically. E. S. H.

Energy of lattice distortion in cold-worked permalloy. F. E. HAWORTH (Physical Rev., 1937, [ii], 52, 613—620).—The lattice distortion produced

by severe cold-working of permalloy (70% Ni) was investigated by measuring with a focussing camera the broadening of the reflexion of the Fe $K\alpha$ doublet by the (311) planes. The broadening decreases on annealing and recovery is complete at 650°. The root-mean-square distortion was 0.31% of the lattice spacing after the material had been reduced 96% in cross-sectional area by cold-working, and the calc. energy of distortion in the hard-worked condition is 23×10^6 ergs per c.c. or 0.065 g.-cal. per g.

N. M. B.

Graphic method for the determination of the lattice constant of iron by means of cobalt rays. P. MÖLLER (Z. tech. Physik, 1937, 18, 167—169).

O. D. S.

Extension of the conception of the electronic lattice to crystals of mono-ionised salts. R. FORRER (J. Phys. Radium, 1937, [vii], 8, 375—382; cf. A., 1937, I, 116, 231).—Consideration of the m.p. and lattice characteristics of a no. of salts of the NaCl, CsCl, and ZnS types indicates the existence of an electronic lattice, in which each "contact" between neighbouring ions is effected by a pair of p electrons from each ion, an ion normally possessing three such pairs in planes at right angles. The intensity of contact in salts is comparable with that occurring in metals, and the stability of the cryst. state generally is attributed to the electronic lattice. Contacts may occur between ions of opposite sign only (*e.g.*, in NaCl and CsCl), or, in cases where the anions are large, additional contacts between anions may be formed (*e.g.*, in Li halides and CsI). Exceptionally (*e.g.*, in Cu^I halides and AgI) contacts may exist between the anions alone, the cations remaining "free" and imparting good electrical conductivity to the crystal.

A. J. E. W.

Melting. V. V. SCHTUTZER (J. Phys. Chem. Russ., 1937, 9, 359—363).—The transformation of crystal lattices into semicryst. liquids is considered.

J. J. B.

Lattice perturbations, particle size, and heat content of pyrophoric iron. R. FRICKE, O. LOHRMANN, and W. WOLF (Z. physikal. Chem., 1937, B, 37, 60—74).—Reduction with H₂ at 350° of hydrated Fe₂O₃ having an "amorphous" X-ray diagram gave pyrophoric Fe, whilst the product of reduction at 640° was not pyrophoric. The heat of dissolution in 23% H₂SO₄ showed the heat content, H , of the pyrophoric form to be the higher by 1.4 kg.-cal. per g.-atom. The mean particle size of the pyrophoric was < that of the non-pyrophoric form, but not so much smaller that the difference of H could be attributed to difference in surface energy. In pyrophoric Fe, however, there were numerous irregular lattice perturbations, the mean distance of the Fe atoms from the normal position being 0.06 Å., whilst in the non-pyrophoric Fe there were none, and this difference was calc. to result in a divergence in the vals. of H approx. equal to the above.

R. C.

Cathode precipitates formed at high current density. K. N. IVANOV and O. K. KUDRA (J. Phys. Chem. Russ., 1935, 6, 469—477).—X-Ray investigation of powder-like cathode ppts. of Cu, Zn, Cd, S S (A., I.)

and Ag obtained from aq. solutions at high c.d. show them to be disperse and to contain O. The lattice parameters of Cu, Cd, Cu₂O, and ZnO in such ppts. were increased up to 100% owing to absorption of H. Zn and Ag gave normal parameters. CH. ABS. (e)

Spiriform morphology of some lead crystal growths in silica gel. N. STUART (Nature, 1937, 140, 589).—Right-handed and left-handed spiral growths of Pb can be obtained from Pb(OAc)₂ and Sn in SiO₂ gel. The type of growth is very sensitive to the concn. of the reactants. L. S. T.

Crystal structure of the compounds of the rare earths with the metalloids of the fifth group. III. Arsenides and antimonides of lanthanum, cerium, and praseodymium. A. IANDELLI and E. BOTTI (Atti R. Accad. Lincei, 1937, [vi], 25, 498—502; cf. A., 1937, I, 401).—X-Ray measurements show that LaAs, CeAs, PrAs, LaSb, CeSb, and PrSb have a face-centred cubic lattice, with a 6.125, 6.060, 5.997, 6.475, 6.399, 6.353 Å., respectively.

O. J. W.

Crystal structure of hydrogen peroxide. F. FÉHER and F. KLÖTZER (Z. Elektrochem., 1937, 43, 822—826; cf. A., 1936, 143).—The tetragonal symmetry of H₂O₂ with a 4.02, c 8.02 Å. is confirmed by measurements on single crystals. The Laue symmetry is class D_{4h} . The possible space-groupings are discussed. J. W. S.

Free two-dimensional crystals of silicon pentoxide. N. A. SCHISCHAKOV (Phil. Mag., 1937, [vii], 24, 687—695).—The existence of nearly identical electron diffraction patterns for pumice, vitreous SiO₂, puzzuolanas, and kaolins is attributed to the presence of two-dimensional Si₂O₅ crystals. K. S.

Fibrous arrangement of micro-crystals of silver chloride. S. SHIMADZU (Mem. Coll. Sci. Kyoto, 1937, 20, A, 179—183; cf. A., 1937, I, 553).—Fibrous crystals are formed on the surface of a AgCl plate dipped in HOCl for 50 hr. The fibre axis is [331], oriented perpendicular to the surface of the plate. F. J. L.

Fibrous arrangements of the micro-crystals of some substances. N. MATSUMATO (Mem. Coll. Sci. Kyoto, 1937, 20, A, 147—151).—Fibrous crystals of K₂CrO₄, Na₂SO₄, KBr, MgSO₄, and potato starch are obtained on slow evaporation from stretched rayon threads saturated with an aq. solution of the substance. The micro-crystals are formed in the interstices with a principal axis parallel to the fibre axis. F. J. L.

Crystallochemistry of nitrates of univalent cations. II. C. FINBAK and O. HASSEL (Z. physikal. Chem., 1937, B, 37, 75—80; cf. A., 1937, I, 401).—By rapidly cooling dry KNO₃ from 140° to 110—115° a metastable form having the calcite lattice and a rhombohedral unit cell with a 6.835 Å., α 46° 48', is obtained. By rotation of the NO₃' ions of the low-temp. form about their trigonal axis the stable high-temp. form of KNO₃ results. X-Ray cameras suitable for high and low temp. are described. R. C.

X-Ray investigation of the structure of cobalt and nickel bromate hexahydrates. C. BELDER-

BOS (Natuurwetensch. Tijds., 1937, 19, 189—196).—The unit cells of $\text{Co}(\text{BrO}_3)_2 \cdot 6\text{H}_2\text{O}$ and $\text{Ni}(\text{BrO}_3)_2 \cdot 6\text{H}_2\text{O}$ contain four mols. The corresponding space-group is T_h^2 with the following parameters determined for Co, Ni, and Br atoms: $d_{100} = [\text{Co}(\text{BrO}_3)_2] 10.320 \pm 0.005 \text{ \AA.}$, $[\text{Ni}(\text{BrO}_3)_2] 10.272 \pm 0.002 \text{ \AA.}$ S. C.

Crystal structure of ammonium, potassium, rubidium, and caesium stannibromides. J. A. A. KETELAAR, (FRL.) A. A. RIETDIJK, and (FRL.) C. H. VAN STAVEREN (Rec. trav. chim., 1937, 56, 907—908).—Powder diagrams obtained with Cu K_α radiation show that the crystal structures of $(\text{NH}_4)_2\text{SnBr}_6$, K_2SnBr_6 , Rb_2SnBr_6 , and Cs_2SnBr_6 are of the K_2PtCl_6 type with a 10.57, 10.48, 10.58, and 10.77 \AA. , respectively. The unit cell contains 4 mols. The Sn—Br distance is 2.60 \AA. , in accord with theory. J. W. S.

Structure of some crystal antimonates. J. BEINTEMA (Rec. trav. chim., 1937, 56, 931—967; cf. A., 1936, 143, 669, 783).—X-Ray investigations show that $\text{Na}_2\text{H}_2\text{Sb}_2\text{O}_7 \cdot 5\text{H}_2\text{O}$, $\text{Mg}(\text{SbO}_3)_2 \cdot 12\text{H}_2\text{O}$, $\text{Ni}(\text{SbO}_3)_2 \cdot 12\text{H}_2\text{O}$, $\text{Ba}(\text{SbO}_3)_2 \cdot 8\text{H}_2\text{O}$, and $[\text{Cu}(\text{NH}_3)_3(\text{H}_2\text{O})_3](\text{SbO}_3)_2 \cdot 6\text{H}_2\text{O}$ (I) all contain Sb with co-ordination no. 6. (I) shows a structure somewhat similar to the alternating structure of CdBr_2 (A., 1934, 16). The term "intrataxy" is suggested for this phenomenon, which is also shown by the triclinic forms of $\text{Mg}(\text{SbO}_3)_2 \cdot 12\text{H}_2\text{O}$ and $\text{Co}(\text{SbO}_3)_2 \cdot 12\text{H}_2\text{O}$. J. W. S.

Lattice constants and space-group of durangite. P. KOKKOROS (Naturwiss., 1937, 25, 717).—X-Ray spectroscopic investigations give a 6.53 ± 0.01 , b 8.46 ± 0.01 , c $7.00 \pm 0.02 \text{ \AA.}$, β 115° , 4 mols. in unit cell, for durangite, $\text{NaAlF}(\text{AsO}_4)$. The structure is very similar to that of titanite, $\text{CaTiO}(\text{SiO}_4)$. A. J. M.

Space lattice and "superlattice" of pyrrhotite. S. S. SIDHU and V. HICKS (Physical Rev., 1937, [ii], 52, 667).—Powder diffraction spectra confirm the presence of a "superlattice" in paramagnetic and in natural and synthetic ferromagnetic pyrrhotites. Data obtained from single crystals do not support the existence of a "superlattice." N. M. B.

Constitution of diethylmonobromogold and di-*n*-propylmonocyanogold. A. BURAWOY, C. S. GIBSON, G. C. HAMPSON, and H. M. POWELL (J.C.S., 1937, 1690—1693).—Although symmetrical diethylmonobromogold (I) and di-*n*-propylmonocyanogold in CCl_4 have dipole moments of 1.32 and 1.47 D., respectively, crystallographic examination of (I) indicates that the atoms and groups attached to a tervalent and quadricovalent Au atom are coplanar with the Au. W. R. A.

Basic lead acetates.—See A., II, 440.

Grating space of barium-copper stearate films. C. HOLLEY and S. BERNSTEIN (Physical Rev., 1937, [ii], 52, 525).—Results of X-ray and optical measurements are not in agreement. N. M. B.

Crystal structure of *p*-dichlorobenzene at different temperatures. S. C. SIRKAR and J. GUPTA (Indian J. Physics, 1937, 11, 283—288). Laue photographs of $\text{p-C}_6\text{H}_4\text{Cl}_2$ at 37° and 20° are

identical, and afford no evidence of the α - β transformation of Vuks (A., 1937, I, 219). F. J. L.

Crystallographic constants [of substituted phenols]. M. G. GILTA (Bull. Soc. chim. Belg., 1937, 46, 275—282).—Measurements are given (cf. following abstract) for *p*-phenetidine hydrochloride, *p*-carbamidophenetole, 3:4-dihydroxyphenylacetyl chloride, *p*-carbamidophenylarsinic acid, SePh_2Cl_2 , SePh_2Br_2 , and SnPh_2 tartrate. I. McA.

Crystalline form of "tryparsamide" and of related compounds. M. G. GILTA (Bull. Soc. chim. Belg., 1937, 46, 263—274).—By optical examination, crystallographic consts. including system, elements, habit, and interfacial angles are recorded for phenylglycine-4-arsinic acid, its trihydrate and Me ester, and for carbamylphenylglycine-4-arsinic acid and its Li, Na, K ($+3\text{H}_2\text{O}$), Rb ($+3\text{H}_2\text{O}$), and NH_4 salts. Crystals are rhombic or monoclinic. I. McA.

Structure of organic molecular compounds. J. S. ANDERSON (Nature, 1937, 140, 583—584).—Vals. of α , b , and c , and β , and the space-groups, as determined by X-ray analysis, are recorded for quinhydrone and six related compounds. Structural characteristics revealed by the data are discussed. L. S. T.

Structure of insulin. D. M. WRINCH (Trans. Faraday Soc., 1937, 33, 1368—1380; cf. A., 1937, III, 362).—A structure is proposed for the mol. of insulin, consisting of a portion of the cyclol fabric bent around to enclose a portion of space. The dimensions of the mol. are correlated with X-ray data. H. J. E.

Diffraction of X-rays by built-up films of proteins. G. L. CLARK and S. ROSS (Science, 1937, 86, 292—293).—The diffraction obtained from 30, 40, or 70 layers of egg-albumin corresponds with a spacing of 73.3 \AA. No side-chain spacing of approx. 10 \AA. could be detected. A long spacing of the order found is in accord with the polymerised cyclol theory of protein structure. L. S. T.

Change of lattice constants of fibroin by perfect drying. Y. MATSUNAGA (Mem. Coll. Sci. Kyoto, 1937, 20, A, 157—171).—The lattice consts. of wet silk fibroin are a 9.68, b 7.00, c 8.80 \AA. , β $75^\circ 50'$, and of fibroin dried in vac. for several hr., a 9.19, b 6.63, c 8.56 \AA. , β $76^\circ 43'$. Wetting causes inter- and intra-mol. swelling, one mol. of H_2O entering the lattice (removed by intensive drying). Measurement of the density of fibroin indicates that the width of the intermicellar spaces is $< 10 \text{ \AA.}$ F. J. L.

Highly polymerised compounds. CLXXIV. Rotating goniometer fibre diagram. Polymorphism of native cellulose and cellulose hydrate. I. E. SAUTER (Z. physikal. Chem., 1937, B, 37, 161—167).—The rotating goniometer, the advantages of which are discussed, has been used to determine the intensities of the diatropic reflexions of native cellulose and cellulose hydrate. The results support Sponser and Dore's theory of the structure of cellulose (A., 1928, 939), rather than that of Meyer and Mark. R. C.

Electronic analysis: oxidation of Au-Cu alloys. J. TRILLAT, S. OKETANI, and S. MIYAKÉ (*J. Phys. Radium*, 1937, [vii], 8, 353—354).—"Diagram O," obtained by electron diffraction from Au foil containing Cu on heating in air (cf. A., 1937, I, 289), is due to a form of CuO stable at the temp. employed.

A. J. E. W.

Strain in galena crystals produced by abrasion. L. H. GERMER (*Physical Rev.*, 1936, [ii], 49, 885).—The abraded surface obtained by filing or grinding a galena crystal gives an electron diffraction pattern consisting of Debye-Scherrer rings of PbS. Light etching in aqua regia changes the surface so that it gives a complex diffraction pattern consisting of two superposed patterns arising from different parts of the surface. The parts from which large blocks are torn by grinding or filing give the pattern of an almost perfect crystal, whilst other areas give a pattern characteristic of a mass of minute crystallites. This layer of rotated crystallites extends 0.003 mm. below the surface, after which the crystal is nearly perfect.

L. S. T.

Structure of Langmuir-Blodgett films of stearic acid. L. H. GERMER and K. H. STORKS (*Proc. Nat. Acad. Sci.*, 1937, 23, 390—397).—Multiple films of stearic acid, prepared by the Blodgett method (A., 1935, 931), and examined by electron diffraction, give clear indications of crystal structure (monoclinic; a 9.4, b 5.0 Å., β 57°; c , undetermined). Comparison is made between these vals. and those obtained by other methods (cf. Müller, A., 1927, 503).

F. A. A.

Saturation magnetisation and approximation law of iron. W. STEINHAUS, A. KUSSMANN, and E. SCHOEN (*Physikal. Z.*, 1937, 38, 777—785).—The saturation magnetisation of various specimens of polycryst. Fe, and Fe alloys (with Ni, Cr, Cu, and Al), and the effect on it of cold-working and heat-treatment, have been determined. The form of the approximation law is different in different ranges of field-strength. At about 2% < saturation, $I = 1 - (\text{const.}/H^2)$; at higher intensities, $I = 1 - (\text{const.}/H)$. Assuming the accuracy of the second formula, the sp. saturation of pure Fe at room temp. is 217.98 ± 0.1.

A. J. M.

Optical constants of liquid gallium. J. B. NATHANSON (*Physical Rev.*, 1936, [ii], 49, 887).—For λ of 4358, 5461, and 6708 Å. the coeffs. of absorption are 7.3, 5.9, 5.4, respectively, and n (relative to air) 0.58, 0.88, and 1.10, respectively. Reflecting powers for normal incidence vary only slightly with λ , being 88.7, 88.3, and 88.5, respectively. A variation in temp. from 24° to 40° had no effect.

L. S. T.

Elastic constants of crystalline sodium at 80° K. S. L. QUILBY and S. SIEGEL (*Physical Rev.*, 1937, [ii], 52, 665).—High-precision data are reported; $s_{11} = 4.86$, $s_{12} = -2.17$, and $s_{44} = 1.76$, all $\times 10^{-11}$ dynes per sq. cm.

N. M. B.

Mechanism of compression and recrystallisation in zinc. M. ŚMIAŁOWSKI (*Z. Metallk.*, 1937, 29, 199—202).—Compression tests on cubes cut from Zn single crystals show that deformability is greatest

in the [0001] direction with loads up to 5 kg. per sq. mm. owing to copious twinning; with greater loads work-hardening is rapid. When the load is applied in the [10 $\bar{1}$ 0] or [1 $\bar{1}$ 20] directions compression is slow until the load exceeds 24 or 13 kg. per sq. mm., respectively, after which a small increase in load produces a relatively great reduction in height of the cube. Grain-growth of Zn compressed in the [0001] direction proceeds very rapidly at 260—280°, whereas in Zn compressed in either of the other two directions it occurs only in the vicinity of distorted slip planes below 260° and above 260° proceeds throughout the specimen until very large grains are formed.

A. R. P.

Influence of difference of orientation of two crystals on the mechanical effect of their boundary. B. CHALMERS (*Proc. Roy. Soc.*, 1937, A, 162, 119—127).—Specimens of Sn consisting of two crystals with a longitudinal boundary are tested in tension. The orientation of the crystals is such that the direction of stress is the same in each. The tension required to produce a certain small deformation is found to vary with the relative orientation of the pair of crystals in a specimen. It is concluded that the boundary has no inherent strength and the results are explained as the effect of a transitional lattice. The evidence is against the existence of an amorphous layer or an intercryst. cement at the boundary.

G. D. P.

Investigation of thermal behaviour of alkaline-earth carbonates by emanation method. I. Monotropic transformation of calcium carbonate. II. Enantiotropic transformations of barium and strontium carbonates. K. E. ZIMMENS (*Z. physikal. Chem.*, 1937, B, 37, 231—240, 241—259).—I. A detailed account of work the principal results of which have already been published (A., 1937, I, 403).

II. The graphs of emanating power (E) against temp. (θ) for samples of CaCO₃ and SrCO₃ containing Th-X all have two peaks corresponding with enantiotropic transformation and dissociation but otherwise their form is considerably influenced by variations in particle size and by impurities. The temp. at which lattice loosening causes an increase in E varies with the particle size. Rhombic SrCO₃ undergoes enantiotropic transformation into the hexagonal form at 925° ± 10° and dissociates at 1260° ± 10°. In certain cases E - θ curves may give information about the state and behaviour of solids which is not otherwise obtainable.

R. C.

Magnetism and chemical constitution. R. F. ROBEY and W. M. DIX (*J. Chem. Educ.*, 1937, 14, 414—423).—A review.

L. S. T.

Variation of the diamagnetism of water with temperature. S. SEELY (*Physical Rev.*, 1937, [ii], 52, 662).—Measurements with a manometric balance (cf. A., 1936, 931) over the range 2—74° indicate a continuous irregular increase of susceptibility with temp. with a marked change at 45°. Honda's equation is discussed (cf. A., 1937, I, 404).

N. M. B.

Diamagnetism of heavy water. O. SPECCHIA and G. DASCOLA (*Nuovo Cim.*, 1935, 12, 606—609).— χ for D₂O at 20°, determined by Quincke's method, is

0.732×10^{-6} , and is slightly $<$ the val. for H_2O . χ decreases with increasing temp. ($5-40^\circ$).

CH. ABS. (e)

Magnetism and polymorphism of internally complex salts; iron salts of dithiocarbamic acids. L. CAMBI and L. MALATESTA (Ber., 1937, 70, [B], 2067—2078; cf. A., 1933, 556).—Röntgen investigation shows that the majority of Fe dithiocarbamates are isomorphous with the typically diamagnetic Co dithiocarbamates. Fe *NN*-dipropyl-, *NN*-diisobutyl-, and *NN*-diisoamyl-dithiocarbamates have practically the same susceptibility in the cryst. condition, in solid solution with the corresponding Co salt, and in certain liquid solvents, showing thus that χ_A depends mainly on the intramol. field. In other cases polymorphism is apparent. The val. of χ_A for the form (I) of Fe^{III} *NN*-dibutyldithiocarbamate obtained by crystallisation at room temp. is $<$ that of the variety (II) obtained by re-solidification of the salt after being melted. The forms exhibit so little symmetry that their cryst. structure cannot be deduced but (I) is isomorphous with the corresponding Co salt which separates from all solvents; (II) is not thus isomorphous. (II), stable at higher temp., is probably metastable at lower temp. The paramagnetic behaviour of (I) appears independent of the cryst. state since practically identical vals. of χ_A are observed in C_6H_6 or $CHCl_3$ at the same temp. A similar example is found in Fe^{III} *N*-butyl-*N*-isobutyldithiocarbamate; only the variety with greater paramagnetism has been obtained with certainty in the cryst. condition. It is a typical Fe^{III} salt and the more stable of the two varieties. H. W.

Diamagnetism of superconducting bodies. G. C. WICK (Physical Rev., 1937, [ii], 52, 526; cf. London, A., 1937, I, 292).—A simple interpretation of the Meissner effect is given. N. M. B.

Thermomagnetic study of two paramagnetic solutions. A. NICOLAU (Compt. rend., 1937, 205, 557—558).—Aq. solutions of $NiSO_4$ and $Fe(NH_4)_2(SO_4)_2$ have been studied in the temp. range $20-85^\circ$; vals. of χ for Ni^{++} and Fe^{++} are given, and conform to Weiss' law. The deduced vals. of M are for Ni^{++} 16.6, and for Fe^{++} 25.5 Weiss magnetons. A break in the $1/\chi-I$ curve for Fe^{++} occurs at 66° , above which M is $<$ the above val. A. J. E. W.

Electrical and optical properties of semi-conductors. XIV. Magnetic measurements on cuprous oxide. F. HOMMEL (Ann. Physik, 1937, [v], 30, 467—480).—The CuO lattice cannot be detected in O-rich Cu_2O by means of Debye-Scherrer patterns, which are sensitive to 1.5% CuO in Cu_2O . The magnetic susceptibility of Cu_2O has been measured from room to liquid air temp. Vals. depend on previous treatment of the specimen. Pure Cu_2O is diamagnetic, $\chi = -0.2 \times 10^{-6}$. The paramagnetic part of the magnetism is increased by heating in O_2 and decreased by heating in vac. On cooling the paramagnetic part increases in O-poor and decreases in O-rich specimens. There is no simple relationship between χ and the resistance of Cu_2O specimens. The absence of Fe in the Cu_2O used was proved by a magnetic method. O. D. S.

Rules of magnetic binding. Stereomagnetism. O. VON AUWERS (Wiss. Veröff. Siemens-Werken, 1937, 16, 92—116).—The magnetism of metallic elements, and its variation with the position of the element in the periodic system, is discussed. Such elements can be classified into three groups: (a) univalent metals, and metals of *B* sub-groups, (b) transition metals, and (c) rare-earth metals. Binary alloys are considered under three types: (a) dil. solutions of non-ferromagnetic metals in ferromagnetic lattices, (b) dil. solutions of ferromagnetic metals in diamagnetic lattices, and (c) conc. solutions of ferromagnetic metals in ferromagnetic lattices. Metals and alloys having diamagnetism or Langevin-paramagnetism are those in which there is no interaction between the lattice constituents. Those having metallic paramagnetism ("anti-ferromagnetism") and ferromagnetism are those with interaction. Anti-parallel impulse coupling gives anti-ferromagnetism; parallel impulse coupling produces ferromagnetism. The type occurring is governed by rules which represent an extension of Hund's rules of homopolar binding. A. J. M.

Superconductivity in aromatic compounds. F. LONDON (J. Chem. Physics, 1937, 5, 837—838).—By means of an equation (i) derived from the extension of the "mol. orbital theory" to the case of the presence of a magnetic field, vals. of the magnetic anisotropies of $C_{10}H_8$, anthracene, phenanthrene, pyrene, and Ph_2 have been calc. on the basis that the anisotropy of C_6H_6 is 1, and agree with experimental vals. The method used by Pauling to calculate the diamagnetic anisotropies of aromatic compounds is represented as showing that the aromatic compounds behave as superconductors and an equation (ii) is given. Vals. obtained from equation (ii) do not agree with (i), and the application of the corrections suggested by Pauling are held to be incompatible with the exactness of the theoretical calculations and with the accuracy of the experimental measurements. W. R. A.

Discontinuity in the thermoelectric power of rhodium. E. T. BOOTH and E. H. DIXON (Rev. Sci. Instr., 1937, [ii], 8, 381—382; cf. A., 1931, 277).—An investigation of the temp.-e.m.f. relations of a Pt-Rh thermocouple in the range $850-1350^\circ$ supports the view that Rh undergoes a change of structure at 1091° . N. M. B.

Derivation of the latent heat equation from the principles of dilute solutions. B. N. BISWAS (Indian J. Physics, 1937, 11, 239—250).—Theoretical. F. J. L.

Phase equilibria in hydrocarbon systems. XIX. Thermodynamic properties of *n*-butane. B. H. SAGE, D. C. WEBSTER, and W. N. LACEY (Ind. Eng. Chem., 1937, 29, 1188—1194; cf. A., 1935, 149; 1936, 930; B., 1936, 866).—From measurements of sp. vol. as a function of pressure and temp. and published data on the isobaric sp. heat of the saturated liquid and gas, the vals. of \bar{H} , S , and fugacity at temp. between 70° and $250^\circ F.$, and pressures between atm. and 3000 lb. per sq. in., have been calc. and are recorded in tables and graphs. R. C. M.

Rapid and approximate calculation of the specific heats of liquids. P. GUARESCHI (Atti R. Accad. Lincei, 1937, [vi], 25, 481—484).—The sp. heat at const. vol. of a liquid is given approx. by $C_v = k/\alpha M$, where k is the mean Trouton-Hildebrand const., α is the association coeff., M = mol. wt. k can be interpreted as a mol. sp. heat. O. J. W.

Relationship between the form of the functions $T = f(M)$ and $n = f(M)$ and the number of members. V. K. NIKIFOROV (J. Phys. Chem. Russ., 1937, 9, 449—453).—The average b.p. of org. compounds having mol. wt. $M \pm 10$ is $T = 38\sqrt{M}$. The no. of known org. compounds within the range between $M - 10$ and $M + 10$ is max. when $M = 150$. J. J. B.

Most probable b.p. of chemical compounds. V. K. NIKIFOROV and M. M. SOKOLOV (J. Phys. Chem. Russ., 1937, 9, 454—460).—The probability for an org. compound of the mol. wt. M to have a b.p. T is discussed. $T \propto \sqrt{M}$. J. J. B.

Method for deriving expressions for the first partial derivatives of thermodynamic functions. F. LERMAN (J. Chem. Physics, 1937, 5, 792—794).—Mathematical. Any first partial derivative of the thermodynamic functions may be resolved into terms of temp., vol., pressure, entropy, and six basic forms of a mathematical quantity called a "vired." These basic vireds have been expressed in terms of better known and more easily determined thermodynamic quantities, increment of work done by the system, increment of heat absorbed by the system, internal energy of the system, heat content, Helmholtz free energy, and Gibbs free energy. Operating rules are given. W. R. A.

Critical temperature and orthobaric densities of diphenyl ether and naphthalene. D. T. SHURAVLEV (J. Phys. Chem. Russ., 1937, 9, 875—882).—The crit. temp. of Ph_2O is 494° , that of C_{10}H_8 476.5° . Orthobaric densities are determined in the intervals 30 — 494° for Ph_2O and 80 — 476.5° for C_{10}H_8 . The equations of the rectilinear diameters are $0.5440 - 4.3 \times 10^{-4}t - 4.1 \times 10^{-8}t^2$, and $0.5197 - 3.737 \times 10^{-4}t - 1.18 \times 10^{-7}t^2$. The density of liquid Ph_2O is $d = 1.0880 - 0.00086t$. Consts. of the Ferguson-Miller density formula are calc. E. R.

