BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

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

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New tables of the 100,000 principal spectrum lines of the chemical elements between 10,000 and 2000 A. G. R. HARRISON (Proc. Sixth Conf. Spectros., 1938, 118—124).—Details of the method of prep. of the tables, shortly to be published, are given. A. J. M.

Ultra-violet end of the solar spectrum. M. W. CHIPLONKAR (Current Sci., 1939, 8, 312—313).— Using a simple Dobson's spectrograph, the solar spectra at Poona and at Bombay at noon in April (sun nearly overhead) had ultra-violet limits of 2895 and 2874 A., respectively. W. R. A.

Radiation measurements in the ultra-violet with the barrier-layer cell. H. KREFFT and F. RÖSSLER (Z. tech. Physik, 1936, **17**, 479–481; Chem. Zentr., 1937, i, 1735).—Spectral sensitivity data (2400—7500 A.) for the Se barrier-layer cell are given. Combined glass and liquid filters for isolating four narrow ultra-violet regions are described.

Temperature of the solar chromosphere. L. GOLDBERG (Astrophys. J., 1939, 89, 673-678).— The excitation temp. of the solar chromosphere appears to increase with height, ranging from 4300° for the chromospheric slab 670 km. above the solar limb to 6700° for a height of 2330 km. L. S. T.

Spectra of two reflexion nebulæ. J. L. GREEN-STEIN and L. G. HENYEY (Astrophys. J., 1939, 89, 647-652).—The spectra of the Orion nebula and of the Pleiades nebula are described. The former has a strong continuous reflexion spectrum superposed over the bright line spectrum. L. S. T.

Diffuse nebulæ. J. L. GREENSTEIN and L. G. HENYEY (Astrophys. J., 1939, 89, 653-658).--Emission line intensities in the spectrum of the Orion nebula are recorded. An electron temp. of ~5000° is indicated. Spectral characteristics of other nebulæ are recorded. L. S. T.

Physical processes in gaseous nebulæ. VI. Equations of radiative transfer. L. H. ALLER, J. G. BAKER, and D. H. MENZEL (Astrophys. J., 1930; 89, 587-593; cf. A., 1939, I, 167).—The general equations for bound-bound, bound-free, and free-free transitions for a H nebula are derived. L. S. T.

Physical state of interstellar hydrogen. B. STRÖMGREN (Astrophys. J., 1939, 89, 526-547).— The ionisation and excitation of interstellar H, its actual physical state, the ionisation of other elements, and the relative abundance of elements in interstellar space are discussed. L. S. T. Stark-effect broadening of hydrogen lines. II. Observable profiles. L. SPITZER, jun. (Physical Rev., 1939, [ii], 56, 39–47; cf. A., 1939, I, 289).-----Mathematical. N. M. B.

New emission lines in the spectrum of γ Cassiopeiæ. T. M. LIN and J. DUFAY (Compt. rend., 1939, 209, 342—344).—The emission spectrum (3750—5876 A.), photographed between October, 1937, and July, 1938, contains lines due to H, He, Fe, Ti, Mg, Al, Cr, Ni, Sr, and Ca. Lines of Fe III and other atoms with ionisation potentials <30.5 v. (N II, C II, Ti III) are also detected, and forbidden Fe II and III lines may occur. A. J. E. W.

Equivalent widths of helium lines in earlytype stars. L. GOLDBERG (Astrophys. J., 1939, 89, 623-646).—Curves of growth have been constructed for the He lines in O- and B-type stars. L. S. T.

Temperature parameters from negative bands of nitrogen under excitation by electron impact. O. S. DUFFENDACK and K. T. CHAO (Physical Rev., 1939, [ii], 56, 176—184; cf. A., 1934, 823).—In a field-free space, temp. determinations along the axis of the discharge tube were made from measurements of band intensity distribution under different excitation conditions. Good agreement between theory and experiment was obtained. The change of thermal conductivity of the gas was found to account for the variation of temp. with gas pressure. The indicated temp. was independent of the accelerating potentials from 20 to 800 v. The non-transference of energy between electrons and mol. rotation is attributed to the large difference of the masses of the electrons and N₂ mols. N. M. B.

Paschen-Back effect. V. Theory of the effect for intermediate coupling. J. B. GREEN and J. F. EICHELBERGER. VI. Spectrum of neon. J. B. GREEN and J. A. PEOPLES, jun. (Physical Rev., 1939, [ii], 56, 51-53, 54-57).-V. Mathematical. General spectroscopic theory is applied and simplified methods are developed for determining the positions of the energy levels and intensities of lines for cases of intermediate coupling. They are expressed in terms of LS coupling as the zero-order functions.

VI. Methods developed above are applied to the spectrum of Ne. When applied to several lines of the $p^5p \rightarrow p^5s$ and $p^5p \rightarrow p^5d$ transitions, results are in good agreement with observed patterns. N. M. B.

Intensity ratio of the two components of the D line in the moving and stationary emission. J. STARK and H. VERLEGER (Physikal. Z., 1939, 40, 518–519).—The intensity ratio D_2/D_1 is greater for moving than for stationary emission. A. J. M.

A. J. E. W.

Characteristic lines of the low-voltage arc in argon. H. KNIEPKAMP (Z. tech. Physik, 1936, 17, 398—404; Chem. Zentr., 1937, i, 1381).—The effect of the discharge conditions on the characteristic lines, using hot and oxide cathodes, is discussed in detail. A. J. E. W.

Pressure displacements in the second spectrum of iron. C. J. HUMPHREYS (J. Res. Nat. Bur. Stand., 1939, 23, 125—135).—The changes in λ of the ultra-violet lines of the Fe II spectrum resulting from pressure changes of 1 or 2 atm. have been measured with Fabry-Perot interferometers. The pressure effect is only ~1 in 6×10^6 for 1 atm. pressure change and demands an increase of 0.001 A. in only five of the proposed secondary λ standards, measured by Burns and Walters, to convert from vac. arc to arc in air. J. W. S.

New X-ray lines in the L series resulting from K Auger transitions. C. J. BURBANK (Physical Rev., 1939, [ii], 56, 142—146).—Using a highpotential X-ray vac. spectrograph with an anode of thin Ag foil backed with Al, and precautions to suppress continuous background radiation, new Xray lines in the L series of Ag were found at $4\cdot030$, $4\cdot016$, $3\cdot805$, and a much fainter line at $4\cdot023$ A. The lines are due to processes in which an atom, initially ionised in the K shell, undergoes transitions of the type $K \rightarrow LL +$ expelled electron (Auger transition) and $LL \rightarrow LM +$ quantum (radiative transition). The lines are more widely separated from each other and from the diagram lines than those previously observed from multiply ionised atoms.

N. M. B.

Theory of the X-ray lines LL—LM. R. D. RICHTMYER (Physical Rev., 1939, [ii], 56, 146—152). —X-Ray line structure to be expected from the transitions is calc. by quantum theory, and results agree satisfactorily with observation (cf. preceding abstract). N. M. B.

Absorption and emission spectra of rare earth crystals. P. C. MUKHERJI (Indian J. Physics, 1939, 13, 185—197; cf. A., 1938, I, 494).—Correlation of the absorption and emission spectra of the rare-earth ions has been attempted. Ce^{\cdot} ions in CeCl₃ and Ce₂(SO₄)₃ crystals emit two discrete bands, the positions of which differ slightly in the two salts but are approx. the same for hydrated and dehydrated salts. The CeF₃ emission spectrum consists of three discrete bands, whilst high frequency excitation causes a weak luminescence on the long- λ side of them. These bands are attributed to the true fluorescence of Ce" ions and, in conformity with the explanation of the corresponding absorption spectra (cf. A., 1939, I, 16), are supposed to be due to $5D \rightarrow 4F$ transitions. The two bands observed with $CeCl_3$ and $Ce_2(SO_4)_3$, and the two low-frequency CeF3 bands, are due to the transitions $5^2D_{5/2} \rightarrow 4^2F_{5/2}$, 7/2, whilst the third CeF₃ band is due to $5^2D_{3/2} \rightarrow 4^2F_{5/2}$. The w of the emission and absorption bands are related. The weak luminescence of CeF₃ is possibly sensitised fluorescence. The La" ion in crystals does not fluoresce.

W. R. A.

Temperature classification of europium lines. A. S. KING (Astrophys. J., 1939, 89, 377-430; cf. A., 1931, 7).— $\lambda\lambda$ and temp. classifications for 3950 Eu lines from 2100 to 10165 A., ~2200 of which belong to neutral Eu, are recorded. The intensity range for both neutral and singly-ionised lines is large. An ultra-violet spark spectrum, absent from the arc, probably belongs to Eu III. Agreement of lines in the sunspot spectrum with the ultimate lines of Eu I indicates the presence of neutral Eu in the solar atm. Of the lines ascribed by Eder (A., 1918, ii, 181) to "eurosamarium," ~75% belong to known rare earths, ~ one-half being lines of Eu. Limiting $\lambda\lambda$ and the distinctive features of 17 bands appearing in the furnace spectrum of EuCl₃ (5695—7450 A.) are described. L. S. T.

Differences between the M_5 and M_4 absorption edges of gold in the pure metal and in a goldcopper alloy. J. W. McGRATH (Physical Rev., 1939, [ii], 56, 137—142).—The M_4 and M_5 edges were photographed in a vac. spectrometer. The change of lattice const. from 4.06 for gold to 3.86 A. for the alloy, which caused the energies of the lattice levels to change, produced shifts towards higher energies in Au M_5 of 2.5 and in Au M_4 of 6.8 e.v., showing that the final levels of these edge transitions are lattice levels. Results support the view that, if the same vals. of l are assigned to the low lattice levels as in free atoms, there are preferred at. to low lattice level transitions which are often given by $\Delta l = \pm 1$.

N. M. B.

Zeeman effect of the hyperfine structure of optically excited mercury resonance radiation. E. H. COLLINS (Physical Rev., 1939, [ii], 56, 48—51). —Magnetic fields of 0—2000 gauss were applied to the Hg resonance line 2537 A. and the Zeeman patterns for the hyperfine structure determined. Results agree with theory. The Paschen-Back effects for the hyperfine structure of ¹⁹⁹Hg and ²⁰¹Hg are worked out and experimental support is given for the view of Goudsmit and Bacher (cf. A., 1930, 265) that the Zeeman effect for the hyperfine structure may be treated in the same manner as that for the fine structure if the appropriate change in quantum nos. is made. N. M. B.

Extinguishing and depolarisation of the mercury fluorescence by hydrogen and deuterium. F. SUPPE (Z. Physik, 1939, 113, 141—149).—The degree of depolarisation and the extinguishing power of H_2 and D_2 on the Hg resonance line 2537 A. have been measured. In spite of their different masses and impact velocities, both particles exhibit similar quant. effects. Partial depolarisation with H_2 or D_2 is increased by addition of N_2 to either gas, but the strong depolarising power of N_2 is reduced by addition of H_2 or D_2 . L. G. G.

Regularities in the third spectrum of thorium. R. J. LANG (Physical Rev., 1939, [ii], 56, 272–273).— Using a condensed spark in air and in N₂ between metallic electrodes, the Th III spectrum in the range 3500-2200 A. was investigated. 12 even and 12 odd energy vals. and the lines on which these are based are tabulated. N. M. B.

Theory of control by quenching grids in gas discharges. F. LÜDI (Helv. Phys. Acta, 1936, 9, 655-677; Chem. Zentr., 1937, i, 1895).—A theory is developed for the extinction of d.c. discharges in Hg vapour by a negatively charged quenching grid, based on Schottky's theory of the positive column. The calc. time of extinction is approx. equal to the experimental val. (10⁻⁴ sec.). A. J. E. W.

Time of establishment of a glow discharge. R. SCHADE (Z. tech. Physik, 1936, 17, 391–393; Chem. Zentr., 1937, i, 1381).—Non-statistical delays of 10⁻⁵—1 sec. in the striking of a discharge represent the time of its establishment, which is dependent on the mechanism of development of the primary current.

A. J. E. W.

Positive column of a gaseous discharge. B. KLARFELD (Tech. Phys. U.S.S.R., 1938, 5, 913— 931).—Using the probe method, the ionisation in the positive column of a Hg-vapour discharge proceeds in a direct, non-cumulative way at pressures of ~0.001 mm. but at higher pressures it is cumulative, particularly at higher current strengths (I). For direct ionisation, potential gradient and electron temp. are independent of I but they decrease with increasing I for the cumulative ionisation. The data are discussed from the viewpoint of the low-pressure plasma theory of Tonks and Langmuir (A., 1929, 1359).

W. R. A. Extinguishing of the arc "hot-spot" at a mercury cathode. G. MIERDEL (Z. tech. Physik, 1936, 17, 452-455; Chem. Zentr., 1937, i, 1382).--A Hg arc is extinguished by reducing the current to zero for $\Rightarrow \sim 10^{-9}$ sec. This period is insufficient for appreciable change of the thermal conditions at the "hot-spot," but is \sim one order of magnitude > the time required for breakdown of the cathode field mechanism. A. J. E. W.

Secondary electron emission. IV. Compounds with a high capacity for secondary electron emission. V. Mechanism of secondary electron emission. H. BRUINING and J. H. DE BOER (Physica, 1939, 6, 823—833, 834—839; cf. A., 1939, I, 51).—IV. Pure NaCl has a high secondary electron emission which decreases with time as free Na accumulates. The Na arises from agglomeration of colour centres formed by loss of 3p electrons of Cl⁻. Measurements show that not all the secondary electrons can be emitted by the colour centres. The effect of field strength on the secondary emission of MgO, and the effect of O poisoning on a BaO–SrO cathode, suggest that the resistance of the layer has a marked influence.

V. A distribution of energy levels is proposed to account for the high secondary emission of compounds of metals with closed electron shells and low ionisation energy, and the low emission of those of metals with high ionisation energy. L. J. J.

Thermo-electronic study of molybdenumthoria [filaments]. P. GRAUWIN (Ann. Physique, 1939, [xi], **12**, 88—160).—A detailed account of work already noted (A., 1938, I, 109). W. R. A.

Dissociation of propane, propylene, and allene by electron impact. J. DELFOSSE and W. BLEAK-NEY (Physical Rev., 1939, [ii], 56, 256–260).— The appearance potentials of all the ions from $C_3H_8^+$ to $C_3H_2^+$ and $C_2H_5^+$ to $C_2H_2^+$ resulting from bombardment of C_3H_8 , C_3H_6 , and C_3H_4 were measured. Most of the reactions leading to the observed ions are specified, and this allows upper limits in the range 9–12 v. to be assigned to the ionisation potentials of the free radicals. N. M. B.

Condensation of supersaturated vapours on ions. L. SCHARRER (Ann. Physik, 1939, [v], 35, 619-637).—The condensation in a Wilson chamber of H₂O, EtOH, MeOH, C₆H₆, CCl₄, CHCl₃, PhCl, and mixtures of EtOH and H₂O and of CHCl₃ and EtOH, on positive and negative ions, and in the absence of ions, has been investigated, and condensation limits have been measured. O. D. S.

Atomic beam study of the hyperfine structure of the metastable ${}^{2}P_{3/2}$ state of 115 In. I. Electric quadrupole moment of 115 In. D. R. HAMILTON (Physical Rev., 1939, [ii], 56, 30—38).—Using the zero-moment method of at. beams, 13 zero-moment peaks were observed. Their behaviour is completely described by a hyperfine structure energy level equation, and consts. are evaluated. The total hyperfine structure separation is 0.1184 ± 0.0015 cm.⁻¹, the quadrupole moment of 115 In is 0.84×10^{-24} sq. cm., and the nuclear spin is 9/2. N. M. B.

International table of stable isotopes for 1939. F. W. ASTON, N. BOHR, O. HAHN, W. D. HARKINS, R. S. MULLIKEN, and M. L. OLIPHANT (Union Internat. Chim., 1939, 3—14; cf. A., 1938, I, 426).— The isotopes ³⁶S, ⁴⁶Ca, ⁴⁸Ca, ¹⁵²Gd, ¹⁵⁴Gd, ¹⁵⁸Dy, ¹⁶⁰Dy, ¹⁶²Er, ¹⁶⁴Er, ¹⁶⁸Yb, ¹⁷⁰Yb, and ¹⁷⁶Lu are added to the table. The abundance ratios of these elements and of Cl, Ti, Zn, Sr, Cd, Ba, and Tl are modified. O. D. S.

At. wt. of the natural elements and their isotopes. R. LAUTIÉ (Bull. Soc. chim., 1939, [v], 6, 1429—1434).—Further discussion and verification of the rule (cf. A., 1939, I, 603) that the difference between the mass no. and the at. no. is an even no. F. J. G.

Natural radioactivity of lutecium. W. F. LIBBY (Physical Rev., 1939, [ii], 56, 21–23).— The half-life of the Lu radioactivity reported by Heyden and Wefelmeier (cf. A., 1938, I, 547) is $2\cdot9\pm0\cdot5\times10^{12}$ years for the element or $7\cdot3\pm2\times10^{10}$ years for 176 Lu, which is probably the active isotope. Negative electrons are emitted. The upper energy limit of the spectrum is 215 ± 15 ke.v. N. M. B.

Standardisation of radium and radon solutions. D. BUCHGRABER (Sitzungsber. Akad. Wiss. Wien, 1936, IIa, 145, 261—267; Chem. Zentr., 1937, i, 1369).—The ionising activity of Rn represents 49.9% of the total activity of the Rn in equilibrium with its disintegration products. The logarithmic ionisation curves for equal degrees of saturation are parallel straight lines. A. J. E. W.

Differences in the counting of *H*-rays by electrical and scintillation methods. A. WAGNER (Sitzungsber. Akad. Wiss. Wien, 1936, II*a*, 145, 175—194; Chem. Zentr., 1937, i, 1368—1369; cf. A., 1929, 1123).—The scintillation method (ZnS) may give counts 50—70% > those recorded by a counter; the difference is not due to a radiation. The consequent uncertainty is not large in comparative scintillation measurements. A. J. E. W.

Development in time of chain reactions in a uraniferous mass. F. ADLER (Compt. rend., 1939, 209, 301-303).—A theory of the development of chains with time (t) in a uraniferous sphere surrounded by any medium affords an expression for the crit. radius, r_c , which is identical with that of Perrin (A., 1939, I, 398). Flügge's neutron density relation (*ibid.*, 447) is also obtained for small t vals. At room temp., $r_c = 72$ cm. The no. of neutrons in the sphere increases indefinitely with t $(r > r_c)$, rises asymptotically to a limiting val. $(r = r_c)$, or rises to a max. and then falls asymptotically to zero $(r < r_c)$. A. J. E. W.

Delayed γ -rays from uranium activated by neutrons. J. C. MOUZON and R. D. PARK (Physical Rev., 1939, [ii], 56, 238—241; cf. A., 1939, I, 294).— A cloud chamber in a magnetic field was operated in conjunction with a source of neutrons so as to observe γ -rays emitted during the bombardment of U by neutrons and the no. emitted ~ 0.5 sec. after bombardment in alternate expansions; the total no. emitted in the former case is considerably greater, although the energy distribution is about the same in the two expansions, indicating that more γ -rays are obtained which are coincident (or nearly so) with fission than those associated with a period up to several sec. N. M. B.

Neutron production and absorption in uranium. H. L. ANDERSON, E. FERMI, and L. SZILARD (Physical Rev., 1939, [ii], 56, 284-286; cf. A., 1939, I, 294).—An attempt was made to determine whether the no. of neutrons emitted from U under the action of slow neutrons exceeds the no. absorbed. To avoid errors due to deviations from a spherically symmetrical distribution, a photo-neutron source was placed at the centre of a tank containing 10% MnSO₄ solution with and without U_3O_8 distributed in cylinders throughout the tank. The activity was $\sim 10\%$ higher with U than without, showing that more neutrons are emitted than are absorbed. About 50% of the neutrons emitted by the source are absorbed as thermal neutrons by U, and the average emission is 1.2—1.5 neutrons per thermal neutron absorbed. The possibility of maintaining a nuclear chain reaction is discussed. N. M. B.

Absorption of slow neutrons in uranium. H. REDDEMANN and H. BOMKE (Naturwiss., 1939, 27, 518).—The absorption of slow neutrons in U, U_3O_8 , and PbO₂ has been determined. The total crosssections for Ra-Be neutrons which have passed through 2.5 cm. of paraffin, and have been filtered with Cd and Rh, are U 6 ± 2 , U_3O_8 16 ± 3 , and PbO₂ 5 ± 1 (×10⁻²⁴ sq. cm.). A. J. M.

Products of the disintegration of uranium by neutrons. P. ABELSON (Physical Rev., 1939, [ii], 56, 1-9).—A detailed account of results previously reported (cf. A., 1939, I, 296, 350). N. M. B.

Uranium and thorium fission produced by fast neutrons of nearly homogeneous energy. R. LADENBURG, M. H. KANNER, H. BARSCHALL, and C. C. VAN VOORHIS (Physical Rev., 1939, [ii], 56, 168—170).—The effective cross-section of U and Th fission for 2.4-Me.v. d-d neutrons is 5×10^{-25} and 1×10^{-25} sq. cm., respectively (uncertainty $\sim 25\%$). The ratio of the cross-sections for Th and U fission is the same within 10% for neutrons of 2.1, 2.4, 2.9, and 3.1 Me.v. average energy. N. M. B.

Some products of disintegration of thorium. O. HAHN, F. STRASSMANN, and S. FLÜGGE (Naturwiss., 1939, 27, 544—547).—Bombardment of Th by rapid neutrons gives rise to Ba isotopes of halflife 14 min., 300 hr., and 86 min., and I of half-life 2·3 hr. from Te of half-life 66 hr. and Mo of half-life approx. 66 hr. A. J. M.

Intensity of neutrons of thermal energy in the atmosphere at sea level. C. G. MONTGOMERY and D. D. MONTGOMERY (Physical Rev., 1939, [ii], 56, 10—12).—The no. of α -particles released in the disintegration of B by neutrons in the atm. was measured in an ionisation chamber filled with BF₃. The flux of neutrons of thermal energy was found to be 0.091 ± 0.007 per sq. cm. per min., or one thermal neutron for every 16 ionising cosmic rays. Consequences are discussed. N. M. B.

Collision cross-sections for D-D neutrons. W. H. ZINN, S. SEELY, and V. W. COHEN (Physical Rev., 1939, [ii], 56, 260—265).—Nuclear collision cross-sections of H, D, B, C, N, O, Na, Mg, Al, Si, S, Cl, K, Mn, Fe, Cu, Zn, Se, Mo, Sn, Hg, and Pb for $2\cdot88\pm0\cdot04$ -Me.v. neutrons from a D-D source were measured and found to vary irregularly with the at. wt. The proton cross-section determined for paraffin and for H₂O scatterers is $2\cdot36 \times 10^{-24}$ sq. cm., which is < the theoretical val. The cross-sections of C, N, O, Na, Al, S, and K for $2\cdot46$ -Me.v. neutrons are tabulated. Compared with the vals. for $2\cdot88$ -Me.v. neutrons, there is in some cases an increase and in others a decrease. N. M. B.

Investigation of boron by slow neutrons. W. E. GOOD and R. D. HILL (Physical Rev., 1939, [ii], 56, 288).—An ionisation chamber investigation of the ¹⁰B (n, α) disintegration shows that the distribution with respect to the plane perpendicular to the incident neutron direction is symmetrical.

N. M. B.

Organic compounds containing radioactive sulphur.—See A., 1939, II, 418.

Half-value period of ${}^{13}_{7}$ N. A. G. WARD (Proc. Camb. Phil. Soc., 1939, 35, 523—525).—A val. of $9\cdot93\pm0\cdot03$ min. has been obtained for the half-val. period of ${}^{13}_{7}$ N by measurements of the ionisation current in A due to quantum radiations from a source enclosed in Al sufficiently thick to absorb all positrons. L. J. J.

Atomic disintegration experiments with radium-B + -C as a source of radiation. II. Nitrogen. E. FISCHER-COLBRIE (Sitzungsber. Akad. Wiss. Wien, 1936, IIa, 145, 283—300; Chem. Zentr., 1937, i, 1368).—Absorption measurements show that two groups of *H*-rays are emitted during bombardment of N with α -particles from Ra-C'; the energies of the corresponding processes, which indicate two energy levels in the N nucleus, are -2.8 and -1.4 Me.v. The difference between these energies represents a γ -radiation. A. J. E. W.

Recoil of the nucleus in β-decay. H. R. CRANE and J. HALPERN (Physical Rev., 1939, [ii], 56, 232-237; cf. A., 1938, I, 383).—Continued experiments on the recoil of the nucleus in the disintegration of ³⁸Cl confirm that momentum is not conserved in the system consisting only of the nucleus and the emitted electron. By measuring the momenta of the electron and nucleus, the direction of emission of the neutrino with respect to the direction of the electron in each case was found, and results tend to accord with the Fermi theory. Investigations with NO₂, CO₂, N₂O, HNO₃, NH₃, H₂O, and air as to the manner in which droplets in the cloud chamber are produced by the recoil atom indicate that the products resulting from dissociation of the gas mols. act as centres for condensation, and this effect, in addition to ionisation, accounts for the droplets observed. N. M. B.

β- and γ-Radiations from ⁶⁴Cu and ¹⁵²Eu. A. W. TYLER (Physical Rev., 1939, [ii], 56, 125– 130).—Investigations with a magnetic spectrometer of high resolution show that ⁶⁴Cu emits both positrons and electrons of max. energy 0.659 ± 0.003 and 0.578 ± 0.003 Me.v. respectively. The spectra obtained with a very thin source contained fewer low-energy particles than those with a thicker source. The unmodified Fermi theory of β-decay is best for the thin source, while the Konopinski–Uhlenbeck modification holds for thicker sources. ¹⁵²Eu emits electrons of max. energy 1.885 ± 0.012 Me.v., and several γrays, three of which have energies 0.123 ± 0.001 , 0.163 ± 0.001 , and 0.725 ± 0.003 Me.v. N. M. B.

β-Ray spectra of phosphorus, sodium, and cobalt. J. L. LAWSON (Physical Rev., 1939, [ii], 56, 131-136).-Using a magnetic spectrometer of high resolving power, the shapes of the spectra in the case of P and Na showed fewer low-energy particles, because of the relative absence of scattering at the source, than previously reported, and tended to agree with the unmodified Fermi theory (cf. preceding The max. energy of the continuous abstract). electrons emitted from P and Na is 1.72 and 1.4 Me.v., respectively. The shape of the Co positron spectrum suggests two superimposed continuous distributions, and the observed upper energy limit of 1.50 Me.v. agrees fairly well with available data. The high resolution allows separation of the K and Lshell conversion electrons arising from a γ -ray in In. N. M. B.

Coupling of β - and γ -rays of radio-manganese and the energy levels of the stable iron nucleus. F. NORLING (Naturwiss., 1939, 27, 432—433).— Investigation of β - γ coincidences of radio-Mn gives results in agreement with the resolution of the β spectrum into two parts, the second being coupled with γ -rays. γ - γ coincidences were also found. A transformation and term scheme is given which embodies the experimental facts. The equation $n + {}^{55}\text{Mn} = 10 \text{ Me.v.} + {}^{56}\text{Fe}$ holds. Using Dempster's val. for the packing fraction of ${}^{56}\text{Fe}$, $(-7 \cdot 0 \pm 0.4) \times$ 10^{-4} , the mass of ${}^{55}\text{Mn}$ is 54.963. A. J. M. **Existence of radioactive** ²⁹Al. W. J. HENDER-SON and R. L. DORAN (Physical Rev., 1939, [ii], **56**, 123).—The decay curve of very pure Mg bombarded by α -particles from a cyclotron shows no evidence of ²⁹Al, and the activity previously attributed to ²⁹Al is considered to be due to Ca, present as an impurity in the Mg, giving rise to ⁴³Sc. N. M. B.

Energy released in the production of deuterium from beryllium under proton bombardment. L. S. SKAGGS (Physical Rev., 1939, [ii], 56, 24–29; cf. A., 1938, I, 489; 1939, I, 172).—The kinetic energy of the deuterons liberated in the reaction ⁹Be (p, d) ⁸Be was measured by deflecting the deuterons in an accurately known electrostatic field. From measurements at proton energies 258, 262, and 315 kv. the energy released was found to be 0.557 ± 0.006 Me.v. By combining the result with known energy data it is shown that the threshold for the disintegration of ⁹Be by γ -rays is 1.62 ± 0.02 Me.v., and that ⁸Be is stable with respect to disintegration into two α -particles by 0.174 ± 0.09 Me.v. N. M. B.

Self-diffusion of copper. J. STEIGMAN, W. SHOCKLEY, and F. C. NIX (Physical Rev., 1939, [ii], 56, 13—21).—Measurements were made with a radioactive isotope (⁶⁴Cu), prepared by neutron bombardment of Zn, and electroplated in a thin layer on the surface of a Cu disc. By measuring the decrease in β -ray emission from the sample due to the penetration of the ⁶⁴Cu the self-diffusion const. is found to be 11 sq. cm. per sec. exp. (-57,200/*RT*). Methods of analysing the data are given and the significance of the variation of activation energy between selfdiffusion and heterogeneous diffusion is discussed. N. M. B.

New reactions in light nuclei with high-energy protons. W. H. BARKAS (Physical Rev., 1939, [ii], 56, 287).—Evidence is given in support of the reaction ¹⁴N (¹H, ⁴He) ¹¹C (21 min.). A curve relating activity of ¹¹C recoils to proton range is given. Bombardment of B by 5.9-Me.v. protons gave rise to a very intense ¹¹C activity attributed mainly to the reaction ¹¹B (p, n) ¹¹C. Si bombarded with 5.8-Me.v. protons gave a strong 2.5-min. activity ascribed to the reaction ³⁰Si (p, n) ³⁰P. There was no evidence of the reaction ²⁹Si (p, α) ²⁶Al. N. M. B.

Disintegration of deuterium by protons and p-n reactions in light gaseous elements. W. H. BARKAS and M. G. WHITE (Physical Rev., 1939, [ii], 56, 288–289).—Using D_2 , H_2 , O_2 , N_2 , CO_2 , and A as targets for the proton beam from a cyclotron, an experiment to detect the reaction ${}^{1}\text{H} + {}^{2}\text{H} \rightarrow {}^{2}\text{H} + {}^{1}n$ (i) is described. Results show that from O_2 , N_2 , and C the neutron emission is \ll from D_2 , and from A about the same as from D_2 , giving evidence for the reaction ${}^{40}\text{A}$ (p, n) ${}^{40}\text{K}$. The estimated abs. cross-section in reaction (i) for 5·1-Me.v. protons is $\sim 1.4 \times 10^{-26}$ sq. cm. N. M. B.

Fission products of thorium. A. LANGSDORF, jun. (Physical Rev., 1939, [ii], 56, 205).—Several long-lived noble gases from Th irradiated with fast neutrons have been observed. One of these gases is 3-hr. Kr (probably ⁸⁸Kr) decaying into 18-min. Rb, probably ⁸⁸Rb (cf. Snell, A., 1938, I, 8). N. M. B. Artificial radioactivity and the gaps in the periodic table. H. A. C. MCKAY (Chem. and Ind., 1939, 762-763).—A review. W. R. A.

Energies released in the reactions ⁷Li (p,α) ⁴He and ⁶Li (d, α) ⁴He. S. K. ALLISON, L. S. SKAGGS, and N. M. SMITH, jun. (Physical Rev., 1939, [ii], 56, 288; cf. A., 1939, I, 292).—Precision re-measurement gave the energy vals. $17\cdot28\pm0\cdot03$ and $22\cdot20\pm0\cdot04$ Me.v., respectively. These vals. lead to the revised masses ⁶Li $6\cdot01682\pm0\cdot00011$, ⁷Li $7\cdot01784\pm0\cdot00009$, ⁸Be $8\cdot00766\pm0\cdot00015$, and ⁹Be $9\cdot01486\pm0\cdot00013$. (Cf. Barkas, *ibid.*, 297.) N. M. B.

Photographic investigation of atomic nuclear processes of ultra-radiation. E. SCHOPPER (Forsch. u. Fortschr., 1939, 15, 299–300; cf. A., 1939, I, 116). O. D. S.

Correlation of counter and electroscope measurements of cosmic radiation in the stratosphere. S. A. KORFF and W. E. DANFORTH (J. Franklin Inst., 1939, 228, 159–167). W. R. A.

Production of atomic and cosmic rays in supernovæ. F. ZWICKY (Proc. Nat. Acad. Sci., 1939, 25, 338—344).—Theoretical. W. R. A.

Origin of cosmic rays. F. CERNUSCHI (Physical Rev., 1939, [ii], 56, 120—121).—A mechanism for the provision of energy to explain the appearance of a supernova and the origin of cosmic radiation is proposed. N. M. B.

Study by counters of the secondary radiation of cosmic ultra-radiation at an altitude of 2300 metres. J. A. PRIEBSCH (Sitzungsber. Akad. Wiss. Wien, 1936, IIa, 145, 101—144; Chem. Zentr., 1937, i, 1369—1370).—The intensity of the secondary component is affected to a greater extent by atm. pressure (1% per mm.) than the total radiation, indicating a soft primary radiation. The pressure coeff. increases with altitude, owing to a widening of the energy spectrum of the secondary rays. A positive temp. effect (0.5% per degree) is observed.

A. J. E. W.

East-west symmetry of cosmic radiation at very high elevations near the equator and evidence that protons constitute the primary particles of the hard component. T. H. JOHNSON and J. G. BARRY (Physical Rev., 1939, [ii], 56, 219— 226).—Stratosphere flight experiments indicate that the asymmetry is $<\sim 7\%$. Analysis shows that $<\sim 10\%$ of the intensity at a depth of 1 m. H₂O is attributable to unbalanced positives. Evidence is advanced that the mesotrons are produced in the upper atm., not by the primary electrons of the soft component, but by an independent primary component consisting probably of protons or some other more massive positive ion. N. M. B.

Angular dispersion of cosmic radiation in the upper atmosphere resulting from deflexions of low-energy particles in the earth's magnetic field. T. H. JOHNSON (Physical Rev., 1939, [ii], 56, 226-231).—Mathematical. It is found that at a depth of 1 m. H₂O, rays with energy >15 Me.v. lie within 30°, and half of the intensity is within 5°, of the original direction. The correction to east-west asymmetry measurements for broadening at high elevations or for the inclusion of lower energies is negligible (cf. preceding abstract). N. M. B.

Hard showers in cosmic ultra-radiation and the second maximum of the Rossi curve. A. EHMERT (Z. Physik, 1939, 113, 234—246).—The absorption coeffs. for narrow-divergence showers in Pb, Fe, and H₂O are measured; for single particles the coeffs. are respectively slightly >0.15, 0.065, and 0.0135 per cm. A hypothesis is advanced in explanation of the second max. of the Rossi curve. L. G. G.

Supernovæ and the neutron-core stars. F. CERNUSCHI (Physical Rev., 1939, [ii], 56, 120).— Energy considerations indicate that a supernova does not represent the transition of an ordinary star into a neutron star, and that the formation of a neutron core can never produce an explosion as required to explain the appearance of a supernova. N. M. B.

Wave functions of the relativistic hydrogenic atom. L. DAVIS, jun. (Physical Rev., 1939, [ii], 56, 186-187).-Mathematical. N. M. B.

Self-consistent field, including exchange and superposition of configurations, with some results for oxygen. D. R. HARTREE, W. HARTREE, and B. SWIRLES (Phil. Trans., 1939, 238, A, 229— 247; cf. A., 1937, I, 271).—Mathematical. The single electron wave functions of O⁺ have been recalc. allowing for the superposition of configurations. The effect is small and does not remove the discrepancy between observed and calc. ratios of the intermultiplet separations (cf. *loc. cit.*). O. D. S.

Atom factors of positive ions. T. DERENZINI (Nuovo Cim., 1936, 13, 341—348; Chem. Zentr., 1937, i, 2092).—Atom factors for K (1·2), Na and Rb (0·4), and Sr (1·5 × 10⁸ cm.⁻¹) are calc. by the Fermi statistical method for sin θ/λ varying from 0 to the vals. in parentheses. Agreement with other methods is satisfactory. A. J. E. W.

Theory of particles of any spin. L. DE BROGLIE (Compt. rend., 1939, 209, 265—268).—The representation of the particle formed by fusion of two corpuscles of spin I is considered. The most general theory of particles of any spin is probably reached by considering the fusion of n corpuscles of spin $\frac{1}{2}$, giving a particle of max. total spin n/2. A. J. E. W.

Mean free path of mesotrons. H. ERTEL and W. KOLHÖRSTER (Naturwiss., 1939, 27, 550-551).— Mathematical. A simple expression for calculating the mean free path of mesotrons from the atm. pressure coeff. is deduced. The val. for the decomp. path calc. from the equation is 15.3 km., giving a val. of 2.25×10^9 e.v. for the energy of the mesotron. A. J. M.

Elastic collisions of mesons with electrons and protons. H. S. W. MASSEY and H. C. CORBEN (Proc. Camb. Phil. Soc., 1939, 35, 463-473).— Theoretical. Cross-sections for elastic scattering of mesons by protons and electrons are calc. For meson energies up to 100 times the rest energy, the results differ from those for Fermi-Dirac particles of the same mass only in the case of collisions with protons. In a Coulomb field the cross-section for scattering of a Inno L. J.J. meson of infinite energy is finite.

Multiple scattering of charged particles. S. GOUDSMIT and J. L. SAUNDERSON (Physical Rev., 1939, [ii], 56, 122-123).-Mathematical. N. M. B.

Self-energy and electromagnetic field of the electron. V. F. WEISSKOPF (Physical Rev., 1939, [ii], 56, 72-85).-Mathematical. N. M. B.

Position and width of the energy band of the valency electrons of sodium, potassium, rubidium, and cæsium. P. GOMBÁS (Z. Physik, 1939, 113, 150—160; cf. A., 1939, I, 118).—Mathematical. The energy band widths for the valency electrons in Na, K, Rb, and Cs are 7.43, 5.12, 3.98, and 3.44 e.v. L. G. G.

Nuclear five-body problem. W. A. TYRRELL, jun. (Physical Rev., 1939, [ii], 56, 250-255; cf. Margenau, A., 1939, I, 6).—Mathematical. Per-turbational and variational calculations with singleparticle Legendre functions are made for the nuclear five-body problem of ⁵He. Positions and limits of low-lying virtual ${}^{2}P$ and ${}^{2}S$ states are examined.

N. M. B. Theory of polarisability. I. M. M. BIEDER-MANN (Physica, 1939, 6, 717-720).-Silberstein's formula is proved and applied to He. L. J. J.

Regularity in nuclear magnetic moments. E. E. WITMER (Physical Rev., 1939, [ii], 56, 203).-Available data lead to the view that the magnetic moment μ of any nucleus is such that $14\mu = r\mu_N$, where r is a rational no., usually with a small denominator. N. M. B.

Fundamental relations of thermomagnetics. A. D. FOKKER (Physica, 1939, 6, 791-796). Theoretical. The interaction of a pair of magnetic atoms, and of a magnetic atom and a coil, is considered. L. J. J.

Simplified expression of the value of some complex atomic constants. L. LABOCCETTA (Ric. sci. Progr. tecn., 1936, [ii], 7, II, 330-331; Chem. Zentr., 1937, i, 2091).—Expressions are derived for the vals. (in e.m.u.) of a no. of fundamental consts. A. J. E. W.