Fluorine at low temperatures. II. Vapour pressure of fluorine. S. AOYAMA and E. KANDA (Bull. Chem. Soc. Japan, 1937, 12, 416—419; cf. A., 1937, I, 629).—The v.p. of F_2 has been measured between -187° and -213° . The b.p. is -188° , heat of vaporisation 1581 g.-cal., heat of evaporation of solid 1970 g.-cal. F. J. L.

Thermal properties of vinyl bromide. A. GUYER, H. SCHÜTZE, and M. WEIDENMANN (Helv. Chim. Acta, 1937, 20, 936—949).—The v.p. of $\text{CH}_2\text{:CHBr}$ between -80° and 50° follows approx. $\log p = -1281/T + 7.322$. d has been determined over the temp. range -40° to 30° . The deviations of the vapours from the ideal gas laws have been determined for 20 — 50° . The heat of vaporisation is calc. for the range -40° to 50° . J. W. S.

Rate of evaporation of small water drops. T. NAMEKAWA and T. TAKAHASHI (Mem. Coll. Sci. Kyoto, 1937, 20, A, 139—146).—Equations for determining the rate of evaporation of small H_2O drops in still and moving air are deduced, and verified experimentally. F. J. L.

Evaporation coefficient of water and two methods for its determination. H. MACHE (Z. Physik, 1937, 107, 310—321).—The evaporation coeff. of H_2O , defined as the rate of lowering of a quiescent meniscus of H_2O per mm. difference in pressure at the liquid-gas interface, is measured in two ways: (i) the H_2O vapour from an enclosed hot surface is collected and weighed, and (ii) the fall in height of a column of H_2O in a narrow tube is observed micrometrically. Deviations from Stefan's law (method ii) lead to the val. 5.5×10^{-6} cm. per sec. per mm. L. G. G.

Theory of motion of anomalous liquids. A. K. SKRJABIN (J. Phys. Chem. Russ., 1937, 9, 901—916).—Mathematical theory of the plastic-viscous flow (with gliding) of anomalous liquids. E. R.

Vapour-liquid equilibria of methylcyclohexane-toluene mixtures. (MISS) D. QUIGGLE and M. R. FENSKE (J. Amer. Chem. Soc., 1937, 59, 1829—1832).— d_4^{20} , n_D^{20} , and b.p. (760 mm.) data are recorded for the mixtures; the relation between the composition of the liquid and vapour has also been examined. The mixture is suitable for testing the efficiency of fractional distillation apparatus. J. W. S.

Study of non-aqueous solutions by methods of physico-chemical analysis. M. A. KLOTSCHKO (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 641—673).—The compound $\text{AlBr}_3 \cdot \text{PhNO}_2$ is suggested by max. or min. on the conductivity-, η -, and d -composition curves, at 5 — 100° . It decomposes with formation of non-conducting products at higher temp. R. T.

Equilibrium diagram of the system aluminium-lithium. F. I. SCHAMRAI and P. J. SALDAU (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 631—640).—The compounds AlLi and AlLi_2 are confirmed; the formation of two layers in alloys containing 40 — 60 at.-% Li (cf. Grabe *et al.*, A., 1936, 151) is denied. The eutectic, m.p. 170.6° , between the γ - and δ -phases contains 94 at.-% Li. R. T.

X-Ray investigation of the system aluminium-beryllium. E. S. MAKAROV and L. TARSCHISCH (J. Phys. Chem. Russ., 1937, 9, 350—358).—Solid Al at 610° dissolves 0.14 wt.-% of Be. α -Be dissolves <0.9 wt.-% of Al. The existence of β -Be is confirmed. J. J. B.

Physico-chemical properties of aluminium-silver alloys containing much aluminium. F. E. TISCHTSCHENKO and I. K. LUKASCH (J. Phys. Chem. Russ., 1937, 9, 605—610; cf. A., 1937, I, 608).—Dilatation in the formation of the alloys is a max. at 11.8 wt.-% of Ag; it is negative at 11% and 31% of Ag. Corrosion in tap- H_2O and aq. KOH is max. at 11.8% of Ag, whilst the hardness at this concn. shows a slight min. Presumably the size of AgAl_2 crystals is min. at this concn. J. J. B.

Structure of aluminium-silver alloys. F. E. TISCHTSCHENKO and I. K. LUKASCH (J. Phys. Chem. Russ., 1937, 9, 440—448).—Thermal and micrographical data are recorded for alloys with 0—80% Ag. Al is in equilibrium with AgAl_2 ; the saturated solution contains 46.5 wt.-% Ag at 558° (eutectic point), 11.8% at 440°, and about 1% at 20°. A transformation occurs at 440°, and this is said to be due to the recrystallisation of the Al-AgAl₂ solution.

J. J. B.

Nature of the iron-manganese alloys. F. M. WALTERS (Met. Prog., 1937, 32, 254—255).—The Fe-Ni and Fe-Mn diagrams are compared.

R. B. C.

New phase in the iron-zinc system. J. SCHRAMM (Z. Metallk., 1937, 29, 222—224).—A phase with 6—6.5% Fe has been detected by thermal, magnetic, X-ray, and micrographic methods in all alloys with <6% Fe below 419° and in alloys with 6—7% Fe below 530°; it is formed by a peritectic reaction at 530° and can be detected by etching with a strongly alkaline Cu cyanide solution, which colours it red to black by deposition of Cu.

A. R. P.

Structure of magnesium-rich magnesium-calcium alloys. H. VOSSKÜHLER (Z. Metallk., 1937, 29, 236—237).—Up to 60% Ca only one compound, Mg_2Ca , m.p. 714°, has been detected; this forms a eutectic with Mg at 516° (16.3% Ca) and with Ca at 445°. Mg dissolves 0.18% Ca at 300°, 0.29% at 400°, 0.66% at 500°, and 0.78% at 516°.

Diagram of state and transformations occurring in the decomposition of the α solid solution in the copper-tin alloys. S. T. KONOBEEVSKI and V. P. TARASOVA (J. Phys. Chem. Russ., 1937, 9, 681—692).—The relation of the α -phase to $\alpha + \gamma$ and $\alpha + \epsilon$ has been determined by X-ray analysis. An intermediate phase ϵ' has been found; it is formed in the transformation $\gamma \rightarrow \epsilon$ and separates from the α -solid solution above 380°; its lattice corresponds with a rhombic cell containing 32 atoms.

E. R.

Constitution of the copper-gallium alloys in the region 18—32 at.-% gallium. W. HUME-ROTHERY and G. V. RAYNOR (J. Inst. Met., 1937, 61, Advance copy, 419—436).—The peritectic horizontal $\alpha + \text{liquid} \rightleftharpoons \beta$ is at 915.1° and the liquid contains 21.5 at.-% Ga; the $\beta + \text{liquid} \rightleftharpoons \gamma$ peritectic is at 835.9° and the solidus of the β -phase is almost a straight line joining 19.5 at.-% Ga on the first to 27.5 at.-% Ga on the second peritectic horizontal. The β range rapidly decreases with fall in temp. until a eutectoid point is reached at 618°, 23.7 at.-% Ga corresponding with the transformation $\beta \rightleftharpoons \beta' + \gamma$. The pure β' phase exists over a narrow range of composition around 22.3 at.-% Ga and decomposes at 475° to form $\beta'' + \gamma$, β'' having a narrow homogeneous range around 21.5 at.-% Ga and appearing to decompose on annealing for several weeks at 380—400° with the formation of a fourth modification of β .

A. R. P.

Cadmium-indium alloy system. C. L. WILSON and O. J. WICK (Ind. Eng. Chem., 1937, 29, 1164—1166).—Thermal analysis and electrical resistivity measurements show that no compounds are formed.

In and Cd are completely miscible in the liquid state; a eutectic (m.p. 122.5°) is formed at 75% In. Solid solutions of Cd in In (15% at room temp.) are formed, but solid Cd dissolves little or no In.

E. S. H.

Platinum-molybdenum alloys. V. A. NEMILOV and N. M. VORONOV (Ann. Sect. Platine, 1937, 14, 157—162).—Hardness, conductivity, and thermal e.m.f. data for alloys containing 0—60% Mo indicate the existence of a series of solid solutions. This view is confirmed by a study of the micro-structure.

R. T.

Transformation in the β -brasses. C. SYKES and H. WILKINSON (J. Inst. Met., 1937, 61, Advance copy, 401—418).—The sp. heat-temp. curve of α -brass shows an anomaly at 200° but is linear at higher temp.; the curve for $\alpha + \beta$ brasses still shows this anomaly, but the intensity decreases with increasing proportion of β , and above 200° the curve rises steeply to a max. at 456°, the intensity of which becomes much greater as pure β is approached. The shape of the curve for pure β -brass is not appreciably affected by quenching. The graph showing the difference in energy content between 240° and 500° consists of a series of straight lines intersecting at the phase boundaries at 450°; the Zn contents corresponding with these are $\alpha/(\alpha + \beta)$ 38.3, $(\alpha + \beta)/\beta$ 45.4, and $\beta/(\beta + \gamma)$ 49.6%, confirming the vals. found by other workers by thermal analysis. For the compound CuZn the energy content difference from 240° to 500° is 37.3 g.-cal. per g., the max. sp. heat 0.27 g.-cal. per g. per °c., and the change in entropy below the crit. temp. 0.0157 g.-cal. per g. compared with a theoretical val. for an order-disorder transformation of 0.0198 g.-cal. per g. according to Bethe's theory which, therefore, is in better agreement with the experimental results than that of Bragg and Williams.

A. R. P.

X-Ray investigations on tin bronzes. II. T. ISAWA (Mem. Ryojun Coll. Eng., 1937, 10, 53—61; cf. A., 1935, 693).—Investigations with a high-temp. camera show at 550° the presence of the α and β phases in alloys containing 20—27% of Sn, and of the δ phase in alloys with 32.5% of Sn. At 600—650° the alloys with >23% of Sn consist entirely of the β phase. There is no eutectoid transformation at 580°, but the transformation is similar to that of β -brass. The changes produced by quenching and annealing have been investigated and the stages $\beta \rightarrow \beta' \rightarrow \alpha + \delta$ established for the annealing process.

E. S. H.

Thermochemistry of alloys. III. Heats of formation of the binary alloys iron-antimony, cobalt-antimony, nickel-antimony, cobalt-tin, copper-tin, and copper-zinc in the cast state. F. KÖRBER and W. OELSEN (Mitt. Kaiser-Wilh. Inst. Eisenforsch., 1937, 19, 209—219).—Heats of formation for the complete series of binary alloys are compared with the respective equilibrium diagrams. With Sn alloys the heats of mixture in the liquid state show that there is considerable dissociation of the compounds in the melts. The heats of formation of alloys of Sb or Sn with the ferromagnetic metals increase in the order Fe < Co < Ni, as found previously for Al and Si alloys.

E. S. H.

Thermochemistry of alloys. II. Direct determination of heats of formation of the ternary alloys iron-nickel-aluminium, iron-cobalt-aluminium, copper-nickel-aluminium, iron-aluminium-silicon, as well as a series of alloys of the system copper-manganese-aluminium. F. KÖRBER, W. OELSEN, and H. LICHTENBERG (Mitt. Kaiser-Wilh. Inst. Eisenforsch., 1937, 19, 131—159; cf. preceding abstract).—Thermal data for the complete series of ternary alloys are compared with the corresponding equilibrium diagrams and data previously obtained for binary systems of the same components. E. S. H.

Influence of aluminium, titanium, vanadium, copper, zinc, tin, and antimony on the polymorphic transformation of cobalt. W. KÖSTER and E. WAGNER (Z. Metallk., 1937, 29, 230—232).—Addition of any of the above metals to Co has a marked influence on the temp. at which the ϵ - γ change takes place and considerably increases the hysteresis effects. The temp. of the γ - ϵ change on cooling is reduced from 420° to 0° by 12% V, 10% Cu, 14% Zn, and 5% Al, to 130° by 5% Sn, to 160° by 7.2% Ti, and to 190° with 8.5% Sb. The temp. of the ϵ - γ change on heating is correspondingly altered to 600°, 380°, 580°, 150°, 380°, 350°, and 530°, respectively. The magnetic transformation in Co at about 1100° is reduced to 780° by 5.2% Al, to 890° by 7.2% Ti, to 1040° by 12% Cu, to 1070° by 9% Sn, and to 990° by 8.5% Sb. Except in the cases of V and Zn these vals. represent the solid solubility of the metals in Co at the temp. indicated. A. R. P.

Influence of beryllium, carbon, and silicon on the polymorphic transformation of cobalt. W. KÖSTER and E. SCHMID (Z. Metallk., 1937, 29, 232—233).—Co and Be form a eutectic at 4.2% Be, 1115°; the solubility of Be in Co decreases from 2.5% at this temp. to 1.4% at room temp. The temp. of the magnetic transformation in Co is reduced to 950° by 2.5% Be and that of the γ - ϵ change on cooling to 265° whereas that of the ϵ - γ change on heating is raised to 550° by 1.5% Be. The ϵ - γ change occurs at 390° and the γ - ϵ at 90° with 0.1% C in Co, indicating that this is the solubility limit of C at <600°. Co dissolves 7.8% Si at 20° and 9.5% at 1205° (eutectic temp.); the temp. of the ϵ - γ change in Co rises linearly with increasing Si content, intersecting the solubility line at 1180°, 9.5% Si, while the temp. of the magnetic transformation is linearly reduced, the line intersecting the ϵ - γ line at 800°, 4.7% Si and the solubility line at 580°, 8% Si. A. R. P.

X-Ray determination of the solubility of the α -phase in the ternary system copper-zinc-tin at low temperatures. S. T. KONOBEVSKI, V. P. TARASOVA, and A. A. STEPANOVA (J. Phys. Chem. Russ., 1937, 9, 693—703).—The transformation of the α -phase on annealing has been studied in relation to previous thermal and mechanical treatment (quenching, slow cooling, deformation). The transformation is accelerated by deformation. E. R.

Magnesium corner of the magnesium-aluminium-cadmium system. W. KÖSTER and W. DULLENKOFF (Z. Metallk., 1937, 29, 202—204).—

In alloys of Mg with 5% Cd the solubility of Al is 1.2% at 20°, 4% at 300°, and 13.5% at 420° (eutectic horizontal), and in those containing 10% Cd 0.8% at 20°, 3% at 300°, and 11% at 420°. The solid solution range extends at 420° to 16% Al + Cd with a 1:2 Al-Cd ratio and to 28% with a 2:1 ratio. Alloys with >6% Al and 5—10% Cd can be pptn.-hardened by quenching from 420° and reheating at 200—300°, max. Brinell hardness of 80 being obtained with 13% Al and 5% Cd. A. R. P.

Solid solution series magnesium-AgCd₃ in the ternary system magnesium-silver-cadmium. F. LAVES and K. MOELLER (Z. Metallk., 1937, 29, 185—189).—Mg forms a continuous series of solid solutions with the hexagonal compound AgCd₃, the liquidus consisting of two almost straight lines meeting at 420°, 50 at.-% Mg, showing that an intermetallic compound which obeys Hume-Rothery's rule can readily form a solid solution series with a pure metal of similar lattice structure. In alloys with 35—70 at.-% Mg a transformation occurs at 194—271° according to the Mg content; this curve likewise consists of two branches (almost straight lines) with a flat max. at 50 at.-% Mg. The low-temp. modification has a close-packed hexagonal lattice with superstructure, the structure of the 50 at.-% Mg alloy being identical with that of MgCd. A. R. P.

Ternary compound Mg₄Cu₁₁Al₁₁. W. SCHÜTZ (Metallwirts., 1937, 16, 949—950).—Evidence is advanced indicating that the ternary cubic compound with *a* 8.29 Å. in the Mg-Cu-Al system is Mg₄Cu₁₁Al₁₁ and not as previously reported (Laves and Witte, A., 1936, 420) Mg₃Cu₇Al₁₀; the new formula is in agreement with the Hume-Rothery rule. A. R. P.

Constitution of tin-rich antimony-cadmium-tin alloys. D. HANSON and W. T. PELL-WALPOLE (J. Inst. Metals, 1937, 61, Advance copy, 443—485).—The system has been studied by thermal and micrographic methods from the Sn corner up to alloys containing Cd 43 and Sb 14% and the results are shown as isothermal diagrams of the various surfaces and as vertical and horizontal sections through the ternary space model. The solubilities in Sn of Sb and Cd are respectively 9 and 1.5% at 227°, 5.5 and 2.4% at 209°, 1 and 0.7% at 148°, and 0.6 and 0.6% at 20°. The β -Cd-Sn phase dissolves 5.1% Sb at 209° and 0.8% at 145°. The liquidus surface shows five surfaces corresponding with the separation of the α , β , γ , δ , and ϵ phases, six grooves corresponding respectively with the reactions $\delta + \text{liquid} = \alpha$, and $\alpha + \text{liquid} = \beta$, and the separation of $\beta + \gamma$, $\epsilon + \delta$, $\beta + \epsilon$, and $\gamma + \epsilon$, and three invariant points corresponding to the ternary reactions: $\text{liquid} + \delta = \alpha + \epsilon$, $\text{liquid} + \alpha = \beta + \epsilon$, and $\text{liquid} + \epsilon = \gamma + \beta$. The peritectic reaction at 246° in the Sb-Sn system takes place at lower temp. on addition of Cd, and that at 223° in the Sn-Cd system is depressed slowly by addition of Sb; the eutectic temp. (176°) in the Cd-Sn system is raised to 180° by addition of Sb but there is no ternary eutectic. There are three peritectic reactions, viz., $\delta + \text{liquid}$ (Cd 10, Sb 8.2%) = $\epsilon + \alpha$ (Cd 1.5, Sb 9%) at 227°, α (Cd 2.4, Sb 5.5%) + liquid (Cd 15.4, Sb 4.3%) = $\beta + \epsilon$ a

209°, and ϵ + liquid (Cd 33, Sb 1%) = β (Cd 7, Sb 2%) + γ (nearly pure Cd). The temp. of the eutectoid decomp. of β is raised by the addition of >0.8% Sb from 133° at the Cd-Sn side to 145°. The α , β , and γ phases are structurally identical with those of the Cd-Sn system, δ is a solid solution of Cd in SbSn, and ϵ the compound CdSb containing a small amount of Sn in solid solution. A. R. P.

Influence of chromium on the γ field of iron-nickel alloys. Transformation diagrams of "irreversible alloys." J. B. FRIDMAN (J. Phys. Chem. Russ., 1937, 9, 502—510).—Cr decreases the γ field in Fe and increases it in Fe + Ni. An explanation is given on the basis of at. vols. (cf. Wever, A., 1929, 745). The temp. of the transformation $\alpha \rightarrow \gamma$ in Fe-Ni-Cr alloys is > that of $\gamma \rightarrow \alpha$; this hysteresis effect is discussed. J. J. B.

Investigation of equilibrium diagrams of ternary alloys by X-rays. A. J. BRADLEY, H. J. GOLDSCHMIDT, H. LIPSON, and A. TAYLOR (Nature, 1937, 140, 543—544).—As an example of the readiness with which such diagrams can be obtained by means of X-ray analysis, a diagram for the system Al-Ni-Cu is reproduced and discussed. The X-ray method gives at the same time the no., nature, and relative amount of phases present, and the lattice spacing of each phase. L. S. T.

Inverse segregation. N. B. VAUGHAN (J. Inst. Met., 1937, 61, Advance copy, 377—399).—Recent work on and theories of the phenomenon are summarised; an extensive bibliography is included. A. R. P.

Solubility of carbon dioxide in water under pressure. J. D. ZELVENSKI (J. Chem. Ind. Russ., 1937, 14, 1250—1257).—The solubility at 0—100° and 1—100 atm. is given by $S = ap + bp^2$, where a and b are consts. at a given temp., and diminish with rising temp. For concns. up to 0.015M-CO₂ S varies according to Henry's law. The differential heat of dissolution of CO₂ is 5870 g.-cal. at 25°/760 mm. A cryst. nona- or deca-hydrate, with dissociation pressure 10.3 atm. at 0°, is obtained by forcing CO₂ into H₂O at 0° and <11 atm. R. T.

Henry's coefficient for a gas dissolved in a liquid with a high vapour pressure. I. R. KRITSCHESKI (J. Phys. Chem. Russ., 1937, 9, 313—316).—Thermodynamic expressions are given for (a) the relation between the concns. of a component in the vapour and liquid phases, and (b) the difference between the partial molal vols. in both phases. J. J. B.

Solubility in liquid ammonia of hydrogen at 0° and of nitrogen at 0°, 50°, 75°, 90°, and 100° at pressures to 1000 atmospheres. Critical phenomena of ammonia-nitrogen mixtures. R. WIEBE and V. L. GADDY (J. Amer. Chem. Soc., 1937, 59, 1984—1987).—The solubility of H₂ in liquid NH₃ has been determined at 0° and 50—1000 atm., and the solubility of N₂ in liquid NH₃ at 0—100° and 50—1000 atm. In the latter system two crit. points exist, at about 90°/600 atm., and about 100°/375 atm., respectively. J. W. S.

Solubilities of hydrocarbons in anhydrous hydrogen fluoride and their modification by added salts. W. KLATT (Z. anorg. Chem., 1937, 234, 189—192).—Saturated hydrocarbons are insol. in anhyd. HF, but those having double linkings are appreciably sol. if they do not undergo polymerisation. Data are given for C₆H₆, PhMe, anthracene, *m*- and *o*-xylene, and tetrahydronaphthalene at temp. between -20° and 15°. The solubility is increased by addition of Hg(CN)₂, Hg(N₃)₂, AgN₃, AgF, and TlF; the increment is in all cases 4 mols. of hydrocarbon per mol. of salt. The hydrocarbons also increase the solubilities of the salts, so that the ratio excess of salt : hydrocarbon is 1 : 4. The solutions are coloured in most cases, and the colour is changed by the heavy-metal salts. This fact may be used to test for impurity in HF. F. J. G.

Solubility of gases in metals under pressure. I. R. KRITSCHESKI (J. Phys. Chem. Russ., 1937, 9, 867—869).—For diat. gases (H₂, N₂) in metals (e.g., Fe) the solubility $\propto \sqrt{p}$. This suggests that the dissolved gas consists of free atoms. A thermodynamic formula is derived which shows that the \sqrt{p} law ceases to be exact at high pressures. E. R.

Solubility of sodium and potassium chlorides in corresponding hydroxide solutions at 25°. G. ÅKERLÖF and O. SHORT (J. Amer. Chem. Soc., 1937, 59, 1912—1915).—The solubility curves of NaCl in aq. NaOH and of KCl in aq. KOH at 25° are in accordance with those calc. from a general solubility equation. The consts. required to calculate the solubility of NaNO₃ in aq. NaOH and of KNO₃ in aq. KOH at 25° are also deduced. J. W. S.

Solubility equilibria of sodium sulphate at temperatures from 150° to 350°. III. Effect of sodium hydroxide and sodium phosphate. W. C. SCHROEDER, A. A. BERK, and A. GABRIEL. IV. Comparison of evaporation and equilibrium solubility values. W. C. SCHROEDER, A. A. BERK, and E. P. PARTRIDGE (J. Amer. Chem. Soc., 1937, 59, 1783—1790, 1790—1795; cf. A., 1935, 1314; 1936, 798).—III. At >120° the solubility (s) of Na₂PO₄ in H₂O decreases rapidly with rising temp. and approaches zero at 350°. At 120—215° the stable solid phase is Na₂PO₄·H₂O; at >215° it is Na₃PO₄, and the latter can be prepared by crystallisation at high temp. NaOH (8—20 g. per 100 g. of H₂O) decreases s considerably at 150° and slightly at 250°, but causes a small increase in s at 350°. The system Na₂SO₄-Na₃PO₄-H₂O has been studied at 150—350°. At 200° the double salts Na₂SO₄·2Na₃PO₄ (I) and Na₂SO₄·5Na₃PO₄ are formed. At 250° (I) forms solid solutions with Na₃PO₄ or with other double salts. At 150° and 250° NaOH decreases the solubilities of all the solid phases, but increases them markedly at 350°.

IV. Removal of H₂O vapour from a solution containing Na₂SO₄ alone or in presence of NaOH, NaCl, Na₂CO₃, or Na₃PO₄ does not cause supersaturation with respect to Na₂SO₄ if the latter is the only solid phase, but supersaturation may occur if the solid phase is a double salt of Na₂SO₄ with Na₂CO₃ or Na₃PO₄. Na₂SO₄ and NaCl form heavy

scales in the region over which the solubility increases with rising temp. J. W. S.

Solubility of silver permanganate in water and in aqueous solutions of silver nitrate and perchlorate. F. HEIN and W. DANIEL (Z. anorg. Chem., 1937, 234, 155—160).—Small additions of both AgNO_3 and AgClO_4 decrease the solubility of AgMnO_4 , but in more conc. solutions of AgNO_3 the solubility increases again, whereas in AgClO_4 it decreases continuously. In both cases there is a distinct change of colour. F. J. G.

Solubility and dissociation of lead chloride in solutions of potassium nitrate. F. ISHIKAWA and K. MORIKAWA (Bull. Inst. Phys. Chem. Res. Japan, 1937, 16, 915—920).—The solubility of PbCl_2 in aq. KNO_3 solutions has been measured at 25°, and the Debye-Hückel and Hückel equations applied to the results, assuming complete dissociation of PbCl_2 . The latter equation affords a satisfactory interpretation of the results. The dissociation of PbCl_2 in two stages has been theoretically treated. J. W. S.

Preparation, aqueous and perchloric acid solubilities, solution densities, and transition temperature of silver perchlorate. G. F. SMITH and F. RING (J. Amer. Chem. Soc., 1937, 59, 1889—1890).—Redetermination of the solubility of AgClO_4 at 0—35° confirms previous vals. (A., 1922, ii, 555). The transition of $\text{AgClO}_4 \cdot \text{H}_2\text{O}$ to AgClO_4 at 43·0° is also confirmed. Data are recorded for n of saturated aq. solutions at 15—35°, and for the solubility of AgClO_4 in 60—73·6% HClO_4 at 0° and 25°. Solution densities are also recorded. J. W. S.

Separation of calcium fluoride from supersaturated solutions. A. T. JENSEN (Z. physikal. Chem., 1937, 180, 93—116).— CaF_2 separates from supersaturated solutions within a few days only if the solubility product is considerably exceeded. There is first a period of incubation (t) in which little CaF_2 separates, after which the solution becomes turbid and the rate of separation rises rapidly to a max. and falls again slowly. t is practically independent of the p_{H} but decreases rapidly with rise of temp. $\log t$ increases linearly with $\log (1/[\text{Ca}^{++}][\text{F}'^2])$, unless the latter rises below a certain limit, when t increases rapidly and indefinitely. Even in solutions in which Ca^{++} and F' are not present in equiv. concns. t is determined by the val. of the ionic product. The presence of starch increases t . It seems that it is only the CaF_2 mols. with especially high translational energy which are able to form nuclei. Nuclei appear to be formed spontaneously, and during the incubation period the rate of formation is probably const. The rate of growth of the particles of visible dimensions is so small that it cannot possibly be determined by the rates of diffusion of Ca^{++} and F' ions. It seems that a solid salt separates from its supersaturated solution the less readily the harder is the salt. R. C.

Solubility of quartz in hydrogen borofluoride. W. B. HARRIS (J. Ind. Hyg., 1937, 19, 463—464).— SiO_2 particles $< 5 \mu$. are about as sol. in HBF_4 as in H_2SiF_6 . J. N. A.

Absorption capacity of silver, rhodium, and tungsten for hydrogen, and stability of gauzes made of their alloys with platinum in ammonia oxidation. I. E. ADADUROV and N. I. PEVNYI (J. Phys. Chem. Russ., 1937, 9, 592—597).—Pt-Ag, Pt-Rh, and Pt-W alloys are less rapidly corroded by NH_3 + air than is Pt alone. In agreement with Adadurov and Prozorovski (cf. B., 1936, 316) Rh and W do not absorb H_2 between 100° and 450°.

J. J. B.
Adsorption studies with radon. W. SIEBERT (Z. physikal. Chem., 1937, 180, 169—184).—In the adsorption on SiO_2 gel at -80° from a mixture of Rn with a large excess of another gas the adsorption coeff. of the Rn is independent of the pressure of the second gas but falls approx. linearly with rise in its b.p. Measurements of the adsorption of Rn on technical org. pigments have shown that in general the adsorption increases with decreasing covering power. SiO_2 gel catalyses the decomp. of C_2H_4 . R. C.

Sorption of chlorine by silica gel. L. H. REYERSON and A. W. WISHART (J. Physical Chem., 1937, 41, 943—953; cf. A., 1935, 696).—Four isotherms are given for the range 35·9—81·5°. Equilibrium is attained rapidly (15 min.) and no hysteresis occurs. F. L. U.

Kinetics of sorption. II. Sorption of carbon monoxide on alumina. N. M. MOROZOV (J. Phys. Chem. Russ., 1937, 9, 641—658).—The velocity of sorption between -50° and 450° has been measured. Two types have been observed, one below 250—300°, and the other above 200°. The first is a rapid process (activation energy of desorption 9·9 kg.-cal. per mol.), the second a slower one (activation energy 19·1 kg.-cal. for sorption, 27·4 kg.-cal. for desorption). Sorption isothermals have been determined at -15° to 40°; calc. heat vals. are 1·1 to 0·7 kg.-cal. for the high-temp. sorption and 1·6 to 1·0 kg.-cal. for the low-temp. sorption. E. R.

Heat of interaction of cellulose nitrate with solvents. II. S. P. PAPKOV and V. A. KARGIN (J. Phys. Chem. Russ., 1937, 9, 631—643; cf. A., 1936, 1056).—Heats of sorption of EtOH and Et_2O by cellulose nitrate (I) have been determined. The isothermals for the sorption from solutions in light petroleum are recorded. 1 mol. of $\cdot\text{O}\cdot\text{NO}_2$ absorbs 0·35 mol. of EtOH and 0·1 mol. of Et_2O ; 1 mol. of OH absorbs 0·95 mol. of EtOH and 0·31 mol. of Et_2O . Heats of dissolution of (I) in EtOH- Et_2O mixtures are measured. The competition of EtOH and Et_2O in the solvation of (I) is discussed. E. R.

Adsorption of electrolytes on crystalline surfaces. VII. (MLLE.) L. DE BROUCKÈRE (Bull. Soc. chim. Belg., 1937, 46, 301—316; cf. A., 1936, 1195).—The $\log x - \log C$ curves (x = electrolyte adsorbed, C = concn. of solution) for the adsorption of MgCl_2 , CuCl_2 , and LaCl_3 at 25° on charged BaSO_4 (A., 1934, 359) are similar to those for alkali chlorides. At low concn. the adsorption on negatively charged BaSO_4 increases with the cationic charge of the electrolyte, but is const. on positively charged BaSO_4 . The saturation vals. for x , (x_+) , (x_-) , increase in the

order $\text{LaCl}_3 < \text{CuCl}_2 < \text{MgCl}_2 < \text{KCl} < \text{LiCl}$. $(x_2)_+ / (x_2)_-$ is lower for LaCl_3 than for alkali chlorides.

I. MCA.

Adsorption of organic substances on the surface of crystals and the influence of electrolytes on the extent of adsorption. N. A. HELD (Inst. Mech. Obr. Polz. Isk., 1935, 1, 136—161; cf. A., 1935, 1069).—Flotation experiments with various powdered minerals and org. collectors are described. The attractive forces operative in flotation are discussed.

CH. ABS. (e)

Adsorption of potential-determining ions. A. KELLERMANN and E. LANGE (Kolloid-Z., 1937, 81, 88—104).—A survey of theoretical and experimental work on ion adsorption in electrochemical two-phase systems.

F. L. U.

Capillary condensation in an artificial capillary space, and determination of the thickness of the water film adsorbed on glass. K. V. TSCHEMUTOV (J. Phys. Chem. Russ., 1937, 9, 345—349).—The condensation of H_2O vapour in the space between a plane and a convex glass surface has been measured and the radius r of the meniscus calc. according to W. Thomson's equation. The difference between the width of the capillary space and $2r$ represents the double thickness of the adsorbed H_2O film. The thickness increases from 4×10^{-6} to 39×10^{-6} cm. when the v.p. rises from 6 to 32 mm. Hg.

J. J. B.

Capillary systems. XIX. (2) Calculation and experimental determination of free space in compact or coherent material. E. MANEGOLD.

(3) **Effective free space in branched canal systems.** E. MANEGOLD and K. SOLF (Kolloid-Z., 1937, 81, 19—35, 36—40; cf. A., 1937, I, 180).—(2) A comprehensive review is given of methods available for calculating or measuring the free space in compact material (e.g., atoms, ions, liquids, crystals) and in capillary systems such as wood, leather, charcoal, wool, powder, etc.

(3) The free space in porous solids which is "effective" with respect to the penetration or transmission of a fluid is calc. for simple cases in which the intercommunicating pores are of circular, square, and rectangular (slit-like) section.

F. L. U.

Drop formation as revealed by the high-speed motion camera. H. E. EDGERTON, E. A. HAUSER, and W. B. TUCKER (J. Physical Chem., 1937, 41, 1017—1028; cf. A., 1937, I, 99).—The apparatus previously described has been used to study the formation of drops of H_2O , PhNO_2 , $\text{EtOH-H}_2\text{O}$, glycerol- H_2O , glycerol-EtOH, and Na oleate- H_2O , from tips of different size. Primary drops from large tips are smaller, whilst those from small tips may be larger, than the tips. The no. of secondary drops formed by segmentation of the stem varies both with tip size and nature of the liquid, and in the experiments described varied between 0 and 15. A min. γ was observed in the freshly formed surfaces of aq. Na oleate solutions. It is found that the use of large tips for measuring γ is inadvisable and that the drop-wt. and drop-no. methods applied to mixtures or solutions are untrustworthy.

F. L. U.

Interfacial tension between a solution of palmitic acid in benzene and an aqueous solution of mono-, di-, or tri-ethanolamine. L. GAY and L. RAYMOND (J. Chim. phys., 1937, 34, 517—528).—The lowering of interfacial tension by amines at low concns. is $>$ that produced by NaOH or KOH. At higher amine concns. this order is reversed. Differences in the interfacial tension-concn. curves for the three amines are discussed.

D. F. R.

Wetting characteristics of a surface. A. VOET and J. F. VAN ELTEREN (Rec. trav. chim., 1937, 56, 923—926).—Drops of H_2O show a const. contact angle of 35° against a glass surface covered with an adsorbed layer of night-blue so long as the density of occupation of the surface (d) is $< 36\%$ of a unimol. layer. The contact angle decreases sharply as d falls below 36° and becomes 0° when $d = 32\%$.

J. W. S.

Wetting phenomena. H. LIMBURG (Chem. Weekblad, 1937, 34, 716—719).—Variations with time of the angle made by a drop of a 0.1% solution of a series of wetting agents on a carnauba wax surface have been studied. The rates of change are different for "advancing" and "receding" drops. The results are compared with those of wetting and penetration tests on a similar surface and with measurements of γ against liquid paraffin. Each method ranges the various wetting agents in a different order. The wetting power of a particular substance depends entirely on the method of assessment. In practically all methods at present used the surface does not reach equilibrium.

S. C.

Spreading and the electric potential at surfaces. J. J. DE HAAS (Chem. Weekblad, 1937, 34, 719—722).—Measurements are recorded of the electric potential at H_2O -air surfaces on which various substances have been spread. It is suggested that the observed variations are due to alterations in p_{H} and of H_2O or O content of the reaction layer, in which a normal oxidation-reduction reaction occurs.

S. C.

Electron rays and the structure of unimolecular films. J. DE WAEL (Chem. Weekblad, 1937, 34, 698—701).—The application of electron rays in the study of unimol. films of the Ba salts of the higher fatty acids is discussed.

S. C.

Built-up films of barium stearate. K. B. BLODGETT (J. Physical Chem., 1937, 41, 975—984; cf. A., 1935, 931).—Films of Ba stearate on a Cr plate corresponding with steps of two unimol. layers form an accurate colour gauge with which the thickness of monolayers of other substances can be measured. A method is described whereby monolayers < 5 A. thick can be measured with a probable error of 2.5 A. without the use of optical apparatus. Properties of Ba stearate films containing Cu and of skeleton films (A., 1937, I, 458) are discussed.

F. L. U.

Unimolecular films of α -aminostearic acid, stearic acid, and heptadecylamine. E. F. PORTER (J. Amer. Chem. Soc., 1937, 59, 1883—1888).—The mechanical and electrical properties of unimol. films of α -aminostearic acid (I), stearic acid (II), and heptadecylamine (III) have been measured on aq.

substrates of p_H 3—11. The area, extrapolated to zero compression, occupied by mols. of (I) in the iso-electric range is 30.3 sq. A., 50% > for non-ionised mols. of (II) or (III). Outside this range films of (I) are more expanded. The surface potential (V) of (I) resembles that of (II) on alkaline solutions and that of (III) on acid solutions. The fact that V for (I) is never \geq for (II) or (III) leads to the conclusion that V cannot reflect exactly the magnitude of the electric moments of the mols. J. W. S.

Monolayers and multilayers of chlorophyll. I. LANGMUIR and V. J. SCHAEFER (J. Amer. Chem. Soc., 1937, 59, 2075—2076).—Monolayers of chlorophyll (I) on H_2O behave as two-dimensional liquids until submitted to pressures >20 dynes per cm., when they become viscous. Multilayers up to 600 layers thick can be built as Y layers (cf. A., 1937, I, 458) on glass or Cr, using a piston oil of tritolyol phosphate ($F = 9$ dynes per cm.) on H_2O . Assuming $n_D = 1.64$, the thickness of these films is 14.2 Å. With a piston oil pressure of 16 dynes per cm. hydrous films are formed with H_2O separating the A and B monolayers, which have total thickness 35 Å. Dehydrous multilayers have also been produced. A Y multilayer is not wetted by H_2O but is sol. in hydrocarbons, which are rendered fluorescent. (I) monolayers can be produced on Ba stearate multilayers. The fluorescence of (I) in C_6H_6 disappears when it spreads as a monolayer, indicating that the fluorescence is not due to dispersion alone.

J. W. S.

Built-up films of protein and of sterol. H. B. BULL (J. Physical Chem., 1937, 41, 985—986).—Films containing 100 unimol. layers of zein have been built up on highly polished Cr slides. The films are strongly hydrophilic. The thickness is 14 Å. per unimol. layer. Attempts to deposit similar films of egg-albumin were unsuccessful. Films of cholesterol, deposited from light petroleum, are strongly hydrophobic. F. L. U.

Relation between molecular stability and p_H . F. VLÈS (Bull. Assoc. Amicale Ing. Chim. Inst. Chim. Strasbourg, June, 1937, 97—113).—The influence of p_H on the constitution of dissolved mols., particularly as indicated by its effect on rotatory power and ultraviolet absorption, is discussed on the bases of experiments carried out during the past 12 years.

F. L. U.

Influence of electrolyte on non-aqueous cellulose nitrate solutions. II. Influence of heavy-metal salts and amines. N. V. MICHAÏLOV and V. A. KARGIN (J. Phys. Chem. Russ., 1937, 9, 805—814).—Small quantities of heavy-metal salts decrease the viscosity of $COMe_2$ solutions (e.g., by 30%). NH_3MeI decreases the viscosity, but NMe_4I increases it. The ζ -potential remains small (0.01 mv.) in presence of heavy-metal salts ($AgClO_4$, $HgCl_2$) but NMe_4I and NH_3EtCl increase sharply the negative ζ -potential (up to 0.3 mv.). $AgClO_4$ is strongly adsorbed by cellulose nitrate particles. E. R.

Influence of electrolytes on non-aqueous cellulose nitrate solutions. I. Actions of nitric acid and NH_3 . V. A. KARGIN and N. V. MICHAÏLOV (J. Phys. Chem. Russ., 1937, 9, 793—804).—The

electric conductivity of cellulose nitrate (I) in $COMe_2$ is due to the presence of HNO_3 and other electrolytes and not to dissociation of (I) itself. η of (I) attains a max. on addition of a quantity of NH_3 which corresponds with the neutralisation of the (I) acids. Measurements of ζ -potentials show that purified (I) carries no electric charges. Considerable amounts of electrolytes are adsorbed by (I) particles in $COMe_2$; comparison with the ζ -potential points to the mol. nature of the adsorption. Changes in viscosity produced by addition of HNO_3 and NH_3 are not due to electric charges on the particles, but to the entry of electrolyte molecules into the solvate layers.

E. R.

Apparent molar volume of inorganic salts in methyl alcohol solution. J. B. STARK and E. C. GILBERT (J. Amer. Chem. Soc., 1937, 59, 1818—1820).— d^{25} has been measured for solutions of $KCNS$, NH_4NO_3 , $Ca(NO_3)_2$, and $HgCl_2$ in $MeOH$. The apparent molar vols. are calc. and compared with data for aq. solutions. The differences can be explained in terms of the properties of the solvents. J. W. S.

Viscosity and fluidity of aqueous potassium ferrocyanide solutions. G. R. HOOD and J. C. WILLIAMS (Ohio J. Sci., 1935, 35, 415—420).—The η has been measured at 18° and 25° for 0.003—0.223 molar solutions. The data agree with $\phi = 1 - 0.0245\sqrt{c} - 0.3185c$ at 18°, and with $\phi = 1 - 0.0245\sqrt{c} - 0.3720c$ at 25°. The Falkenhagen const. $A = 0.0245$ accords with the expected val.

CH. ABS. (e)

Absorbing and reflecting powers of electrolytes in the far infra-red. C. H. CARTWRIGHT (J. Chem. Physics, 1937, 5, 776—786).—The absorbing and reflecting powers and the dispersion of solutions of HCl , $LiCl$, $NaCl$, KCl , KBr , LiI , KI , ZnI_2 , $MgSO_4$, KOH , and H_2SO_4 in the region 50—150 μ . have been measured by an apparatus which is described. The results are discussed in terms of Maxwell's equations in which the inertia of the ions is included, the influence of ions on the absorbing power of H_2O mols., the electrical conductivity for high-frequency electromagnetic fields, the radius and hydration of ions, and the validity of Stokes' law for the microscopic process involved. W. R. A.

Optical absorption of cobalt chloride solutions. Å. VON KISS and M. GERENDÁS (Z. physikal. Chem., 1937, 180, 117—130).—The absorption curves in aq. solution and in presence of various salts have been measured between 200 and 730 $m\mu$. In conc. HCl there is a spectrum consisting of six band triplets, which appears to be the electron-vibration spectrum of the relatively stable complex $CoCl_4''$. Pure conc. aq. $CoCl_2$ has a quite different spectrum, and the solution probably contains, not $CoCl_4''$, but a mixture of complexes of different compositions, some of which unite to form polynuclear complexes. $CoCl_2$ solutions containing $LiCl$, $NaCl$, $MgCl$, and $CaCl_2$ have spectra similar to that in conc. HCl ; in the latter complex formation and dehydration occur at the same time. In conc. $ZnCl_2$ solution, however, the spectrum is structureless and similar to that of pure conc. aq. $CoCl_2$. There seems to be no simple relation between the dehydrating and the complex-forming

action of neutral salts. The reddish-violet colour of CoSO_4 in conc. H_2SO_4 and the blue colour of CoCl_2 in conc. aq. $\text{Na}_2\text{S}_2\text{O}_3$ are ascribed to sulphato- and thiosulphato-complexes, respectively. R. C.

Determination of the density of aërodispersoid particles (aërosuspensions of ammonium chloride, mercuric iodide, and magnesium oxide). K. N. SAMOCHVALOV (J. Phys. Chem. Russ., 1937, 9, 611—617).—Rate of sedimentation is measured by counting particles on the bottom at definite intervals and determining the average size of the settled particles. Stokes and Cunningham's law then gives the d . This is small even in fresh smokes and in the course of a single experiment it decreases in NH_4Cl smokes, remains const. in stabilised NH_4Cl and non-stabilised HgI_2 smokes, and rises in stabilised HgI_2 smokes. J. J. B.

Sedimentation analysis with photo-electric cell. E. G. RICHARDSON (Kolloid-Z., 1937, 81, 87—88).—Comments on a paper by Hoffmann (A., 1937, I, 374). The method described therein was published by the author in 1934 (B., 1934, 806). F. L. U.

Dependence of the absorption of sound in aërosols on frequency. O. BRANDT (Kolloid-Z., 1937, 81, 2—6).—See A., 1937, I, 230. F. L. U.

Experimental investigation of the light scattering by organosols of metals in media of varying refractivity. J. I. VEIZER (J. Phys. Chem. Russ., 1937, 9, 486—492).—Experiments have been made with Svedberg's Al sol in MeOH diluted with Bu^nOH , CHCl_3 , and $\text{CHCl}_3 + \text{CS}_2$; with Svedberg's Fe sol in MeOH diluted with CHCl_3 and C_6H_6 ; with Svedberg's Mg sol in MeOH diluted with CHCl_3 ; and with hydrosol of Au diluted with COMe_2 and quinoline. In agreement with Mie's theory the intensity of the Tyndall beam increases with increasing refractivity of the medium for Au sol. The relation is inverted for the other sols, which are coarser; this agrees with the theory of ordinary reflexion. J. J. B.

Reciprocity theorem in colloid optics. R. S. KRISHNAN (Current Sci., 1937, 6, 90—91).—A preliminary account is given of the relative intensities of the light from beams characterised by vertical and horizontal vibrations, respectively, when the light is scattered transversely by colloids. The results agree with the author's theory (A., 1935, 1075) but disprove that of Gans (A., 1937, I, 496) in which no account is taken of the magnetic and higher electrical partial waves. F. R. G.

Viscosity of suspensions and solutions. VIII. Inertia effects of suspended spheres. F. ERICH and O. GOLDSCHMID (Kolloid-Z., 1937, 81, 7—18; cf. A., 1936, 1066).—The η of suspensions of glass spheres with radii 0.016—0.0075 cm. is in substantial agreement with the modified Einstein formula $\eta = \eta_0(1 + 2.5c + 14.1c^2)$ when determined in the Couette apparatus. Lower vals. are obtained with the capillary viscosimeter. The observed differences, which are attributed to different modes of flow, support the view that the effect is due to inertia forces. A theoretical discussion is given. F. L. U.

Applications of ultrasonics in colloid investigation. H. A. WANNOW (Kolloid-Z., 1937, 81, 105—113).—Recent work is reviewed, with special reference to the production of ultrasonic waves, their dispersing and coagulatory effects, and their influence on the orientation of anisodimensional particles. F. L. U.

Effect of X-radiation on colloidal carbon. J. A. CROWTHER, H. LIEBMANN, and T. B. LANE (Phil. Mag., 1937, [vii], 24, 654—664).—Exposure to X-rays produces changes in the potential of the colloid particle, the potential showing alternate max. and min. with increasing exposure. K. S.

Increase of negative photophoresis by a high-frequency electric field. G. GROETZINGER (Physikal. Z., 1937, 38, 766—767).—The behaviour of sub-microscopic particles exposed to light in a high-frequency electric field (8×10^7 Hertz) has been investigated. In the case of Se and Te a few particles move rapidly in a direction opposite to that of the light when the field is applied, but the remainder fall at the normal rate. The particles affected show negative photophoresis which is increased by the field. Particles showing positive photophoresis are not affected. A. J. M.

Colloidal properties of clays as related to their crystal structure. C. E. MARSHALL (J. Physical Chem., 1937, 41, 935—942).—The cryst. structure of halloysite, kaolinite, pyrophyllite, talc, beidellite, and montmorillonite is discussed in relation to base exchange capacity and electrical properties. F. L. U.

Coagulation coefficient of ammonium chloride smokes. L. V. RADUSCHKEVITSCH (J. Phys. Chem. Russ., 1937, 9, 883—888).—Coagulation coeffs. ranging from 2.6×10^{-8} to 5.4×10^{-8} (c.c./min.) have been found for NH_4Cl smokes, with a density about 19.2 mg. per cu. m. The vals. are const. for a given smoke, but change occurs as a result of condensation and re-sublimation. It is probably due to circumstances which affect the shape of the particles and the amounts of NH_3 , HCl , and H_2O which are sorbed. E. R.

Electrolyte coagulation of weakly solvated sols and electrolyte activity. X. Influence of non-electrolytes. W. OSTWALD, H. KOKKOROS, and K. HOFFMANN (Kolloid-Z., 1937, 81, 48—61; cf. A., 1937, I, 410).—The coagulation concns. of NaCl , MgCl_2 , and LaCl_3 for sols of As_2S_3 in H_2O — EtOH mixtures are < those for the pure hydrosols. The observed effects are in quant. agreement with the author's theory when account is taken of the change in the activity coeff. of the electrolyte resulting from decrease of the dielectric const. of the dispersion medium. F. L. U.

Ageing of precipitates. XV. Mechanism of the interaction between dissolved bromide and solid silver chloride. I. M. KOLTHOFF and H. C. YUTZY (J. Amer. Chem. Soc., 1937, 59, 2029—2032; cf. A., 1937, I, 564).—The rate of distribution (v) of Br' between a solution containing Cl' and Br' and a well-aged AgCl ppt. increases with increasing ratio (r) of Br' in solution to Ag in the ppt. When r

is small, v is determined by the velocity of recrystallisation of the AgCl. The greater val. of v when r is large is attributed to direct attack of Br' on solid AgCl. The Br' taken up in the surface by exchange is assumed to cause disruption of the AgCl lattice, exposing fresh surfaces to attack. J. W. S.

Reversal of charge of the disperse phase of organic and inorganic dispersoids by radon. E. EPSTEIN (Kolloid-Z., 1937, 81, 80—87).—Rn dissolved in a phosphatide sol causes flocculation which is complete in 24 hr. Under similar treatment a red Au sol becomes blue. F. L. U.

Chemical reactions between colloids of the same sign. I—III. R. TSCHERNITZKAJA and V. KARGIN (J. Phys. Chem. Russ., 1937, 9, 461—470, 471—480, 481—485).—I. According to spectroscopic observations the rate of reaction between colloidal V_2O_5 and As_2S_3 is almost independent of the dilution of the $As_2S_3 + 3V_2O_5$ mixture. For such a mixture the rate $\propto [H^+]$ and the calc. surface of the particles. The explanation advanced is that As_2S_3 particles react with the molecularly dissolved V_2O_5 the concn. of which is independent of dilution, being that of saturated V_2O_5 . Formation of V_2O_4 during an experiment causes a decrease of $[H^+]$ and $[VO_3^-]$. That the reaction does not occur between colloid particles is also indicated by the fact that gelatin is unable to retard it.

II. The light absorption, $[Ag^+]$, and electrical conductance of reacting $AgBr + As_2S_3$ and $AgI + As_2S_3$ mixtures, and the electrical conductance and $[Ag^+]$ of $AgBr + Sb_2S_3$ and $AgI + Sb_2S_3$, have been measured. The relationship between the reaction rate and dilution is irregular. Coagulation interferes with the reaction. The total change is more rapid in systems containing $AgBr$ than in those containing AgI .

III. When vapours of H_2O , Hg, and S are frozen out on a cooled glass surface (cf. Rabinovitch *et al.*, A., 1931, 560) and then thawed, the mixed sol obtained is very unstable but no formation of HgS takes place in the absence of air. Colloid particles do not affect one another but react with the intermicellar liquid only. J. J. B.

Properties of the saponin sol. R. RUYSSSEN and E. O. K. VERSTRAETE (Natuurwetensch. Tijds., 1937, 19, 169—183).—Electrodialysed, ash-free saponin sols are pronouncedly acid in character (p_H 3.08 at 1%) and potentiometric titrations with NaOH show a sharp inflection at p_H 7.95 (acid equiv. 1712). The sols are discharged by multivalent ions (Th^{+++} , Al^{+++}) but are flocculated only by Hexol nitrate. The reciprocal Th no. is rather $<$ the acid equiv. Flocculation occurs with $COMe_2$ but not with EtOH. The η and the Gortner effect show that the hydration of the sol is extremely small. The electro-viscous effect is also discussed. Saponins can be purified conveniently by pptn. of the EtOH extract with $COMe_2$ and Et_2O followed by dissolution in H_2O and pptn. with $COMe_2$ after dialysis. S. C.

Thixotropy. II. Thixotropic behaviour and structure of bentonite. E. A. HAUSER and C. E. REED (J. Physical Chem., 1937, 41, 911—934; cf.

A., 1937, I, 181).—Base exchange capacities and p_H -concn. relations of five fractions of H bentonite having mean particle radii (r) 7—43 μ . are identical. Sp. conductivity increases with decrease in r , and is \ll that calc. from the H^+ activity. Comparing suspensions of the same wt. concn. but different r , the time required for gelation in presence of KOH decreases with fall in r . With the finest particles there is evidence of gel structure for a concn. $<0.05\%$. In the ultramicroscope gelating suspensions show the formation of primary aggregates which then form a network. F. L. U.

Diffusion constants of the amino-acids. A. POLSON (Biochem. J., 1937, 31, 1903—1912).—The diffusion consts. (D) of some H_2O -sol. NH_2 -acids have been determined at several concns. and found to depend on mol. size and shape. Arginine, which is a stretched mol. of M 174, has D 57.6×10^{-7} sq. cm. per sec., whilst tryptophan, which is a more spherical mol. of M 204, has D 61.4×10^{-7} sq. cm. per sec. Results with proline show that it exists in the same condition in 71.5% EtOH as in H_2O , but that in abs. EtOH it forms an association product with M 3 or 4 times that of proline. Comparative results obtained by Mehls' porous disc method give a roughly const. ratio of 0.8825 : 1. P. G. M.

Gels. H. FREUNDLICH (J. Physical Chem., 1937, 41, 901—910).—A review of recent work on hydration, thixotropy, rheopexy, and swelling. F. L. U.

Electrolytic properties of proteins and their structure. G. ETTISCH (J. Chim. phys., 1937, 34, 473—506).—The reaction of proteins with acids and with bases occurs in two stages. The primary (instantaneous) reaction can be successfully explained by Bjerrum's theory of ampholytes, treating the protein as an "ampholyte of higher order." The secondary (slow) reaction, studied by reference to viscosity, depolarisation, and diffusion data, involves an initial expansion of the protein mol., followed, on increasing the p_H , by a reversible splitting-up of the mol.; above p_H 11, and for low p_H at elevated temp., this latter stage is irreversible. The effect of neutral salts is discussed. Previous measurements of the affinity of protein for Cu (A., 1931, 503) are in accordance with this theory. D. F. R.

Electrokinetic aspects of surface chemistry. II. Electrokinetic theory in the calculation of the charge of proteins. L. S. MOYER and J. C. ABELS (J. Biol. Chem., 1937, 121, 331—344).—Calculation of the charge on the egg-albumin "mol." from titration curves of solutions at const. ionic strength (0.02) yields results which are in fair agreement with those derived from electric mobility measurements. The data are discussed and an expression is derived by which electric mobilities of proteins may be calc. from titration curves. C. R. H.

Dielectric measurements with hydrophilic colloids. I. Measurements with agar and gelatin at 261 m. P. J. DENEKAMP and H. R. KRUYT (Kolloid-Z., 1937, 81, 62—80).—The ϵ of 0.5% agar sol is about 4% $>$ that of H_2O , and the same increase is observed when the agar is in the form of gel. Addition of tannic acid, EtOH, or $COMe_2$ causes a

reduction of ϵ , whence it is inferred that the increase in the case of the sol or gel is due to hydration. Addition of a quadrivalent cation, which markedly lowers η , is without influence on ϵ . Gelatin sols exhibit a similar increase of ϵ , but the val. is diminished on gelatinisation, owing to the micelle possessing a permanent electric moment. F. L. U.

Electrometric determination of the p_H of gelatin gels with the quinhydrone electrode. J. SWYNGEDAUF (Compt. rend. Soc. Biol., 1937, 126, 42—43).—Between p_H 1.5 and 9.5 the vals. obtained with quinhydrone and H_2 electrodes agree within 0.04 p_H unit; the use of the quinhydrone electrode is more expeditious. H. G. R.

Quantitative study of electrofiltration of gelatin gels as a function of the p_H . J. SWYNGEDAUF (Compt. rend. Soc. Biol., 1937, 126, 39—41).—The rate of electrofiltration is a function of the p_H near the isoelectric point but reaches a const. val. below p_H 3.5 and above p_H 6.5; the lower p_H region is represented by a greater rate than the higher. H. G. R.

Electrochemical preparation of isoelectric gelatin. Deviations in the isoelectric point of commercial gelatin. J. SWYNGEDAUF (Compt. rend. Soc. Biol., 1937, 126, 35—37).—The method (cf. A., 1936, 1396) is superior to that of Loeb and gives a yield of 60—70%. Variations of p_H between 4.68 and 5.32 have been observed in the examination of various samples of gelatin. H. G. R.

Checking isoelectric state of gelatin gels by electrofiltration. J. SWYNGEDAUF (Compt. rend. Soc. Biol., 1937, 126, 33—35).—The precision of the method is comparable with that of the electrophoretic method. H. G. R.

Structure catalyst. R. E. LIESEGANG (Kolloid-Z., 1937, 81, 1—2).—When KCl diffuses into gelatin jelly containing $AgNO_3$, the resulting ppt. is uniformly distributed. If, however, a very small amount of Ag_2CrO_4 (or $K_2Cr_2O_7$) is added, the ppt. is banded. By using an old dried gelatin prep. with concentric rings of Ag_2CrO_4 , a diffusion of KCl from one side produced an interlacing pattern of rings, in which the Ag_2CrO_4 was partly changed to $AgCl$ *in situ*, whilst an independent ring system of $AgCl$ was simultaneously formed. F. L. U.

Vapour density of nitrogen tetroxide over carbon tetrachloride solutions by a colorimetric method. E. D. COON (J. Amer. Chem. Soc., 1937, 59, 1910—1912).—The concns. of NO_2 and N_2O_4 over solutions in CCl_4 have been determined by combination of colorimetric and v.p. data. The equilibrium consts. in this system have been calc. and show that the solutions are nearly ideal. J. W. S.