Present dilemma regarding the values of e_i m, and h. New graphical method of present-ation. J. W. M. DU MOND (Physical Rev., 1939, [ii], 56, 153-164).-Experiments determining some function of one or more of the consts. e, m, and hare classified into groups, and the three most satis-factory experiments (the directly measured X-ray val. of e, concordant measurements of e/m, and the vals. of h/e from the limit of the continuous X-ray spectrum) are exhibited on a new type of diagram showing separately the results of all independent reliable determinations and emphasising the discrepancy graphically. It is concluded that there is some unsuspected flaw in the determination of h/eby the continuous X-ray spectrum method, and the need for renewed study of this experiment along with X-ray ionisation and excitation potentials over a wider range of voltages with better spectral resolution is stressed. I off street of to borner a to N. M. B. H

LL* (A., I.)

Structure and absorption spectrum of ophthalaldehydic acid. B. Hoï and L. C. KIN (Compt. rend., 1939, 209, 221-223).-The ultraviolet absorption spectra of 3-ethoxyphthalide (I) and Na o-phthalaldehydate (II) are different, but that of (I) closely resembles that of phthalide. Solutions of o-phthalaldehydic acid in H₂O or dioxan have spectra compounded of those of (I) and (II), showing that these solutions contain two tautomeric forms. J. L. D.

Spectral study of the arylamines and their hydrochlorides. A. WOHL (Bull. Soc. chim., 1939, [v], 6, 1312-1319).-Ultra-violet extinction curves are given for NH_2Ph , o- and $p-C_6H_4Me\cdot NH_2$, as well as N-Me derivatives, o- and p-NH2 C6H4 OMe, oand p-NH2 C6H4 CO2H, m-4-xylidine, and most of the hydrochlorides in H₂O and in aq. HCl. F. J. G.

Ultra-violet absorption of diazonium salts. A. WOHL (Bull. Soc. chim., 1939, [v], 6, 1319-1324).-Extinction curves are given for diazonium sulphates derived from NH, Ph, o-, m-, and p-C6H4Me·NH2, o-, m-, and $p-\mathrm{NH}_2\cdot\mathrm{C}_6\mathrm{H}_4\cdot\mathrm{OMe}$, o-, m-, and p- $NH_2 C_6H_4 CO_2H$, and $\beta C_{10}H_7 NH_2$. F. J. G.

Behaviour of dehydroisoandrosterone and androsterone in the *m*-dinitrobenzene reaction. -See A., 1939, II, 481.

cis-Azo-compounds. III. Absorption spectra. A. H. COOK, D. G. JONES, and J. B. POLYA (J.C.S., 1939, 1315-1320).-Absorption spectra of a no. of substituted cis-azobenzenes have been determined over the range 280-480 mµ., usually in CHCl, solution. Absorption spectra of the trans-isomerides have also been determined. The spectra of the trans-compounds usually consist of an intense (K) band $(320-370 \text{ m}\mu)$, a less intense (R) band (440-470 mµ.), and a third band at 230–270 mµ. The Rband is more intense in the spectra of the cis-compounds, with λ unchanged, while the K band is sometimes displaced, but is always weaker in the spectra of the *cis*-compounds. Stepwise isomeris-ation of the azo-linkage in 1:4-bisbenzeneazobenzene and -diphenyl has been studied.

A. J. M. Ultra-violet absorption spectra and constitution of organic molecules. K. DIMROTH (Angew. Chem., 1939, 52, 545-556).—A review.

W. R. A.

Structure and absorption spectrum of phthalonic acid. B. Hoï and L. C. KIN (Compt. rend., 1939, 209, 346-348).-The extinction coeff. curves (2350-3150 A.) for solid phthalonic acid (I) and its aq. and Et₂O solutions closely resemble those for phthalide-3-carboxylic acid, showing that (I) exists exclusively in the oxylactone form under these conditions. The keto-acid form of (I), stable in 0.4% NaOH, gives a totally different curve. A. J. E. W.

Absorption spectra of some sulphur compounds. R. A. MORTON and A. L. STUBBS (J.C.S., 1939, 1321—1324).—Comparison of the ultra-violet absorption spectrum of $C_6H_4 < \frac{S}{NH} > CS$ (Ia) [altern-

ative structure $C_6H_4 \leq \underset{N}{S} > C \cdot SH$ (Ib)] with those of

(b) III (a)

 $C_{6}H_{4} < \stackrel{S}{\underset{NMe}{NMe}} CS$ and $C_{6}H_{4} < \stackrel{S}{\underset{N}{\underset{N}{\gg}}} C$ ·SMe shows that I(a) is correct. The compound (II) may be formulated as $C_{6}H_{4} < \stackrel{CMe:CH}{\underset{NH-CS}{CMe}}$ or $C_{6}H_{4} < \stackrel{CMe:CH}{\underset{N==}{\underset{N==}{C}} C$ ·SH, but its absorption spectrum differs widely from that of $C_{6}H_{4} < \stackrel{CMe:CH}{\underset{N==}{\underset{SR}{C}} R$ (R = Me, Et, or Pr^{β}), from which it is inferred that (II) must be a thioketone if the ethers can be proved to be substituted thiolquinolines. Comparisons with the spectra of o-hydroxycarbanil, 1-hydroxybenzthiazole derivatives, and substituted quinolines and quinolones agree with the above structures. 2-Methyl-, m.p. 37°, -ethyl-, b.p. 170–173°/14 mm., -thio-4-methylauinoline are described. A. J. M.

Equilibrium between phosphorus paranitride, (PN)_n, and diatomic PN molecules, deduced from the band spectrum. H. MOUREU, B. ROSEN, and G. WETROFF (Compt. rend., 1939, 209, 207— 209).—The sole occurrence of PN bands in the absorption spectrum of the vapour over (PN)_n at $<450^{\circ}$ shows that the vapour consists of PN mols. resulting from the equilibrium (PN)_n \implies nPN, and not of mols. of a polymeride. Decomp. of the (PN)_n to P and N₂ occurs at >750°. The normal state of PN is ¹ Σ ($\omega_e = 1337$ cm.⁻¹). A. J. E. W.

Absorption spectra of certain P^{III} derivatives. II. T. MIŁOBĘDZKI and W. BOROWSKI. III. T. MIŁOBĘDZKI and M. LEWANDOWSKI (Rocz. Chem., 1939, 19, 507—508, 509—513).—II. Selective absorption in the ultra-violet by H_3PO_3 esters, previously reported (A., 1939, I, 238), was due to traces of C_5H_5N used in the prep. of the esters.

 C_5H_5N used in the prep. of the esters. III. P(OPr^a)₃ and PPr^aO(OPr^a)₂ were prepared by heating a mixture of OH·P(OPr^a)₂ and ONa·P(OPr^a)₂. The esters do not exhibit selective absorption in the ultra-violet; addition of 0·1—0·2% of C_5H_5N causes appearance of definite absorption bands. R. T.

Structure of the triplet bands $(d^{3}\Pi \rightarrow a^{3}\Pi)$ of carbon monoxide. L. GERÖ and F. SZABÓ (Ann. Physik, 1939, [v], **35**, 597-618).—Rotational structure is analysed. O. D. S.

Band spectrum of antimony monoxide (ShO). A. K. SENGUPTA (Indian J. Physics, 1939, 13, 145— 157).—The vibrational structure in the emission band spectrum of SbO (3200—6800 A.) has been analysed. The bands belong to two systems, (i) the more refrangible due to the ${}^{2}\Sigma \rightarrow {}^{2}\Pi$ transitions, and (ii) the less refrangible due to transitions ${}^{2}\Pi \rightarrow {}^{2}\Pi$. They have a common lower state with a separation of 2272 cm.⁻¹ between its II-components. This lower state is, from analogy with the other members of group V(b) oxides, the probable ground state of the SbO mol. W. R. A.

Electron vibration spectrum of neodymium salt crystals. K. H. HELLWEGE (Z. Physik, 1939, 113, 192—202).—The infra-red reflexion spectrum of $Zn_3Nd_2(NO_3)_{12}$,24H₂O is given over the range 25— 58 μ . The appearance of groups of lines in the absorption spectrum in the visible region is due to superposition of lattice vibrations on electron transitions, which also causes rules governing forbidden transitions to break down. L. G. G.

Arrangement of electron bands in solution spectra. III. Light absorption of nitrous and nitric acids, and their salts and esters. G. KORTÜM (Z. physikal. Chem., 1939, B, 43, 418– 431).—Theoretical. The possible structures of HNO₂, HNO₃, and derivatives thereof in solution, and the activation and photochemical decomp. of these mols. as revealed by absorption spectra, are discussed. C. R. H.

High-frequency discharges and their application to molecular spectroscopy. P. MESNAGE (Ann. Physique, 1939, [xi], 12, 5—87).—The use of the high-frequency electrodeless discharge as a source of band spectra is discussed and has been studied for $FeCl_2$, $FeBr_2$, $NiCl_2$, $NiBr_2$, $CoCl_2$, $CoBr_2$, $MnCl_2$, $MnBr_2$, $CrCl_3$, and the alkaline-earth iodides. Anhyd. specimens in a cylindrical tube are placed along the axis of a solenoid through which a high-frequency current passes. The salt must be heated, and the presence of Ne is essential to the ignition and maintenance of the discharge. The spectra described have mostly not been observed previously; the iodides of Fe metals show no mol. spectra. W. R. A.

Absorption spectrum of the dichromate ion at 20° K. J. TELTOW (Z. physikal. Chem., 1939, B, 43, 375-383).-The visible absorption spectrum of Cr_2O_7'' ions, observed with thin layers (0.19 and 0.53 mm.) of $K_2Cr_2O_7$ at 20° K., contains ~20 sharp and 30 diffuse lines between 18,165 and 19,190 cm.⁻¹, and a continuum gradually increasing in intensity towards higher frequencies. Increase of temp. causes the intensity and definition of the lines to decrease rapidly, and at 60° K. they cannot be observed. The sharp lines are interpreted as pure electronic transitions which are split extensively as a result of asymmetrical crystal fields and the complicated nature of the Cr_2O_7'' ions. The diffuse lines, the continuum, and the temp.-dependence of the lines are due to lattice vibrations. etnoterroo oirriot W. R. A.

Band spectroscopic investigations on molecule formation. E. OLSSON (Naturwiss., 1939, 27, 582-583).—In the band spectrum of AlH there are some diffuse absorption lines due to breakdown of AlH into Al and H. These lines are also emitted when there is thermal excitation. It is possible to investigate the formation of AlH from its atoms by studying the emission of these lines. If the formation of the mol. proceeds largely in this manner, the band spectrum would develop in such a way that the diffuse lines would appear first and the other lines would gradually appear, gaining in intensity until the thermal equilibrium distribution was reached. The formation of AlH can also take place as follows: $Al + H_2 = AlH + H$, and in this case AlH mols. are formed in the stable ${}^{1}\Sigma$ and ${}^{1}\Pi$ states. A. J. M.

Ultra-violet rays and the solar cycle. J. R. ASHWORTH (Mem. Manchester Phil. Soc., 1939, 83, 81—86).—The obstruction of light by atm. pollution has been studied by determining daily the loss of visible light, and more particularly of ultra-violet rays, at Rochdale for a period of 10 years. The transparency of the atm., which was different on weekdays and Sundays, is dependent on wind direction. The nature and origin of the ultra-violet radiation and its connexion with the sunspot cycle are discussed.

W. R. A.

7.4 μ . fundamental vibration of methyl chloride. A. H. NIELSEN and H. H. NIELSEN (Physical Rev., 1939, [ii], 56, 274—275; cf. A., 1935, 145).—Using a prism-grating spectrometer, a new attempt to resolve the fundamental vibration-rotation band v_3 of MeCl is reported. The rotational line spacing averaged over the *P* and *R* branches is 1.15 cm.⁻¹, giving 48.0×10^{-40} g. cm.² for the moment of inertia *A*. The *Q* branch of the band has a satellite at a separation of ~1.0 cm.⁻¹ towards lower frequencies, and this line is taken to be the *Q* branch for v_3 in Me³⁷Cl, since it agrees with the calc. position of this band when valency forces are assumed. N. M. B.

Infra-red absorption spectrum of gaseous and liquid sulphur trioxide. H. GERDING and J. LECOMTE (Physica, 1939, 6, 737—763).—The absorption of liquid and gaseous SO₃ has been studied at 7—20 μ . SO₃ in the vapour phase has a plane symmetrical configuration with D_{sa} symmetry, and mol. vibration frequencies 653, 1068, 1332, and probably 530 cm.⁻¹ In the liquid phase mol. interaction causes considerable deviation from D_{sa} symmetry, and frequencies 530, 653, 1068, and 1378— 1402 cm.⁻¹ are found. The liquid contains a cyclic polymeride (SO₃)₃, with a non-planar ring S₃O₃ having C_{sv} symmetry. Data are recorded for absorption at ~2 μ . L. J. J.

Infra-red absorption of rare-earth ions. G. ROSENTHAL (Physikal. Z., 1939, 40, 509-511).— The infra-red absorption spectra of Yt, Tu, Er, Ho, Dy, Eu, Sm, Nd, Pr, and Ce ions have been determined up to 2.5μ . No absorption could be detected in the case of Tb. A. J. M.

Optical properties of zinc silicate phosphors. F. A. KRÖGER (Physica, 1939, 6, 764-778).-Excitation, absorption, and emission spectra of Zn₂SiO₄ and Zn₂SiO₄-Be₂SiO₄, activated with Mn, have been studied in the visible and ultra-violet to 2000 A. at room temp. and -180° . The phosphors are mixed crystals with Mn₂SiO₄, 0-50 mol.-% Mn. Emission at both temp. is in two bands with max. 5200 and 6100 A., attributed to electron transitions in Mn^{**}. Absorption is in three regions, viz., <2200 A. due to lattice absorption in Zn_2SiO_4 ; <3000 A. due to lattice absorption in Zn2SiO4-Mn2SiO4; and a system of bands at higher $\lambda\lambda$ to 5000 A. due to electronic transitions in Mn". Irradiation in the regions of lattice absorption gives phosphorescence and fluorescence, and in the third region gives L. J. J. fluorescence only.

Fundamental absorption of ZnS-MnS and ZnS-CdS-MnS mixed crystals. F. A. KRÖGER (Physica, 1939, 6, 779-784).—The long- λ limit of absorption of ZnS is at ~3380 A. With MnS in solid solution a new absorption band appears, identical with that of pure MnS, and having an edge at 3650 A. Increasing additions of CdS to ZnS-MnS produce a

progressive shift of the ZnS absorption towards longer λλ. L. J. J.

Fluorescence of flavins.—See A., 1939, III, 868. J. J. F.

Fluorescence and phosphorescence of photographic layers of silver halides in gelatin at low temperatures. W. MEIDINGER (Physikal. Z., 1939, 40, 517—518).—Investigations with a series of emulsions showed that those containing AgI fluoresced more intensely at low temp. than those containing pure AgBr. The greenish-yellow fluorescence becomes a max. at about 5% AgI. A AgCl-gelatin emulsion gave a bluish-white fluorescence when exposed to ultra-violet light. The afterglow of AgCl and AgBr layers rapidly disappears on warming, but a bright afterglow persists in the case of AgI when irradiated with ultra-violet or light of λ 4360. A. J. M.

Metastable character of the "anlagerung" points in crystalline phosphors. M. SCHÖN (Naturwiss., 1939, 27, 432).—Theoretical. The mechanism governing the term scheme of the absorption of a cryst. phosphor is discussed, and one agreeing well with observation in the case of sulphide phosphors is proposed. A. J. M.

Infra-red luminescence emission of rare elements. Application to analysis. M. SERVIGNE (Compt. rend., 1939, 209, 210—212).—The photoluminescence spectra (6000—12,000 A.) of CaWO₄ phosphors containing Pr and Nd are illustrated, and the $\lambda\lambda$ of the principal lines are given. Prominent series of lines at 8696—9124 and 10,772—11,188 A. are given by ~5 p.p.m. of Nd, affording a sensitive test which is not vitiated by Pr, Sm, Eu, or other rare earths. A. J. E. W.

Luminescence of sugar wafers. E. N. HARVEY (Science, 1939, 90, 35—36; cf. A., 1939, I, 404).— Sugar wafers flavoured with wintergreen (I) give a bright greenish flash of light when broken in the dark, due to the fluorescence of (I) being added to the luminescence of the sugar. With other flavourings the effect is smaller. After displacement of air between the sugar crystals by various solvents, there is triboluminescence on grinding. Excitation of luminescence in the sugar mol. as well as electrical discharges in the gas between the crystals can therefore occur. L. S. T.

Chemiluminescence of hydrazides of carboxylic acids.—See A., 1939, II, 425.

Raman spectrum of o-diphenylbenzene. S. K. MUKERJI and S. A. AZIZ (Indian J. Physics, 1939, 13, 209–217).—A detailed account of work already noted (A., 1938, I, 555). W. R. A.

Raman effect in camphor. B. M. ANAND and S. NARAIN (Indian J. Physics, 1939, **13**, 159–165).— The Raman spectra of cryst. camphor and of saturated solutions of camphor in CCl₄, CS₂, CHCl₃, MeOH, and AcOH are recorded and compared with existing data. w are assigned to various bonds and groupings in the mol. W. R. A.

Raman effect. CIII—CVI. Nitrogen compounds. XIII—XVI. XIII. Alkyl carbamates. J. WAGNER. XIV. Acid amides, carbamide, guanidine hydrochloride. A. W. REITZ and J. WAGNER. XV. Alkylated acid amides. K. W. F. KOHLRAUSCH and R. SEKA. XVI. Condensation products of aldehydes with amines (I). L. KAHOVEC (Z. physikal. Chem., 1939, B 43, 333— 338, 339—354, 355—363, 364—374).—XIII. Raman spectra of cryst. and molten NH_2 ·CO₂R (R = Me, Et, Pr^a, Pr^β, Bu^β) and of cryst. NH_2 ·CO₂R (R = Bu^a, *n*- and *iso*-C₅H₁₁) are recorded. Differences between the spectra for the cryst. and molten states are discussed.

XIV. Spectra of the following are recorded and discussed : $\text{HCO}\cdot\text{NH}_2$ (liquid); NH_2Ac (cryst., molten, in H_2O , in EtOH); $\text{EtCO}\cdot\text{NH}_2$ (cryst., molten); $\text{Pr}^{\alpha}\text{CO}\cdot\text{NH}_2$, $\text{Pr}^{\beta}\text{CO}\cdot\text{NH}_2$, $\text{Bu}^{\alpha}\text{CO}\cdot\text{NH}_2$, $\text{CO}(\text{NH}_2)_2$ (all cryst.); guanidine hydrochloride (cryst., in H_2O). The effect of physical state of the amides on the spectra is discussed. The amide spectra indicate the existence of a monomeric mol. of approx. classical amide structure and a dimeride with a resonance structure. The structures of $\text{CO}(\text{NH}_2)_2$ and of the guanidinium ion are also discussed. For all the substances, however, it is concluded that experimental data are inadequate to determine their structures unequivocally.

XV. Spectra of the following are recorded and discussed: NHAcR (R = Me, Et, Pr^a, Bu^a), NMe₂Ac (all liquid); CO(NHMe)₂, CO(NHEt)₂, and NH₂·CO·NEt₂ (all cryst.). Contrary to the results of other investigators, N-alkylated amides exhibit a NH valency frequency of normal intensity. It is concluded that the spectral complications of acid amides are not the result of enolisation.

XVI. The prep., Raman spectra, and structure for the following Schiff's bases are discussed: NMe:CHR (R = Me, b.p. 27—28°, *Et*, b.p. 51·5—53·5°, *Pr*^a, b.p. 80—82°, *Pr*^β, b.p. 68—70°), and for various *N*-trialkyltrimethylenetriamines, (NR:CH₂)₃ (R =Me, Et, Pr^a, *Pr*^β, b.p. 102—104°/11 mm., Bu^a, Bu^β, *iso*-C₅H₁₁). In the Schiff's bases, the *trans*-forms exist almost exclusively and no enolisation to R·NH·CH:CHR/ occurs. W. R. A.