Dissociation constants of chlorophenol-blue and iodophenol-blue. F. W. PANEPINTO and M. KILPATRICK (J. Amer. Chem. Soc., 1937, 59, 1876—1878; cf. A., 1934, 1307).—From measurements in OBz' and OAc' buffer solutions it is found that the thermodynamic dissociation consts. of chlorophenol-blue and iodophenol-blue are 3.7×10^{-5} and 6.4×10^{-5} , respectively. J. W. S.

Ionisation constants of some secondary amines in methanol. C. L. MEHLTRETER (Iowa State Coll. J. Sci., 1936, 10, 87—89).—The order of polarity for the secondary amines is the same as that for the corresponding primary amines. The solvent and radical effects are const. for each series.

CH. ABS. (e)

Basic dissociation constant of α -picoline. E. S. G. BARRON (J. Biol. Chem., 1937, 121, 313—314).—Data for titration with HCl using a glass electrode give a mean val. $K_b = 1.05 \times 10^{-8}$ at 25°. C. R. H.

Acidity in non-aqueous solution. M. KILPATRICK (Trans. Electrochem. Soc., 1937, 72, Preprint 27, 411—420).—The construction of a general acidity scale applicable to any solvent is discussed. F. L. U.

Chemical hydration numbers. J. KIELLAND (J. Chem. Educ., 1937, 14, 412—413).—The nos. calc. by Ulich (A., 1930, 1251) for various ions have been revised and extended. Hydration nos. for 32 gases and org. compounds in H_2O have also been calc. by the entropy deficiency method. The hydration of these non-electrolytes is as great as that of the low-valent ions. The higher aliphatic alcohols have nos. corresponding with the most highly hydrated univalent ions. For aliphatic compounds the hydration nos. are approx. additive, and the following preliminary vals. are assigned: $\cdot OH$, 2; $\cdot NH_2$, 2; $\cdot CO$, 1; $\cdot Cl$, 1; $\cdot Me$, 1; $\cdot CH_2$, 1; and $\cdot CH$, $\frac{1}{2}$. L. S. T.

One-third basic aluminium acetate solution. III. Further properties of the solution. C. ROHMANN and W. MIRUS (Arch. Pharm., 1937, 275, 541—552; cf. A., 1937, I, 184).—Vals. of Δ at 16° and 25°, f.p. depression, dialysis const., and γ support the view that this solution contains a polymerised univalent ion. The degree of polymerisation in 0.2N solution is approx. 2 and in 1.0N solution approx. 2.8. The dimeride is associated with 18 and the trimeride with about 12 H_2O . R. S. C.

Variation of the activity coefficient of hydrochloric acid in hydrochloric acid-sodium chloride solutions of constant total ionic strength from 0° to 50° and the solubility of sodium chloride in hydrochloric acid solutions at 25° with methyl alcohol-water mixtures as solvent. G. ÅKERLÖF, J. W. TEARE, and H. TUROK (J. Amer. Chem. Soc., 1937, 59, 1916—1920; cf. A., 1930, 996).—E.m.f. data have been obtained for cells $Pt, H_2 | HCl (m), NaCl (1 - m), in aq. MeOH (x wt. \%) | AgCl | Ag$ at 0—50° with $x = 0-60$, and $m = 0.1-1.0$. It is deduced that in HCl-NaCl solutions of total ionic strength = $1 \log f$ (f = activity coeff. of HCl) varies linearly with m , and $d \log f / dm$ is independent of $[MeOH]$. The solubility of NaCl in HCl- H_2O -MeOH mixtures at 25° is such that the activity coeff. varies with $[MeOH]$ independently of the $[HCl]$. J. W. S.

Thermodynamics of concentrated aqueous solutions of hydrochloric acid. G. ÅKERLÖF and J. W. TEARE (J. Amer. Chem. Soc., 1937, 59, 1855—1868).—The e.m.f. of the cell $H_2 | HCl (m), AgCl | Ag$ has been studied for m (mols. HCl per 1000 g. H_2O) = 3—16 at 0—50°. The activity coeff. (f) of HCl is

given by $\log f = -u\sqrt{m}/(1 + 2\sqrt{m}) + Bm + Cm^2 + Dm^3 + Em^4$, where u is the universal const. of the Debye-Hückel limiting law and B , C , D , and E are consts. varying linearly with temp. Equations are derived for the activity of the solvent, and the relative partial molar heat content, heat capacity, free energy, and entropy of both solute and solvent. J. W. S.

Activity and osmotic coefficients of some hydroxide-chloride mixtures in aqueous solution. H. S. HARNED and M. A. COOK (J. Amer. Chem. Soc., 1937, 59, 1890—1893).—From e.m.f. measurements on the cells $H_2|MOH(m_1), MCl(m_2)|M_xHg|MOH(m_0)|H_2$ and $Ag|AgCl, MOH(m_1), MCl(m_2)|M_xHg|MCl(m_0')|AgCl|Ag$ ($M = Na$ or K) the activity coeff. (f) of the hydroxide and chloride in solutions of total concn. 0.5 and 1.0M have been determined. Contrary to observations on other uni-univalent electrolyte mixtures f can be expressed by $-\log f = -\log f_0 + \alpha m + \beta m^2$, where m is the partial molar concn. of the hydroxide or chloride and f_0 the activity coeff. in the pure aq. solution at the const. total molarity under consideration. J. W. S.

Thermodynamics of aqueous sodium bromide solutions from electromotive force measurements. H. S. HARNED and C. C. CRAWFORD (J. Amer. Chem. Soc., 1937, 59, 1903—1905; cf. A., 1929, 513).—The e.m.f. of the cells $Ag|AgBr, NaBr(c)|Na_xHg|NaBr(0.1M), AgBr|Ag$ has been determined at 0—40° for $c = 0.1$ —4M. The activity coeff., relative partial molar heat content, and heat capacity of NaBr in the solutions are calc., fairly good agreement being obtained with calorimetric vals. J. W. S.

Ionic activity coefficient product and ionisation of water in barium chloride solutions from 0° to 50°. H. S. HARNED and C. G. GEARY (J. Amer. Chem. Soc., 1937, 59, 2032—2035).—The e.m.f. of the cells $H_2|Ba(OH)_2(0.005M), BaCl_2(m)|AgCl|Ag$ and $H_2|HCl(0.01M), BaCl_2(m)|AgCl|Ag$ has been measured at 0—50°. From the results the standard potential of the Ag-AgCl electrode, ionisation const. of H_2O , activity coeff. and relative partial molar heat content of HCl in BaOH solutions, the ionic activity coeff. product, ionisation, and heat of ionisation of H_2O in these solutions are calc. for this temp. range. J. W. S.

Dissociation pressures of potassium deuteroide and potassium hydride. (Miss) E. F. SOLLERS and J. L. CRENSHAW (J. Amer. Chem. Soc., 1937, 59, 2015—2022).—The dissociation pressures (p) of KH and KD have been measured at 270—360°, the results for KH being in accord with those of Keyes (A., 1912, ii, 627). p for KD is approx. double that for KH at the same temp. The calc. heats of formation of KH and KD are 14,150 and 14,450 g.-cal. per mol., respectively. A possible method of separating H_2 and D_2 by passing the gases over an excess of K is suggested. J. W. S.

Freezing points of the system *p*-dioxan-*tert*-butyl alcohol. F. H. GETMAN (Rec. trav. chim., 1937, 56, 927—930).—A eutectic is formed at -9.15°. The anomalous variation of the mol. wt. of Bu^oOH as calc. from f.-p. depressions in dioxan cannot be attributed to mixed crystal formation. J. W. S.

Systems of carbamide with nitrobenzene, *m*-dinitrobenzene, and 1:3:5-trinitrobenzene. D. A. VAN DORP, J. LIMBURG, and P. C. NOBEL (Rec. trav. chim., 1937, 56, 983—984).—The characteristic points in the m.p. diagrams of the three systems are tabulated. The solubility of $CO(NH_2)_2$ in $PhNO_2$ or C_6H_6 at low temp. is so small that the f.-p. depression cannot be detected on a Beckmann thermometer. J. W. S.

Ternary system methyl alcohol, toluene, and water. L. S. MASON and E. R. WASHBURN (J. Amer. Chem. Soc., 1937, 59, 2076—2077).—The solubility of H_2O in MeOH-PhMe mixtures has been determined at 25° and n_D^{25} measured for the equilibrium solutions. The distribution ratio of MeOH between PhMe and H_2O is 0.01 at low concn. but increases with increasing [MeOH], probably owing, in part, to the increased miscibility of H_2O and PhMe in presence of MeOH. J. W. S.

Solubility relations in the system lead acetate-sodium acetate-acetic acid at 30°. E. GRISWOLD and F. V. OLSON (J. Amer. Chem. Soc., 1937, 59, 1894—1895).—The solubilities (s) of $Pb(OAc)_2$ and $NaOAc$ in $AcOH$ at 30° are 19.72 and 7.70 mol.-%, respectively, the solid phases being $Pb(OAc)_2 \cdot 0.5AcOH$ and $NaOAc \cdot 2AcOH$, respectively. No other solid phase has been obtained. s for each acetate increases with increasing concn. of the other salt. The solution in equilibrium with both salts contains approx. 24.5 mol.-% of $Pb(OAc)_2$ and 14.0 mol.-% of $NaOAc$. J. W. S.

25° solubility isotherm of the system $K_2O-P_2O_5-H_2O$. L. G. BERG (Kalii, 1937, No. 1, 28—36).—Slowness of crystallisation and the formation of metastable phases introduce difficulties in the determination of the isotherm. The existence of a section characterised by anhyd. K_3PO_4 as the solid phase (D'Ans *et al.*, A., 1910, ii, 1050; 1914, ii, 848) is not confirmed. Mono-, di-, and tri-substituted K phosphates can be crystallised satisfactorily. K_2PO_4 crystallises as the tri- or hepta-hydrate. The octahydrate described by Jänecke (A., 1927, 731) is not indicated but the existence of the double salt $KH_2PO_4 \cdot 2K_2HPO_4 \cdot H_2O$ is confirmed. D. G.

Crystallographic study of the solid phases in the system $K_2O-P_2O_5-H_2O$. (1) $KH_2PO_4 \cdot H_3PO_4$, (2) $K_2HPO_4 \cdot 3H_2O$. G. B. BOKIJ and E. E. BUROVAJA (Kalii, 1937, No. 2, 32—33).— $KH_2PO_4 \cdot H_3PO_4$ can be obtained in the form of well-defined crystals. Isothermal crystallisation at 20° gives symmetrical crystals, whilst those obtained on cooling from 60° to 20° consist of flat plates. $K_2HPO_4 \cdot 3H_2O$ forms elongated and lamellar crystals. Illustrations and measurements are given. D. G.

Solubility study of the system ammonia-phosphoric acid-water at 50°. B. A. MUROMTSEV (Kalii, 1937, No. 1, 36—39).—The results obtained at 50° are compared with those of D'Ans and Schreiner (A., 1910, ii, 1050) at 25° and those of Jänecke (A., 1927, 731) at 0°. Addition of H_3PO_4 has no effect on the solubility of $NH_4H_2PO_4$ whilst $(NH_4)_2HPO_4$ greatly increases it. The mono-ammonium salt section is distinctly curved, whereas the di-ammonium salt section is almost a straight line and the

(NH₄)₃PO₄·3H₂O section is much straighter than at lower temp. D. G.

Ice fields of the ternary systems potassium oxide-phosphoric anhydride-water, and ammonia-phosphoric anhydride-water. M. I. RAVITSCH and N. B. TROITZKAJA (Kalii, 1937, No. 3, 34—41).—The equilibrium relations are discussed with particular reference to the ice fields. D. G.

Solubility isotherms of di-substituted phosphates of potassium and ammonium at 0°. The system K₂HPO₄-(NH₄)₂HPO₄-H₂O. S. I. SOKOLOV (Kalii, 1937, No. 2, 28—32).—The solubility curve consists of two sections corresponding with the separation of the solid phases (NH₄)₂HPO₄ and K₂HPO₄·6H₂O. Mixed crystals are not formed. D. G.

Quaternary system K₂O-NH₃-P₂O₅-H₂O. Solid solutions in the system KH₂PO₄-NH₄H₂PO₄-H₂O. N. S. DOMBROVSKAJA and A. J. ZVORIKIN (Kalii, 1937, No. 2, 24—28).—The 25° and 50° isotherms have been determined. The results of Askenasy and Nessler (A., 1930, 872) indicating the existence of a continuous series of solid solutions have been confirmed. D. G.

Equilibrium of the system TiO₂-SO₃-H₂O at 100°. I. Hydrolysis product of titanium sulphate solution. T. SAGAWA (Kinz.-no-Kenk., 1935, 12, 543—547).—TiO₂ containing 2—5% SO₃ and 3—5% H₂O is pptd. by the hydrolysis of Ti(HSO₄)₄ at 100°. The SO₃ and H₂O are believed to be adsorbed on the TiO₂. Pptn. of TiO₂·H₂O occurs when solutions of much greater concn. are hydrolysed. CH. ABS. (e)

Metastable hydrates of magnesium sulphate in the ternary system: magnesium chloride-magnesium sulphate-water. N. S. KURNAKOV and V. G. KUZNETZOV (Trans. VI Mendeleev Congr., 1935, 1932, 2, Part I, 619).—Data relating to the isothermal evaporation of solutions at 25° and 35° are recorded; solubilities and *d* vals. at 25° are also given. CH. ABS. (e)

Nature and structure of the micro-disperse crystals in the system NH₄Cl-CoCl₂-H₂O. N. S. KURNAKOV, N. P. LUSHNAJA, and V. G. KUZNETZOV (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 577—606).—The solid phases in the system at -29.5° to 50° are 2NH₄Cl·CoCl₂·2H₂O (I) and α- and β-crystals. The α-crystals are micro-disperse mixtures of (I) with solid solutions of (I) or of CoCl₂·2H₂O (II) in NH₄Cl, whilst the β-crystals represent micro-disperse mixtures of a solid solution of (II) in (I) with (II). The lattice const. of NH₄Cl diminishes with increasing [CoCl₂] of the solid phase. R. T.

Anomalous solid solutions in the system NH₄Cl-MnCl₂-H₂O. N. S. KURNAKOV and N. K. VOSKRESENSKAJA (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 607—630).—Four types of solid phases are formed in the system at 25°: α- [<15.4 mol.-% MnCl₂·2H₂O (I)], consisting of micro-inclusions of a solid solution of NH₄Cl in 2NH₄Cl·MnCl₂·2H₂O (II) in a solid solution of (I) in NH₄Cl; β- [16.9—33.3 mol.-% (I)], representing an inversion of the above system; β'- [33.3—34.3 mol.-% (I)], consisting of

(I) dispersed in (II); γ-crystals, consisting of NH₄Cl or (II) dispersed in MnCl₂·4H₂O. Crystallographic and space lattice data are recorded for (II). R. T.

Equilibrium diagram of the ternary system CaO, TiO₂, SiO₂-CaO, SiO₂-CaO, Al₂O₃, 2SiO₂. U. NISHIOKA (Kinz.-no-Kenk., 1935, 12, 449—458).—The diagram is of the simple eutectic type with a ternary eutectic point at 1240° (CaO, TiO₂, SiO₂, 25, CaO, SiO₂ 37.5, CaO, Al₂O₃, 2SiO₂ 37.5 wt.-%). CH. ABS. (e)

Solubility isotherm of the reciprocal system FeSO₄-NaCl at 25°. L. BERG (Trans. VI Mendeleev Congr., 1935, 1932, 2, Pt. I, 619—620).—The system resembles the system MgSO₄-NaCl. Fe astrakhanite resembles Mg astrakhanite in its optical properties and cryst. form, but is formed more readily. Pure FeCl₂·4H₂O may be obtained by filtering, crystallising, and drying in an atm. of Et₂O vapour. CH. ABS. (e)

Fugacity of gas mixtures. I. R. KRITSCHESKI (J. Phys. Chem. Russ., 1937, 9, 659—667).—Theoretical. E. R.

Free energies of formation of sodium carbonate and hydrogen carbonate. I. R. KRITSCHESKI and J. S. KASARNOVSKI (J. Phys. Chem. Russ., 1937, 9, 668—680).—The free energy of formation (Δ*F*) of Na₂CO₃ is calc. (a) from the sum of changes in *F* corresponding with eight partial reactions, and (b) from the third law of thermodynamics. The vals. obtained are Δ*F*_{298.1} = 249.8 kg.-cal. (a) and 251.8 kg.-cal. (b). The corresponding vals. for NaHCO₃ are 203.2 and 204.3 kg.-cal. For the reaction 2NaHCO₃ → Na₂CO₃ + H₂O + CO_{2(gas)}, Δ*F*_{373.1} = 2.0 kg.-cal. (calc.), compared with 2.5 kg.-cal. (exp.). E. R.

Thermodynamics of lead iodide. (MISS) J. Y. CANN and (MISS) A. C. TAYLOR (J. Amer. Chem. Soc., 1937, 59, 1987—1989).—From e.m.f. measurements on the cell PbHg₇|PbI₂(s), PbI₂(sat.) + *m*KI (aq.), AgI(s)|Ag(s) the vals. of Δ*G*, Δ*H*, and Δ*S* for the reaction Pb + I₂ = PbI₂ are -41,479, -42,259, and 1.11 g.-cal. per mol., respectively. J. W. S.

Energy hump in chemistry. II. W. D. BANCROFT and J. E. MAGOFFIN (J. Franklin Inst., 1937, 224, 475—499).—The theory of the energy hump (A., 1937, I, 567) is applied to the H₂ ⇌ 2H⁺ reaction. There are two energy humps corresponding respectively with 2H⁺ → H₂ (given by the cathodic overvoltage), and H₂ → 2H⁺. Platinised Pt removes both humps, and makes the H electrode reversible. The increasing effectiveness of H₂ for pptg. metals from solutions of their salts as pressure and temp. are increased is due to the decrease of the energy hump under these conditions. O₂ also has two energy humps corresponding with 0.3 v. in acid solution and 0.36 v. in alkaline solution. Catalyses of all types, including contact, solvent, H⁺, and H₂O vapour catalysis, can all be explained by the removal of the energy hump. A catalytic agent may initiate a reaction, and such catalysts may be said to act like a siphon, rather than like a lubricant. A. J. M.

Modern thermochemistry and its scientific and technical importance. W. A. ROTH (Chem.-Ztg., 1937, 61, 897—900).—A review.

Heat of formation and specific heat of silicon nitride. S. SATOH (Bull. Inst. Phys. Chem. Res. Japan, 1937, 16, 906—914).—Ice calorimeter measurements for the temp. intervals 0—99.5°, 0—316.4°, and 0—585° indicate that the sp. heat (*c*) of Si₃N₄ is given by $c = 0.165 + 1.847 \times 10^{-4}\theta - 4.5 \times 10^{-8}\theta^2$. ($\theta = ^\circ\text{C}$). From these vals. and the dissociation pressure at high temp. the calc. heat of formation of Si₃N₄ is 163,000 g.-cal. per mol. J. W. S.

Equilibrium $\text{CMe}_3\text{I} \rightleftharpoons \text{CMe}_2\text{CH}_2 + \text{HI}$. J. L. JONES and R. A. OGG, jun. (J. Amer. Chem. Soc., 1937, 59, 1943—1945).—The thermal decomp. of Bu^γI is heterogeneous. At 408—464° K. the heat of reaction is $-19,150 \pm 1000$ g.-cal. per mol. The calc. standard entropy of liquid Bu^γI is $S_{298} = 60.2 \pm 3.3$ entropy units in accord with theory, whilst the free energy of formation of the gas is 6260 g.-cal. per mol. J. W. S.

Differential dilution of sodium hydroxide solutions. F. L. E. SHIBATA and F. MURATA (J. Sci. Hiroshima Univ., 1937, A, 7, 335—340).—The e.m.f. of the reversible cell H₂(Pt)|NaOH aq., HgO|Hg has been measured for solutions (0.5 molal to saturated) at 20° to 30°. ΔF and ΔH for the differential dilution of NaOH solution are calc. for all concns. The following consts. are obtained. Initial heat of dilution of NaOH solution, $\Delta H - \Delta H'$, -2626 g.-cal.; NaOH, H₂O → saturated solution, ΔH_{298} , 666 g.-cal.; Hg + 0.5O₂ = HgO, ΔF_{298} , $-13,850$ g.-cal., ΔH_{298} , $-21,625$ g.-cal., ΔS_{298} , -26.08 g.-cal. per degree. O. D. S.

Isotope effects in heats of dissolution of 99 salts and of mercuric cyanide at 25°. E. LANGE and W. MARTIN (Z. physikal. Chem., 1937, 180, 233—245; cf. A., 1936, 1340).—The differences in the first heats of dissolution in D₂O and H₂O at 25° have been determined and resolved into the contributions of the constituent ions. The heat of hydration of Hg(CN)₂ has been calc. and the heat of dissolution and the isotope effect have each been resolved into a component due to van der Waals adhesion and one due to the heat of void formation. A similar resolution for alkali halides has shown that the heat of formation of voids accounts for a considerable part of the heat of ionic hydration. R. C.

Heats of combustion and formation of gaseous normal olefines. F. D. ROSSINI and J. W. KNOWLTON (J. Res. Nat. Bur. Stand., 1937, 19, 339—345).—Existing data are discussed, and a list of "best" vals. for the heats of combustion of the gaseous hydrocarbons at 25°/1 atm. (H₂O liquid), and of heats of formation at 25° and at 0° K., is given. The heat of combustion at 25°/1 atm. of C_nH_{2n} ($n > 5$) is $21.90 + 157.00n \pm (0.10n - 0.10)$. F. L. U.

Heats of combustion of ethylene and propylene. F. D. ROSSINI and J. W. KNOWLTON (J. Res. Nat. Bur. Stand., 1937, 19, 249—262).—The heats of combustion at 25°/1 atm. to form gaseous CO₂ and liquid H₂O are: C₂H₄ 337.28 ± 0.07; C₃H₆ 491.82 ± 0.15 kg.-cal. per mol. These vals. are respectively 1.6 and 0.4% > the hitherto accepted "best" vals. F. L. U.

Determination of heats of combustion from refractive indices. M. M. SAMYGIN (J. Phys. Chem. Russ., 1937, 9, 929—931). E. R.

Conductance of mixtures of strong electrolytes. K. A. KRIEGER and M. KILPATRICK (J. Amer. Chem. Soc., 1937, 59, 1878—1883).—The conductivities of LiCl solutions have been measured at 25°, and the results compared with previous vals. The conductivities of 19 aq. LiCl-KCl mixtures are compared with theoretical vals. J. W. S.

Potential of the silver-silver thiocyanate electrode. J. N. PEARCE and L. SMITH (J. Amer. Chem. Soc., 1937, 59, 2063—2065).—From e.m.f. measurements on cells of the types Ag|AgCNS, KCNS (*m*)|KHg₂|KCNS (0.1M), AgCNS|Ag; Ag|AgCNS, KCNS (*m*)|KCNS (0.1M), AgCNS|Ag; and Hg|Hg₂Cl₂, KCl (0.1M)|KCNS (0.1M), AgCNS|Ag at 25° the transport no. of the K⁺ ion in KCNS solutions has been calc. The electrode potential of Ag|AgCNS, KCNS (*m* = 1) at 25° is -0.0947 v. J. W. S.

Liquid junction potentials for certain complex systems. A. L. FERGUSON, R. HITCHENS, and K. VAN LENTE (Trans. Electrochem. Soc., 1937, 72, Preprint 20, 283—300).—Const. and reproducible boundaries can be obtained for the systems HCl + either aq. NH₃, glycine, glutamic acid, or NH₂Ph. The difference between the calc. and observed boundary potential vals. is $> 2\%$. J. W. C.

Electromotive forces of concentration chains in the fused state. S. A. PLETENEV and V. N. ROZOV (J. Phys. Chem. Russ., 1937, 9, 854—866).—AgCl, PbCl₂, CdCl₂, and ZnCl₂ have been used as solvents with LiCl, KCl, CaCl₂, and MgCl₂ as solutes in concn. chains. The e.m.f. is a linear function of the log of the mol. concn. of the solute. E. R.

A working electrode of pure carbon does not produce an electrolytic gas cell. V. SIHVONEN (Suomen Kem., 1937, 10, B, 21).—An e.m.f. is developed with extreme slowness between perforated electrodes of purified graphite through which H₂ and O₂ are passed, the electrodes being immersed in an aq. solution. A graphite anode, whether in an aq. solution or molten NaOH, is not appreciably depolarised by a current of H₂. F. L. U.

Sparks in electrolytic valve action. A. GÜNTHER-SCHULZE and H. BETZ (Z. Physik, 1937, 107, 347—353).—The relationship between applied potential, current, time of "forming," and electrolyte concn. during valve action at a Ta electrode is examined, with special reference to the effect of gas bubbles on the sparking. L. G. G.

Electrolytic reduction potentials of organic compounds. XXIII. Reduction potential of quinoline. I. TACHI and H. KABAI (J. Electrochem. Assoc. Japan, 1935, 3, 250—257).—The reduction of quinoline to dihydroquinoline has been studied with the dropping Hg cathode. Quinoline lowers the H overvoltage. From a comparison of the polarograms with those for quinine, the reduction of the latter appears to involve the quinoline nucleus.

CH. ABS. (e)

Oxidation-reduction potentials of hydroxynaphthaquinones in alkaline solutions. E. G. BALL (*J. Amer. Chem. Soc.*, 1937, **59**, 2071—2072; cf. A., 1936, 1206; 1937, I, 246).—Phthiocol and lapachol in 1.0M-NaOH both give titration curves which are much steeper than those predicted on the basis of the two equiv. change. At p_H 13.5 the mid-point potentials of the titration curves are -0.555 and -0.568 v., respectively. This is in accord with the formation of semiquinones. J. W. S.

Oxidation-reduction potentials. IV. Substituted hydrazine- and diazo-sulphonates. G. HOLST (*Z. physikal. Chem.*, 1937, **180**, 161—163; cf. A., 1937, I, 310).—The oxidation-reduction potentials, E , of $X \cdot C_6H_4 \cdot NH \cdot NH \cdot SO_3 \rightleftharpoons X \cdot C_6H_4 \cdot N \cdot N \cdot SO_3 + H_2$, where X is Cl or Me *o*, *m*, or *p* to the N, have been measured at 25°. The Cl-substituted systems have more positive and the Me-substituted systems more negative E than the unsubstituted system, and the effect of Cl substitution is > that of Me substitution. Measurements of the rate of the reaction methylene-blue + $X \cdot C_6H_4 \cdot NH \cdot NH \cdot SO_3 \rightleftharpoons X \cdot C_6H_4 \cdot N \cdot N \cdot SO_3 +$ leucomethylene-blue in 0.01N-HCl at 20° indicate that the velocity of the forward, but not that of the reverse, reaction changes with the p.d. of the systems. The change corresponds with a fall of 1.4 kg.-cal. in the activation energy for a variation of 0.03 v. in the p.d. It seems that the constitution of the functional chromophoric group of the H acceptor determines the dark reactivity. The relation of these results to Dimroth's theory (A., 1933, 1123) is examined, and a statistical interpretation of Dimroth's const. suggested. R. C.

Properties of metals in relation to the p_H scale, and the isopotential point. F. VLÈS (*Congr. Corrosion*, Monaco, 1937, separate, 5 pp.).—The "isopotential point" (P) of a metal in a salt solution is defined as the p_H val. at which the equilibrium potential is established immediately without preliminary change. Examples are given for Zn and Pb in aq. KCl. P is a characteristic of any given metal-salt solution system and is determined by the nature of the metal and the concn. of the salt. It is in several respects analogous to the isoelectric point of an ampholyte. F. L. U.

Significance and measurement of polarisation in the cathodic deposition of metals. F. MÜLLER (*Z. Elektrochem.*, 1937, **43**, 812—821).—Present data and theories are summarised. The direct and commutator methods of measuring polarisation potential are described and the difficulty of obtaining reproducible measurements is discussed. J. W. S.

Solutions of electrolytes showing no polarisation on electrolysis. V. S. FINKELSTEIN and P. V. USTJANOVA (*J. Phys. Chem. Russ.*, 1937, **9**, 773—779).—The anodic and cathodic potentials of ICl_3 in Br, $EtCO_2H$, $PhNO_2$, and $AsCl_3$, of ICl in $EtCO_2H$ and $PhNO_2$, and of $PbCl_2$ and $SbCl_3$ in Br do not change with the c.d. In most cases, this can be explained by the assumption that electrolysis involves an exchange of electrons between the solute and the solvent; the solvent itself acts under these conditions as a depolariser. E. R.

Theory of limiting currents. I. Polarographic limiting currents. D. MACGILLAVRY and E. K. RIDEAL (*Rec. trav. chim.*, 1937, **56**, 1013—1021).—The theory of the diffusion and limiting currents observed with the dropping Hg cathode (cf. A., 1935, 305) is examined critically, and the expressions for the limiting currents at growing and steady drops are compared. An approx. theory of the complete polarographic wave is deduced. The driving force and mobility of the reducible ion are discussed, better accord between experiment and theory being obtained when the proper ionic mobilities are employed. J. W. S.