Association of Raman frequencies of less than 1400 cm.-1 with longitudinal vibrations in elongated organic molecules. L. SIMONS (Soc. Sci. fenn., Comm. phys.-math., 1936, 8, No. 16, 12 pp.; Chem. Zentr., 1937, i, 1406).—A theory of Raman w for a linear chain of 2-8 atoms of equal mass is developed, and comparison is made with Raman data for a no. of org. mols. at w~1400 cm.-1, which is the upper limit of longitudinal vibrations in a C-chain. The no. of Raman lines in this region increases with the no. of C atoms; the lines are segregated in groups, the mean w of which are in approx. agreement with theory. Deviations from the calc. vv are caused by the angles in the C-chain, and by attached groups. Numerical agreement occurs only with a mol. of elongated form giving Raman lines of the correct state of polarisation.

A. J. E. W.

Behaviour of the Raman bands of water in solutions of some sulphates. F. CENNAMO (Nuovo Cim., 1936, 13, 304-309; Chem. Zentr., 1937, i, 1891).—The max. of the H_2O Raman band at ~3500 cm.⁻¹ have been measured for aq. solutions of CuSO₄, MnSO₄, and FeSO₄. A. J. E. W.

Raman spectra of crystalline powders. Hydrates. E. CANALS and H. COLLET (Compt. rend., 1939, 209, 212—214).—MgSO₄,7, 6, and $1H_2O$, Na₂HPO₄,12, 7, and $2H_2O$, and $CuSO_4$,5 and $3H_2O$ give broad, diffuse Raman bands (3100— 3900 cm.⁻¹) with several max., the vv of which are recorded. The most persistent band occurs at ~3400 cm.⁻¹; with Na₂HPO₄ the v of this band decreases with the no. of H_2O . No apparent relation exists between the Raman spectra of different hydrates of the same salt, salts of the same degree of hydration, or hydrates of the same cryst. form. In general the bands become wider as the no. of H_2O is reduced. A. J. E. W.

Secondary electron emission of pure metals in the ordered and disordered state. R. SUHR-MANN and W. KUNDT (Naturwiss., 1939, 27, 548).— The dependence of the efficiency of secondary electron emission, S/P (S = secondary electron current, P = primary electron current), on crystal structure can be determined with thin films of metals deposited at low temp. (83° K.) in a high vac. At low temp. such films are disordered, the orientation becoming more complete as the temp. is raised. To investigate the effect of lattice order on the secondary emission, S/P has been determined for such films with varying accelerating potentials of the primary electrons, between 83° and 293° κ . For Cu, Ag, and Au, S/Pfor the disordered state was > that for the ordered state. If a new film is deposited on an ordered film at low temp. this shows the higher efficiency at low temp. of the disordered state. After warming and re-cooling the smaller efficiency of the ordered state is found. used by a bloos not more detection A. J. M.

Effect of adsorbed oxygen on the secondary electron emission of pure metals at 83° and 293° K. R. SUHRMANN and W. KUNDT (Naturwiss., 1939, 27, 548).—The curve of efficiency of secondary electron emission against accelerating potential of primary electrons is considerably higher at 83° K. than at 293° K. for films of Cu, Ag, and Au which had adsorbed O₂ at room temp. It is considered that this result can be explained by a change in the mol. state of the adsorbed O₂ with temp. There was no change in the secondary electron emission when mol. H₂ was adsorbed. A. J. M.

Theory of electrical breakdown of solid insulators. W. FRANZ (Naturwiss., 1939, 27, 433— 434).—The hypothesis of von Hippel that electrical breakdown of solid insulators depends on ionisation by electron collision is discussed in connexion with a calculation by Fröhlich (A., 1937, I, 444), which, however, is paradoxical. A more accurate calculation, taking into account the widths of energy bands of conductivity electrons, gives field strengths which are of the right magnitude but are considerably affected by temp., contrary to experiment. A wavemechanistic treatment is necessary to overcome this discrepancy. A. J. M. Effect of pressure on the positive point-toplane discharge in N_2 , O_2 , CO_2 , SO_2 , SF_6 , CCl_2F_2 , A, He, and H_2 . H. C. POLLOCK and F. S. COOPER (Physical Rev., 1939, [ii], 56, 170–175).— The voltage at which corona first appears in a 3-mm. point-to-plane gap and the breakdown voltage of the gap were determined, with point both positive and negative, and over a pressure range of ~30 atm., for the gases alone and for some mixtures. Voltagepressure curves are given and types of corona are discussed. There is a marked dependence of the positive point breakdown voltage on pressure in those gases which form negative ions. N. M. B.

Electric moments in some homologous series. P. TRUNEL (Ann. Chim., 1939, [xi], 12, 93-168).-The degree of interaction between the substituent groups in compounds of the type $X \cdot [CH_2]_n \cdot X$ has been studied by determination of the dipole moments of a no. of diamines $(C_2 - C_8)$ and dinitriles $(C_3 - C_{12})$ in C_6H_6 solution at 25° and 45° or 75°. For the diamines μ is independent of temp. and agrees with vals. calc. for free rotation about the C·C bond. For the dinitriles μ is < the val. for free rotation, the divergence decreasing with rise of temp. and with increasing chain-length from C_6 , becoming negligible at C_{12} . The relative divergence is a max. at C_6 , and this cannot be attributed to association, for the cryoscopic mol. wts. are normal, nor to the presence of a cyclic isomeride, for $[R]_{D}$ is normal. Other instances of anomalous behaviour at chain-lengths C₆ are cited. The following are described : ω -bromoundeco-amide, m.p. 88°, and -nitrile, $n_{\rm p}^{25}$ 1.4704; $\alpha\omega$ -dicyanodecane, m.p. 20°, n²⁵_D 1.4492; ε-bromohexonitrile, b.p. 120-130°/11 mm. F. J. G.

Temperature-independent negative Faraday effect. G. GASSMANN (Ann. Physik, 1939, [v], 35, 638-656).—The magnetic rotation of the plane of polarisation of light, and its variation with λ and with temp., have been measured for crystals of TiCl₄, UO₂(NO₃)₂,6H₂O, K(UO₂)(MeOAc)₃,H₂O, Ba[(Cl,Mn)O₄]₂,3H₂O, Al₂O₃, CuCl, K₄[Fe(CN)₆],3H₂O, Na₂[Fe(CN)₅,NO],2H₂O, and [Co(NH₃)₆](ClO₄)₃, and for a supercooled melt of UO₂(NO₃)₂2H₂O, solutions of TiO₂,UO₃, and WO₃ in borax glass, and aq. CrO₃. A strong negative Faraday effect, independent of temp., is shown by compounds containing transition

ions in a state of high valency. Results are compared with the theory of Serber (A., 1932, 1077). O. D. S.

Resonance and physical and chemical properties of diphenyl types.—See A., 1939, II, 412.

Critique of the pair theory of mesomerism. E. H. LLOYD and W. G. PENNEY (Trans. Faraday Soc., 1939, 35, 835–840).—Energies of the bonds in (CH₂:CH)₂, C(:CH₂)₂, (CH:C)₂, and C₆H₆ are considered. Although the regular hexagon structure for C₆H₆ is the most stable it is easily distorted. F. R. G.

Structure and energies of some hydrocarbon molecules. J. E. LENNARD-JONES and C. A. COULSON (Trans. Faraday Soc., 1939, 35, 811—823).— A review of theoretical valency rules in mols. (cf. Coulson, A., 1939, I, 243). The C to C bond energies and lengths deduced are in agreement with experimental vals. The properties of mobile electrons permit the transmission of influences from one part of a mol. to another, and also help to form a temporary union between two mols. such as $(CH_2:CH)_2$ leading to polymerisation, and modification of the electric and magnetic properties. F, R. G.

Normal vibrations and the configurations of hydrazine. I. Group theory calculations. K. SCHÄFER (Z. physikal. Chem., 1939, B, 43, 409– 417).—Selection rules for infra-red and Raman spectra of possible configurations of N_2H_4 are derived. C. R. H.

Vibration-rotation energies of the non-linear triatomic XY₂ type of molecule. W. H. SHAFFER and H. H. NIELSEN (Physical Rev., 1939, [ii], 56, 188—202).—Mathematical. The energies and their dependence on the consts. occurring in the potential energy function are examined quantum-mechanically. N. M. B.

Applications of magnetism, particularly in inorganic chemistry. W. KLEMM (Z. Elektrochem., 1939, 45, 583—592).—A review. J. W. S.

Magnetism and organic chemistry. E. MÜL-LER (Z. Elektrochem., 1939, 45, 593—597; cf. A., 1938, I, 565).—A review of the relationship between the structure and magnetic behaviour of org. mols, including the K compounds of ketones. J. W. S.

Order and disorder in pure liquids and solutions. J. H. HILDEBRAND (Science, 1939, 90, 1-8).-A lecture. L. S. T.

Nature of the bond between dipolar molecules and the central ion in the inner sphere of complex compounds. A. M. SHARNOVSKI and B. E. HAISINSKI (Chimia, 1936, 7-23).-The salts Rb[AuI], $Rb[TII_4]$, $Rb_8MAu_8I_{22}$ (M = Be, Mg, Ca, Zn, Cd, Hg), and $Rb_5MTl_2AuI_{16}$ (M = Zn, Cd, Hg) are described. Their thermostability rises with increasing complexity, but falls with increasing ionic radius of M, being smaller for the alkaline-earth than for the Zn group. Attempts to prepare salts with Sr or Ba in the inner sphere were unsuccessful. The stability of the more complex salts is related to resonance between the electronospheres of the inner sphere atoms and the nucleus, this leading to establishment of attractive forces \ge those expected on the basis of the electrostatic theory. R. T.

Structure of proteins .- See A., 1939, II, 461.

Constitution of cellulose with special regard to hydrolytic experiments. O. ANT-WUORINEN (Suomen Kem., 1939, 12, A, 103-108).—Dissolved cellulose (I) is hydrolysed preferentially at the middle of the chains. Native or repptd. (I) is not hydrolysed uniformly, chains forming part of the crystal lattice having a different chemical resistance from chains in the amorphous interlattice region. Crystallites of native (I) are more cohesive than those of repptd. (I). Mols. of native (I) are probably too long to dissolve in any solvent; irreversible fission always precedes dissolution. M. H. M. A.

Van der Waals forces. H. MARGENAU (Rev. Mod. Physics, 1939, 11, 1-35).—A crit. discussion of the forces between polar mols., between non-polar mols., and between excited mols., based on the theory of London (A., 1937, I, 116). Tables of calc. consts. are given. W. R. A.

Nuclear magnetic moments of the boron isotopes. S. MILMAN, P. KUSCH, and I. I. RABI (Physical Rev., 1939, [ii], **56**, 165–167).—Using the mol. beam magnetic resonance method with $\text{Li}_2\text{B}_4\text{O}_7$, $\text{Na}_2\text{B}_4\text{O}_7$, $\text{K}_2\text{B}_4\text{O}_7$, NaBO_2 , and KBO_2 , the nuclear Landé g vals., in units of e/2Mc, are 0.597 ± 0.003 and 1.788 ± 0.005 , and evidence is given for assigning these to ¹⁰B and ¹¹B, respectively. Assuming respective nuclear spin vals. of I and 3/2, the magnetic moments are 0.597 ± 0.003 and 2.682 ± 0.008 nuclear magnetons, respectively. N. M. B.

Ridges in a liquid surface due to the temperature dependence of surface tension. A. V. HER-SHEY (Physical Rev., 1939, [ii], 56, 204).—Experiments show that the existence of a ridge at each border of a layer of a pure liquid draining from a flat vertical surface is due to the effect of temp. on surface tension, and is analogous to the occurrence of tears on the sides of a glass containing strong wine. The phenomenon is analysed mathematically.

N. M. B.

Derived Patterson analysis of the skeleton of the cyclol C_2 molecule. D. P. RILEY and I. FAN-KUCHEN (Nature, 1939, **143**, 648—649).—Vector maps of the C and N atoms of the skeleton of the cyclol C_2 mol. are derived. The results indicate that Crowfoot's X-ray data (A., 1938, I, 300) afford no direct evidence for the cyclol structure of insulin (cf. Wrinch, *ibid.*, 502). J. W. S.

Vector map of the cyclol C_2 molecule. E. H. NEVILLE (Nature, 1939, 143, 803).—A criticism (cf. preceding abstract). L. S. T.

Diffraction of X-rays at very small angles. Application to the study of ultramicroscopic phenomena. A. GUINIER (Ann. Physique, 1939, [xi], 12, 161-237; cf. A., 1938, I, 454, 611).—Full details are given of the investigation of systems of small dispersed particles by the diffraction of monochromatic X-rays at small angles. O. D. S.

Scattering of X-rays from crystals. (A) Total. (B) Alleged discontinuities in diffuse scattering at small angles. G. G. HARVEY (Physical Rev., 1939, [ii], 56, 242-247, 247-249).-(A) Mathematical. A general formula for the total intensity of X-radiation scattered by a general crystal in any direction is derived.

(B) The positions of discontinuities, reported by Laval (cf., A. 1936, 15), in the diffuse scattering from crystals all occur at places corresponding with reflexions of radiation of $\lambda/2$, $\lambda/3$, etc. of the main beam. For Al, an experiment designed to accentuate the expected effect shows, not discontinuities, but peaks corresponding with reflexions of radiation of half the primary λ , indicating that Laval's reported effect probably does not exist. N. M. B.

X-Ray fluorescing coefficient and the orientation of a zinc crystal. O. J. BALTZER and G. E. M. JAUNCEY (Physical Rev., 1939, [ii], 56, 289).—An experiment is described which indicates that the coeff. of X-ray fluorescence (K characteristic rays) is not a function of the orientation of an anisotropic crystal such as Zn. N. M. B.

Some problems connected with crystalgrowth. H. E. BUCKLEY (Mem. Manchester Phil. Soc., 1939, 83, 31-62).—A lecture. W. R. A.

Radiated crystals in cast stearin. C. G. CARLSON and A. HULTGREN (Jernkont. Ann., 1936, **120**, 577–587; Chem. Zentr., 1937, i, 1894).—Plates of stearin cast in moulds at 5° < the m.p. and etched with C_6H_6 exhibit a radiating cryst. structure which resembles that of cast steel, except that the striations are bent. Experiments described show that this bending is due to a convection current in a direction opposite to that of crystal growth. A. J. E. W.

Crystal structure of hexamethylbenzene and the length of the methyl group bond to aromatic carbon atoms. L. O. BROCKWAY and J. M. ROBERTSON (J.C.S., 1939, 1324-1332).—The crystal structure of C6Me6 has been reinvestigated using the double Fourier series method, and the early results of Lonsdale (A., 1929, 750) have been corr. Projection along the c axis gives an electron-density contour diagram in which two of the Me C atoms are clearly resolved. The distance between these C atoms and the centre of the ring is 2.92 A., and the Me bond length (Cal.-Car.) is 1.53 A., equal to the distance Cal.-Cal. and agreeing with the val. found by electron diffraction (Pauling and Brockway, A., 1937, I, 448). The min. intermol. approach distances are 3.70 and 3.87 A. between C atoms and 2.0-2.2 A. between H atoms. The C₆Me₆ mols. are packed as closely as H–H repulsions will allow. A. J. M.

X-Ray diffraction patterns of Hevea, manihot, and other rubbers. G. L. CLARK, S. T. GROSS, and W. H. SMITH (J. Res. Nat. Bur. Stand., 1939, 23, 1-5).—Rubber from Manihot glaziovii has been separated into Et_2O sol and gel fractions which have been examined by X-rays. The stretched sol and gel yield a few and many interferences, respectively. After crystallising by freezing at -20° for 24 hr. the gel still showed more interferences than the sol. The measurements accord with those obtained with Hevea rubber (A., 1938, I, 29). X-Ray examination of frozen specimens of rubber obtained from Funtumia elastica, Cryptostegia grandiflora, and Castilloa elastica indicates that all the rubbers have similar structure. The spacing of 54 A. previously observed in unstretched Hevea gel rubber has been observed, together with a spacing of about 108 A. in a stretched specimen. J. W. S.

Temperature-dependence of the system cellulose-sodium hydroxide-water. H. SOBUE, H. KIESSIG, and K. HESS (Z. physikal. Chem., 1939, **B**, 43, 309—328).—During the systematic investigation of the influence of temp. on the action of aq. NaOH of varied concess. on natural cellulose fibres, two new *Na-celluloses* have been found, viz., V at 12—25% NaOH, 5° to -10°, and Q at 7—8% NaOH, -5° to 1°, respectively. The X-ray diagram of V, which has a rhombic elementary cell, a 9·92, b 26·1, c 15·3 A., resembles that of Na-cellulose II, whilst that of Q is similar to that of Na-cellulose IV. W. R. A.

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Fibre period of sodium cellulose I. H. SOBUE (Z. physikal. Chem., 1939, **B**, 43, 329—332; cf. preceding abstract).—Consideration of new X-ray pictures of Na-cellulose I confirms the order of 20 A. for the fibre period, in support of the data of Hess and Trogus (A., 1931, 1219). W. R. A.

Superstructure in FeNi₃. F. E. HAWORTH (Physical Rev., 1939, [ii], 56, 289; cf. A., 1939, I, 11).—A specimen containing 73.8% Ni heated at 490° for 6 days and then cooled to 440° in 14 days gave superstructure lines with 16 hr. exposure to X-rays, confirming Leech and Sykes (cf. A., 1939, I, 412). Unlike the case of Cu₃Au, it appears that lowering of resistance does not first occur at the same temp. at which ordering becomes sufficient to be detected by X-rays. N. M. B.

X-Ray study of potassium chlorochromate, KCrO₃Cl. S. GAWRYCH (Rocz. Chem., 1939, 19, 413—417).—The unit cell consists of 4 mols. of KCrO₃Cl, and has a 7.83₂, b 7.46₅, c 7.82₁ A., β 88° 36′. The crystals belong to the monoclinicprismatic system, space-group C_{2h}^{5} — P_{1}^{2}/c . R. T.

Crystal structure of the pressure modification of potassium nitrate. T. F. W. BARTH (Z. physikal. Chem., 1939, **B**, 43, 448—450).—KNO₃ III belongs to the ditrigonal pyramidal system, spacegroup C_{3z}^{5} , with a_0 4.365 A., α 76° 56′. The K—O distance is 2.95 A. C. R. H.

[Structure of] double copper ammonium bromide. M. A. SILBERSTEIN (Bull. Soc. franç. Min., 1936, 59, 329–337; Chem. Zentr., 1937, i, 1398).— $CuBr_{2,2}NH_4Br, 2H_2O$ (tetragonal) has a 7.98, c 8.41 A., c/a 1.054, the unit cell containing 2 mols.; space-group $D_{4\pi}^{44}$ —P4/mnm. At. parameters are given. Each Cu atom is surrounded by 2 O and 4 Br in a distorted octahedron, the interat. distances being Cu—O 2.20, Cu—Br 2.46 and 3.14 A. A. J. E. W.

Electron diffraction with low voltages. J. J. TRILLAT (Compt. rend., 1939, 209, 201–203).— Satisfactory electron diffraction photographs (by reflexion or transmission) have been obtained with accelerator potentials of ~ 3500 v. (~ 10 ma.), using an external camera focussed on the fluorescent screen, and exposures varying from 30 sec. to several min. Plates treated with oil or Na salicylate may be used internally with ≤ 4000 v., but longer exposures are required. A. J. E. W.

Electron diffraction studies of thin films. I. Structure of very thin films. L. H. GERMER (Physical Rev., 1939, [ii], 56, 58-71).-Thin films having calc. thicknesses ~ 1 at. layer, deposited on org. supporting foils by vaporisation in high vac., were investigated by electron diffraction by the transmission method in the case of Au, CsI, Sb₂O₂, Pd, Cu, CuCl, Ni, CaF₂, Al, Mg, NaF, and Be, and satisfactory diffraction patterns characteristic of threedimensional crystals were obtained. The ionic compounds produce films made up of rather large crystals, 100 A. or more on a side, even in the thinnest films; metal films are, in general, made up of smaller crystals. Observations prove that atoms and mols. can move over the surface of the supporting foil, and that they are drawn together into crystals of considerable size.

Crystals in metal films are randomly oriented, except for slight orientation in Al films; crystals of some ionic compounds have strong preferential orientation, others are randomly oriented. No correlation is observed between average crystal shape and degree of orientation. Intensity anomalies are observed in diffraction patterns from CaF, and CuCl.

N. M. B.

Electron distribution in zinc oxide crystals. H. M. JAMES and V. A. JOHNSON (Physical Rev., 1939, [ii], 56, 119; cf. Yearian, A., 1935, 1452).— Deviations from calc. vals. of intensities in the electron diffraction pattern are attributed to the valency electrons, and observed intensities are approx. accounted for by assuming a concn. of valency electrons in the region between each Zn and its nearest O neighbour. Agreement with observed strong lines is given by a distribution of three electrons over ellipsoids (axes 2·1 and 0·35 A.) which enclose each pair of Zn–O nearest neighbours. N. M. B.

Electronic states at the surfaces of crystals. IV. Activation of adsorbed atoms by surface electrons. E. T. GOODWIN (Proc. Camb. Phil. Soc., 1939, 35, 474—484).—In the case of excitation of an adsorbed atom by surface electrons of an underlying metal, the mean life time in a typical excited level is 3.7×10^{-11} sec. The effect is negligible in conductors, but may be appreciable in semiconductors and insulators. L. J. J.

Magnetism and metal research. E. Vogt (Z. Elektrochem., 1939, 45, 597-608; cf. A., 1938, I, 391). J. W. S.

Problems of dia- and para-magnetism. C. J. GORTER (Z. Elektrochem., 1939, 45, 615-621). —The magnetic behaviour of metals, particularly in the superconducting state, and of salt hydrates is discussed. J. W. S.

Problems of ferromagnetism. W. DÖRING (Z. Elektrochem., 1939, 45, 621-629).—A review. Spontaneous magnetisation, the magnetisation curves of various alloys, and the practical applications of ferromagnetic materials are discussed. J. W. S.

Influence of mechanical strains on ferromagnetic properties. H. SCHLECHTWEG (Ann. Physik, 1939, [v], 35, 657—664).—Theoretical. The alteration in the exchange energy between neighbouring atoms, due to distortion of the crystal lattice, leads to a spatial variation in the wall energy between neighbouring elementary zones, and thence to a Barkhausen effect independent of magnetostriction and crystal anisotropy. O. D. S.

Electrical resistance of single molybdenum crystals under the action of strong transverse and longitudinal magnetic fields. A. FOROUD and E. JUSTI (Physikal. Z., 1939, 40, 501-506).--The resistance of single Mo crystals was determined over the temp. range $4\cdot 2$ --- 373° K., under the influence of strong external magnetic fields (up to 35,000 gauss). Mo shows a resistance anisotropy in the magnetic field, the anisotropy factor being independent of field strength. Mo follows Kohler's rule that the relative increase of resistance in the field is independent of temp., and is a function only of the ratio

of field strength to resistance without the field. Mo thus has the Ba type of mechanism for electrical conduction. The resistance of Mo without the field decreases below 20° K., approx. $\propto T^2$. The characteristic temp. of Mo is 384°, and the normal temp. coeff. (over the range 0-100° c.) is 0.471% per degree. A. J. M.

Calculation of the Peltier effect. J. A. CHAL-MERS (Proc. Camb. Phil. Soc., 1939, 35, 521-522).-By considering a virtual current at const. electron density instead of const. vols. of the metals, Fowler's val. for the Peltier coeff., derived thermodynamically, is increased by a factor of 3. L. J. J.

Experimental study of some cases of paramagnetism. G. FOEX and (MLLE.) M. \hat{G} RAFF (Compt. rend., 1939, 209, 160–162).— χ for Cr₂O₃ (prepared by ignition of K2Cr2O7), after an initial increase with temp., obeys the Weiss law at $>100^{\circ}$, and gives the 19.1 magneton moment of Cr.... This effect is due to the disappearance of the antiparallel orientation of interaction moments which accounts for the const. paramagnetism of Cr. CrSb and CrSb₂ also lose their paramagnetism at ~400°, but the $1/\chi-T$ variation is complex; thermal anomalies also occur in the temp. regions for which χ is max. The Weiss const. Θ has a high negative val. in each case.

A. J. E. W.

Magnetic after-effects at higher inductions. J. L. SNOEK (Physica, 1939, 6, 797-805).-A specimen of Fe containing 0.006% of C in solid solution shows the effect already described (A., 1939, I, 186) in a much higher degree. The reluctance $r(1/\mu)$ is composed of a const. term r_0 and a time- and temp.-dependent term $r_1 \propto$ the concn. of dissolved C or N. The max. in the curve of r as a function of temp. becomes less pronounced, and occurs at a higher temp., the higher is the induction. L. J. J.

Paramagnetic relaxation in gadolinium sulphate. W. J. DE HAAS and F. K. DU PRÉ (Physica, 1939, 6, 705-716).-By means of a mutual inductance bridge the differential susceptibility of Gd₂(SO₄)₃,8H₂O has been measured in an external magnetic field up to 1820 gauss at temp. down to 1.3° K. For the lower temp., the results are in agreement with theory (cf. A., 1938, I, 391), and the relaxation time is $\sim 10^{-2}$ sec. The heat capacity from the susceptibility data is in agreement with direct measurements, giving $0.00032T^3$ g.-cal. per $\frac{1}{2}$ mol. for the lattice vibrations and $0.56T^{-2}$ g.-cal. per $\frac{1}{2}$ mol. for the spin system. The overall splitting of the lowest level in Gd^{••} due to the electric field in the crystal is 1.17° K. L. J. J.

Magnetic measurements with long rods of considerable cross-section of steel and the newer alloys. H. SCHMIDT-GLENEWINKEL (Physikal. Z., 1939, 40, 519-533).-Rods of circular cross-section and bars of prismatic section were used for the determination of magnetic properties. The effect of eddy currents was negligible. The dimensions of the test-piece have no effect on the magnitude of the demagnetisation factor. The magnetic properties of some new Al alloys have been investigated. The alloys used [bondur (Al-Cu-Mg), B6 sea-H₂O (Al-Mg), pantal (Al-Mg-Si), and mangal (Al-Mn)] were

weakly magnetic. Data are also given for a Be alloy (B7M), an Fe-Ni alloy (V2A), and Riefler steels. A. J. M.

Magnetic susceptibility of manganous fluoride, MnF₂, at low temperatures. H. BIZETTE and B. TSAÏ (Compt. rend., 1939, 209, 205–206).—At -201° to room temp., $\chi_{\rm M} = C_{\rm M}/(T-\theta)$, with $C_{\rm M} = 4.08$ and $\theta = -113.2^{\circ}$ K., giving an at. moment of 5.73 Bohr magnetons (theoretical val., 5.92). MnF₂ has a transition point at -201° , below which χ decreases with falling temp., and increases slightly with the magnetic field. A. J. E. W.

Supersonic phenomena. W. T. RICHARDS (Rev. Mod. Physics, 1939, 11, 36-64).- A review dealing with the theory of the propagation of plane sound waves, the experimental determination of the velocity and absorption of sound, and the physical and chemical effects of sound waves of large amplitude. A comprehensive bibliography is given.

Velocity of sound in liquid helium under pressure. J. C. FINDLAY, A. PITT, H. G. SMITH, and J. O. WILHELM (Physical Rev., 1939, [ii], 56, 122; cf. A., 1938, I, 607).-Previous measurements for He evaporating under its own v.p. are extended for He under 1-5 atm. pressure, and results are plotted. Changes in compressibility at the λ -transition for N. M. B. various pressures are tabulated.

Stroboscopic phenomena due to passage of light through two ultrasonic wave-trains. R. BÄR (Helv. Phys. Acta, 1936, 9, 678-688; Chem. Zentr., 1937, i, 1366).—A stroboscopically interrupted light beam passing through an ultrasonic wave-train (<1000 kc. per sec.) gives visible fringes, the separation of which is the λ of the sound waves. An unmodulated beam passing through two successive wave-trains also gives stroboscopic effects, which are applied to the study of unevenly propagated waves (7000-10,000 kc. per sec.). A. J. E. W.

Birefringence measurements in the far ultraviolet. R. SERVANT (Compt. rend., 1939, 209, 206-207).—Vals. of the birefringence (b) of barytes $(n_m - n_p)$ and gypsum $(n_q - n_p)$ at <1700 A. are recorded. b increases rapidly in the neighbourhood of absorption bands, b for barytes in the Schumann region being \sim six times its val. in the visible spectrum. A. J. E. W.

Specific heat of gases at high temperatures. R. W. FENNING and A. C. WHIFFIN (Phil. Trans., 1939, 238, A, 149-228).-The mean mol. heats at const. vol., C, between 373° K. and temp. from 2370° to 3060° K. of CO, N₂, and CO₂ have been measured by comparison with the mol. heat of A by the method of matched explosions. C for H_2 and H_2O has been measured by the explosion method between 373° and 2090–2930° κ . $C_{co} = 4.854 + 0.0_37725T - 0.027725T$ $0.002284T = 0.0_6256T^2$ ($T = upper temp. in {^{\circ}K.}$). Vals. agree fairly well with spectroscopic data. Apparatus for measuring the compressibility of gases

W. R. A.

Heat capacity of potassium dihydrogen phosphate at the Curie point. C. C. STEPHENSON and J. G. HOOLEY (Physical Rev., 1939, [ii], 56, 121).— The heat capacity-temp. curve shows a large anomaly at 122° K. in agreement with theory. N. M. B.

Specific heat of cobalt from 2° to 18° K. G. DUYCKAERTS (Physica, 1939, 6, 817—822).—Data obtained by means of heating curves are in agreement with the expression $c = 1.20 \times 10^{-3}T + 464 \cdot 5(T/443)^3$ g.-cal. per g.-atom per degree. The first term represents the electronic, and the second term the lattice, sp. heat. L. J. J.

K. Schäfer's work on the thermal properties of ortho- and para-hydrogen and ortho- and para-deuterium. K. COHEN and H. C. UREY (Z. physikal. Chem., 1939, B, 43, 432–438).—Recent conclusions by Schäfer (cf. A., 1939, I, 311) which conflict with those of the authors (cf. *ibid.*, 248) are criticised. C. R. H.

Theory of the solid state and the m.p. G. MOLIÈRE (Ann. Physik, 1939, [v], **35**, 577—596).— Mathematical. O. D. S.

Equations of state and thermodynamics. N. V. KARPEN (Bull. Acad. Sci. Roumaine, 1939, 21, 199—205).—A re-presentation and expansion of demonstrations formerly noted (A., 1929, 387, 498, 1144). F. J. G.

Critical state and a new general equation of state. R. PLANK (Forsch. Gebiet Ingenieurw., A, 1936, 7, 161–173; Chem. Zentr., 1937, i, 2336).—An equation of the fifth degree in v, applicable to normal and associated substances for $v \gg v_e$ and $p \gg \sim 3p_e$, is evolved. A. J. E. W.

Effect of compression on the homogeneous systems ethylene and air-ethylene in the critical region. R. L. MCINTOSH, J. R. DACEY, and O. MAASS (Canad. J. Res., 1939, 17, B, 231-240).-The effect of compression on the d of C_2H_4 above and below the crit. temp., 9.50° , and also over a narrow region near this temp. ($\sim 0.3^{\circ}$) has been determined; at 9.17° spontaneous condensation occurred. Above 9.50° compression of a homogeneous system re-creates heterogeneity. Below 9.17° the liquid appearing on condensation is increased in d and amount by compression. Between these temp. condensation is brought about and a liquid separates subsequent to compression. It is suggested that the system, although apparently homogeneous, is still a two-phase system and that temp. variations bring about the mutual dispersion of the two phases. The re-creation of heterogeneity has also been observed with C2H4-air mixtures. C. R. H.

Physical properties of compressed gases. VI. Fugacity of carbon dioxide. W. E. DEMING and (Mrs.) L. S. DEMING (Physical Rev., 1939, [ii], 56, 108—112; cf. A., 1935, 1313).—Michel's compressibility data for CO₂ (cf. A., 1937, I, 453) for 0—150° and 0—3000 atm. are smoothed and interpolated graphically, and the fugacity f is computed at certain integral pressures. The ratio f/p decreases with p to a min. at ~600 atm. for all isotherms above crit.; it then increases, and fugacity first equals and then exceeds p.

L L** (A., I.)

At 50°, f = p at 2435 atm.; at 150°, f = p at 1675 atm. N. M. B.

Critical, pre-critical, and post-critical phenomena. W. ŚWIENTOSŁAWSKI (Rocz. Chem., 1939, 19, 375—386).—Apparatus for observation of the crit. state of liquids is described. The pre-crit. state is that of co-existence of liquid with mist, and in this state the surface tension of the liquid is only slightly > zero, and its d > that of the vapour. At the crit. point the mist disappears. The existence of a post-crit. state is postulated at temp. and pressures > the crit.

R. T. Conduction of heat. H. S. CARSLAW and J. C. JAEGER (Proc. Camb. Phil. Soc., 1939, 35, 394—404). —Theoretical. A solution of the problem of conduction of heat in a system consisting of a solid spherical shell which has an inner surface at a const. temp., and is bounded externally by an infinite solid of a different material, is obtained. L. J. J.

Formulæ for calculating compressibility and thermal expansion. R. GIANASSO (Nuovo Cim., 1936, 13, 355—365; Chem. Zentr., 1937, i, 2102— 2103).—Formulæ for the compressibility, vibration vv, and thermal expansion of ionic crystals of various lattice types are considered, and tested by experimental data. A. J. E. W.

Flow and viscosity of liquid helium. H. E. JOHNS, J. O. WILHELM, and H. G. SMITH (Canad. J. Res., 1939, 17, A, 149-163).-The flow of liquid He I and He II through capillaries of a wide variety of sizes and for a wide range of pressure differences has been measured. For He I the vol. per sec. flowing through the capillary strictly \propto the pressure head and η can be calc. from Poiseuille's formula. η decreases as temp. falls, in agreement with previous work. For He II the flow is expressible as a laminar flow obeying Poiseuille's law and of the same magnitude as for He I, together with a residual flow independent of the pressure head. Residual flow takes place in darkness but increases with increasing light intensity. The mechanism of residual flow is apparently connected with the ponderomotive effect which accompanies a temp. gradient in He II. Light absorption by the reservoir walls causes a slight temp. difference between the reservoir and the surrounding vessel. On the other hand, small pressure differences can also cause residual flow without input of thermal energy. Residual flow is further discussed in connexion with the fountain effect, high heat conductivity, and other properties. C. R. H.

Viscosities of chemically related liquids, and their dependence on mol. wt. and molecular volume. II. D. T. LEWIS and A. R. MORGAN (J.C.S., 1939, 1341—1345; cf. A., 1938, I, 446).—By considering the η of Ph halides it is shown that the intercept, α , of the Andrade equation $\log \eta = \beta/T - \alpha$ is primarily determined by the mol. vol. PhF is a normal member of the series of Ph halides as regards the η relationship. The equation $\log \eta = A(\log M)/T$ $+ x \log P + \log y$ is derived for a series of related liquids (x and y are consts. for the series, M = mol. wt., P = parachor, A is const.). There is good agreement between vals. of η calc. from this equation and those observed for the series of Pr halides. The equation is also applied to fused salts, but the data available do not permit a crucial test. A. J. M.

Relation between chain length and viscosity of polyoxyethylene glycols.—See A., 1939, II, 402.

Oiliness of liquids. VII. Static frictional coefficients of esters, ketones and glycerol. T. ISEMURA (Bull. Chem. Soc. Japan, 1939, 14, 270—273; cf. Akamatu *et al.*, B., 1938, 478 etc.).—The static frictional coeffs. μ for various esters and ketones are : MeOAc 0.87; EtOAc 0.81; Pr^aOAc 0.81; Bu^aOAc 0.78; $n-C_5H_{11}$ ·OAc 0.74; $n-C_8H_{17}$ ·OAc 0.73; EtCO_Et 0.80; COMe₂ 0.86; COMeEt 0.83; COEt₂ 0.84; COPhMe 0.73. For glycerol μ is 0.86; revised figures for H₂O and MeOH are 0.90 and 0.79, respectively. These results, obtained by placing the various liquids between glass plates, are very high and indicate the unsuitability of the compounds as lubricants. It is suggested that since the esters and ketones have their polar groups near the middle of the mol. they cannot easily orient themselves regularly with respect to the sliding surface. Glycerol has a high μ by virtue of its three polar groups which can all attach themselves to the glass. T. H. G.

Oiliness of liquids. VIII. Measurements of static friction coefficients for silver surfaces. T. ISEMURA (Bull. Chem. Soc. Japan, 1939, 14, 297–302). —Vals. of the static friction coeff. μ are given for H₂O and for hydrocarbons, alcohols, acids, and esters of the paraffin series, between clean Ag surfaces. The lubricating effect of H₂O and the hydrocarbons, including C₆H₆, is almost nil. For acids, alcohols, and esters, μ decreases generally in each group with increasing length of the C chain. With glass (A., 1937, I, 294) similar results were obtained for all substances except acids, for which μ was nearly independent of the no. of C atoms.

Equation of state for gas mixtures. I. R. KRTTSCHEVSKI and J. S. KAZARNOVSKI (J. Phys. Chem. Russ., 1939, 13, 378—396).—A semi-empirical equation for the total pressure, p, of a binary gas mixture is proposed: $p = p_1^{0}N_1 + p_2^{0}N_2 + aN_1N_2(p_1^{0} - p_2^{0})$, where p_1^{0} and p_2^{0} are the pressures of the components for a vol. equal to the mol. vol. of the mixture, N_1 and N_2 the mol. fractions of the components, and a is a const. which can be a function only of the temp. (cf. A., 1938, I, 611). It agrees with existing data for a wide range of temp., pressure, fugacity, and composition. R. C.

Thermal diffusion in mixtures of the inert gases. B. E. ATKINS, R. E. BASTICK, and T. L. IBBS (Proc. Roy. Soc. 1939, A, 172, 142-158).---Measurement of the thermal separation of all pairs of inert gases was made, and the repulsive force index obtained. In all cases the index decreases as a heavier mol. is substituted for a lighter one in a mixture. G. D. P.

Duhem's equation and Raoult's law. J. JAźWIŃSKA (Przemysł Chem., 1939, 23, 207-210).--For binary liquid mixtures Raoult's law is a mathematical consequence of Duhem's equation; both hold only when the heat effect of mixing the liquids is zero, and when the saturated or unsaturated vapours behave as ideal gases. This does not apply to azeotropic EtOH-H₂O mixtures. R. T.

Liquid mixtures separated into two layers and critical opalescence. P. MONDAIN-MONVAL and J. QUIQUEREZ (Kolloid-Z., 1939, 88, 140—144).— Examination of a large no. of binary and ternary mixtures of partly miscible liquids shows that no opalescence is observed when the difference between the refractive indices of the constituents is >0.03. As the difference increases opalescence appears, at first slight and restricted to the immediate neighbourhood of the crit. point, and later (difference >0.15) strongly marked and extending over a greater range of temp. and composition. The opalescence is an indication, crude compared with that afforded by viscosity measurements, of the existence of a colloidal emulsion near the crit. point. F. L. U.

Physical constants of hydrocarbon mixtures. II. A. V. LOZOVOI, M. K. DJAKOVA, and T. G. STEPANTZEVA (J. Gen. Chem. Russ., 1939, 9, 540— 546).—NH₂Ph points, n_{D}^{20} , and d_{4}^{20} are recorded for the binary systems alkylbenzene–alkyl*cyclo*hexane (alkyl = Bu^a, *n*- and *iso*-amyl, *n*-octyl), *o*- or *p*-C₆H₄MePr^a-1-methyl-2- or -4-*n*-propyl*cyclo*hexane, hydrindene–octahydrindene, and tetrahydronaphthalene–decahydronaphthalene. n-*Octyl*cyclohexane, b.p. 117—119°/11 mm., is described. R. T.