Mechanism of electrolysis. V. SIHVONEN (*Suomen Kem.*, 1937, **10**, B, 19—20).—Equations for the c.d. are derived both for the case where ionic discharge is the rate-determining process and for that in which an active depolariser is present. F. L. U.

Passivity of iron and steel in nitric acid solution. XXI. Y. YAMAMOTO (*Bull. Inst. Phys. Chem. Res. Japan*, 1937, **16**, 1130—1148).—Agitation of the solution inhibits development of the passivity of an Fe anode during electrolysis of aq. HNO_3 , probably owing to removal of the corrosion product from the surface. It is suggested that the development of passivity of the Fe is assisted by the presence of corrosion product because the chief component of the latter is $Fe(NO_3)_2$, which reacts with HNO_3 to yield HNO_2 and at. O. J. W. S.

Passivity of metals in relation to the theory of W. J. Müller. V. ČUPR (*Chem. Listy*, 1937, **31**, 353—358).—A review.

Corrosion of iron in potassium iodide-iodine solution. G. V. AKIMOV (*J. Phys. Chem. Russ.*, 1937, **9**, 493—501).—The current strength i and the potentials E of the systems (I) $Pt|0.5N-KI|Fe$ and (II) $Pt|0.5N-KI + I|Fe$ have been measured. For (II) i is 50—100 times that for (I). The e.m.f. of (II) is nearly const. but E for Fe and Pt falls suddenly owing to the activation of Fe by I. Addition of I to the cathode increases i , but has no effect at the anode. The corrosion of Fe in $KI + I$ is an electrochemical process of the same kind as that which occurs in (II). J. J. B.

Standardisation of hydrogen ion determination. I. Hydrogen electrode measurements with liquid junction. D. I. HITCHCOCK and (MISS) A. C. TAYLOR (*J. Amer. Chem. Soc.*, 1937, **59**, 1812—1818).—E.m.f. measurements have been made on cells of the type $H_2|buffer\ solution|KCl\ (sat.)|Hg_2Cl_2\ (sat.)|Hg$. Assuming the thermodynamic dissociation consts. of the acids, extrapolation of the data obtained with OAc' , PO_4''' , BO_2'' , and glycolate buffer solutions yields a const. val. of E° (0.2441 v.) for the Hg_2Cl_2 half-cell. The same val. is obtained with aq. $HCl + NaCl$, but not with HCl alone or $HCl + KCl$. p_H vals. over the range 1—9 are assigned to a series of standard solutions, without correction for liquid junction potential, and can be used for exact determination of the thermodynamic dissociation consts. of weak acids from H_2 electrode measurements with buffer solutions containing the

acid and its Na salt, providing the p_{H_2} is between 4 and 9. J. W. S.

Electrochemical investigation of potassium silicate hydrates. T. TAKETA, H. IRIE, and F. L. E. SHIBATA (J. Sci. Hiroshima Univ., 1937, A, 7, 327—334).—The transition point of the hydrates $K_2SiO_3 \cdot 4H_2O \rightarrow K_2SiO_3 \cdot 3H_2O$ is determined from e.m.f. data for the cell $K-Hg|K_2SiO_3 \cdot nH_2O, H_2O \text{ sat.}, HgO|Hg$ to be 21.9° . No other hydrates were observed between 0° and 50° . O. D. S.

Manometric determination of fermentation and equivalent carbonic acid in two-buffer systems.—See A., III, 483.

Rôle of radicals in gas reactions. H. SACHSSE (Z. Elektrochem., 1937, 43, 806, and Angew. Chem., 1937, 50, 847—854).—A lecture. J. W. S.

Investigating time-temperature effects on the properties of reactants. W. M. BREITMANN (Ind. Eng. Chem., 1937, 29, 1202—1206).—A theoretical expression to represent the dependence of the physical properties of the product of a polymerisation reaction as a function of temp. and time is derived. To a first approximation, any physical property of the product may be expressed as a function of $\int \theta dt$, where θ is the temp. in $^\circ C.$ and t is the time, so that if the observed vals. of the property in question be plotted against the area of the temp.-time plot for the experiment, a curve will be obtained, from which the results of further experiments may be predicted in terms of the val. of $\int \theta dt$, or of the more complex unsimplified function. The practical application of the theory is illustrated with reference to the changes of d and of η during the boiling of linseed oil in the "rain" apparatus. R. C. M.

Kinetics of the thermal decomposition of isopropyl iodide. J. L. JONES and R. A. OGG, jun. (J. Amer. Chem. Soc., 1937, 59, 1939—1942).—The velocity of thermal decomp. of Pr^iI at $565-609^\circ$ is given by $-d(Pr^iI)/dt = k[Pr^iI]$, where $k = 1.59 \times 10^{13} \times e^{-42,900/RT}$. It is suggested that the mechanism of the decomp. is either $Pr^iI \rightarrow Pr^i + I$; $Pr^i + Pr^iI \rightarrow C_3H_8 + C_3H_6I$; $C_3H_6I \rightarrow C_3H_6 + I$; $M + 2I \rightarrow I_2 + M$; or $Pr^iI \rightarrow C_3H_6 + HI$; $HI + Pr^iI \rightarrow C_3H_8 + I_2$. J. W. S.

Kinetics of the pyrolysis of *n*-propyl iodide and *n*-butyl iodide. J. L. JONES and R. A. OGG, jun. (J. Amer. Chem. Soc., 1937, 59, 1931—1939).—The velocity of thermal decomp. of gaseous Pr^aI at $584-627^\circ K.$ can be expressed $-d(Pr^aI)/dt = k[Pr^aI][I_2]^{\frac{1}{2}}$. The mechanism of the reaction can be represented (a) $Pr^aI \rightleftharpoons Pr^a + \frac{1}{2}I_2$; (b) $Pr^a + I_2 \rightarrow Pr^iI + I$ (slow); and (c) $Pr^iI \rightarrow \frac{1}{2}C_3H_8 + \frac{1}{2}C_3H_6 + \frac{1}{2}I_2$ (rapid). From the strength of the bonds involved and the entropies of the reactions the equilibrium const. of reaction (a) is calc. as $1.22 \times 10^4 \times e^{-24,700/RT}$, and the velocity const. of reaction (b) as $1.79 \times 10^8 \times T^{\frac{1}{2}}e^{-12,600/RT}$. The decomp. of Bu^aI at $590-622^\circ$ is similar to that of Pr^aI and is also catalysed by I_2 . J. W. S.

Kinetics of the explosive reaction between hydrogen and oxygen sensitised by nitrogen peroxide. G. VON ELBE and B. LEWIS (J. Amer.

Chem. Soc., 1937, 59, 2022—2025).—Kinetic analysis of the explosion of H_2 and O_2 sensitised by NO_2 eliminates the mechanism based on O atoms, and suggests mechanisms in which NO_3 , H, OH, and HO_2 participate. Equations are derived for the upper and lower crit. concns. of NO_2 which are in accord with experiment. J. W. S.

Carbon monoxide-oxygen flame. II. Influence of composition on the intensity of the visible luminosity of the flame. III. Absolute intensity of electronic emission of the flame. E. KONDRATEVA and V. KONDRATEEV (J. Phys. Chem. Russ., 1937, 9, 736—745, 747—751; cf. A., 1936, 1469).—II. With $p_{CO} = 40$ mm., the change in p_{O_2} from 20 to 360 mm. causes a decrease in luminosity which can be explained by a quenching of chemiluminescence with a quenching const. $K_{O_2} = 0.162 \text{ mm.}^{-1}$. With $p_{O_2} = 20$ mm., the change in p_{CO} from 40 to 180 mm. causes a quenching with the const. $K_{CO} = 0.034 \text{ mm.}^{-1}$. N_2 (0—440 mm.) causes a change in luminosity, indicating its influence on the mechanism of the reaction $CO + O_2$ (formation of N oxides).

III. One excited CO_2 mol. is formed per 125 mols. of CO_2 in the CO flame at $p = 100$ mm. and 740° . The concn. of CO_2 in the flame is \gg the thermodynamical equilibrium val. E. R.

Kinetics of F_2O_2 decomposition. H. J. SCHUMACHER and P. FRISCH (Z. physikal. Chem., 1937, B, 37, 1—17).—The thermal decomp. between -60° and -25° under 2.5—400 mm. is a homogeneous and unimol. reaction, and $k_{\infty} = 5.9 \times 10^{12} e^{-17,300/RT}$. The graph of $1/k$ against $1/p$ where k is the velocity coeff. under pressure p is not linear if p is small, but the variation of k with p is quantitatively accounted for by the Rice-Ramsperger-Kassel theory, assuming that the no. of degrees of freedom is 6, the mol. diameter 7×10^{-8} cm., and q_0 17,300 g.-cal. Energy transfer apparently occurs at almost every collision of F_2O_2 mols. No indication of the existence of FO, even as a short-lived intermediate product, has been obtained. The reaction mechanism does not involve chains. R. C.

Thermal behaviour of F_2O_2 . Kinetics of the decomposition and influence of foreign gases. P. FRISCH and H. J. SCHUMACHER (Z. Elektrochem., 1937, 43, 807).—See A., 1937, I, 86, 624. J. W. S.

Oxidation of propane. I. Products of slow oxidation at atmospheric and at reduced pressures. D. M. NEWITT and L. S. THORNES. II. **Products of slow oxidation at high pressures.** D. M. NEWITT and W. G. SCHMIDT. III. **Kinetics of oxidation.** D. M. NEWITT and L. S. THORNES (J.C.S., 1937, 1656—1665, 1665—1669, 1669—1676).—I. The distribution of O in the products has been determined by analysis and the formation of cool flames identified with the presence of a crit. concn. of higher aldehydes in the reacting medium. Conditions for the propagation of a succession of cool flames during the reaction of an equimol. $C_3H_8-O_2$ medium have been investigated.

II. At high pressures Pr^iOH and $COMe_2$ are formed, probably by direct oxidation of C_3H_8 at the β -C

atom. $\text{Pr}^{\alpha}\text{OH}$, EtOH , and MeOH are also formed in considerable quantities; the yield of the higher alcohols is favoured by increase of pressure. C_3H_8 appears to undergo oxidation in two ways, yielding as initial products $\text{Pr}^{\alpha}\text{OH}$ and EtCHO , and $\text{Pr}^{\beta}\text{OH}$ and COMe_2 , respectively.

III. The surface and homogeneous reactions have been investigated separately; the influence of vessel diameter and of diluents on reaction rate is in accordance with the operation of a chain mechanism. Analytical and kinetic results indicate that the following intermediate stages, controlling the course and rate of combustion, occur: (1) an initiating process, which almost certainly starts as a surface reaction and gives rise to crit. concns. of a higher aldehyde, (2) a series of homogeneous reactions by which the higher aldehyde is reduced stepwise to CH_2O , (3) a reaction which occurs simultaneously with (2) and results in thermal decomp. of the aldehyde or of some intermediate product of its further oxidation. E. S. H.

Spectroscopic studies of reaction flames. I. Reaction flame of acetylene and halogen. II. Reaction flame of mercury and halogen. H. TOMINAGA and G. OKAMOTO (Bull. Chem. Soc. Japan, 1937, 12, 401—404, 404—408).—I. The reaction between C_2H_2 and halogen (Br and Cl_2) is examined spectroscopically and a chain mechanism $\text{Cl} + \text{C}_2\text{H}_2 \rightarrow \cdot\text{C}:\text{CHCl} + \text{H}$; $\text{H} + \text{Cl}_2 \rightarrow \text{HCl} + \text{Cl}$; $\cdot\text{C}:\text{CHCl} = \text{C}_{\text{gas}} + \text{C}_{\text{solid}} + \text{HCl}$, is postulated.

II. The reaction flame of $\text{Hg} + \text{Cl}_2 \rightarrow \text{HgCl}_2$ shows two bands $\lambda\lambda$ 5600 and 6700—5700 \AA ., and that of the reaction $\text{Hg} + \text{Br}_2 \rightarrow \text{HgBr}_2$ one band λ 6700—4300 \AA . The origin of the bands is discussed.

F. J. L.

Thermal decomposition of dioxan. L. KÜCHLER and J. D. LAMBERT (Z. physikal. Chem., 1937, B, 37, 285—306; cf. A., 1936, 1208).—At 723—808° K. dioxan (I) decomposes chiefly into $2\text{CO} + \text{H}_2 + \text{C}_2\text{H}_6$, the reaction is of the order 3/2, and the velocity coeff. is given by $\log k = 13.65 - 58,500/(2.3RT)$. H_2 and N_2 have little influence on the velocity, even at low (I) pressures. Small amounts of NO retard powerfully, suggesting a chain mechanism. Attempts to detect H atoms by the $p\text{-H}_2$ method or to initiate chains with Me radicals formed by decomp. of CH_2N_2 failed. The following mechanism, according to which the chains are propagated by CH_2 radicals, accounts for the experimental observations: (I) $\rightarrow \text{CH}_2\text{O} + \cdot\text{CH}_2\text{CH}_2\text{O}$; (II) $+ \text{CH}_2$; (II) $\rightarrow \text{CH}_2\text{O} + \text{CH}_2$; (II) $\rightarrow \text{MeCHO}$; $\text{CH}_2 + \text{I} \rightarrow \text{CH}_2\text{O} + \text{C}_2\text{H}_4 + \text{II}$; $\text{CH}_2 + \text{CH}_2 + \text{M} \rightarrow \text{C}_2\text{H}_4 + \text{M}$; $\text{CH}_2 + \text{II} \rightarrow \text{CH}_2\text{O} + \text{C}_2\text{H}_4$. The energy of activation of the first step is 71,000 g.-cal.

R. C.

Inflammability limits of air-gas mixtures in contact with a hot point.—See B., 1937, 1155.

Steric factor in reactions in solutions. W. HÜCKEL (Z. physikal. Chem., 1937, 180, 139—140).—A reply to criticism (A., 1937, I, 522). R. C.

Comparison of action of oxidising agents liberating iodine. O. I. ANDREEVA and B. B. VASLIEV (J. Chem. Ind. Russ., 1937, 14, 1097—1105).—The reaction of oxidation of NaI by KClO_3

or $\text{K}_2\text{Cr}_2\text{O}_7$ is bimol.; its velocity $\propto [\text{H}^+]$, temp., and $[\text{K}_2\text{Cr}_2\text{O}_7]$. The reactions with NaNO_2 , KMnO_4 , or $\text{Ca}(\text{OCl})_2$ are very rapid, and are not uni- or bimol. In the case of KMnO_4 excess of the reagent causes oxidation of part of the liberated I to oxyacids. The p_{H} ranges of the reactions are: KClO_3 —1.5 to 0, $\text{K}_2\text{Cr}_2\text{O}_7$ 0—1, NaNO_2 1.75—2.5, KMnO_4 2.5—7, and $\text{Ca}(\text{OCl})_2$ 2.5—11. R. T.

Kinetics of the thermal decomposition of oxalic acid. E. SCHRÖER and (FRL.) A. DINGLINGER (Z. Elektrochem., 1937, 43, 808).—The decomp. of $\text{H}_2\text{C}_2\text{O}_4$ in aq. solution at 100—170° and in dioxan solution at 130—150° is homogeneous and of the first order. In H_2O the products are CO_2 , CO , HCO_2H , and H_2O , their proportions being almost independent of temp. In dioxan the products are CO_2 and HCO_2H . The reaction is unaffected by the presence of decomp. products, but H^+ has a catalytic effect. Salts affect the reaction only when acid oxalates are produced, as with $\text{K}_2\text{C}_2\text{O}_4$ and K_2SO_4 . The activation energy in dioxan is 29.45 kg.-cal., the same val. as in conc. H_2SO_4 . In H_2O it varies with temp. but converges towards the same val. as in dioxan at higher temp. The results with H_2O are interpreted on the basis of the unsymmetrical structure of the acid. The temp. coeff. of activation is related to the solvation of the acid at low temp. J. W. S.

Effect of heavy water on rate of hydrolysis of esters and on the equilibrium constant. A. KAILAN and F. EBENEDER (Z. physikal. Chem., 1937, 180, 157—160).—In the hydrolysis of EtOAc and EtOBz by H_2O at 205° the equilibrium const. is not materially altered by replacing the H_2O by D_2O , but the rate of hydrolysis is lowered considerably. This agrees with Bonhoeffer and Reitz's theory (A., 1937, I, 469). R. C.

Rates of exchange reactions of resorcinol and pyrogallol in heavy water. K. H. GEIB (Z. physikal. Chem., 1937, 180, 211—232; cf. A., 1936, 1104).—The exchange reactions between resorcinol (I) and D_2O , deuterioresorcinol (II) and H_2O , and deuteropyrogallol (III) and H_2O have been studied. At 230° only 5 H in (I) are exchangeable; the $m\text{-H}$ is not exchanged. The rate of exchange of D atoms 4 and 6 in (II) catalysed by H^+ is given by $\log k = 11.5 \pm 0.5 - (20,500 \pm 700)/2.3RT$, and at 65° the rate of exchange of H^+ ions in H_2O for D in (II) is 1—1.4 times as great as that of D^+ ions in D_2O for H in (I); the exchange thus resembles the acid-catalysed mutarotation of glucose. The rate of exchange of the third nuclear H is 6.7 times smaller. In alkaline solution the exchange is a complex process. OAc^+ ions, but not AcOH , catalyse the exchange. In neutral solution the rate of exchange is independent of the (I) concn. In (III) D atoms 4 and 6 are exchanged at the same rate at 65° in presence of H^+ ions as catalyst, and the third nuclear D is exchanged 2000 times more slowly, apparently owing to a higher energy of activation. R. C.

Kinetics of aldol condensation. R. P. BELL (J.C.S., 1937, 1637—1640).—Dilatometric measurements show that the condensation of MeCHO to aldol in 0.0005—0.03N- NaOH is a reaction of the

first order with respect to MeCHO when correction is made for the further slow condensation of the aldol. The rate-determining step is probably the formation of free MeCHO from $\text{CHMe}(\text{OH})_2$, which is catalysed by OH' and H_2O ; this view is supported by the variation of reaction velocity with $[\text{OH}']$. The catalytic power of aq. Na_2CO_3 is due to the OH' content.

E. S. H.

Mechanism of sulphonation of aromatic compounds and the hydrolysis of their sulphonic acids.—See A., II, 490.

Autoxidation processes. X. Oxidation of desylamine and benzoin methyl ether. T. H. JAMES and A. WEISSBERGER (J. Amer. Chem. Soc., 1937, 59, 2040—2042).— $\text{COPh}\cdot\text{CHPh}\cdot\text{NH}_2$ (I) is oxidised (method: A., 1929, 1301) by O_2 in aq. KOH about 1.75 times as fast as benzoin, the rate being \propto the concn. of (I) and to $[\text{OH}']$. Benzil (II), H_2O_2 [identifiable when $\text{Ba}(\text{OH})_2$ is the alkali used], and NH_3 are the initial products; BzOH is subsequently formed from the H_2O_2 and (II). (I) is oxidised by Fehling's solution to (II). Benzoin Me ether also undergoes autoxidation; the rate is about 0.005 of that of benzoin. The limiting process in all the autoxidations is the rate of dissociation of H' from the C to which is attached the OH, NH_2 , or OMe group.

H. B.

Active oxides. CVIII. Rate of dissolution in various solvents of aluminium oxides formed by heating basic aluminium acetate in presence of different gases. G. F. HÜTTIG and E. R. KÜRSCHNER (Kolloid-Z., 1937, 81, 40—45; cf. A., 1937, I, 363).—The rate of dissolution of Al_2O_3 prepared by heating $\text{Al}(\text{OH})(\text{OAc})_2\cdot\text{H}_2\text{O}$ at 600° in air, N_2 , SO_2 , $4\text{NO}_2 + \text{O}_2$, NH_3 , H_2O , and Ac_2O exhibits marked differences, depending on the gas used, and on the solvent chosen (aq. H_2SO_4 , HNO_3 , AcOH).

F. L. U.

Reactions between solid substances. I. Kinetics of reactions of polycrystalline substances. B. V. EROFEEV (J. Phys. Chem. Russ., 1937, 9, 828—853).—Six possible cases of reaction kinetics in systems containing one solid component before and after the reaction (e.g., allotropic changes, dehydration of salts, etc.) are considered theoretically.

E. R.

Reduction of chromium oxide. R. H. GRIFFITH, S. G. HILL, and J. H. G. PLANT (Trans. Faraday Soc., 1937, 33, 1419—1425).—The rate of reduction of hydrated Cr_2O_3 with H_2 , C_6H_{14} , cyclohexane, C_6H_6 , and decahydronaphthalene at 350 — 450° has been measured. With hydrocarbons the extent and velocity of reduction are $>$ with H_2 . The hydrocarbon mol. is completely broken down, CO_2 being formed. Activated adsorption of the reducing agent precedes reduction. The adsorption of C_6H_6 on the oxide reduced in H_2 is of the van der Waals type up to 300° . Activated adsorption occurs at 350° and decomp. of the C_6H_6 occurs at 375° . Adsorption of C_6H_6 is less after reducing the oxide in C_6H_{14} than in H_2 . A modified McLeod gauge suitable for accurate pressure determinations with a condensable vapour is described.

H. J. E.

Rate of dissolution of bivalent rhombohedral carbonates in acids. A. FERRARI and L. Sessa (Gazzetta, 1937, 67, 501—510).—Measurements of the rate of dissolution of the carbonates of Ca, Cd, Mn, Zn, Co, and Mg and of certain natural carbonates (rhodochrosite, smithsonite, dolomite, siderite, magnesite) in 8% HCl and in 60% HClO_4 have been made. In general, the rate of dissolution decreases rapidly with decreasing radius of the bivalent cation.

O. J. W.

Reactivity of binary alloys. I. C. GORLA and G. VENTURELLO (Gazzetta, 1937, 67, 487—501).—The reactivity of binary alloys with H_2O vapour at high temp. has been studied for the systems Al—Mg, Al—Fe, Al—Be, and Cu—Mg. The amount of reaction was found by measuring the increase in wt. of the powdered alloy after exposure to H_2O vapour under standard conditions, and was also followed qualitatively by means of photomicrographs. The reactivity of intermetallic compounds is markedly different from, and generally $<$, that of solid solutions or of mixtures.

O. J. W.

Kinetics of silicate formation in the system CaO— SiO_2 . P. S. MAMIKIN and S. G. ZLATKIN (J. Phys. Chem. Russ., 1937, 9, 393—406).—Ignition of equimol. mixtures of CaO and SiO_2 at 800° , 1200° , and 1400° affords chiefly $2\text{CaO}\cdot\text{SiO}_2$ and $3\text{CaO}\cdot 2\text{SiO}_2$, the amount of the latter compound rising with temp. and time (up to 3 hr.). In 3 hr. no formation of $\text{CaO}\cdot\text{SiO}_2$ occurs. A mixture of 1 mol. of CaO and 25 mols. of SiO_2 at 1200° gives mainly $3\text{CaO}\cdot 2\text{SiO}_2$; its amount increases in agreement with Jander's theory (A., 1928, 256).

J. J. B.

Application of Hahn's emanation method to investigation of reactions in solid state. IV. Kinetics of calcium silicate formation. R. JAGITSCH (Z. physikal. Chem., 1937, B, 36, 339—346; cf. A., 1936, 1210).—The rate of reaction, dy/dt , between CaO and pptd. SiO_2 at 775 — 1091° is given by $-dy/dt = k/y$, where y is the thickness of the reaction layer and k is a const., and the emanating power, E , $\propto (1/y)$, so that $\log_e E = -kt + \text{const.}$ The graph of $\log E$ against t consists of two straight lines, which is interpreted as meaning that at first, the rate of reaction is determined by the rate of the surface reaction and later by the rate of diffusion of CaO mols. through the product. In both stages the energy of activation is 23.2 kg.-cal. With rise of temp. the velocity increases abruptly at 940° owing to transformation of α -quartz into tridymite.

R. C.

Reactions in the solid state. I. Reactions between barium carbonate and ferric oxide in the presence of oxygen. R. WARD and J. D. STRUTHERS (J. Amer. Chem. Soc., 1937, 59, 1849—1854).—The rates of reaction of $\text{BaCO}_3 + \text{Fe}_2\text{O}_3$ mixtures in a current of O_2 have been measured at 610 — 970° , and the Fe in the product sol. in dil. HCl has been determined. The mol. ratio sol. Fe : Ba decreases with rising temp., and indicates that either $\text{Ba}_2\text{Fe}_2\text{O}_5$ (I) is the product at higher temp. and both (I) and $\text{Ba}(\text{FeO}_2)_2$ at lower temp., or that a solid solution of Fe_2O_3 in (I) is produced at lower temp. The heats of activation of BaCO_3 below and above

the transition point are 25,000 and 19,000 g.-cal. per mol., respectively. The mechanism of the reaction involves diffusion of BaCO_3 through the reaction products. When the ferrites are heated in O_2 at $>700^\circ$, oxidised Fe compounds are formed, the optimum temp. for their production being $835\text{--}880^\circ$, above the reported range of stability of Ba per ferrite (A., 1910, ii, 36). No BaO_2 could be detected in the reaction products. J. W. S.

Determination of detonation velocity of explosives.—See B., 1937, 1279.

Combustion and detonation of solid explosives.—See B., 1937, 1278.

Velocity of combustion of colloidal powders under atmospheric pressure.—See B., 1937, 1278.

Combination of sugars with amino-acids. II.—See A., II, 483.

Kinetics of coagulation of latex of *Hevea brasiliensis*.—See B., 1937, 1244.

Effect of oxygen, fluorine, nitrogen, argon, helium, and carbon dioxide on the rate of decomposition of F_2O_2 . P. FRISCH and H. J. SCHUMACHER (Z. physikal. Chem., 1937, B, 37, 18—24).—From the increase in the velocity coeff. caused by these gases the probabilities of their activating F_2O_2 have been calc. R. C.

Kinetics of the dry and water-catalysed reaction between carbon monoxide and oxygen at and above the upper explosion limit. G. VON ELBE and B. LEWIS (J. Amer. Chem. Soc., 1937, 59, 2025—2029).—Chain mechanisms are proposed for the dry and H_2O -catalysed reactions between CO and O_2 at and above the upper explosion limit. At this limit the reaction depends on O and O_3 as chain carriers, whilst the catalytic effect of H_2O above the limit is attributed to a chain-initiating mechanism. J. W. S.

Catalytic transfer in the isotopic exchange of bromine. N. BRESHNEVA, S. ROGINSKI, and A. SCHILINSKI (J. Phys. Chem. Russ., 1937, 9, 752—754).—The exchange of radioactive Br between different alkyl bromides (EtBr , $\text{C}_2\text{H}_4\text{Br}_2$, $\text{C}_5\text{H}_{11}\text{Br}$, and CHBr_3) was measured (a) in presence of AlBr_3 and (b) in its absence. No transfer occurs in 45 min. in case (b), and a considerable transfer in case (a). Radioactivity of the AlBr_3 after the exchange shows that the mechanism of the catalysed reaction consists in an exchange of Br atoms between the two alkyl bromides and AlBr_3 . E. R.

Ozone as oxidising catalyst. IX. Analysis of very dilute ozone. IV. Study of reactions by the amount of oxygen absorbed. E. BRINER and E. PERROTTET (Helv. Chim. Acta, 1937, 20, 1207—1213).—Comparison of the static and dynamic methods of determining the catalytic effects of O_3 on the oxidation of aldehydes indicates that, although similar, the results by the static method are less regular and reproducible. J. W. S.

Amorphous and crystallised oxide hydrates and oxides. XXXVII. Acceleration of the air-oxidation of ferrous hydroxide by lead ions or lead hydroxide, and the effect of these in directing

and stabilising the lattice. A. KRAUSE, Z. ERNST, and T. GRZEŠKOWIAK (Z. anorg. Chem., 1937, 234, 51—58).—When $\text{Fe}(\text{OH})_2$ in presence of aq. NH_3 is oxidised by air, the % of Fe^{III} in the product is much increased by small amounts of Pb^{++} or $\text{Pb}(\text{OH})_2$. With larger amounts of Pb the oxidation is complete and the product has the structure of $\alpha\text{-FeO}\cdot\text{OH}$ or, under certain conditions, of $\gamma\text{-FeO}\cdot\text{OH}$. As the amount of Pb increases the products become more finely divided, and with still larger amounts of Pb amorphous products are obtained. The presence of Pb also hinders the change of γ - to $\alpha\text{-Fe}_2\text{O}_3$. F. J. G.

Catalytic oxidation of iodides by persulphates. I. Mechanism of the oxidation. II. Homogeneous catalysis of the reaction by organic catalysts. P. V. AFANASIEV (J. Phys. Chem. Russ., 1937, 9, 559—567, 568—574).—I. The reactions $\text{K}_2\text{S}_2\text{O}_8 + \text{KI}$ (i) and $\text{K}_2\text{S}_2\text{O}_8 + \text{BaI}_2$ (ii) are of the second order; that of $\text{K}_2\text{S}_2\text{O}_8$ and BaI_2 in presence of $\text{Na}_2\text{S}_2\text{O}_3$ is of the first order. The rate is deduced from conductivity measurements. (ii) is quicker than (i). The influence of admixtures on (ii) in presence of $\text{Na}_2\text{S}_2\text{O}_3$ is determined by measuring the time before appearance of free I. This time, τ , is decreased by $\text{Ba}(\text{NO}_3)_2 > \text{Al}(\text{NO}_3)_3 > \text{KNO}_3 > \text{NH}_4\text{NO}_3 > \text{NaNO}_3 > \text{glucose}$.