Theory of solutions. II. Significance of partial molar quantities in the theory of solutions. K. FREDENHAGEN and W. SCHULZE (Z. physikal. Chem., 1939, **B**, 43, 439—447; cf. A., 1938, **I**, 399).— Theoretical. For a solution containing dissolved Aand B, the partial mol. vol. (v_A) and mol. energy (u_A) of A are defined as the rate of change of total vol. (V) and energy (U) of the solution with change in the no. of mols. of A. The conclusion that v_A and u_A correspond with the true vol. and energy of A is correct only if V and U for the solution are linear functions of the no. of mols. of A. This condition is fulfilled if v_A and u_A = the mol. vol. and mol. energy of pure A. Deviations from linearity are due to reciprocal action between A and B. C. R. H.

Effect of an electric field on the viscosities of liquids [solutions]. O. KIMURA (Bull. Chem. Soc. Japan, 1939, 14, 243—249).—Using a modified Ostwald viscosimeter, to the capillary of which an electric field can be applied, η has been measured for solutions of lauric (I), myristic, palmitic, and stearic acids (II) and of cetyl alcohol (III) in C₆H₆ and in C₆H₁₄, with and without an applied field. η increases with the field. This effect ($\Delta\eta$) increases with the length of the mol. and is \propto concn. With (I) $\Delta\eta$ increases linearly with the voltage, but with (II) no further increase occurs beyond a certain voltage. (III) shows a stepwise increase of $\Delta\eta$ with voltage. The electro-viscous effect is due to the orientation of the mols. of the solute, the irregularities with (III) and (II) being apparently caused by association.

T. H. G. Dielectric properties of carbon monoxidehæmoglobin solutions mixed with foreign substances. S. ARRHENIUS (Physikal. Z., 1939, 40, 534-539).—The dielectric properties of solutions of CO-haemoglobin containing glucose, glycerol, $CO(NH_2)_2$, and glycine were investigated over the λ range 90—3000 m. In all cases the dipole moment is slightly < that of the aq. solution without the addition of foreign substances. The relaxation times for glucose and glycerol are < those calc. The results are discussed. A. J. M.

Physical chemistry of cystine peptides. J. P. GREENSTEIN, F. W. KLEMPERER, and J. WYMAN, jun. (J. Biol. Chem., 1939, **129**, 681–692).—The dielectric properties of diglycylcystine (I) are identical with those of its isomeride cystinyldiglycine (II) and their dipole moments are calc. to be 30.2. From titration data for (I) and cystine, titration consts. and actual acidity consts. are calc. The apparent mol. vol. of (I) is 199 c.c. compared with 194 c.c. for (II). E. M. W.

[Constitution of] solutions of nitric acid in diethyl ether. R. DALMON (Compt. rend., 1939, 209, 413—414).—The constancy of ε in the ultraviolet with varying concn. shows that Et₂O solutions of HNO₃ (\geq 30%) contain a single species of absorbing mol. The solutions do not nitrate cellulose, showing that this mol. is not the pseudo-form of HNO₃, as supposed by Hantzsch, but is probably a HNO₃-Et₂O compound. Solutions containing free nitrous vapours deposit NH₄NO₃ on keeping. A. J. E. W.

Relation between viscosity and concentration of mixtures of molten salts. A. G. STROMBERG (J. Phys. Chem. Russ., 1939, 13, 436—445).—The viscosity, η , of 0.05—0.7N. solutions of AgI in HgI₂ at 270—450° and of 0.009—0.5N. solutions of KCl in SbCl₃ at 100° is a linear function of the concn. It is inferred that here η is determined by the hydrodynamic factors postulated in Einstein's theory of the viscosity of sols, rather than by electrostatic effects.

R. C.

Transformations of the metastable B-phase in copper-zinc alloys. E. KAMINSKI (Tech. Phys. U.S.S.R., 1938, 5, 953-967).-In Cu-Zn alloys a martensite transformation of the β phase occurs and in alloys containing a certain amount of impurities the body-centred β phase lattice is changed on quenching into the face-centred tetragonal α' lattice. This is due to an initial change from the disordered β lattice to an ordered lattice of the CsCl type followed by the body-centred to the face-centred transformation. The α' lattice is unstable, but it can exist at room temp. for a very long time. On tempering it changes to the cubic α lattice, very slowly at 100° but more rapidly at higher temp. and at 200° it takes place in ~30 min. In quenched alloys a supersaturated β phase exists which on tempering decomposes into $\alpha + \beta$ phases through intermediate formation of a ζ phase between 200° and 270°. Production of the ordered α' lattice by quenching alloys containing impurities has been investigated; in the absence of impurities no ordered α' lattice was found. The transformation temp. is lowered as the concn. of Zn increases. (1 how previous W. R. A. T.

X-Ray study of recrystallisation of copper and α -brass. V. I. IVERONOVA and H. S. SCHDANOV (Metallwirts., 1936, 15, 1086–1088; Chem. Zentr., 1937, i, 1894).—The temp. of recrystallisation of α -

brass falls with increasing [Zn] (5-40%). Two successive stages are distinguishable in the recrystallisation of Cu, viz., growth of the individual grains, and aggregation to a massive structure, but abrupt formation of the massive structure occurs in α -brass. The dependence of the grain size and rate of recrystallisation on the previous thermal treatment is studied. A. J. E. W.

Binary alloy system Ag-Te. V. KOERN (Naturwiss., 1939, 27, 432).—The Ag-Te system has been investigated by thermal, microscopic, and X-ray methods. Only two compounds exist, Ag₂Te and Ag₁₂Te₇, both occurring in two modifications. α -Ag₂Te (low-temp. modification) is apparently orthorhombic, a 13.0, b 12.7, c 12.2 A. α -Ag₁₂Te₇ is hexagonal, a 13.429, c 8.4508 A., n = 3. Space-group D_{6h}^{1} — C6/mmm or D_{6}^{1} —C62. A. J. M.

Age-hardening of copper-aluminium alloy.----See B., 1939, 946.

Kinetics of deposition processes on the basis of magnetic measurements. H. AUER (Z. Elek-trochem., 1939, 45, 608-615).-Magnetic methods of detecting and investigating phase changes in ferrous and non-ferrous metals and alloys by magnetic measurements are discussed. A quenched sample of Al-Cu alloy (5% Cu) shows changes in magnetic susceptibility (χ) during age-hardening at room temp., χ varying linearly with log t (t = time of keeping). If the sample is kept at room temp. and subsequently heated at 200° χ returns to its initial val. before increasing again at the rate which would be anticipated. Experiments with samples aged at 100° indicate that this behaviour depends on the stage to which the aging has progressed, and the temp. to which it is subsequently heated, more advanced stages of hardening and lower temp. of heating favouring only a partial decrease in χ before the final increase. The interpretation of the results is discussed. J. W. S.

Niobium-iron alloys. R. GENDERS and R. HARRISON (Iron & Steel Inst., Sept., 1939, Advance copy No. 2, 9 pp.).—The phase diagram of the Nb–Fe system is of the same type as that of the Ta–Fe system. Alloys containing $\geq 50\%$ of Nb can be considered as an alloy of Fe and Fe₃Nb₂. Addition of >1% Nb to Fe increases hardness. Further hardening is obtained by tempering at 700° after quenching. The phase diagram for alloys containing $\geq 6\%$ of Nb completes and in general confirms that of Eggers and Peter (cf. A., 1939, I, 18, 19). Micrographs are given. C. R. H.

X-Ray investigation of the iron-rich nickeliron alloys. A. J. BRADLEY and H. J. GOLDSCHMIDT (Iron & Steel Inst., Sept., 1939, Advance copy No. 1, 17 pp.).—X-Ray powder photographs of Ni-Fe alloys containing 0.—35 at.-% Ni indicate that the γ - α transformation is spontaneous during the quenching of alloys containing <20% of Ni. Slow cooling tends to retain a certain amount of face-centred cubic structure in alloys containing >6% Ni. This effect is partly reversed if the alloys are immersed in liquid air. Annealing experiments indicate that the alloys are divisible into four ranges, viz., 0.—6, 6.—25, 25.—

v(a-c)

40, and 40—100% of Ni. The upper temp. limit to the two-phase $\alpha - \gamma$ range is 580°, all alloys containing >12% Ni being pure γ above that temp. The lower temp. limit to the range is 350°, at which temp. the α and γ phases react to form a phase with the approx. composition Fe₃Ni. Comparison is made between the alloys examined and the alloy Invar. The latter appears to be a supersaturated γ solid solution which, under certain heating conditions, may ppt. Fe₃Ni. An equilibrium diagram has been constructed.

C. R. H.

Properties of aluminium bronzes containing beryllium.—See B., 1939, 950.

Magnetic study of the iron-nickel-aluminium system. W. SUCKSMITH (Proc. Roy. Soc., 1939, A, 171, 525—540).—The magnetic saturation intensity has been measured for >80 alloys in the system at temp. up to the Curie point. Each phase region exhibits characteristic features and the magnetic effects accompanying order-disorder transformation are studied. G. D. P.

System iron-cobalt-tantalum. W. KÖSTER and G. BECKER (Arch. Eisenhüttenw., 1939–40, 13, 93– 94).—The phase boundaries in the region enclosed by Fe-Co-Co₅Ta₂-Fe₂Ta have been delineated at various temp. and are illustrated by a triangular diagram for 20°, and a perspective of the solid model. The hardest alloys are the martensitic ones containing 20–80% Co, at 8 and 10% Ta; a max. hardness at 50% Co occurred. R. C. M.

System iron-nickel-tin. P. SCHAFMEISTER and R. ERGANG (Arch. Eisenhüttenw., 1939, 13, 95-103).-The phase boundaries have been delineated at temp. up to 1500° in the region bounded by Fe-Ni-Ni₃Sn₂-Fe₂Sn. The two last-named compounds form a complete set of mixed crystals. Four primary mixed crystals occur, α , γ , ε (Fe₂Sn-Ni₃Sn₂), and non-magnetic β (Ni₃Sn). Two four-phase invariant points were found. Brinell hardness, remanence, and coercivity were determined for typical ferritic (Ni 5, Sn 15%), martensitic-austenitic (Ni 30, Sn 6%), and pure austenitic (Ni 62, Sn 9%) alloys after quenching from 1000° and annealing for 30 min. at various temp. up to 800°. The first alloy had a high max. hardness after annealing at 600°, the second a high max. coercivity after annealing at 700°, the temp. at which the martensite-austenite transition proceeds most rapidly. The pure austenite alloy had low vals. of all the three properties. The magnetic observations are in general agreement with those of Legat (B., 1938, 293). R. C. M.

Hydrogen bonding by negatively substituted CH groups. VI. Acetylenic compounds. M. J. COPLEY and C. E. HOLLEY, jun. (J. Amer. Chem. Soc., 1939, 61, 1599—1600; cf. A., 1939, I, 20).— The solubility of C_2H_2 in 17 solvents shows the same type of deviation from Raoult's law as does that of CHCl₂F, the C;C having the same effect as the electronegative halogen in activating the H. The heat of mixing of CH;CPh with NMe₂Ac, Et₂O, COMe₂, *cyclohexylamine*, and MeOAc is a max. for 1 : 1 mixtures, indicating existence of 1 : 1 mol. compounds. R. S. C. Solubility of barytes in distilled water. S. J. THUGUTT (Arch. Min. Soc. Sci. Varsovie, 1936, 12, 75—81; Chem. Zentr., 1937, i, 1391—1392).—A solution containing 0.00126 g. of $BaSO_4$ in 100 c.c., which exhibits Brownian movement, is prepared by heating finely-powdered barytes (2 g.) with H₂O (530 c.c.) at 203—206° for 49 hr., in a Pt-lined tube. The rapid separation of $BaSO_4$ from this solution explains the observed decrease of electrical conductivity of aq. $BaSO_4$. The occurrence of colloidal $BaSO_4$ in nature is also explained. A. J. E. W.

Solubility of zinc and cadmium nitrates in liquid ammonia. D. B. DONSKAJA and M. A. PORTNOV (J. Gen. Chem. Russ., 1939, 9, 526–531).— The solubility curve of $Zn(NO_3)_2$ in NH_3 consists of a no. of branches, corresponding with the ammoniates $Zn(NO_3)_2,10NH_3$ (-75° to -55°), $Zn(NO_3)_2,8NH_3$ (-55° to 0°), $Zn(NO_3)_2,6NH_3$ ($0-58^{\circ}$), and $Zn(NO_3)_2,4NH_3$ ($>58^{\circ}$). The crit. temp. of solubility is 61°. The solubility rises from -81° to $-77 \cdot 5^{\circ}$, above which it falls continuously. R. T.

Solutions of metallic cadmium in molten chlorides. S. KARPATSCHEV and A. STROMBERG (J. Phys. Chem. Russ., 1939, 13, 397—405).—The potential of a C electrode in a solution of Cd in a molten mixture of CdCl₂, KCl, and NaCl at 700° is given by $E = \text{const.} - 2 \cdot 3(RT/2F) \log [Cd]$, indicating that the Cd is dissolved as single atoms. The solubility of Cd in mixtures of the above chlorides has been deduced from e.m.f. measurements, the results being confirmed by direct determination. R. C.

Precipitability of hemicolloidal polyoxyethylene glycols.—See A., 1939, II, 402.

Halogen cyanides. II. Distribution of cyanogen bromide and iodide between benzene and water, and between benzene and some aqueous salt solutions. Synthesis and mol. wt. of cyanogen iodide. M. Møller (Kong. Dansk. Vidensk. Selsk., mat.-fys. Medd., 1936, 14, No. 3, 37 pp.; Chem. Zentr., 1937, i, 1412-1413).-The activities of CNI and CNBr in very dil. aq. solution are deduced from distribution measurements between C_6H_6 and H_2O , in which their mol. wts. are normal. The distribution between C_6H_6 and aq. NaClO₄, NaBr, KBr, KCl, KNO₃, and K₂SO₄ is also studied; the salting-out effect for CNBr in these solvents can be evaluated, as complex formation occurs only with Br'. CNI gives complexes (except with ClO_4^{\prime}), and the following equilibrium consts. are deduced : [CNIBr']/[CNI][Br'] = 0.65; [CNICl']/[CNI][Cl'] =0.39; [CNI·NO₃']/[CNI][NO₃'] = 0.14. The structure of the CN halides is discussed; the differences in their properties are due to variations in the position of the electron-pair between the halogen and CN. The prep. and purification of CNI are described.

A. J. E. W.

Dynamics of sorption. A. A. SHUCHOVITZKI, J. L. ZABESHINSKI, and D. S. SOMINSKI (J. Phys. Chem. Russ., 1939, 13, 303—310).—Mecklenburg and Kubelka's theory (Z. Elektrochem., 1925, 31, 488) is invalidated by mathematical and other errors and has no physical basis. R. C. Absorption of hydrogen by chromium. I. E. ADADUROV, N. I. PEVNI, I. I. RIVLIN, and G. P. KUSCHTA (Trudy Charkov Chim. Tech. Inst., 1939, No. 1, 12—18).—H₂ is not absorbed by Cr at ~800°. The catalytic activity (oxidation of NH₃) of 3:97Cr-Pt is \leq that of pure Pt, but the stability of the contact is considerably greater. The Cr-Pt lattice const. a = 3.8845 A., as compared with 3.9030 A. for pure Pt; after use, the val. of a rises to 3.9112 A., probably as a result of formation of CrN. R. T.

Sorption of gases on reduced nickel. II. Sorption of gaseous hydrogen bromide and hydrogen chloride and sorption of hydrogen bromide through a liquid medium. M. TAKE-BAYASHI (Bull. Chem. Soc. Japan, 1939, 14, 290— 294; cf. A., 1939, I, 253).—Data are recorded for the adsorption with time of HBr at 0° and of HCl at 0° and 20°. The equilibrium adsorption of both gases is greater at 20° than at 0°, and at either temp. the adsorption of HBr is > that of HCl. Adsorption of HBr from solution in CCl₄, corr. for concn., is slightly < from the gas. The presence of $o-C_6H_4(OH)_2$ (2 mg. per c.c.) increases the adsorption. F. L. U.

Adsorption of iodine vapour by powders. H. C. HAMAKER [with J. H. VAN DER VALK] (Rec. trav. chim., 1939, 58, 903—916).—The adsorption of I by finely-powdered $BaCO_3 + SrCO_3$ (1:1 mixed crystals), $BaSO_4$, and Al_2O_3 has been investigated with a view to its use as a measure of particle-size. The effects of various treatments on the reproducibility of the results is described. The amount of I adsorbed increases on grinding in a ball mill, proportionally to the cube root of the time of grinding. F. J. G.

Electrolyte adsorption and activity coefficient. III. Adsorption of neutral salts. I. W. OST-WALD (Kolloid-Z., 1939, 88, 144—161).—Data for the adsorption of neutral salts of valency type 1-1, 1-2, 1-4, 2-1, 3-1 on different varieties of C, on MnO₂ gel, and on Al₂O₃ conform to the relation previously established for acids (A., 1939, I, 366, 414). Departure from linearity is shown by salts which do not behave as strong electrolytes, e.g., CdI₂. The vals. of the consts. a and b in the equation $f_x = af_{c-x} + b$ afford a quant. measure of the adsorption activity of strong electrolytes, the most active [e.g., Al(CNS)₃ on C] being associated with large a and small b.

F. L. U. Adsorption of cis- and trans-azobenzene. H. FREUNDLICH and W. HELLER (J. Amer. Chem. Soc., 1939, 61, 2228-2230).-The adsorption of cis- (I) and trans-azobenzene (II) at 20° on Al₂O₃ and on charcoal in MeOH and in ligroin has been investigated. (I) is adsorbed more strongly than (II) on Al_2O_3 , markedly in ligroin and less so in MeOH. On the other hand, the (II) is adsorbed the more strongly on C, especially in MeOH. These results support the view that the more hydrophilic isomeride (I) will be more strongly adsorbed by the more strongly hydrophilic adsorbent (Al₂O₃), especially in the more hydrophobic medium (ligroin), and vice versa. Previous experimental data on the adsorption of maleic and fumaric acids on C in H₂O and of Me-violet on C and SiO, gel in H₂O and tetralin can also be explained

on this view. Additional evidence that (I) is the more hydrophilic is its greater solubility in H_2O and MeOH and lower solubility in ligroin than (II). W. R. A.

Chemical specificity of those modifications of a particular crystalline species which differ in energy content. II. γ -Al₂O₃. R. FRICKE and H. DEIFEL. III. ZnO and α -Fe₂O₃. R. FRICKE and H. KEEFER (Ber., 1939, 72, [B], 1568—1572, 1573—1576; cf. A., 1938, I, 532).—II. When specimens of γ -Al₂O₃ which have been dried under different conditions are shaken with aq. K₂HPO₄, the ratio (K' adsorbed): (HPO₄'' adsorbed) increases with increasing particle size, *i.e.*, decreasing energy content.

III. When specimens of ZnO and of α -Fe₂O₃ which have been dried under different conditions are shaken with aq. KOAc, the ratio (K^{*} adsorbed): (OAc' adsorbed) increases with decreasing energy content for ZnO, but decreases with decreasing energy content for α -Fe₂O₃. F. J. G.

Adsorption of hydrous metallic oxides by kieselguhr. E. C. C. BALY, W. P. PEPPER, and C. E. VERNON (Trans. Faraday Soc., 1939, 35, 1165-1175).—The adsorption of Al₂O₃, CoO, and NiO from dil. colloidal solution by carefully purified kieselguhr (I) has been followed by measuring the ζ-potential corresponding with increasing amounts of adsorbate. The curves so obtained show a sharp max. of ζ at a point corresponding with a complete unimol. layer of oxide. The max. vals. of ζ are > those shown by the respective oxides, whence it is inferred that the adsorbate is activated owing to formation of adsorption complexes. NiO and CoO are each adsorbed in three layers together forming a single layer of cryst. unit cells; the outer surfaces of these adsorbates themselves adsorb 1 unimol. layer of H.O. Calculations from the NiO and CoO experiments each give the same val., 2.869×10^6 sq. cm., for the effective surface of 100 g. of (I). When a mixture of composition 1ThO2: 24NiO (CoO) is adsorbed, one out of every seven groups of 4Ni(Co) + 40 atoms in each of the three layers of the cryst. lattice is displaced by 1 mol. of ThO₂. F. L. U.

Mechanical properties of monolayers of fatty acids, alcohols, and esters, and effect on them of acidity and cations of substrate. III. A. A. TRAPEZNIKOV (J. Phys. Chem. Russ., 1939, 13, 406-416; cf. A., 1939, I, 196).—On pure H₂O a palmitic acid film remains of low η up to the point of destruction; the formation of tough films is caused by soap formation by cations in the substrate, this effect increasing with the valency of the cation. The various cations differ in the $p_{\rm H}$ region in which the film changes from slightly viscous to tough. The immediate effect of the $p_{\rm H}$ of the substrate on the mechanical properties of films of alcohols and esters is small compared with the effect of cations or of the $p_{\rm H}$ of the substrate in presence of cations on the properties of films of acid. On ascending a homologous series the film changes continuously from slightly viscous through highly viscous and plastic to elastic. The mechanical properties of films are influenced by the polar group as well as by the length of the chain. R. C.

Pressure-area and pressure-temperature relations of expanded monolayers of myristic and pentadecoic acids. G. C. NUTTING and W. D. HARKINS (J. Amer. Chem. Soc., 1939, 61, 2040-2046). -Pressure (f)-area (A) isotherms for monolayers of myristic acid (I) on 0.01N-H2SO4 have been determined at 7 temp. between 6.7° and 25°. The graphs show a marked curvature (expanded film), and a break towards high pressures which characterises the formation of an intermediate film. The 25° isotherm is displaced towards low vals. of f and A, owing to the solubility of (I) at the highest temp. in the H_oSO₄. Decrease in the rate of compression of the intermediate film causes an increase in A at a given f and an increase in f at a given A. At const. temp. an intermediate film undergoes a gradual transition into a condensed liquid film by increase of f. The film thus formed exhibits a linear f-A relation and, for pentadecoic acid (II) at 25°, undergoes a sharp transition to a plastic solid film at 21.3 dynes per cm. and 20.52 sq. A. For any long straight chain mol., A for the transition liquid \rightarrow solid is much more dependent on the pressure than on the material of the film. f-T measurements have been made on monolayers of (I) and (II) on 0.01 n-H₂SO₄ at const. vals. of A. The order of the slope $\partial f/\partial T$ is ~ 1.0 for the intermediate and ~ 0.2 for the expanded films. W. R. A.

Films at the liquid/liquid interface. III. Specific effect of calcium ions on kephalin monolayers. A. E. ALEXANDER, T. TEORELL, and C. G. ÅBORG (Trans. Faraday Soc., 1939, 35, 1200—1205). —Force-area curves have been determined for kephalin (I) at the interface between C_6H_6 and aq. NaCl, KCl, NaOH, HCl (0·1M.), MgCl₂, CaCl₂ (0·005M.). Ca^{••} ions exercise a sp. stabilising effect not shown by Na[•], K[•], or Mg^{••}, although a similar effect is obtained with NaOH and HCl. The effect is attributed to stabilisation of (I) in the interface preventing its dissolution in the C_6H_6 phase. At an air-H₂O interface Ca^{••} causes slight condensation of the film and an increase of 30—40 mv. in the surface potential. F. L. U.

Experimental verification of O. Stern's theory of double layer. O. Essin and B. MARKOV (J. Phys. Chem. Russ., 1939, 13, 318-325).-In testing Stern's theory in so far as it relates the potential, e, to the adsorption potentials of the ions, the conditions should be such that complications are not introduced by the exchange of ions between metal and solution, e.g., the relation between e at the max. of the electrocapillary curve and the concn., c, of capillary-active ions in the solution may be examined. New data for the interface Hg/0.01-3N-KI and existing data agree with $e = \text{const.} - k \log_e (c/e)$, but the val. of k differs from that required by Stern's theory, probably as a result of the neglect by the theory of the interaction between the adsorbed ions parallel to the interface. ini opritadua orR.C.

Electro-capillary curves in non-aqueous solution. I. Capillary-active organic cations in methyl alcohol. A. MURTAZAEV and M. ABRAMOV (J. Phys. Chem. Russ., 1939, 13, 350—352).—The electro-capillary curves for solutions of NMe₄I, NEt₄I, NHMe₃Cl, and NH₄NO₃ in contact with Hg have been determined. The effect of the cations on the curve resembles that for aq. solutions. R. C.

Influence of carbohydrate substances on interfacial tension between water and cyclohexane. J. B. MATTHEWS (Trans. Faraday Soc., 1939, 35, 1113—1122).—The change of interfacial tension (γ) with concn. has been measured for cyclohexane and aq. solutions of sugars, dextrins, pectins, gum arabic, glycogen, inulin, and starch. Equilibrium vals. were obtained for all but the last two. The shape of the $\Delta\gamma$ -concn. curve depends on the type of film at the interface, and on the basis of the results it is inferred that glucose, lactose, sucrose, and gum arabic form gaseous films at all concns., whilst dextrin gives a gaseous film which becomes condensed above a crit. concn. Citrus and apple pectins form films of an intermediate type. F. L. U.

Stability and properties of aerosols. R. G. RUYSSEN (Natuurwetensch. Tijds., 1939, 21, 159-170).--A review. S. C.

Nature of foam. VI. Emulsion and foam formation in the system ethyl alcohol-ethyl ether-water. T. SASAKI (Bull. Chem. Soc. Japan, 1939, 14, 250—258; cf. A., 1939, I, 368).—The mutual solubility curve, tie lines, and the foam stability of the system have been determined. The foam stability curve shows two max., one on the phase boundary between homo- and hetero-geneous regions and the other on the EtOH-H₂O side of the diagram. The heterogeneous region can be subdivided into three portions, the first two of which give H₂O-in-oil and oil-in-H₂O emulsions respectively however such mixtures are shaken. The third is a foam inversion region in which mixtures may give either type of emulsion according to the method of shaking.

T. H. G. Interaction between two hydrophobic colloidal particles, using the approximate Debye-Hückel theory. I. General properties. S. LEVINE and G. P. DUBE. II. Numerical computations of energy function. G. P. DUBE and S. LEVINE (Trans. Faraday Soc., 1939, 35, 1125-1140, 1141-1156).—I. An alternative method, simpler than that previously given (cf. A., 1939, I, 416) for obtaining the interaction energy, is developed, and the physical meaning of the various terms in the expression is explained. The results obtained by Langmuir (A., 1939, I, 873) and by Derjaguin (Acta Physicochim. U.R.S.S., 1939, 10, 333), so far as they bear on this problem, are held to be incorrect. It is pointed out that Debye and Hückel, in developing their theory, omitted a term which, whilst negligible for dil. solutions, is important at high concns.

II. The interaction energy is calc. to the third approximation for both metallic and insulating particles. The results are discussed. F. L. U.

London-van der Waals force between two particles in the form of discs. G. P. DUBE and H. K. DASGUPTA (Compt. rend., 1939, 209, 340-342; cf. A., 1938, I, 14).—Expressions are derived for the interaction energy of two disc-shaped colloidal particles, (a) with the discs in the same plane, and (b) with a common perpendicular line of centres. A. J. E. W. Structure and properties of highly purified reduction gold sols. W. PAULI, J. [SZPER], and S. SZPER (Trans. Faraday Soc., 1939, 35, 1178— 1183).—The prep. of red Au sols in quantities of 1500 c.c. by reduction of slightly alkaline HAuCl₄ with EtOH at 60° is described. The sols can be purified and conc. by electrodecantation to >5% or >0.1%when the "Gegenionen" are K° or H° respectively. Analysis of the sols and of the liquid obtained by freezing coagulation shows that the stabilising ionogenic groups are Au-Cl complexes which can partly hydrolyse to mixed Cl-OH complexes, in agreement with the results obtained with Au sols of other types (cf. A., 1932, 225). F. L. U.

Composition of the colloidal platinum micelle. S. W. PENNYCUIK (J. Amer. Chem. Soc., 1939, 61, 2234—2237).—Pt sols were prepared by the Bredig method and particles were isolated by coagulating the sol by freezing and subsequent thawing. From analyses by microchemical methods the composition of the average micelle is $[3 \cdot 9Pt, 1 \cdot 16PtO_2, 1 \cdot 0H_2Pt(OH)_6]_n$. All the H₂O in the micelle is contained in the selfformed stabilising PtO₂,4H₂O [= H₂Pt(OH)₆] (I). The total amount of (I) is 27 ·2% of the gross wt. and the greater part of it is combined in the micelle, where it remains even after prolonged boiling. On ageing the ppt. formed is less rich in stabilising material than the ordinary micelle. The residue in the Bredig vessel is light grey and nearly pure Pt. W. R. A.

Stability of silver iodide sols in presence of gelatin. I. R. PROTAS (J. Phys. Chem. Russ., 1939, 13, 446-450).—The stability has been studied by turbidity measurements. It is increased by gelatin if the $p_{\rm H}$ is such that the charge of the gelatin has the same sign as that of the sol, and vice versa. The effect of KNO₃, Ba(NO₃)₂, and Th(NO₃)₄ on positive sols seems to consist in consolidation of the diffuse part of the double layer by the NO₃' ions and with-drawal from it of anions under the influence of cations, an effect which increases with the valency of the cations. R. C.

Colloidal solution of chalcedony. S. J. THUGUTT (Arch. Min. Soc. Sci. Varsovie, 1936, 12, 64—68; Chem. Zentr., 1937, i, 1388).—An electronegative colloidal solution with a weakly acid reaction, containing 0-126 g. of SiO₂ per 100 c.c., is prepared by heating powdered chalcedony with H₂O at 180—185° for 100 hr. in a Pt-lined tube. The solution is coagulated by aq. HCl, ZnCl₂, or NH₄Cl, but not by EtOH or aq. NH₃. A. J. E. W.

Behaviour of some mixed colloids at high temperature. S. J. THUGUTT (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 69—74; Chem. Zentr., 1937, i, 1388—1389).—Evaporation of a mixture of similarly charged hydrosols after heating at 200° gives the unchanged solid phases. A mixture of oppositely charged calcite and chalcedony (I) sols yields (I) and aragonite (II) on similar treatment. (II) is also formed in absence of (I), but the presence of CO_2 , which forms Ca(HCO₃)₂ as an intermediate, is essential. A. J. E. W. Colloidal solution of fluorspar. S. J. THUGUTT (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 187—192; Chem. Zentr., 1937, i, 1389).—A slightly acid solution containing 29.6 p.p.m. of CaF_2 , which exhibits Brownian movement, is obtained by heating finelypowdered fluorspar with H₂O at 206—210° for 52 hr. in a Pt-lined tube. The solution is coagulated by EtOH and aq. NH₃, but not by HCl, NH₄Cl, or BaCl₂, and is thus electropositive. A. J. E. W.

Disperse structure of solid systems and its thermodynamic basis. D. BALAREV [with N. KOLAROV] (Kolloid-Z., 1939, 88, 161—171).—The reversibility of structural changes in crystals is shown by a study of the heating curves of CaCO₃ and BaCO₃, and by the behaviour of CaCO₃ and BaSO₄ containing Th-X ("emanation method "). The observations afford additional support for the author's theories (cf. A., 1934, 148; 1939, I, 195, 369). F. L. U.

Diffusion of an aggregating electrolyte in the transition range from simple to colloidal solution. G. S. HARTLEY (Trans. Faraday Soc., 1939, 35, 1109—1113).—The existence of a min. diffusion velocity for a colloidal electrolyte in the transition range, reported by McBain (A., 1939, I, 369), is accounted for theoretically on the assumption that only one kind (*i.e.*, charged) of micelle is present.

F. L. U. Influence of ultrasonic waves on colloid phenomena. VI. Influence of ultrasonics on rotatory power of high-molecular colloid substances. II. Experiments with tannin solutions. N. SATA (Kolloid-Z., 1939, 88, 182—184; cf. A., 1939, I, 369).—Aq. solutions of tannin darken considerably and may become turbid when subjected to ultrasonic vibrations. This change is due to dissolved air and is not observed either in aq. solutions in a vac. or in EtOH solutions. In no case is the rotatory power affected. F. L. U.

Ageing phenomena and molecular dimensions of chain complexes in solution. [I.] W. WEHR (Kolloid-Z., 1939, 88, 185—208).—The influence of various factors on the ageing of cellulose nitrate (I) and acetate, benzylcellulose, polymerised hydrocarbons and chlorinated hydrocarbons, and polyvinyl acetate has been studied, chiefly by measurements of η . The changes observed are associated with shortening of the chains due to hydrolysis or oxidation. Breakdown is accelerated by peroxides (Bz₂O₂) and retarded by antioxidants. Saturated synthetic polymerides and chlorinated or vulcanised rubber are relatively stable, whilst in the other classes the strength of films is substantially diminished by ageing the parent solutions. Determinations of the mol. size of (I) and cellulose products are described and discussed.

F. L. U.

Macromolecular compounds. CCXX. Dissociation of multivalent macromolecular acids. W. KERN (Biochem. Z., 1939, 301, 338—356).—An extension of the Michaelis dissociation equation to multivalent macromol. acids leads to the expression $\alpha' = 1/[1 + (h/k_m')^{1-A}]$ where h = H' activity, 1 - A = titration exponent, $k_m' =$ average titration (dissociation) const., and $\alpha' =$ degree of titration (dissociation) (cf. A., 1938, I, 512). Potentiometric data obtained for aq. solutions of synthetic polyacrylic and polymethacrylic acids have been successfully applied to the expression. Calculations from published data on natural macromol. acids also lead to vals. agreeing with the expression. The val. of 1 - A depends on the distance between the dissociating groups in the macromol. If the groups are well separated the influence is small and the acid behaves as a monobasic acid. The least vals. for 1 - A were obtained for polynucleic and agaric acids and the highest vals. for the synthetic and gum arabic acids. C. R. H.

Action of ammonia on collodions. J. GRÉVY (Compt. rend., 1939, 209, 304-306).-The increase and subsequent decrease of η for EtOH-Et₂O solutions of cellulose nitrate (I) containing NH₃ (cf. A., 1932, 1202) is accompanied by partial denitration of the (I) and formation of NH4NO2 and NH4NO3. Conc. (4%) unstabilised collodions show a decrease of η (35% in the first week) on keeping in the absence of NH₃. The η max. is reached more rapidly after addition of NH₃, and becomes less marked on keeping the collodion. The effects are very small with low (I) concns. (0.4-0.8%). A close relation exists between the effect of NH₃ and the state of dispersion. Stabilised collodions do not show the initial increase of η on addition of NH₃, but effects analogous to the above are observed with C₆H₆ solutions of rubber.

A. J. E. W.

Pasting of starch. V. Determination of heat of pasting. A. KÜNTZEL and K. DOEHNER (Kolloid-Z., 1939, 88, 209–215; cf. A., 1939, I, 141).—The total heat of pasting is made up of the heats of hydration (swelling) of dry starch (q_1) and pasted starch (q_2) , the heat of deformation (q_3) and heat of fusion (q_4) . These have been determined calorimetrically as follows: $q_1 - 17.47$, $q_2 - 2.6$, $q_3 + q_4$ 39.35 g.-cal. per g. of dry potato starch. q_3 and q_4 cannot be measured separately. F. L. U.

Theory of force-extension diagram of hydrous cellulose and its experimental examination. P. H. HERMANS (Kolloid-Z., 1939, 88, 172—182).— Additional formulæ are deduced (cf. A., 1938, I, 311; 1939, I, 141) and shown to agree with experimental data. F. L. U.

Wild silks. IV. Viscosity concentration constant of fibroin sols. S. Brro (Bull. Sericult. Japan, 1939, 11, 146—148).—For fibroin sols in Loewe's reagent, the vals. of $K (= \log_e \eta/C)$, where $\eta =$ relative viscosity and C = concn.) for *Bombyx*, yamamai, tussah, and kuriwata silks are 0.3631, 0.2862, 0.2598, and 0.2023, respectively. F. O. H.

Solubility of crystalline pepsin.—See A., 1939, III, 871.

Influence of an alternating electric field on rate of coagulation. I. Negative silver iodide sols. II. Sols of tungstic acid. J. J. HERMANS (Rec. trav. chim., 1939, 58, 725-740, 741-750).--I. The initial rate of coagulation of negative AgI sols in presence of KNO_3 is increased by an alternating electric field, the relative increase being greatest at low [KNO_3]. The effect is similar to that of a sonic field (A., 1939, I, 197). The increase in rate ∞ approx. the fourth power of the field strength but is independent of the frequency between 50 and 400 sec.⁻¹ Possible interpretations are discussed, and it is concluded that distortion of the electrical double layer plays an important part.

II. Once the max. slope has been attained, the turbidity-time curves for mixtures of Na_2WO_4 and excess of HCl follow the normal course of coagulation curves. A study of the effect of an alternating electric field on this coagulation is impracticable because of the heat developed. If the reagents are in equimol. proportions a sol results which is coagulated normally by BaCl₂. The initial rate of this coagulation is decreased by an alternating electric field, and if the field is applied after coagulation has proceeded for some time, the turbidity diminishes sharply to a min. and then increases at a rate corresponding with the applied field. F. J. G.

Influence of ionic strength and $p_{\rm H}$ on electrophoretic mobility. B. D. DAVIS and E. J. COHN (J. Amer. Chem. Soc., 1939, 61, 2092-2098).-The electrophoretic mobility (v) of carboxyhæmoglobin has been studied at 25° in phosphate and citrate buffers ($p_{\rm H}$ 5.65—7.2, ionic strength 0.02—0.20). v is extremely sensitive to $p_{\rm H}$, ionic strength, and the valency and nature of the ions present. Corrections for the influence of electrostatic forces both in diminishing v and in changing the isoelectric point are considered. Computations attempted on the basis of these results yield consts. for the effect of the buffers at const. $p_{\rm H}$ and at const. $p_{\rm H}$ intervals from the isoelectric condition. Both v and the diminution in v due to electrostatic forces are a function of the net charge and increase with distance from the isoelectric W. R. A. condition.

Electrical conductivity of molten system KCl-MgCl₂ in region of possible existence of compound 2KCl,MgCl₂. A. SCHTSCHERBAKOV and B. MARKOV (J. Phys. Chem. Russ., 1939, **13**, 353– 355).—The conductivity of mixtures containing 27—37 mol.-% MgCl₂ indicates the existence of the compound. With rising temp. the equilibrium MgCl₄" \implies MgCl₂ + 2Cl' shifts towards the right. R. C.

Connexion between complex formation and oxidation-reduction reactions. II. Reactions of cupric salts with aromatic redox systems. L. KULBERG (J. Gen. Chem. Russ., 1939, 9, 663–670).—The expression $L_p = 10^{-(E_1 - E_2)/0.058}$ is derived (L_p is the solubility coeff. of a complex salt of Cu^{II} with org. bases, and E_1 and E_2 are the oxidation potentials of the base and of the system Cu^{II} \rightleftharpoons Cu^I, respectively), and verified for complex salts of benzidine, tolidine, *m*- and p-C₆H₄(NH₂)₂, and 1:2:5-C₆H₃Me(NH₂)₂ with CuSO₄. The complex salts are stable in presence of halides when their L_p is < that of CuX (X = Cl, Br, I, CNS); in accordance with this rule quinol and pyrogallol do not yield complexes with CuSO₄. R. T.