II. The second method is used for determining the influence of amines on reaction (i) in presence of $\text{Na}_2\text{S}_2\text{O}_8$ and HCl. τ is decreased by $p\text{-NMe}_2\cdot\text{C}_6\text{H}_4\cdot\text{NH}_2 > p\text{-C}_6\text{H}_4(\text{NH}_2)_2 > \text{NH}_2\cdot[\text{CH}_2]_5\cdot\text{NH}_2 > \text{NH}_2\cdot[\text{CH}_2]_2\cdot\text{NH}_2 > \text{NH}_2\text{Ph} > \text{N}_2\text{H}_4 > p\text{-NH}_2\cdot\text{C}_6\text{H}_4\cdot\text{OH}$ etc. J. J. B.

Catalytic activation of hydrogen. B. FARKAS and L. FARKAS (Tech. Kurir, 1937, 8, 77—79).—A lecture. E. P.

Preparation of oxide catalysts by deposition of aerosols. I. Catalytic activity of cupric oxide deposited on an aerosol. P. BESALOV and N. KOBOZEV (J. Phys. Chem. Russ., 1937, 9, 815—827).—Catalytically active CuO was obtained from an aerosol and its activity in oxidising CO has been investigated at $30\text{--}400^\circ$. The oxidation begins at $200^\circ <$ with an ordinary CuO powder. The reaction velocity on the aerosol obeys Arrhenius' law (activation energy 32.2 kg.-cal.). Activity of the aerosol increases with temp.; at 250° it is 765 times as active as the CuO powder. X-Ray photographs and photomicrographs show that the aerosol has the same structure as the powder, but smaller crystallites, which decrease further after catalysis. The aerosol absorbs twice as much air as the CuO powder, and 2.8 times as much after catalysis. E. R.

Surface area of mixed catalysts and changes in it caused by reactions in the solid state. K. STARKE (Z. physikal. Chem., 1937, B, 37, 81—104).—The surface area of oxide catalysts has been assessed, using the radioactive indicator method, by determining the amount, m , of $\text{Pb}(\text{NO}_3)_2$ adsorbed from MeOH solution at 25° at adsorption saturation. For $\text{Fe}_2\text{O}_3\text{-ZnO}$ and $\text{Cr}_2\text{O}_3\text{-ZnO}$ mixtures heated at moderate temp. m is \geq the sum of the vals. for the separate oxides, an effect ascribed to the formation of adsorption compounds at the interface between the components

(cf. A., 1935, 944). This kind of surface activation seems to be accompanied by an increase in the sorption of inorg. mols. and ions, but not in that of dyes. It occurs to an appreciable extent only when the surfaces have active centres, and it is hindered by recrystallisation. At higher temp. diffusion becomes possible and a layer of non-cryst. reaction product is formed at the interface, and the sorptive power for dyes increases. With crystallisation of the product the sorptive power falls. In the system $\text{Fe}_2\text{O}_3\text{-ZnO}$ reaction to form ZnFe_2O_4 does not affect m . When $\text{Cr}_2\text{O}_3\text{-ZnO}$ mixtures are heated in air m increases owing to the formation of ZnCrO_4 , whilst by heating in H_2 there is an increase in m due to the formation of active intermediate products preceding the formation of ZnCr_2O_4 . R. C.

Reaction of sulphur dioxide with carbon disulphide and carbon oxysulphide. A. V. AVDEEVA (J. Chem. Ind. Russ., 1937, 14, 1077—1082).—The reactions $\text{CS}_2 + \text{SO}_2 \rightarrow \text{CO}_2 + 3\text{S}$ and $2\text{COS} + \text{SO}_2 \rightarrow 2\text{CO}_2 + 3\text{S}$ proceed practically to completion when the gas mixture is passed over a slag- Al_2O_3 cement catalyst activated with bauxite, at 400—450°. The activity of the catalyst falls when it is heated at >700°, or when $\text{Fe}(\text{OH})_3$ is added to it. The catalyst does not undergo inactivation while in use, but later exposure to the air brings about reversible inactivation, due to formation of a surface film of sulphates. R. T.

Reactions in concentrated sulphuric acid. IX. Kjeldahlisation in presence of various gases. J. MILBAUER (Chem. Obzor, 1937, 12, 17—19).—The acceleration of the oxidation of sucrose in conc. H_2SO_4 at 302° and normal pressure with the passage of air alone, and in the presence of HgSO_4 , Ag_2SO_4 , CuO , SeO_2 , and TeO_2 , individually and in binary and ternary mixtures, is described. Acceleration is noted also with O_2 , and ozonised air and O_2 , in presence of the above catalysts. Oxidation was quickened with the passage of H_2 and SO_2 individually or in the presence of the above catalysts, except TeO_2 with H_2 and Ag_2SO_4 with SeO_2 . N_2 and CO_2 aid the oxidation only by their motion, and Cl_2 , which is very effective generally, gives, in the presence of SeO_2 , the most rapid oxidation. F. R.

Catalytic action of $\text{Fe}(\text{OH})_3$ on oxidation of SO_2 to SO_3 by atmospheric oxygen. M. TALINA (J. Phys. Chem. Russ., 1937, 9, 421—430).—At 130° and with 10 vols. of air to 1 vol. of SO_2 the best results are obtained. At low gas velocities dried $\text{Fe}(\text{OH})_3$ sol, and at high velocities $\text{Fe}(\text{OH})_3$ adsorbed by pumice-stone, are most active. Old sols are less active than fresh ones. The activity of $\text{Fe}(\text{OH})_3$ catalysts falls after use for 10 min. The recovered catalyst is less sol. than the fresh one. J. J. B.

Vanadium-thallium catalyst.—See B., 1937, 1199.

Preferential reduction of certain fatty acid groups during hydrogenation of natural fats.—See B., 1937, 1235.

Catalytic purification of nitrogen-hydrogen mixtures from organic sulphur.—See B., 1937, 1200.

Catalytic reduction of azo-dyes.—See B., 1937, 1180.

Rôle of catalysis in textile chemistry.—See B., 1937, 1194.

Electrolytic production of heavy water. Relation between current density and isotope separation coefficient. T. NOGUCHI (J. Electrochem. Assoc. Japan, 1935, 3, 305—310).—Data for the concn. of D_2O in 20% NaOH solution at 18° with Ni electrodes and a c.d. of 0.05—1.0 amp. per sq. cm. are recorded. The separation coeff. is not greatly affected by the c.d. CH. ABS. (e)

Electrolytic separation factor of deuterium at very low concentrations. H. F. WALTON and J. H. WOLFENDEN (J.C.S., 1937, 1677—1679).—Repetition of published work (A., 1936, 298) gives separation factors of 6.5—8, which are not significantly different from those obtained at higher $[\text{D}_2\text{O}]$ with the same cells. E. S. H.

Electrolytic separation of tungsten from aqueous solutions. A. GLAZUNOV and V. JOLKIN (Chem. Listy, 1937, 31, 309—313, 332—335).—Bright metallic deposits of W form on the cathode in the electrolysis of alkali tungstates, at >80°; at <80° the deposit consists of lower oxides of W. Electrolysis of strongly acid solutions was not possible, owing to pptn. of WO_3 , whilst in feebly acid ones lower oxides are deposited. R. T.

Rule governing the electrocrystallisation of metals. A. T. VAGRAMIAN and S. A. ALEMIAN (J. Phys. Chem. Russ., 1937, 9, 517—521).—The no. of Ag crystals deposited on a Pt cathode from AgNO_3 solution was measured at various concns., c , of AgNO_3 . The most probable no. inversely $\propto c$ within the range 2N to 0.1N. J. J. B.

Influence of electrolyte concentration on the number of crystallisation nuclei formed during electrolysis. A. T. VAGRAMIAN (J. Phys. Chem. Russ., 1937, 9, 511—516).—Deposition of Ag on a Pt cathode is observed under the microscope. At a const. c.d. of 10^{-4} amp. per sq. cm. the no. of Ag crystals increases with decreasing concn. of AgNO_3 (1.5 to 0.023N); in 0.023N- AgNO_3 all the crystals formed, but in 1.5N- AgNO_3 only a few of them grow further. At a const. p.d. the c.d. in 3N- AgNO_3 increases more rapidly than in 0.023N- AgNO_3 . J. J. B.

Place of discharge in electrochemical exchange without local action. Comparison of platinum surfaces from different sources in respect of their activity for hydrogen and for hydrogen peroxide catalysis. O. ERBACHER (Z. physikal. Chem., 1937, 180, 141—153; cf. A., 1937, I, 84).—The ratio between the surface areas of two samples of Pt foil, one smooth, the other roughened, determined by measuring their activity in catalysing the decomp. of aq. H_2O_2 was equal to the ratio of the amounts of Bi deposited on them by electrochemical exchange when they were charged with H_2 and brought in contact with a solution of a Bi salt. It is inferred that in electrochemical exchange without local action the electrons set free from the atoms passing into solution

are taken up at the point where dissolution occurs by the ions coming out of solution. R. C.

Kinetics of the quinhydrone electrode reaction. R. ROSENTHAL, A. E. LORCH, and L. P. HAMMETT (*J. Amer. Chem. Soc.*, 1937, **59**, 1795—1804).—The relative catalytic properties of various forms of Pt and other surfaces for the oxidation and reduction of quinhydrone (I) have been investigated. The effects of addition of benzoquinone and *p*-C₆H₄(OH)₂ and of (I) concn. and [H⁺] on the anode c.d., when a const. p.d. is applied to electrodes in the solution, have been examined. From examination of possible mechanisms it is concluded that the anode reaction is complex and involves several parallel paths. J. W. S.

Electrolytic formation of persulphate. IV. Influence of temperature. R. MATSUDA, H. KONYA, and T. NISHIMORI (*Bull. Chem. Soc. Japan*, 1937, **12**, 425—432; cf. *A.*, 1936, 436; 1937, **I**, 37, 525).—7N-(NH₄)₂SO₄ and 10, 15, 20, 25, 30, and 36N-H₂SO₄ have been electrolysed at 5°, 10°, and 25° with c.d. 5, 10, 20, 40, and 80 amp. per sq. dm. The current efficiency (calc. as total peroxidic O) is increased in the first three solutions on lowering the temp. and increasing the c.d. In 20N-H₂SO₄ the influence of temp. is the same at low c.d. and opposite above 40 amp. per sq. dm. H₂S₂O₈ is formed by oxidation of H₂SO₄ with anodic O₂. F. J. L.

Electrochemical protection of iron from corrosion in alkalis.—See *B.*, 1937, 1213.

Electrolytic reduction of Chile saltpetre for production of ammonia.—See *B.*, 1937, 1198.

Electrolytic reduction of glycollic acid and lactic acid.—See *A.*, II, 482.

Oxidation of graphite in the glow discharge. R. NASANEN (*Suomen Kem.*, 1937, **10**, B, 24).—Graphite used as cathode in a glow discharge in O₂ yields CO₂ and CO. The current yield is 8 mol. per faraday when the O₂ pressure is <0.2 mm.; it falls with increasing pressure, and is independent of voltage between 370 and 1500 v. Under otherwise identical conditions the same equilibrium mixture of CO₂ and CO is produced when the vessel is filled initially with O₂, CO₂, or CO. When graphite is used as anode the product is CO₂ only, and the current yield is >1.5 mol. per faraday. F. L. U.

Chemical effects of electrical discharge. K. R. DIXIE (*Current Sci.*, 1937, **6**, 163—180).—A review.

Photochemical investigations in the Schumann ultra-violet. III. Further development of low-voltage xenon lamp. Quantum yields of photochemical gas reactions in the wave-length region below 1500 Å. **IV. Photochemical oxidation of carbon monoxide, and carbon monoxide as sensitiser.** W. GROTH (*Z. physikal. Chem.*, 1937, **B**, **37**, 307—314, 315—322).—The Xe lamp (*A.*, 1936, 1215) has been further improved by combination with a fluor spar vac. spectrograph and the partition between the resonance lines at 1295 and 1470 Å. of the total intensity in the extreme ultra-violet determined. The quantum yield for the formation of O₃ by these λ is 1.90±0.05, that of CO₂ + hν = CO + O 0.98 per CO₂ mol. and 1.47 per CO and O₂

mol., and that of the decomp. of NH₃ 0.17±0.02. The amount of O₃ formed on irradiating O₂-N₂ and O₂-A mixtures is a max. when the O₂ content ≈ 4%.

IV. The amounts of O₃ and CO₂ formed when streaming mixtures of CO with varying small amounts of O₂ are irradiated with light of the above λ have been determined. For the formation of CO₂ by O + CO + M = CO₂ + M the collision efficiency is 1/40. Experiments on the irradiation of H₂-CO mixtures showed the CO to sensitise the formation of CH₂O and (CHO)₂ from CO and H atoms, 0.5 ·CHO group being formed for each quantum absorbed by CO. (CHO)₂ and CH₂O are also formed on irradiation of CO-CH₄ mixtures, ~ 0.1 ·CHO group being produced for each quantum absorbed. R. C.

Release of electrical charges from photographic plates and other materials under moderate pressure. K. PROSAD and L. M. CHATTERJEE (*Indian J. Physics*, 1937, **11**, 289—294).—Photographic plates enclosed in envelopes of black paraffined paper have been subjected to pressures <3.3 × 10⁶ dynes per sq. cm. The electrical charges produced are due mainly to the envelope; the ejection of electrons from the photographic plate could not be ascertained. F. J. L.

Dependence of the Herschel effect on the surrounding gas medium. A. S. VNUKOVA (*J. Phys. Chem. Russ.*, 1937, **9**, 598—604).—The Herschel effect in vac., in N₂, and in CO₂ is insignificant; it is strong in O₂, especially so in H₂O vapour, and negative in H₂. After short exposure of the plate the effect is always negative. J. J. B.

Silver nucleus theory of the latent image. Critical nuclear size. W. REINDERS and R. W. P. DE VRIES (*Rec. trav. chim.*, 1937, **56**, 985—999; cf. *A.*, 1932, 821; 1933, 359).—The physical development of Ag films prepared by sublimation in a vac. can be carried out only when the mean film thickness (*t*) is >0.002 atom. The readiness of development increases very rapidly with increasing *t*. For normal conditions of development only aggregates containing <4 atoms are capable of forming nuclei. J. W. S.

Mass and distribution of photolytic silver in silver bromide-gelatin emulsions of different grain size. II. Mass and distribution of photolytic silver in photographic films containing nitrite. W. MEIDINGER (*Physikal. Z.*, 1937, **38**, 737—747; cf. *B.*, 1937, 1136).—The surface Ag and that formed within the emulsion were separately determined for different exposures and [NO₂']. The curve of "internal" Ag against light intensity reaches a limiting val., but the curve of surface Ag is linear. With increasing [NO₂'] the amount of photolytic Ag is greatly increased, particularly in the surface. A. J. M.

Photolyses with zinc sulphide. K. GLOOR (*Helv. Chim. Acta*, 1937, **20**, 853—877).—Dyes such as phenosafranine, methylene-blue, alizarin-direct-green, and Janus-green inhibit the photochemical blackening of ZnS. The ZnS, however, acts as a sensitiser for the photolysis of the dyes to their oxidation products and leuco-bases in ultra-violet light. The addition of CdS causes the photolysis

to occur also in visible light. Salts of heavy metals of variable valency (Co^{II} or Fe^{III}) also inhibit the photolysis of ZnS , but the latter is accelerated by the presence of other Zn salts. The results are in accord with Baur's theory of sensitised photolysis.

J. W. S.

Foundations of the theory of Lippmann's colour photography. K. F. LINDMAN (Z. tech. Physik, 1937, 18, 25—29).—The reflexion and phase change on reflexion of electric waves of λ 25 cm. by finely divided metallic particles dispersed in non-reflecting films (papier maché, shellac) have been measured. The absorption and reflecting power of sand for 25-cm. waves are increased by the addition of fine metal shot, whilst n is slightly decreased. Results disagree with Schütt's theory of Lippmann's colour photography.

O. D. S.

Photochemical chlorination of ethylene compounds and the influence of oxygen thereon.

K. L. MÜLLER and H. J. SCHUMACHER (Z. Elektrochem., 1937, 43, 807—808).—The photochemical chlorinations of *cis*- and *trans*- $\text{C}_2\text{H}_2\text{Cl}_2$ occur with equal quantum yield (about 7×10^3 at $p_{\text{Cl}} = 100$ mm. and $I_{\text{abs.}} = 10^{16}$ quanta per min.) and follow the same velocity law $d[\text{C}_2\text{H}_2\text{Cl}_4]/dt = I_{\text{abs.}}[\text{Cl}_2]k_3/\sqrt{k_4}$ in accord with the mechanism: (1) $\text{Cl}_2 + h\nu = 2\text{Cl}$, (2) $\text{C}_2\text{H}_2\text{Cl}_2 + \text{Cl} = \text{C}_2\text{H}_2\text{Cl}_3$, (3) $\text{C}_2\text{H}_2\text{Cl}_3 + \text{Cl}_2 = \text{C}_2\text{H}_2\text{Cl}_4 + \text{Cl}$, (4) $2\text{C}_2\text{H}_2\text{Cl}_3 = \text{C}_2\text{H}_2\text{Cl}_4 + \text{C}_2\text{H}_2\text{Cl}_4$. The temp. coeff. indicates a total energy of activation of 3.1 kg.-cal. per mol., attributable to reaction (3). Traces of O_2 suppress the reaction completely. The chlorination of C_2HCl_3 follows the same law and reaction mechanism, but the quantum yield is only one twelfth of that with $\text{C}_2\text{H}_2\text{Cl}_2$, and the energy of activation is 5.3 kg.-cal. per mol. In this case O_2 suppresses chlorination almost completely, and sensitised oxidation occurs with quantum yield 40 and of zero order with respect to $[\text{O}_2]$ and $[\text{C}_2\text{HCl}_3]$. The reaction proceeds through C_2HCl_4 radicals and, probably, a peroxide product, to CHCl_2COCl .

J. W. S.

Photobromination of acetylene dichloride in the gaseous phase. J. C. GHOSH, S. K. BHATTACHARYYA, and M. L. NARASIMHA MURTHI (J. Indian Chem. Soc., 1937, 14, 425—434).—The reaction has been studied in light of λ 546 m μ ., and appears to follow the same mechanism as in λ 436 m μ . (A., 1936, 688). In the present case, however, the ratio of the velocity coeffs. in the vapour phase and CCl_4 solution is 47, compared with 32 for λ 436 m μ .

F. L. U.

Photolysis of azomethane. II. Effect of temperature. M. BURTON, T. W. DAVIS, and H. A. TAYLOR (J. Amer. Chem. Soc., 1937, 59, 1989—1993; cf. A., 1937, I, 419).—The rate of photolysis and nature of the products have been determined at 20—223°. The amount of N_2 produced is always > that of hydrocarbons, the excess being a max. at about 200°. The amount of CH_4 produced increases, and the amount of C_2H_6 produced decreases, with rise of temp. The amount of higher hydrocarbon (C_3H_8 ?) increases with rise of temp. The amounts of H_2 and unsaturated compounds produced are negligible. The results support the view that there is a secondary

association reaction between Me radicals and $(\text{MeN})_2$. On the basis of these results the lit. data for quantum yield in this reaction are recalcd. and doubt is cast on the conclusion that the temp. coeff. is zero at <226°. The results also indicate that estimates of the lengths of chains initiated by $(\text{MeN})_2$ can only be min. vals.

J. W. S.

Photolysis of aliphatic aldehydes. IV. *n*- and *iso*-Butaldehydes. P. A. LEIGHTON, L. D. LEVANAS, F. E. BLACET, and R. D. ROWE (J. Amer. Chem. Soc., 1937, 59, 1843—1849).—The photochemical decomp. of both $\text{Pr}^{\text{c}}\text{CHO}$ and $\text{Pr}^{\text{b}}\text{CHO}$ vapours at 30° is analogous to that of MeCHO (A., 1933, 682), comprising both polymerisation and decomp., the quantum yields of which have been studied at $\lambda\lambda$ 2537—3130 Å. and at various pressures. At 400—550° K. chain reactions occur with both compounds, that for $\text{Pr}^{\text{c}}\text{CHO}$ being similar to the reaction for MeCHO , whilst the behaviour of $\text{Pr}^{\text{b}}\text{CHO}$ is more complicated.

J. W. S.

Theory of assimilation. I, II.—See A., III, 500.

Formation of water and hydrogen peroxide at low pressures. W. H. RODEBUSH, C. W. J. WENDE, and R. W. CAMPBELL (J. Amer. Chem. Soc., 1937, 59, 1924—1931; cf. A., 1937, I, 254).—The reaction between the dissociation products of H_2O (produced by rapid passage of H_2O vapour through an electrodeless discharge) has been examined at low pressure. H_2O is formed by two different homogeneous reactions, one of which is $\text{H} + \text{OH} + M \rightarrow \text{H}_2\text{O} + M$. The reaction between H atoms and O_2 may involve intermediate formation of H_2O_2 but none could be detected in the gas phase. The heterogeneous reaction between OH radicals seems to yield H_2 and O_2 . There is no evidence of a homogeneous reaction between OH radicals or that HO_2 exists other than as a collision complex of very short life.

J. W. S.

Metallic amides. II. Amides of the alkali metals. R. JUZA, K. FASOLD, and C. HAEBERLE. **III. Zinc and cadmium amides.** R. JUZA, K. FASOLD, and W. KUHN (Z. anorg. Chem., 1937, 234, 75—85; 86—96; cf. A., 1937, I, 256).— ρ , m.p., and heat of formation (q) have been determined for the amides of the respective metals, as follows: ρ : Li 1.18, Na 1.39, K 1.64, Rb 2.585, Cs 3.435; m.p.: Rb 309°, Cs 262°; Zn and Cd amides decompose at 200° and 120°, respectively. q : Li 56.3, Na 61.4, K 64.9, Rb 66.4, Cs 67.0, Zn 34.9, Cd 13.0 kg.-cal. per g.-mol.

F. J. G.

Crystallisation of potassium chloride from the fused state. Preparation of large monocrystals of sylvine. E. V. ZECHNOVITZER (J. Phys. Chem. Russ., 1937, 9, 917—928).—KCl monocrystals with a diameter of 8—15 cm. were grown by the method of Kyropoulos, *i.e.*, by drawing from the fused salt.

E. R.

Reaction limits in mixed crystals. G. TAMMANN (Z. anorg. Chem., 1937, 234, 33—41).—In previous papers (A., 1919, ii, 398; 1928, ii, 378) accounts were given of the reaction limits when alloys are submitted, during periods of a few months, to the action of corroding reagents. The action of these

reagents has now been continued for 15 to 20 years, without any serious change in the results.

F. J. G.

Combined action of heat and carbon on the alkaline-earth arsenates. H. GUÉRIN (Bull. Soc. chim., 1937, [v], 4, 1683—1696).—In presence of sugar C, conversion of meta- and pyro-arsenates into tribasic orthoarsenates is accelerated, and occurs at lower temp. than on pyrolysis. The orthoarsenates are reduced to arsenites at 700—800°, and at slightly higher temp. these give the alkaline-earth oxide, As, and CO. At 1450—1600° (800—850° for the Ba salt) some arsenide is formed, but cannot be obtained pure. The Ca and Sr salts give some carbide at 1500—1800°.

A. J. E. W.

Reducing action of amalgams. IV. K. MASUDA (J. Chem. Soc. Japan, 1935, 56, 1237—1250).—The reducing action of Zn amalgam increases with decreasing [Zn] (2.00—0.05%). CH. ABS. (c)

Complex compounds of mercury halides with the halides of the aliphatic amines. M. STRAUMANIS and A. CIRULIS (Z. anorg. Chem., 1937, 234, 17—32).—A large no. of salts of types $RNH_2X, HgY_2, 2RNH_2X, HgY_2; RNH_2X, 2HgY_2; C_2H_4(NH_2)_2X_2, HgY_2,$ and $2C_2H_4(NH_2)_2X_2, HgY_2$, where R = Me, Et and X, Y = Cl, Br, I, have been prepared. They are formulated as complex salts of anions $[HgX_3]'$, $[HgX_2Y]'$, $[HgX_4]''$, $[HgX_2Y_2]''$, $[Hg_2X_5]'$, $[Hg_2X_4Y]'$, and $[HgX_4Y_2]'''$. The same salt $(RNH_2)_2[HgX_2Y_2]$ is obtained from RNH_2X and HgY_2 as from RNH_2Y and HgX_2 . For details the original paper should be consulted.

F. J. G.

Aluminium fluorosulphate, and its conversion into fluorides. N. S. NIKOLAEV (J. Chem. Ind. Russ., 1937, 14, 1087—1097).— $Al_2SO_4F_4 \cdot 12H_2O$ (I) is obtained from CaF_2 and boiling aq. $Al_2(SO_4)_3$, or from ignited alunite, CaF_2 , and boiling 30% H_2SO_4 . Fe is removed from the filtrates by boiling with pyrolusite activated by *N*-NaOH or aq. BaS. (I) is converted into chiolite and/or cryolite by the action of Na_2SO_4 and HF, and into Al_2OF_4 by aq. NH_3 .

R. T.

Preparation of compounds of bivalent rare earths. L. HOLLECK and W. NODDACK (Angew. Chem., 1937, 50, 819—824).—Tervalent sulphates of Sm, Yb, Eu, Sc, Gd, Ge, Pr, and Nd may be reduced to small quantities of bivalent sulphates (XSO_4) by Sr amalgam of controlled reduction potential. The ppt. of $SrSO_4$ occludes the XSO_4 . The solutions of XSO_4 are colourless except for Yb (green) and the ppt. of $SrSO_4$ is colourless except for Sm (red). The wt. of X occluded on the $SrSO_4$ is parallel to the solubility of the sulphates $X_2(SO_4)_3$, except with Sc. The occluded XSO_4 is stabilised by the $SrSO_4$, Eu giving the highest ratio of $X^{II}/total\ X$ on the ppt., and Ce, Pr, and Nd the lowest. The XSO_4 on the $SrSO_4$ may be converted into XCO_3 by Na_2CO_3 solution, with corresponding colour change of the ppt.

R. S. B.

Malleable titanium and zirconium. W. KROLL (Z. anorg. Chem., 1937, 234, 42—50).—Apparatus for the reduction of large amounts of the oxides by Ca is described. The metals so obtained still contain

O which cannot be removed; they can be worked when warm but are more or less brittle in the cold.

F. J. G.

Lead thioaluminates. G. G. MONSELISE and G. SCACCABAROZZI (Gazzetta, 1937, 67, 511—513).—The thermal diagram of the system $PbS-Al_2S_3$ at temp. up to 1100° shows the existence of the two compounds $2PbS, Al_2S_3$ and PbS, Al_2S_3 . O. J. W.

Thermal decomposition of lead formate and of formic acid at a lead surface. L. C. FREIDLIN and T. F. BULANOVA (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 555—568).— $(HCO_2)_2Pb$ (I) decomposes at 240—280° chiefly according to $(I) \rightarrow Pb + 2CO_2 + H_2$. The side-reactions are: $Pb + CO_2 + HCO_2H \leftarrow (I) \rightarrow PbO + CO_2 + CH_2O$, and traces of HCO_2Me and $MeOH$ are also formed. HCO_2H decomposes at 240—280° at a Pb surface exclusively according to the first reaction. It is concluded that (I) is an intermediate stage in the thermal decomp. of HCO_2H in Pb vessels. R. T.

New phosphates. G. HEDRICH (Chem.-Ztg., 1937, 61, 793—795).—The formation, properties, and applications of polymetaphosphates, polyorthophosphates, and thiophosphates are reviewed.

J. S. A.

Hexametaphosphoric acid. W. D. TREADWELL and F. LEUTWYLER (Helv. Chim. Acta, 1937, 20, 931—936).—The product obtained by heating NaH_2PO_4 or H_3PO_4 strongly still contains appreciable traces of PO_4''' , which may be detected from the amount of NaOH required to change the p_H from 4.3 to 9.5. The titration curve shows that the sixth dissociation const. of $H_6P_6O_{18}$ is about $10^{-1.8}$.

J. W. S.

Basic properties of orthophosphoric acid. E. J. ARLMAN (Rec. trav. chim., 1937, 56, 919—922).—When dry H_3PO_4 is mixed with excess of dry $HClO_4$ and the mixture cooled in ice and NaCl the compound $H_3PO_4 \cdot HClO_4$, m.p. 46—47°, separates. Electrolysis of a solution in $MeNO_2$ causes migration of H_3PO_4 towards the cathode, so it is suggested that the compound should be formulated $P(OH)_4 \cdot ClO_4$.

J. W. S.

Hydrogen compounds of arsenic. I. Preparation of arsine in liquid ammonia. Physical properties of arsine. II. Sodium and potassium dihydrogen arsenides. W. C. JOHNSON and A. PECHUKAS (J. Amer. Chem. Soc., 1937, 59, 2065—2068, 2068—2071).—I. AsH_3 can be prepared in good yield by the action of NH_4Br on Na arsenides (Na_3As_r) in liquid NH_3 . No other As-containing gas or solid hydride is formed. The v.p. of solid and liquid AsH_3 has been measured at -138° to -63° and d for liquid AsH_3 at -111.8° to -64.3° . The b.p. (760 mm.) is -62.4° , the m.p. -116.3° , and the latent heats of vaporisation and fusion 4165 and 675 g.-cal. per mol., respectively. Liquid AsH_3 is only slightly sol. in liquid NH_3 .

II. Action of Na, K, or KNH_2 on AsH_3 in liquid NH_3 yields Na and K H_2 arsenides ($MAsH_2$), which regenerate AsH_3 on the action of NH_4Br in liquid NH_3 . $KAsH_2$ reacts with $MeCl$ in liquid NH_3 to yield $AsMeH_2$, m.p. -143° . The v.p. of $AsMeH_2$ has been determined at -74° to 3.0° , and indicates that

the b.p. is 2.0° and the heat of vaporisation 5390 g.-cal. per mol. KAsH_2 decomposes at $>115^\circ$ yielding H_2 and K_3As_7 .
J. W. S.

Thermal decomposition of tervalent vanadium sulphate. F. RIVENQ (Bull. Soc. chim., 1937, [v], 4, 1697—1702).—The reactions occurring on heating in a vac. are: (above 410°) $2\text{V}_2\text{O}_3(\text{SO}_3)_3 \rightarrow \text{V}_2\text{O}_4(\text{SO}_3)_2 + \text{V}_2\text{O}_4 + \text{SO}_2 + \text{SO}_3$; $\text{V}_2\text{O}_4(\text{SO}_3)_2 \rightleftharpoons \text{V}_2\text{O}_5 + \text{SO}_2 + \text{SO}_3$; (below 410°) $\text{V}_2\text{O}_3(\text{SO}_3)_3 \rightarrow \text{V}_2\text{O}_4(\text{SO}_3)_2 + \text{SO}_2$; $2\text{V}_2\text{O}_4(\text{SO}_3)_2 \rightarrow \text{V}_2\text{O}_5(\text{SO}_3)_2 + \text{V}_2\text{O}_4 + \text{SO}_2 + \text{SO}_3$; $\text{V}_2\text{O}_5(\text{SO}_3)_2 + \text{V}_2\text{O}_4 \rightarrow 2\text{V}_2\text{O}_5 + \text{SO}_2 + \text{SO}_3$.
A. J. E. W.

Sulphur iodide. M. R. A. N. RAO (Current Sci., 1937, 6, 63).—A yellow solution of *S iodide* is formed on treatment of a dil. CCl_4 solution of S_2Cl_2 with KI. The solution has a characteristic absorption band in the visible spectrum. It decomposes at room temp., giving S and I, but is stable at low temp. The reaction in CCl_4 with aq. NaOH is analogous to that of a similar S_2Cl_2 solution.
A. J. E. W.

Oxidation of chromic oxide by silver oxide. R. LYDÉN (Z. anorg. Chem., 1937, 234, 59—62).—In presence of H_2O , Cr_2O_3 and Ag_2O react forming Ag_2CrO_4 and Ag. The reaction proceeds moderately rapidly at 100° and with an appreciable velocity at room temp.
F. J. G.

Tungsten bronzes. A. GLAZUNOV and V. JOLKIN (Chem. Listy, 1937, 31, 358—363).—W bronzes are probably solid solutions of two or more tungstates in each other. The bronzes react with Na, Li, or K liberated at the cathode, to yield M_2WO_4 , $\text{M}_2\text{W}_2\text{O}_7$, and W.
R. T.

Fluorine at low temperatures. I. Preparation, analysis, and handling of fluorine. S. AOYAMA and E. KANDA (Bull. Chem. Soc. Japan, 1937, 12, 409—416).—Technical details of the prep. of F_2 by electrolysis of fused $\text{KF}\cdot\text{HF}$, and of the storage of F_2 , are given. The reactions between C, P, S, Se, and F_2 are facilitated if the F_2 flows past the solids; in some cases no reaction takes place in a still atm. of F_2 .
F. J. L.

Amorphous and crystalline hydrated oxides and oxides. XXXIV. Hypotonic external solution as cause of ageing of radiographically amorphous ferric hydroxide. A. KRAUSE and K. DOBRZYŃSKA (Kolloid-Z., 1937, 81, 45—48; cf. A., 1937, I, 196).—Amorphous $\text{Fe}(\text{OH})_3$ ages rapidly when preserved under H_2O or *N*-NaOH, but slowly or not at all when the concn. of NaOH or salts in the external liquid is >4 — $5N$. An explanation is offered.
F. L. U.

Active substances. XXI. Preparation of goethite (α - $\text{FeO}\cdot\text{OH}$). R. FRICKE and O. GLEM-SER (Ber., 1937, 70, [B], 2117—2119).—Freshly prepared Fe^{III} oxide hydrate is allowed to remain in contact with $2N$ -KOH at room temp. for 3—4 hr. after which steam is passed through the mixture for 2 hr. KOH is then “neutralised” with rather more than the calc. amount of NH_4Cl and the ppt. is washed until the washings are free from Cl^- , whereby a very pure goethite *A* is obtained. Goethite *B* is prepared by oxidising FeSO_4 with H_2O_2 at 50° ; after

being washed until the wash H_2O is free from SO_4^{2-} the ppt. is treated with superheated steam at 170° .
H. W.

Reversible oxidation of chlorophyll. E. RABINOWITCH and J. WEISS (Proc. Roy. Soc., 1937, A, 162, 251—267).—Chlorophyll reacts with Fe^{III} salts forming a yellow product from which it can be regained by the action of Fe^{II} salts. The reaction is studied by means of absorption measurements, in the range λ 3500 to 7000 Å., of MeOH solutions of (i) pure chlorophylls *a* and *b* and the “natural” mixture of the two ethylchlorophyllides, (ii) the three substances after reaction with FeCl_3 , and (iii) the same solutions “restored” by FeCl_2 . The characteristic red absorption band is suppressed by the reaction with FeCl_3 and restored by addition of FeCl_2 . The nature of the reaction is discussed. Chlorophyll decolorised by FeCl_3 is restored by keeping in a dark room for several hr. This is attributed to the removal of FeCl_3 , which oxidises the solvent MeOH in the presence of chlorophyll. Analogous results are obtained with Ce^{IV} salts, I, and CuCl_2 .
G. D. P.

Substituted cyano-cobaltates. IV. Aquo-pentacyano-cobaltic acid and its salts. P. R. RAY and N. K. DUTT (Z. anorg. Chem., 1937, 234, 65—74).—When $\text{K}_4[\text{Co}(\text{S}_2\text{O}_3)(\text{CN})_5]$ is oxidised by H_2O_2 in a solution buffered with NaOAc, and the solution treated with AgNO_3 , *Ag aquo-pentacyanocobaltate*, $\text{Ag}_2[\text{Co}(\text{H}_2\text{O})(\text{CN})_5]\cdot 5\text{H}_2\text{O}$ (I), is pptd. By appropriate double decomp. the following salts can be obtained: $\text{M}^{\text{I}}[\text{Co}(\text{H}_2\text{O})(\text{CN})_5]$, ($\text{M}^{\text{I}} = \text{K}, \text{Na}, \text{Li}, \text{NH}_4$); $\text{M}^{\text{II}}[\text{Co}(\text{H}_2\text{O})(\text{CN})_5]\cdot 5\text{H}_2\text{O}$, ($\text{M}^{\text{II}} = \text{Cd}, \text{Ca}, \text{Sr}$); $\text{Ba}[\text{Co}(\text{H}_2\text{O})(\text{CN})_5]\cdot 3\text{H}_2\text{O}$; $\text{PbO}\cdot\text{Pb}[\text{Co}(\text{H}_2\text{O})(\text{CN})_5]\cdot 5\text{H}_2\text{O}$. The free acid $\text{H}_2[\text{Co}(\text{H}_2\text{O})(\text{CN})_5]$ is comparable with H_2SO_4 in strength. When (I) is dehydrated in vac. over H_2SO_4 a salt $\text{Ag}_2[\text{Co}(\text{CN})_5]$ is obtained which is only feebly paramagnetic and is therefore a true complex salt having the co-ordination no. = 5.
F. J. G.

Cobaltinitrites of hexamethylenetetramine.—See A., II, xvii e.

Nitro-pyridino-compounds of rhodium. V. V. LEBEDINSKI and S. F. SILIN (Ann. Sect. Platine, 1937, 14, 33—39).— $\text{Na}_3\text{Rh}(\text{NO}_2)_6$ and $\text{C}_5\text{H}_5\text{N}$ afford the salt $[\text{Rh}(\text{C}_5\text{H}_5\text{N})_3(\text{NO}_2)_3]$, the filtrate from which gives $\text{NH}_4[\text{Rh}(\text{C}_5\text{H}_5\text{N})_3(\text{NO}_2)_3]\cdot 1.5\text{H}_2\text{O}$ (I) when treated with conc. aq. NH_4Cl . The corresponding $[\text{Pt}(\text{NH}_3)_4]$ and guanidine salts of (I) are described.
R. T.

Oxidation of iridium sulphide by nitric acid. N. K. PSCHENITZIN and S. E. KRASIKOV (Ann. Sect. Platine, 1937, 14, 19—32).— $\text{Ir}(\text{SH})_3$ is converted by hot conc. HNO_3 into the acid $\text{H}_2\text{Ir}_4(\text{SO}_3)_7$ [$(\text{NH}_3\text{Et})_2$, $(\text{NH}_3\text{Me})_2$, Ba, Ag, and Hg_2 salts].
R. T.

Oxidation of hydroxylamine compounds of platinum. V. I. GOREMIKIN (Ann. Sect. Platine, 1937, 14, 41—75).—Hydroxylaminoplatinum compounds react with Cl_2 to yield HxCl_2 compounds ($\text{Hx} = \text{NH}_2\text{OH}$), from which Hx is then eliminated, leaving Cl in its place. Thus $[\text{PtHx}_4](\text{OH})_2$ in neutral aq. solution yields successively $[\text{PtHx}_4]\text{Cl}_2$, $[\text{PtHx}_3\text{HxCl}_2]\text{Cl}_2$, $[\text{Pt}\cdot\text{Hx}\cdot\text{HxCl}_2]\text{Cl}_2$, PtCl_4'' , and PtCl_6'' ; an intermediate product is $[\text{PtHx}_4][\text{PtCl}_4]$,

which reacts with Cl_2 to give H_2PtCl_6 and N_2 . The following analogous reactions are described: *cis*- $[\text{PtHx}_2(\text{NH}_3)_2]\text{Cl}_2 + 2\text{Cl}_2 \rightarrow (\text{NH}_4)_2\text{PtCl}_6 + 2\text{H}_2\text{O} + \text{N}_2$; *trans*- $[\text{PtHx}_2(\text{NH}_3)_2]\text{Cl}_2 \rightarrow [\text{Pt}(\text{NH}_3)_2\text{Cl}_2] \rightarrow [\text{Pt}(\text{NH}_3)_2\text{Cl}_4]$; *trans*- $[\text{PtHx}, \text{NH}_3, \text{Cl}]$ (I) $\rightarrow [\text{Pt}, \text{HxCl}_2, \text{NH}_3, \text{Cl}_2] \rightarrow (\text{NH}_4)_2\text{PtCl}_6$; $[\text{Pt}, \text{NH}_3, \text{C}_5\text{H}_5\text{N}, \text{Cl}_4][\text{Pt}, \text{Hx}, \text{NH}_3, \text{C}_5\text{H}_5\text{N}, \text{Cl}]\text{Cl} \rightarrow [\text{Pt}, \text{HxCl}_2, \text{NH}_3, \text{C}_5\text{H}_5\text{N}, \text{Cl}]\text{Cl} \rightarrow [\text{Pt}, \text{C}_5\text{H}_5\text{N}, \text{Cl}_5]\text{NH}_4$; *trans*- $[\text{Pt}, \text{Hx}, \text{NH}_3, (\text{C}_5\text{H}_5\text{N})_2]\text{Cl}_2$ [prepared from (I) and $\text{C}_5\text{H}_5\text{N}$] $\rightarrow [\text{Pt}(\text{C}_5\text{H}_5\text{N})_2\text{Cl}_4]$; *trans*- $[\text{Pt}, \text{Hx}, \text{C}_5\text{H}_5\text{N}, \text{NO}_2, \text{NH}_3]_2[\text{PtCl}_4] \rightarrow [\text{Pt}, \text{NH}_3, \text{C}_5\text{H}_5\text{N}, \text{Cl}_2] \rightarrow [\text{Pt}, \text{NH}_3, \text{C}_5\text{H}_5\text{N}, \text{Cl}_4]$.

R. T.

Ethylene compounds of platinum. I. I. TSCHERNIAEV and A. D. GELMAN (Ann. Sect. Platine, 1937, 14, 77—121).— K_2PtX_4 (I) in 3—5% HCl and C_2H_4 react at room temp. as follows ($\text{X} = \text{Cl}, \text{Br}$): (I) + $\text{C}_2\text{H}_4 \rightarrow \text{K}[\text{Pt}, \text{C}_2\text{H}_4, \text{X}_3]$ (II) + KCl. (II) reacts with $[\text{PtM}_4\text{X}_2]$ to give $[\text{PtM}_4][\text{Pt}, \text{C}_2\text{H}_4, \text{X}_3]$ ($\text{M} = \text{NH}_3, \text{C}_5\text{H}_5\text{N}$), and with M to afford the compounds $[\text{Pt}, \text{C}_2\text{H}_4, \text{M}, \text{X}_2]$. The equilibrium $[\text{Pt}, \text{C}_2\text{H}_4, \text{M}, \text{X}_2] \xrightleftharpoons[\text{M}]{\text{HX}}$ $\text{MH}[\text{Pt}, \text{C}_2\text{H}_4, \text{X}_3]$ is shown to exist, and the products are isolated and described. The C_2H_4 complexes behave analogously to other Pt complexes; they are stable in dry air, and in light, but are instantly decomposed by neutral or alkaline aq. solutions, with production of Pt. The stability of the complexes rises in the series $\text{M} = \text{CS}(\text{NH}_2)_2 < \text{NH}_3 < \text{C}_5\text{H}_5\text{N} < \text{quinoline}$, and $\text{X} = \text{CN} < \text{CNS} < \text{NO}_2 < \text{I} < \text{Br} < \text{Cl}$. Attempts to determine the configuration of the complexes were unsuccessful, owing to their instability.

R. T.

Ring fission in complex platinum compounds. I. I. TSCHERNIAEV and A. N. FEDOROVA (Ann. Sect. Platine, 1937, 14, 9—18).— $[\text{Pt}, \text{en}, \text{NH}_3, \text{Cl}]\text{Cl}$ (I) and $\text{N}_2\text{H}_4 \cdot 2\text{HCl}$ (II) or HCl in hot aq. solution yield a mixture of $\text{Pt}, \text{en}, \text{Cl}_2$, $\text{Pt}, \text{en}, \text{NH}_3, \text{Cl}_2, \text{HCl}$ (III), and $(\text{Pt}, \text{NH}_3, \text{Cl}_2)_{\text{en}}$. (III) reacts with Cl_2 to give $\text{Pt}, \text{en}, \text{NH}_3, \text{Cl}_4, \text{HCl}$ (IV), which regenerates (III) when heated with (II). (IV) undergoes partial hydrolysis when recryst. from H_2O , to yield $([\text{Pt}, \text{NH}_3, \text{Cl}_3, \text{H}_2\text{O}]\text{Cl})_{\text{en}}$. (IV) and aq. NH_3 afford $[\text{Pt}, \text{en}(\text{NH}_3)_2\text{Cl}_2]\text{Cl}_2$, converted by (II) into (I).

R. T.

Chromatography as a new aid to analytical chemistry. G. M. SCHWAB (Z. Elektrochem., 1937, 43, 791).—See A., 1937, I, 529, 578.

J. W. S.

Angular constants of microcrystalline profiles and silhouettes in the conclusive identification of substances. A. C. SHEARD (Ind. Eng. Chem. [Anal.], 1937, 9, 496—502).—Attention is directed to the importance of measuring the profile angles of crystals, which are shown to be const., as a ready means of identification, especially in micro-crystals where the measurement of interfacial angles is difficult. The profile angular consts. of several microcryst. org. and inorg. substances have been determined.

E. S. H.

Quantitative emission spectral analysis of aqueous solutions. F. ROHNER (Helv. Chim. Acta, 1937, 20, 1054—1059).—The test solution is imbibed on discs produced from cotton-wool soaked in

30% gelatin and allowed to set. The emission spectrum of the sample is compared with a standard by the method of homologous linear pairs, using the Gerlach luminous arc with plate electrodes. It is claimed that this method introduces less uncertainty through presence of impurity than the usual method of imbibing the solution on a C rod. The elements are also completely uniformly distributed in the test disc.

J. W. S.

Determination of heavy hydrogen in H_2 - D_2 mixtures by heat conductivity. R. C. BURSTEIN (J. Phys. Chem. Russ., 1937, 9, 870—874).—A discussion of Farkas' method of analysing H_2 - D_2 mixtures.

E. R.

Determination of deuterium oxide-water mixtures. W. H. PATERSON (J.C.S., 1937, 1745—1746).—The temp. of mutual miscibility of PhOH - H_2O - D_2O mixtures have been determined. In replacing H_2O by an equimol. H_2O - D_2O mixture the temp. rise is 6.2° . On the basis that a rise of 1.24° represents 0.1 mol. fraction of D_2O an approx. analysis can be made.

E. S. H.

Potentiometric titration of acids in mixtures of *n*-butyl alcohol and water. R. N. EVANS and J. E. DAVENPORT (J. Amer. Chem. Soc., 1937, 59, 1920—1922).—Curves have been obtained for the titration of equiv. amounts of picric acid and BzOH in several H_2O - Bu°OH mixtures. With increasing $[\text{H}_2\text{O}]$ the stronger acid end-point becomes less distinct and the weaker acid end-point more distinct. The measurements have application in problems where it is necessary to distinguish acids of different strengths in low concn.

J. W. S.

Reaction of bromophenol-blue, iodophenol-blue, and chlorophenol-blue with hydroxyl ion. F. W. PANEPINTO and M. KILPATRICK (J. Amer. Chem. Soc., 1937, 59, 1871—1876).—The fading of the colour of these compounds in presence of OH' follows a unimol. law, the rate-determining step being the reaction between the bivalent sulphonephthalein anion and OH' . The effect of temp., but not that of ionic strength, is in accord with theory.

J. W. S.

Volumetric determination of small amounts of water by means of cinnamoyl chloride. C. J. VAN NIEUWENBURG (Mikrochim. Acta, 1937, 1, 71—74).—The material is heated in a current of dry air, and H_2O is absorbed in $\text{CHPh}\cdot\text{CH}\cdot\text{COCl}$, m.p. 36° (prep. described), maintained at 65° . The HCl evolved is absorbed in H_2O , and titrated with 0.02N-borax.

J. S. A.

Micro-determination of iodine by catalytic method. E. B. SANDELL and I. M. KOLTHOFF (Mikrochim. Acta, 1937, 1, 9—25).—The very slow oxidation of AsO_3''' by $\text{Ce}(\text{SO}_4)_2$ is catalysed by traces of I' ; the catalytic effects of Cl' and Br' on the reaction are 10^{-7} to 10^{-6} as great as that of I' . CN' inhibits the catalysis, as do Ag and Hg, which do not affect the catalytic action of Os on the same reaction. F' also interferes, but interference may be suppressed by adding AlCl_3 . The catalytic action $\propto [\text{I}']$ down to $[\text{I}'] = 10^{-8}$ in the presence of small amounts of Cl' . 0.0005—0.001 mg. of I may be

determined by measuring the time required for the reduction of a measured vol. of 0.1N-Ce(SO₄)₂ by an excess of 0.1N-Na₃AsO₃ containing the sample for analysis, using [Fe *o*-phenanthroline₃]⁺⁺ as indicator. The catalytic effect of other materials is eliminated by measurement of the rate of reaction after the addition of a measured amount of I'. 1 part of I may be so determined in the presence of 10⁶ parts of Cl or Br.

J. S. A.

Volumetric determination of iodine using the Elek-Hill micro-bomb. A. ELEK and R. A. HARTE (Ind. Eng. Chem. [Anal.], 1937, 9, 502).—After fusion in the micro-bomb, I is present as IO₃' and is determined by adding KI and titrating with Na₂S₂O₃. The error is <0.2%.

E. S. H.

Volumetric determination of fluorine. J. N. FRERS and H. LAUCKNER (Z. anal. Chem., 1937, 110, 251—262).—The material is distilled with SiO₂ (ignited previously at 1100°) and HClO₄. The distillate is neutralised (bromophenol-blue), and an equal vol. of EtOH is added. It is then titrated with Th(NO₃)₄ + Zr(NO₃)₄, using a standardised amount of saturated alcoholic quinalizarin + Na alizarin-sulphonate as indicator (cf. A., 1933, 242).

J. S. A.

Uranometric determination of fluoride. R. FLATT (Helv. Chim. Acta, 1937, 20, 894—904).—The formation of double fluorides of the type MUF₅ by the action of alkali fluorides on U^{IV} salts is applied to the potentiometric titration of F'. The solution is titrated with 0.05N-U(SO₄)₂ (0.2N in H₂SO₄) in the presence of a buffer of K sulphanilate and sulphanilic acid. The determination is unaffected by Na⁺, K⁺, NH₄⁺, Fe⁺⁺, Zn⁺⁺, and Cd⁺⁺, but the presence of Al⁺⁺⁺, Ca⁺⁺, Fe⁺⁺⁺, or PO₄^{'''} ions must be avoided. Details are given of the application of the method to the determination of F' in silicofluorides.

J. W. S.

Analysis of very dilute ozone. III. Sensitising action of the per-acid present in the aldehyde. Ozone content of the air at different altitudes. E. BRINER and E. PERROTTET (Helv. Chim. Acta, 1937, 20, 1200—1207; cf. A., 1937, I, 260, 324).—The presence of per-acid in the aldehyde increases the sensitivity of the authors' method of determining atm. O₃. The absorbing agent recommended is 5 c.c. of PrCHO in 20 c.c. of petrol and a per-acid content corresponding with 2 c.c. of 0.1N-Na₂S₂O₃. After the reaction, analysis is carried out rapidly away from bright light, in order to avoid autoxidation. Tests of air from various localities and altitudes indicates an [O₃] varying between 0.7 and 3.8 × 10⁻⁶%.

J. W. S.

Determination of oxygen and nitrogen in steel.—See B., 1937, 1214.

Direct determination of oxygen in coal and other solid fuels.—See B., 1937, 1151.

Indirect titration of sulphate with barium chloride using sodium rhodizonate as indicator in solution. L. VON ZOMBORY (Z. anal. Chem., 1937, 110, 278—279).—A claim for priority over Mutschin and Pollak (cf. A., 1936, 950; 1937, I, 148, 324).

J. S. A.

Simultaneous determination of ammonia and hydrogen sulphide in dark and coloured liquids. I. TARANENKO (Koks i Chim., 1934, No. 3, 65—66).—The 100-c.c. sample was heated for 30—60 min. at 100—150° in a 250-c.c. Kjeldahl flask, and the resulting gases led through a trap and Schiff condenser into three flasks containing (1) standardised H₂SO₄, (2) I, and (3) Na₂S₂O₃.

CH. ABS. (e)

Volumetric micro-determination of nitrates. L. SZEBELLÉDY and M. AJTAI (Mikrochim. Acta, 1937, 1, 255—259).—Disadvantages of the method previously described (cf. A., 1928, 498, 979) have been investigated. Greater accuracy (0.4%) is claimed if dilution of the strongly acid solution is avoided by titrating with N-FeSO₄ delivered from a micro-burette instead of with 0.1N-FeSO₄.

C. R. H.

Determination of orpiment in shellac.—See B., 1937, 1237.

Rapid determination of silicon in cast iron, steel, and silicates.—See B., 1937, 1212.

Spectrographic determination of carbon, silicon, manganese, nickel, chromium, and molybdenum in iron and steel.—See B., 1937, 1212.

Selective analysis of carbon monoxide, hydrogen, and methane.—See B., 1937, 1154.

Microchemical testing of materials [for alkali].—See B., 1937, 1141.

Analysis of alkali metals. T. KATO (J. Electrochem. Assoc. Japan, 1935, 3, 276—283; cf. A., 1936, 578).—The alkali perchlorates are treated with MeOAc and filtered, the residue consisting of the K, Rb, and Cs salts, which are separated by differences in the solubilities of the H tartrates and phosphotungstates. Li and Na are separated by the difference in solubility of their chlorides in aq. NH₃.

CH. ABS. (e)

Internal electrolysis. III. Determination of small quantities of silver in presence of various other metals and its application to the analysis of galena and pyrites. J. G. FIFE (Analyst, 1937, 62, 723—727; cf. A., 1936, 1479).—Using the apparatus described previously (*loc. cit.*), with anodes of 18 S.W.G. Cu wire, an anolyte of Cu(NO₃)₂ = 1 g. of Cu and 0.1 ml. of conc. HNO₃ per 100 ml. and a catholyte, of approx. 300 ml., containing the Ag to be determined (added as AgNO₃), Pb(NO₃)₂ = 10 g. of Pb, 8 ml. of conc. HNO₃, and varying amounts of Cu(NO₃)₂ and Bi(NO₃), electrolysis is carried out for 30 min. at 60°. The max. amount of Ag that can be thus determined is 8.5 mg. In aq. NH₃ in presence of Cu, the Cu in the catholyte must be present as Cu^I, that in the anolyte as Cu^{II}. The anolyte contains 0.1 g. of Cu as Cu(NO₃)₂, 2 g. of NH₄NO₃, and 3 ml. of aq. NH₃ (d 0.880) per 100 ml., the catholyte (300 ml. approx.) the Ag to be determined, 7 g. of Na₂SO₃, 9 ml. of aq. NH₃ (d 0.880), and varying amounts of Cu, and is heated before electrolysis (which is carried out at 70°) until decolorised. The methods are applied to the determination of Ag in galena and cupreous Fe pyrites.

E. C. S.

Spectrographic chemical analysis. III. Quantitative spectrographic analysis of salt

solutions. Y. UZUMASA and H. OKUNO (J. Chem. Soc. Japan, 1935, 56, 1174—1179; cf. A., 1934, 857).—Data connecting spectrographic measurements with the consens. of Ag, Al, Ba, Ca, Cr, Co, Fe, Mn, Mg, Ni, Sr, and Zn in solution, are recorded. CH. ABS. (e)

Determination of silver in photographic fixing baths.—See B., 1937, 1275.

Chemistry of beryllium with special reference to analysis of beryl. L. F. KERLEY (J. Proc. Austral. Chem. Inst., 1937, 4, 223—232).—The quant. analytical separation of Be from beryl is reviewed. Final separation from Fe and Al is best effected by means of NaHCO_3 or 8-hydroxyquinoline + NH_4OAc . In either case, Be is subsequently pptd. by exact neutralisation with aq. NH_3 . J. S. A.

Detection of zinc in the presence of iron. G. ERÉNYI (Tech. Kurir, 1937, 8, 79).—On addition of alkali fluorides to a solution of Zn^{++} and Fe^{+++} in aq. HCl, $[\text{FeF}_6]^{--}$ is formed; this in contrast to Zn^{++} gives no ppt. with $\text{K}_4\text{Fe}(\text{CN})_6$. When using $\text{K}_3\text{Fe}(\text{CN})_6$, the Zn ppt. is brownish-yellow. The sensitivity of the reaction is 1 in 5×10^5 . E. P.

Colorimetry with colloidal solutions. II. Colorimetric determination of cadmium as sulphide. R. JUZA and R. LANGHEIM (Z. anal. Chem., 1937, 110, 262—270).—In presence of Cd alone, the solution is made alkaline with NH_3 , and KCN + $(\text{NH}_4)_2\text{SO}_4$ + 1% aq. gelatin are added. The solution is added to a saturated aq. solution of H_2S , and colorimeted after 15 min. 1000 parts of Zn do not interfere in the presence of sufficient KCN. In presence of Cu, Co, or Ni, KCN is added until the solution is colourless, or a min. of colour is reached; an additional quantity is added for reaction with the Cd, and the CdS suspension is prepared as above. 100 parts of Ni, or 10 parts of Cu or Co, do not interfere. J. S. A.

Determination of small amounts of cadmium with "dithizone." H. FISCHER and G. LEOPOLDI (Mikrochim. Acta, 1937, 1, 30—42).—0.001—0.04 mg. of Cd may be determined colorimetrically by extracting the solution, mixed with 10% aq. NaOH, with a solution of dithizone (I) in CCl_4 . The CCl_4 solution of the Cd-(I) compound is washed with *n*-HCl, and the resulting green CCl_4 solution of (I) is colorimeted. Alternatively, the Cd-(I) compound may be decomposed with 1% HNO_3 , and (I) determined by indirect titration with AgNO_3 (cf. A., 1937, I, 97). 0.002% of Cd may be determined in Zn by preliminary enrichment by pptn. of CdS + some ZnS + other heavy metals with Na_2S . The ppt. is dissolved in HNO_3 ; Cu and Ag are removed by treating the acid solution with (I), and Cd is determined as above. Cd in Sn may be determined by removal of Sn as SnBr_4 . Cu, Ag, Au, Pd, Ni, and Co interfere with the direct determination of Cd. In presence of Ag or Hg, Cd is separated by adding an excess of NH_4CNS + $\text{C}_5\text{H}_5\text{N}$ and extracting with CHCl_3 . The extract is evaporated down with HNO_3 , and Cd is determined as above. If much Cu is present, this must first be reduced to Cu^{I} . J. S. A.

Analytical separation of lead from Mg^{++} , Ca^{++} , Sr^{++} , Ba^{++} , and Tl^{I} by means of carbon dioxide in

pyridine solution. A. JÍLEK and O. LAUBOVÁ-SKLENÁROVÁ (Chem. Listy, 1937, 31, 335—339).—Quant. separation of Pb^{++} from its mixtures with Mg^{++} and Tl^{I} (>0.2 g. of Pb^{++} , Mg^{++} , and Tl^{I} per 100 g. of $\text{C}_5\text{H}_5\text{N}$ solution) is achieved by saturation with CO_2 . In presence of Ca^{++} , the ppt. of PbCO_3 is contaminated with CaCO_3 , necessitating redissolution and repptn. The method is not applicable, even with double pptn., to determination of Pb in presence of Ba and Sr. R. T.

Determination of lead in biological materials.—See A., III, 504.

Determination of lead in tin-plating metal.—See B., 1937, 1221.

Micro-determination of thallium by potentiometric titration using "thionalide." B. BERG and E. S. FAHRENKAMP (Mikrochim. Acta, 1937, 1, 64—70).—Tl is pptd. with thionalide (cf. A., 1937, I, 476), and the ppt. is dissolved in AcOH. Org. compounds are destroyed with H_2SO_4 and H_2O_2 , and the residue is dissolved in HCl. Tl is finally determined by potentiometric titration with 0.002—0.0002N-KBrO₃. Alternatively, the Tl ppt. may be dissolved in AcOH or H_2SO_4 + EtOH, and titrated directly at 50° with 0.002N-I, whereby dithionide is formed. J. S. A.

Colorimetry with colloidal solutions. III. Colorimetric determination of copper as ferrocyanide. H. HAHN, R. JUZA, and R. LANGHEIM (Z. anal. Chem., 1937, 110, 270—275).—AcOH + NH_4OAc + 1% aq. gelatin are added to the solution, and then $\text{K}_4\text{Fe}(\text{CN})_6$. The brown coloration is colorimeted within 1 hr., or photometered using blue-green light. In the presence of Pb, sufficient NH_4OAc must be added. J. S. A.

Titration of copper with alkali cyanide solutions. ANON. (Ind. Chem., 1937, 13, 405—406).—The solution of Cu is treated with a slight excess of aq. NH_3 , and titrated with KCN until just colourless, corresponding with the formation of $\text{K}_3\text{NH}_4[\text{Cu}(\text{CN})_3]_2$ + NH_4CNO . Alkaline plating baths are first boiled with KClO_3 + HCl, and then made alkaline with NH_3 before titration. J. S. A.

Aniline thiocyanate; a sensitive reagent for copper. F. P. DWYER and R. K. MURPHY (J. Proc. Austral. Chem. Inst., 1937, 4, 334—342).—The reagent (prepared by mixing 1 c.c. of 50% aq. NH_4CNS with 1 c.c. of NH_2Ph , adding 2N-HCl until the emulsion clears, diluting to 5 c.c., and clearing with drops of EtOH) yields a yellowish-brown ppt. of $\text{Cu}(\text{CNS})_2 \cdot 2\text{NH}_2\text{Ph}$ (fine needles) when added to a solution containing Cu^{++} . The method enables detection of 0.5×10^{-6} g. of Cu in 1 c.c. of solution. The reagent also yields ppts. with Pb^{++} , Hg^{++} , Bi^{++} , Cr^{+++} , Al^{+++} , Ag^+ , Cd^{++} , Zn^{++} , Co^{++} , Ni^{++} , and Mn^{++} , but the first five can be removed by previous treatment with NH_3 , and Ag⁺ by NaCl. Of the remainder only Cd^{++} and Ni^{++} yield ppts. in 1% solution, and if a min. quantity of reagent is used the colour of the Cu compound can be detected. On keeping the reagent decomposes with separation of $\text{NHPh} \cdot \text{CS} \cdot \text{NH}_2$. J. W. S.

Detection and determination of copper by colour reactions. P. THOMAS (*Biochem. Z.*, 1937, 293, 396—398).—The rose colour reaction of Cu salts with phenolphthalein is more sensitive than that with urobilin in detecting traces ($<10^{-6}$ g.) of Cu.

P. W. C.

Diphenylthiocarbazone (dithizone) as an analytical reagent. H. A. LIEBHAFSKY and E. H. WINSLOW (*J. Amer. Chem. Soc.*, 1937, 59, 1966—1971).—The visible spectral transmissions of CCl_4 solutions of dithizone (I), its oxidation product, and Cu and Pb dithizonates have been measured and are applied to the determination of traces of Pb and Cu. 10^{-6} g. of either metal can be determined with fair accuracy, but difficulties are encountered in obtaining complete extraction of the metal by the CCl_4 solution and in preventing oxidation of the reagent, which seems to be catalysed by Cu^{++} . Optimum conditions for the determinations are detailed. The compounds appear to contain 1 atom of Cu to 2 mols. of (I) and 1 atom of Pb to 1 mol. of (I), respectively. Possible structures of these compounds are discussed.

J. W. S.

Determination of copper, zinc, and lead in silicate rocks. E. B. SANDELL (*Ind. Eng. Chem. [Anal.]*, 1937, 9, 464—469).—The sample is decomposed with HF-HClO_4 and Na_2CO_3 , and Cu, Zn, and Pb are extracted as dithizonates with a solution of dithizone in CCl_4 . The separated CCl_4 layer is shaken with 0.01N-HCl, yielding ZnCl_2 and PbCl_2 in the aq. phase. The CCl_4 layer is evaporated to dryness and the residue ignited to CuO , which is dissolved in HCl and determined colorimetrically with dithizone. Zn and Pb are determined in separate aliquot portions of the aq. solution by colorimetric methods using dithizone.

E. S. H.

Determination of copper in cast iron and steel.—See B., 1937, 1212.

Polarographic determination of copper, nickel, and cobalt in presence of one another in steels.—See B., 1937, 1216.

Photometric determination of copper in metals—See B., 1937, 1215.

Volumetric determination of mercury [in organic compounds].—See A., II, 476.

Use of standard sodium hydroxide solution for the standardisation of potassium permanganate [via oxalic acid]. D. L. SCOLLES and J. ROTHSTEIN (*J. Chem. Educ.*, 1937, 14, 326—327).—An examination of the suitability and accuracy of the method. Data obtained for the N of ten solutions of KMnO_4 each of which was standardised against a standard, CO_3 -free NaOH solution by using each one of six different samples of $\text{H}_2\text{C}_2\text{O}_4$ as a "bridge," are tabulated and discussed. The method is regarded as satisfactory.

L. S. T.

Intensity and stability of ferric thiocyanate colour developed in β -methoxyethyl alcohol. H. W. WINSOR (*Ind. Eng. Chem. [Anal.]*, 1937, 9, 453—455).—The colour is more intense and more stable in $\text{OMe}[\text{CH}_2]_2\text{-OH}$ (I) than in other solvents or solvent mixtures. Other advantages of (I) as a medium are discussed, and its use is recommended in

the determination of small amounts of Fe in biological materials.

E. S. H.

Dipotassium sodium cobaltinitrite and its application to the gravimetric determination of cobalt. C. F. CUMBERS and J. B. COPPOCK (*J.S.C.I.*, 1937, 56, 405—407 π).—The hydration of K_2Na cobaltinitrite depends on pptn. temp., the composition at 60° corresponding with the monohydrate when the ratio $\text{Na}:\text{K}$ in the reagents is 15:1 to 40:1. Co may be determined rapidly using this complex, and for $\text{Ni}:\text{Co} \approx 1$ quant. results are obtained in presence of Ni. Notes on the determination of K as cobaltinitrite and Co as oxine are appended.

Reaction between ammonium salts and cobaltinitrite complexes. I. I. TSCHERNIAEV and J. J. PLAKAN (*Ann. Sect. Platine*, 1937, 14, 123—156).—The NO_2 -group content of Co complexes can be determined by the method previously described for Pt complexes (A., 1934, 380), taking NH_4I instead of NH_4Cl as the reagent. The reaction is, at room temp., independent of the acidity of the solutions.

R. T.

Organic reagents in analytical chemistry. J. V. DUBSKÝ and A. LANGER (*Chem. Obzor*, 1937, 12, 27—32).—The reactions of various org. reagents with Co salts are reviewed. Conditions and in some cases sensitivities are given for the tests.

F. R.

Analysis by means of organic compounds. IV. Volumetric determination of nickel by dimethylglyoxime. V. Separation and determination of nickel and cobalt by means of dimethylglyoxime and sodium anthranilate. VI. Volumetric determination of copper by benzoinoxime. M. ISHIBASHI and A. TETSUMOTO (*J. Chem. Soc. Japan*, 1935, 56, 1221—1227, 1228—1230, 1231; cf. A., 1935, 720).—IV. Ni is determined by pptn. with dimethylglyoxime and determination of excess of the latter with $\text{Fe}(\text{NH}_4)_2(\text{SO}_4)_2$ as external indicator.

V. The filtrate from the dimethylglyoxime pptn. of Ni is treated with H_2SO_4 , evaporated until it fumes, and the Co pptd. with 3% Na anthranilate.

VI. Cu is pptd. from sulphate solution with α -benzoinoxime, which is filtered and hydrolysed by heating with dil. H_2SO_4 . Excess of Fe alum is added, and the excess determined by manganometry.

CH. ABS. (e)

Potentiometric studies in oxidation-reduction reactions. III. Reduction with sodium sulphite. B. SINGH and I. I. MALIK (*J. Indian Chem. Soc.*, 1937, 14, 435—439; cf. A., 1937, I, 263).—I, $\text{K}_2\text{Cr}_2\text{O}_7$, $\text{K}_3\text{Fe}(\text{CN})_6$, CuSO_4 , and H_2O_2 can be accurately determined by potentiometric titration with Na_2SO_3 . Details are given.

F. L. U.

Analysis of chromium oxide.—See B., 1937, 1199.

Detection of molybdic acid by fluorescence reaction. L. SZEBELLÉDY and J. JÓNÁS (*Mikrochim. Acta*, 1937, 1, 46—50).—Molybdic acid gives with cochinal tincture, best at p_{H} 5.7—6.2, a sensitive brilliant red fluorescence. Most heavy metals extinguish or mask the fluorescence.

J. S. A.

Determination of UO_2 and UO_3 in different layers of a single crystal of uraninite. E. GLÉDITSCH and R. BAKKEN (*Mikrochim. Acta*, 1937,

1, 83—86).—The material was dissolved by heating with H_2SO_4 , and UO_2 was determined by titration with 0.01N- $KMnO_4$. UO_3 was reduced, and total UO_2 then titrated. The total U decreases, and the proportion of UO_3 increases, in passing from the core to the outer layer of the crystal. J. S. A.

Electrolytic determination of uranium and its recovery from the filtrate of sodium magnesium uranyl acetate precipitation. M. ISHIBASHI and Y. HARADA (J. Chem. Soc. Japan, 1935, 56, 1234—1236).—Br is added to the filtrate, the solution is filtered, and the U pptd. with aq. NH_3 . The ppt. is filtered, dissolved in $AcOH$, $(NH_4)_2CO_3$ and $EtOH$ are added, and the solution is electrolysed at 60—70° at 6 v. CH. ABS. (e)

Spectral analysis of tin in gold ores.—See B., 1937, 1221.

Volumetric determination of titanium. V. M. SENDEROVA (Trans. All-Union Sci. Res. Inst. U.S.S.R., 1935, No. 68, 85—94).—Titration methods based on the use of $KMnO_4$, methylene-blue, and Fe^{III} alum were studied. CH. ABS. (e)

Gravimetric determination of zirconium using disodium methylarsinate. R. CHANDELLE (Bull. Soc. chim. Belg., 1937, 46, 283—300).—Addition of solid $AsMeO_3Na_2 \cdot 6H_2O$ to solutions of Zr salts in HCl (>0.75N) ppts. $(AsMeO_3)_2Zr$ (I). As in traces is removed by reduction between calcinings of (I) and Zr is determined as ZrO_2 , or as (I) or from its As content. The method detects 0.00075 mg. Zr, and is sp. in presence of Al, Cr, Ni, Co, Zn, Mn, Ca, Mg. Modified procedure is described for pptn. in H_2SO_4 or in presence of Fe. I. MCA.

A. Jilek's thiocarbamide reaction for detection of bismuth. J. V. DUBSKÝ and A. OKAČ (Chem. Listy, 1937, 31, 364).—The reaction given by Bi salts with $CS(NH_2)_2$ was described by Jilek (Chem. Listy, 1920, 14, 165) before Sensi *et al.* (A., 1929, 1412). R. T.

Mutual interference in the microchemical determination of ore minerals. H. J. FRASER and R. M. DREYER (Amer. Min., 1937, 22, 949—976).—The interferences in size, shape, or colours of the crystals produced in the NH_4 molybdate, K mercuric thiocyanate, dimethylglyoxime, $(NH_4)_2Cr_2O_7$, CsCl, KI, KI + CsCl, $CS(NH_2)_2$, and Na bismuthate tests are fully described and discussed. Possible interferences by approx. 20 elements have been investigated for most of these tests. L. S. T.

Thermoregulator for direct control of the electric circuit in a heating bath. F. E. HOLMES (Ind. Eng. Chem. [Anal.], 1937, 9, 481—482).—The apparatus is suitable for controlling the temp. to within 1° or 2°. E. S. H.

Improved form of Strache gas calorimeter (explosion calorimeter). W. COURARD (Österr. Chem.-Ztg., 1937, 40, 445—450).—An improved form of the Strache calorimeter (A., 1924, ii, 319) is described; PhMe is used instead of air as the calorimetric substance, and the calorific val. of gases at const. pressure may readily be determined. R. S. B.

Low-temperature studies. II. Comparison of platinum-rhodium resistance thermometers with the helium gas thermometer from 11° to 300° K. R. W. BLUE and J. F. G. HICKS, jun. (J. Amer. Chem. Soc., 1937, 59, 1962—1965).—Pt-Rh alloy (10% Rh) resistance thermometers have been calibrated against the He gas thermometer as a secondary standard of temp. The normal b.p. of O_2 and H_2 and the triple point of H_2 are 90.20°, 20.37°, and 13.94° K., respectively, based on 273.19° K. as the m.p. of ice. An improved form of low-temp. cryostat is described. J. W. S.

Glass-sealing furnace. J. R. DILLEY (Rev. Sci. Instr., 1937, [ii], 8, 394—395).—The furnace described is designed to secure alignment perpendicular to the axis and absence of curvature when sealing end windows to cylindrical glass cells. N. M. B.

Fluorescence microscopy. M. HAITINGER (Chem.-Ztg., 1937, 61, 847—848).—A brief review. L. S. T.

Recent improvements in diffraction gratings and replicas. R. W. WOOD (Nature, 1937, 140, 723—724). L. S. T.

Absorption step-weakeners of antimony. G. O. LANGSTROTH and D. R. McRAE (Canad. J. Res., 1937, 15, A, 154—160).—A method of obtaining a series of graduated steps of known relative intensity with a single exposure for spectroscopic work has been devised. Sb films of uniform optical density are deposited by thermal decomp. of SbH_3 . E. S. H.

Evaporated aluminium coatings for interferometer plates for use in the ultra-violet. J. E. RUEDY and G. B. SABINE (Physical Rev., 1936, [ii], 49, 887).—Films of Al evaporated on Corex and fused quartz have been measured for reflexion and transmission over the range 2380—4080 Å. L. S. T.

New radiation standard. H. KREFFT, F. RÖSSLER, and A. RÜTTENAUER (Z. tech. Physik, 1937, 18, 20—25).—The construction is described of a high-pressure Hg vapour lamp, running at 250 v., with total radiation, from 2400 Å. to 1 μ ., const. to $\pm 2\%$ and const. energy distribution throughout the spectrum. No change was observed after running the lamp for several hundred hr. O. D. S.

Analysis of doubly refracting materials with circularly and elliptically polarised light. R. D. MINDLIN (J. Opt. Soc. Amer., 1937, 27, 288—291).—Mathematical. When the retardation plates are not accurately quarter-wave plates the interference "brushes" are not completely removed and the fringes are not necessarily unchanged. N. M. B.

Violet absorbing filters. P. L. BAYLEY (J. Opt. Soc. Amer., 1937, 27, 303—304).—In order to find absorbers for the violet lines $\lambda\lambda$ 4046 and 4078 when the Hg blue line λ 4358 Å. is used for Raman excitation, gelatin films dyed with β -methylæsculetin were prepared under various conditions. No satisfactory absorption at λ 4046 was found. Noviol A or aq. $NaNO_3$ are satisfactory, and the Wratten 2A film very satisfactory, for both $\lambda\lambda$. N. M. B.

Electrolytic recording of weak electric currents. F. E. LUTKIN (*J. Sci. Instr.*, 1937, 14, 306—308).—Dark coloured permanent records on absorbent paper are obtained by the use of aq. $\text{NEt}_2 \cdot \text{CS}_2 \cdot \text{Na}$ or rubenic acid (I) in EtOH. Contact is made with a Cu or Fe stylus. Traces were obtained with currents of the order 10 μa . or of 1 μa . on the addition of NH_4Cl and NH_4NO_3 to the solutions. (I) with $\text{Pb}(\text{OAc})_2$ is sensitive to 0.5 μa . Precautions regarding resistance of the test paper and electrode contact p.d. are discussed.
N. M. B.

High-voltage regulation. P. R. PALLISTER and E. E. SMITH (*J. Sci. Instr.*, 1937, 14, 311—313).—A method utilising the property of induction between two conductors and const. to 0.05 v. at 5000 v. is described.
N. M. B.

Portable thermocouple potentiometer. D. R. BARBER (*J. Sci. Instr.*, 1937, 14, 343—346).—The instrument is designed for the range 20—46° with an accuracy of $\pm 0.1^\circ$.
E. S. H.

Geiger-Müller counters for radiochemical investigations. F. T. HAMBLIN and C. H. JOHNSON (*Phil. Mag.*, 1937, [vii], 24, 553—571).—Details of the construction and calibration of Geiger-Müller counters are given.
K. S.

Correction to be applied to the results obtained by using a Geiger counter. H. TODD [with Appendix by F. T. HAMBLIN] (*Phil. Mag.*, 1937, [vii], 24, 572—582).—The optimum operating conditions are calc. and experimental verification is discussed.
K. S.

Counter tubes for the visible region of the spectrum. K. O. KIEPENHEUER (*Z. Physik*, 1937, 107, 145—152).—The use of alkali-metal cathodes in light counter tubes of ordinary design leads to self-excitation by gaseous ions. An apparatus free from this defect is described.
H. C. G.

Apparatus for production of radioactive elements by means of radium. F. T. HAMBLIN (*Phil. Mag.*, 1937, [vii], 24, 582—588).—An apparatus for the production of artificially radioactive elements gives adequate protection with ease of manipulation.
K. S.

Low-voltage positive ion source. W. H. ZINN (*Physical Rev.*, 1937, [ii], 52, 655—657).—A positive ion source of the low-voltage constricted-arc type, yielding intense positive ion beams with small gas pumping, is described. Ion currents up to 4.3 ma. have been obtained, and magnetic analysis when the arc was operated in H_2 showed a max. of 15—20% protons.
N. M. B.

Recording electrochemical meter for determining oxygen [in boiler feed-water].—See B., 1937, 1229.

Improved burette. S. L. PHANSALKAR (*Chem. and Ind.*, 1937, 723—724).—The apparatus consists of a burette and a micro-burette provided with a common outlet and a stop-cock which allows either burette to deliver liquid or connects them together. The liquid level of the large burette is adjusted to scale divisions, where greater accuracy is attainable,

fractions of 1 c.c. being measured in the micro-burette.
I. C. R.

[Improved burette.] A. F. H. WARD (*Chem. and Ind.*, 1937, 908).—In the method of Phansalkar (preceding abstract) the accuracy of the titration is only that obtainable with the ordinary burette also employed.
R. M. M. O.

Automatic pipette. D. BACH (*Bull. Soc. Chim. biol.*, 1937, 19, 1295—1298).—The arrangement permits the rapid and repeated delivery of a particular vol. of fluid with a considerable degree of accuracy.
P. W. C.

Micro-titration by K. Schwarz' method and a micro-pressure pipette. E. ABEL and F. FABIAN (*Mikrochim. Acta*, 1937, 1, 43—45).—Apparatus is described.
J. S. A.

Gasometric analysis. J. MALV (*Chem. Obzor*, 1935, 10, 223—226).—A volumeter and a pressure volumeter are described.
CH. ABS. (e)

Analytical balance. Sensitivity, weighing, and correction of a set of weights. H. SCHMIDT (*Apoth.-Ztg.*, 1937, 52, 811—814).—Theoretical.
F. N. W.

Fume absorber for Kjeldahl digestions. H. G. CASSIDY (*Ind. Eng. Chem. [Anal.]*, 1937, 9, 478—479).—A perforated test-tube containing $\text{NaOH} \cdot \text{CaO}$ is fastened into the neck of the flask.
E. S. H.

Qualitative analysis of microgram samples. General technique. A. A. BENEDETTI-PICHLER (*Ind. Eng. Chem. [Anal.]*, 1937, 9, 483—487).—Apparatus and procedure are described. The chemical operations are performed in cones of 0.5 cu. mm. capacity, prepared from capillary tubing of approx. 0.5 mm. bore. Most of the manipulations are carried out by observation with a low-power microscope.
E. S. H.

Microchemical filter crucible. A. J. BAILEY (*Ind. Eng. Chem. [Anal.]*, 1937, 9, 490—491).
E. S. H.

Laboratory gas-washing or absorption unit. M. W. BRENNER and G. L. POLAND (*Ind. Eng. Chem. [Anal.]*, 1937, 9, 480—481).—The apparatus uses 20—50 c.c. of absorbing liquid and gives a path of travel of 225—250 cm.; the max. possible rate of flow of gas is 80 l. per hr. The efficiency is illustrated by experiments on the absorption of CO_2 by aq. KOH and of NH_3 by aq. H_2SO_4 .
E. S. H.

Self-filling pycnometer. G. F. HENNION (*Ind. Eng. Chem. [Anal.]*, 1937, 9, 479).
E. S. H.

Tubular vacuum type centrifuge. J. W. BEAMS, F. W. LINKE, and C. SKARSTROM (*Science*, 1937, 86, 293—294).—An apparatus effective in the separation of liquids is described and illustrated.
L. S. T.

Filter beakers in quantitative micro-analysis. F. HECHT (*Mikrochim. Acta*, 1937, 1, 284—286).—An improved construction of micro-beakers is described and their use is illustrated with diagrams.
C. R. H.

Fused silica in the laboratory. B. MOORE (*Chem. and Ind.*, 1937, 919—921).
J. S. A.

Variable-slit filter for liquids. E. SIMEON (J. Sci. Instr., 1937, 14, 315).—A small filter, in mild steel, is designed to remove dirt particles from Hg.

N. M. B.

Demountable vacuum joint with clamp. S. WEINTROUB (J. Sci. Instr., 1937, 14, 315—317).—Tubes of varying bore and materials are joined with elimination of lateral strain by a special type of clamp, which presses them against rubber gaskets in contact with an annular metal plate.

N. M. B.

Multi-service wash bottle. R. TAYLOR (Ind. Chem., 1937, 13, 394).—The mouthpiece and combined stirrer and water jet are connected by rubber tubing to an ordinary bottle held in a clamp, leaving the hands of the operator free.

A. K. G. T.

Manometer construction for very small pressure differences. E. RÖBBELEN (Z. tech. Physik, 1937, 18, 11—14).—A differential manometer with plane-sided capillary and range from 0.0001 to 2 mm. of alcohol is described.

O. D. S.

Apparatus for extracting solutions with heavy solvents. S. WEHRLI (Helv. Chim. Acta, 1937, 20, 927—931).—The solvent is distilled from a flask, the condensate falling in drops through the aq. solution to be extracted contained in the wide limb of a U-tube, the bottom and narrow other limb of which contain the solvent, which is fed back automatically to the distilling flask by overflow through a side tube.

J. W. S.

Equilibria in two-phase, gas-liquid hydrocarbon systems. I. Methods and apparatus. E. H. BOOMER, C. A. JOHNSON, and G. H. ARGUE (Canad. J. Res., 1937, 15, B, 367—374).—Apparatus and technique for bringing a gas and a liquid into equilibrium at any desired pressure up to 370 atm. and temp. from 25° to above 100° are described. Provision for taking samples of known vol. from the

liquid and gaseous phases in equilibrium is made. Procedure for determining phase densities and compositions is described.

E. S. H.

Packed fractionating columns. D. F. STEDMAN (Canad. J. Res., 1937, 15, B, 383—400; cf. B., 1937, 853).—Fine-mesh wire-gauze packings, which give an effectiveness up to 20 plates per ft. of height, are described. Special constructions for laboratory use and for high-capacity apparatus are indicated. The factors influencing the efficiency of packings are discussed and evaluated.

E. S. H.

Hydro-agitator for solutions. L. P. CLEMENTS (Science, 1937, 86, 334).

L. S. T.

Determination of the surface tension of solid substances. R. N. J. SAAL (Chem. Weekblad, 1937, 34, 687—694).—The various methods are discussed critically and it is concluded that trustworthy results are not obtained.

S. C.

Method of stirring gases within a closed chamber. J. W. MITCHELL and W. E. MARTIN (Plant Physiol., 1937, 12, 557—558).—A fan is rotated within the chamber by magnetic coupling with an electromagnet on the outside.

A. G. P.

Determination of viscosity.—See B., 1937, 1142.

Historical studies of the phlogiston series. I. The levity of phlogiston. J. R. PARTINGTON and D. MCKIE (Ann. Sci., 1937, 2, 361—404).

Some eighteenth century ideas concerning aqueous vapour and evaporation. S. A. DYMENT (Ann. Sci., 1937, 2, 465—473).

Fifty years of the chemistry of fluorine. E. EINECKE (Angew. Chem., 1937, 50, 859—864).

J. A. Arfwedson and his services to chemistry. M. E. WEEKS and M. E. LARSON (J. Chem. Educ., 1937, 14, 403—407).

L. S. T.

Geochemistry.

Iodine-air investigations. H. JESSER and E. THOMAE (Z. anal. Chem., 1937, 110, 275—278).—Determinations (in Stuttgart) by Cauer's method (A., 1936, 577) show a mean content of 0.0003 mg. of I per cu. m., the val. increasing before rain or with a westerly wind.

J. S. A.

Bromine and iodine content of water from the Kuibischev region oil-wells. N. D. SMIRNOV (J. Chem. Ind. Russ., 1937, 14, 1222—1224).—The petroliferous H₂O contains Br 12.5—650 and I 0.3—7.5 mg. per litre. Complete analytical data are given for the H₂O from a no. of borings.

R. T.

Chemical character of the ground waters the South Atlantic Coastal Plain. (MISS) M. D. FOSTER (J. Washington Acad. Sci., 1937, 27, 405—412).—The characteristics are described. In general, wells of shallow or moderate depths in Virginia and N. and S. Carolina yield Ca(HCO₃)₂ waters and deep wells yield NaHCO₃ waters. In Georgia and Florida both shallow and deep wells yield Ca(HCO₃)₂ waters.

Disturbances of the general characteristics due to admixture with sea-H₂O are discussed.

C. R. H.

[Analysis of] mineral water from Veneto [Italy]. G. BRAGAGNOLO and B. BRUNETTA (Annali Chim. Appl., 1937, 27, 337—358).—Analytical data for the soil and for the chemical constituents, physico-chemical characteristics, dissolved gases, and radioactivity are tabulated.

F. O. H.

Native copper of the Allaverdi [Armenia]. O. E. ZVJAGINTZEV and E. L. PISARSHEVSKAJA (Bull. Acad. Sci. U.R.S.S., Sér. Chim., 1937, 675—680).—The Cu contains Cu 97.20—97.46, Fe 0.25%, and Ag, V, Sb, Si, and As traces, and consists of polyhedra of Cu with inclusions of cuprite. The hardness approximates to that of electrolytic Cu.

R. T.

Application of clay mineral technique to Illinois clay and shale. R. H. BRAY, R. E. GRIM, and P. F. KERR (Bull. Geol. Soc. Amer., 1935, 46, 1909—1926).—Examples of the examination of clays and shale are described.

CH. ABS. (e)