Acid-basic indicators in solvents with different acid-basic properties. A. I. SCHATTEN-STEIN (J. Phys. Chem. Russ., 1939, 13, 366—377).— To examine the relation between indicator equilibrium and the acid-basic properties of the indicator and solvent the colours exhibited by several indicators in various types of solvent and the effect of adding acids and bases have been observed. Phenomena sp. to this equilibrium can be observed in absence of protons. It seems that some of the substances studied, which play the part of acids, owe this property to their being able to saturate the free pair of electrons of bases. R. C.

Differentiating action of solvents on the strength of acids. II. Separate potentiometric titration of mixtures of acids with high dissociation coefficients, in differentiating solvents. N. A. IZMAILOV, M. B. SCHUSTOVA, and N. VODOREZ (J. Gen. Chem. Russ., 1939, 9, 598-605).—The val. of the dissociation coeff. of $CCl_3 \cdot CO_2H$ in various solvents falls in the order $H_2O \gg EtOH > \cdot 1:1$ $EtOH-C_6H_6 > 1:3$ $EtOH-C_6H_6 = 1:1$ $COMe_2-PhNO_2 > 1:3$ $COMe_2-PhNO_2 > 1:1$ $COMe_2-Cfl_3 > COMe_2 > 1:1$ $COMe_2-Cfl_3 > 1:3$ $COMe_2-Cfl_6 > 3:1$ $COMe_2-Cfl_6 = 1:3$ $COMe_2-Cfl_6 > 1:3$ $COMe_2-PhMe > 1:1$ $COMe_2-PhMe = 3:1$ $COMe_2-PhMe_2 COMe_2 PhMe_2 <math>COMe_2$ $COMe_2 PhMe_2 COMe_2 PhMe_2 <math>COMe_2 PhMe_2 COMe_2 PhMe_2 COMe_2 PhMe_2 <math>COMe_2 PhMe_2 COMe_2 PhMe_2 COMe_2 PhMe_2 COMe_2 PhMe_2 COMe_2 PhMe_2 COMe_2 PhMe_2 P$

Electrostatic effect of substituents on dissociation constants of organic acids. IV. Aromatic acids. F. H. WESTHEIMER (J. Amer. Chem. Soc., 1939, 61, 1977-1980; cf. A., 1939, I, 263).-The electrostatic effect of substituents (Me, F, Cl, Br, CN, NO₂, OH, OMe) on the dissociation consts. of *p*-substituted phenylacetic and benzoic acids, phenols, and anilines, computed according to Kirkwood and Westheimer (cf. A., 1938, I, 574), is the important factor in determining the strength of the carboxylic acids with the exception of p-hydroxy- and p-methoxybenzoic acids. This effect also contributes, to a smaller extent, to the variation of acidity among substituted phenols and anilinium ions; the latter are considered as acids according to the Brönsted definition. The greatest difference between the total and electrostatic effects of a substituent is observed for compounds in which resonance interaction of the groups is indicated from dipole moment data.

W. R. A.

Activity coefficients of barium and strontium carbonates in aqueous solutions of alkali chlorides. E. HOGGE and H. L. JOHNSTON (J. Amer. Chem. Soc., 1939, **61**, 2154—2156).—The mean activity coeffs. of BaCO₃ and SrCO₃ in aq. solutions of the alkali chlorides, determined by Townley *et al.* (A., 1937, I, 298), have been recomputed with corrections for the improper evaluations of the mean mobilities, misinterpretation of the data of MacInnes and Belcher (A., 1935, 1321), and differences in the degree of H_2CO_3 dissociation in the alkali halides. The corr. data are recorded for 25° and 40°. W. R. A.

Vapour-liquid equilibrium in the system propane-isobutylene. H. W. SCHEELINE and E. R. GILLIAND (Ind. Eng. Chem., 1939, **31**, 1050—1057).— Data on the v.p. of C_3H_8 , CMe₂:CH₂, and mixtures thereof at 200—600 lb. per sq. in. are presented. Differences occur, especially in the crit. regions, between the observed vals, and those calc. from Lewis' fugacity equation. A method of obtaining an approx. general correlation of vals. of K (= ratio of mol. fraction of component in vapour and liquid phases respectively) in the crit. region is suggested. Accepting the accuracy of the fugacity rule at low pressures and given accurate knowledge of the crit. data for mixtures, it is only necessary to estimate the temp. and pressure at which K for the heavier component passes through min.; complete curves, sufficiently accurate for engineering purposes, can then be sketched in. A glass apparatus which enables equilibrium data to be determined rapidly at high pressures is described. C. R. H.

Vapour pressures of solutions of hypochlorous acid at 10° and 20°. J. OURISSON and M. KASTNER (Bull. Soc. chim., 1939, [v], 6, 1307–1311).—The composition of the vapour in equilibrium with aq. HOCl at 10° and 20° has been determined by a dynamic method. The vapour contains HOCl as well as Cl₂O. In the expressions $p_{\text{Cl}_4O} = K_1$ [HOCl]² and $p_{\text{HOCl}} = K_2$ [HOCl], K_1 and K_2 are 0.21 and 0.24 at 10°, and 0.65 and 0.70 at 20°, respectively, with pin mm. of Hg. F. J. G.

Physical studies of non-aqueous solvates. III. Vapour pressure of zinc bromide-diethyl ether solutions. H. H. ROWLEY and F. V. OLSON (J. Amer. Chem. Soc., 1939, 61, 1949-1952; cf. A., 1937, I, 308).-The v.p. of saturated ZnBr₂-Et₂O solutions has been measured from -10° to 35° . The curve log v.p.-1/T shows three distinct slopes which change at between 0° and 5° and at 20°, indicating three distinct solid phases. Analyses of the wet solids in equilibrium with saturated solution indicate ZnBr₂,2Et₂O (I), ZnBr₂,Et₂O (II), and ZnBr₂ (III). (I), in equilibrium with the saturated solution at 0° , crystallises in transparent plates; these disappear between 0° and 5° , and at 15° the solid (II) in equilibrium is composed of transparent needles; at 25° the equilibrium solid (III) is opaque and finely divided with no cryst. shape. Possible sources of error are indicated in the work of Raynaud (A., 1926, 486) which is in disagreement with the present data. W. R. A.

Thermal conductivity of the system H_2 -HCl and equilibrium in the reduction of cuprous chloride by hydrogen. F. ISHIKAWA and N. IMAMURA (Bull. Inst. Phys. Chem. Res. Japan, 1939, 18, 537-547).—The thermal conductivity of the system H_2 -HCl has been measured at 25° and at 300, 500, and 700 mm. Hg. The results are used to study the equilibrium in the reduction of CuCl by H_2 at 300 mm. and from 290° to 400°. D. F. R.

Dehydration of manganous sulphate by the aqueous method. Intermediate hydrates. R. ROHMER (Compt. rend., 1939, 209, 315—317).— Dehydration of $MnSO_4,7H_2O$ in contact with its aq. solution (cf. A., 1939, I, 420) shows the existence of further hydrates with 5, 4, 2, and $1H_2O$; the solubility and d vals. for the congruent solutions at 31° , 34° , 38° , and 42° are recorded. Invariant systems containing $MnSO_4,5H_2O$ and $MnSO_4,4$, 2, or $1H_2O$ as solid phases occur at $27\cdot5^\circ$, $26\cdot1^\circ$, and $23\cdot9^\circ$, respectively. The di- and tetra-hydrates are metastable.

A. J. E. W.

System $HgCl_2$ - $HgBr_2$. P. G. MEERMAN and W. SCHOLTEN (Rec. trav. chim., 1939, 58, 800-804). The β phase, reported by van Nest (A., 1910, ii, 295) but not found by van Pelt and de Boer (A., 1935, 35), exists between ~50 and 60 mol.-% $HgCl_2$. With rise of temp. it is transformed into the α phase, isomorphous with $HgCl_2$. F. J. G.

Phase equilibrium relations in the system, $Na_2SiO_3-Li_2SiO_3$, F. C. KRACEK (J. Amer. Chem. Soc., 1939, 61, 2157—2161).—Within the ternary system, $Na_2O-Li_2O-SiO_2$, there exists the binary system, $Na_2SiO_3-Li_2SiO_3$, which forms an intermediate compound NaLiSiO_3 (incongruent m.p. $847\pm1^\circ$). The liquidus has two branches. The primary phases in equilibrium with liquid are two series of solid solutions. Vals. of n_D of the glasses and crystals in quenched samples have been measured. W. R. A.

Reversible pairs of salts.—See B., 1939, 936.

Equilibrium between oxygen and titanium in iron melts. H. WENTRUP and G. HIEBER (Arch. Eisenhüttenw., 1939–40, 13, 69–72).—Addition of Ti to Fe reduces the free O_2 content from 0.02% to a const. val. of 0.005% at ~1% Ti; the deoxidising capacity of Ti is thus > that of Si, and < that of Al. The chief compound formed appears to be FeTiO₃ (ilmenite). From these and other published results (A., I, 1938, 448; 1939, I, 322) a phase-rule diagram for the system Fe-FeO-FeTiO₃-Ti₂O₃-Fe₂Ti is constructed. R. C. M.

Systems copper-zinc-sulphur and lead sulphide-cuprous sulphide-zinc sulphide. E. STROHFELDT (Metall u. Erz, 1936, 33, 561-572; Chem. Zentr., 1937, i, 1525).-The related binary systems are discussed. Analytical and microscopical data for the system Cu-Zn-S show that the melt forms an upper Cu₂S-ZnS layer in equilibrium with a Cu-Zn alloy containing ~1% of S; this S occurs preferentially as ZnS, the concn. of which increases with the Zn content of the system. Cu-Zn alloys absorb >1% of S, which separates from the melt as dendritic ZnS or a ZnS-mixed crystal eutectic. Cu_2S and ZnS do not absorb S. The system PbS-Cu₂S-ZnS deposits ZnS or PbS (according to composition) from the melt, but never Cu₂S. A PbS-Cu_oS eutectic occurs, but there is no ternary eutectic. A. J. E. W.

Ternary systems $\text{KBrO}_3-\text{KClO}_3-\text{H}_2\text{O}$ at 25° and $\text{NaBrO}_3-\text{NaClO}_3-\text{H}_2\text{O}$ at 25° and 50°. T. Swenson and J. E. RICCI (J. Amer. Chem. Soc., 1939, 61, 1974—1977).—In the $\text{KBrO}_3-\text{KClO}_3-\text{H}_2\text{O}$ system the two salts dissolve in each other forming solid solutions with $\Rightarrow 3\%$ (KClO₃ in KBrO₃ and $\Rightarrow 5\%$ KBrO₃ in KClO₃. The other system gives a solubility curve at 25° corresponding with the solid phases (a) pure NaBrO₃, (b) NaBrO₃ solid solution containing up to 5—10% NaClO₃, and (c) NaClO₃ solid solution containing up to 60—65% NaBrO₃. The iodometric determination of BrO₃' in presence of excess of ClO₃' is discussed. W. R. A.

System zinc acetate-hydrogen chloride-acetic acid. A. W. DAVIDSON and W. CHAPPELL (J. Amer. Chem. Soc., 1939, 61, 2164-2167).—F.p. data are recorded for anhyd. ZnCl₂-AcOH solutions of various concns. prepared by passing dry HCl over dry Zn(OAc)₂. In the ternary system ZnCl₂-HCl-AcOH, an additive compound of ZnCl₂ and HCl is indicated from f.p. data. In the ternary system ZnCl₂-Zn(OAc)₂-AcOH at 30° two double *salts*, Zn(OAc)Cl and Zn(OAc)Cl,ZnCl₂, have been isolated. W. R. A.

Physico-chemical analysis of reactions of organic amides with acids. I. Reaction of carbamide with fatty acids. A. G. BERGMAN and M. N. KUZNETZOVA. II. Thermal analysis of the ternary system carbamide-acetic acid-water. M. N. KUZNETZOVA and A. G. BERGMAN (J. Gen. Chem. Russ., 1939, 9, 631-636, 637-641).-I. $CO(NH_2)_2$ (I) affords 1:1 compounds with HCO₂H, m.p. -11.2°, with AcOH (I), m.p. 39°, and with EtCO₂H, transition point 22.6°. C₄-C₁₀ acids give homogeneous systems, without compound formation. The system lauric acid-(I) presents regions of stratification. (I) is insol. in molten palmitic or stearic acid.

II. The phase diagram consists of the two ternary systems $AcOH-(II)-H_2O$, eutectic at -28.5° , and $(I)-(II)-H_2O$, eutectic at -22° . R. T.

System $K_2O-N_2O_5$ -HCl-H₂O. Solubility isotherms. D. A. EPSCHTEIN and Z. N. KOSTERINA (J. Gen. Chem. Russ., 1939, 9, 625-627).—The quotient [Cl']/[NO₃'] falls in solutions of K salts in HCl-HNO₃ with (i) rising [H^{*}], (ii) rising temp., from -20° to 21.5°. R. T.

Heat of formation and specific heat of calcium nitride. S. SATOH (Bull. Inst. Phys. Chem. Res. Japan, 1939, 18, 548—557).—From the determination of the sp. heat of Ca_3N_2 from 0° to 500° and measurement of the dissociation pressure at high temp., a val. of 108.2 kg.-cal. has been obtained for the heat of formation. D. F. R.

Heats of formation of the oxides of manganese. H. SIEMONSEN (Z. Elektrochem., 1939, 45, 637-643). —From calorimetric determinations of the heat changes accompanying the reactions $3Mn + 2O_2 =$ Mn_3O_4 , $3MnO + 0.5O_2 = Mn_3O_4$, $3Mn_2O_3 = 2Mn_3O_4$ $+ 0.5O_2$, and $3MnO_2 = Mn_3O_4 + O_2$, the following heats of formation of the oxides are calc. : $MnO 93.1 \pm$ 0.3, Mn_3O_4 336.5 ± 0.2 , Mn_2O_3 232.7 ± 0.3 , and MnO_2 125.4 ± 1.0 kg.-cal. per g.-mol. The entropy changes accompanying the synthesis of the oxides are $14.4 \pm$ 0.6, 35.5 ± 0.7 , 24.7 ± 1.0 , and 13.9 ± 0.4 entropy units per g.-mol., respectively. J. W. S.

[Heat of combustion of succinic acid.] W. A. ROTH (Union Internationale de Chimie, Permanent Committee on Thermochemistry, Second Appendix to First Report, 1939, 1—4).—The heat of combustion of succinic acid (I) in a vac., referred to the standard val. of 6319.0 g.-cal. per g.-mol. for BzOH at 20°, is 3025.5 g.-cal. per. g.-mol. at 20°. Vals. are recorded for the heats of combustion of (I) and the ratio of the heats of combustion of (I) and of BzOH at each degree between 15° and 30°. J. W. S.

Resistance of the surface of contact between antimony and cadmium. S. HOLMQVIST (IVA, 1936, 109-118; Chem. Zentr., 1937, i, 1896).—The temp. coeff. of the resistance of the interface (R) is -0.02 at room temp., and -0.036 at -150° . R is raised by preheating at 200°, the effect increasing with the time of heating. The resistant layer is 0.008 mm. thick, and its sp. resistance (referred to a conductor 1 m. long and 1 sq. mm. in cross-section) is $10^5-2 \times 10^7 \Omega$. at 0° to -180° .

Dependence of conductance on field strength. I. Tetrabutylammonium picrate in diphenyl ether at 50°. D. J. MEAD and R. M. FUOSS (J. Amer. Chem. Soc., 1939, 61, 2047-2053).-The conductivity of NBu4 picrate in Ph2O (10-3 to 10-6 N.) at 50° has been measured at low voltages and 1000 cycles and at 60 cycles with field strengths up to 15 kv. per cm. The activity coeffs., determined from the conductivity-field strength curves, are in approx. agreement with the vals. calc. by the limiting Debye-Hückel law, and thus the existence of an ionic atm. in a solvent of low dielectric const. is demonstrated. low concns. an increase of 1.6% per kv. is found, in fair agreement with the theoretical val., 1.32%, calc. by Onsager's theory, and therefore the existence of ionic association is proved. W. R. A.

Conductivity of aqueous solutions of the difficultly soluble hydroxides $Be(OH)_2$, $Mg(OH)_2$, $Zn(OH)_2$, $Cd(OH)_2$, and $Hg(OH)_2$. M. HŁASKO and A. SALITÓWNA (Rocz. Chem., 1939, 19, 396—408). —Conductivity coeffs. are given for dil. solutions of Be, Zn, Cd, and Hg^{II} hydroxides, at 25°. The transport nos. of the ions of this group rise in the order Be $< Zn < Cd < Mg < Ca < Sr < Hg^{II} < Ba$, and the conductivity coeffs. in the order Be < Zn < Cd <Hg^{II} < Mg < Ca < Sr < Ba. R. T.

Potential of a chromium electrode, and its dependence on the acidity of the solution. V. ČUPR and K. MAREK (Chem. Listy, 1939, 33, 233— 236, 257—260).—A passivated Cr electrode ($K_2Cr_2O_7$ in H_2SO_4) undergoes self-activation in aq. acids, the potential-time curve consisting of three chief branches, corresponding with the passive state, a stage of transition from the passive to the active state, and with dissolution of Cr, respectively. The results obtained with different conces. of different acids (HCl, H_2SO_4 , HClO₄) are explained on the basis of W. J. Müller's theory of the passive state. R. T.

Theory of the electrochemical poly-electrode systems and its application to corrosion problems. II. Potentials of three- and many-electrode systems. N. D. TOMASCHOW (Korros. u. Metallschutz, 1939, 15, 157-168; cf. A., 1937, I, 245). -The theory is exemplified by a study of the threeelectrode system Zn-Cd-Pt. The Cd electrode shows anodic, neutral, or cathodic behaviour according as its own potential is more negative than, the same as, or more positive than that of its point of contact in the two-electrode system, and accordingly all factors which influence the potentials of the two working electrodes affect the behaviour of the intermediate electrode. The effects of various factors (c.d., depolarisers, etc.) on the behaviour of the intermediate electrodes in the three-electrode system and in some many-electrode systems have been studied. co.D.L.T. a polyhydric alcohol is < that in H.O.

Reduction-oxidation potential of the antimony electrode. Y. KAUKO and L. KNAPPSBERG (Suomen Kem., 1939, 12, B, 17-18).—Measurements of $\partial E/\partial \log P_{02}$ with the Sb electrode show that it functions as a true O_2 electrode. E is independent of $P_{\rm H.}$. The dissociation pressures ${\rm Sb}_2O_3$ 10^{-76·2} atm., ${\rm Sb}_2O_4$ 10^{-24·5} atm., and ${\rm Sb}_2O_5$ 10^{-5·2} atm. have been calc. In absence of O_2 Sb gives only ${\rm Sb}_2O_3$ with ${\rm H}_2O$, but may form higher oxides in presence of air. M. H. M. A.

Overvoltage of silver. A. T. VAHRAMIAN (J. Phys. Chem. Russ., 1939, 13, 311—317; cf. A., 1939, I, 421).—When the current starts to pass, the cathodic potential, V, rises rapidly to a max., which is ascribed to the high c.d. on the growing points of the cathode, then falls towards a const. val., E, which is the smaller the higher is the electrolyte concn. In 0·1N-AgNO₃ E rises with the current strength, but in 6N-AgNO₃ there is little change. R. C.

Overvoltage of hydrogen on lead. B. KABA-NOV, S. FILIPPOV, L. VANJUKOVA, Z. IOFA, and A. PROKOFEEVA (J. Phys. Chem. Russ., 1939, 13, 341— 349).—The overvoltage, η , on bright very pure Pb in 0·01—8N-H₂SO₄ is > on all metals so far examined and does not vary with [H₂SO₄]; the literature vals. for η seem all to be incorrect, apparently owing to roughness of the electrode and to impurities. Adsorbed PbSO₄ on the electrode appears to promote the evolution of H, thus changing the slope of the η -c.d. curve (cf. A., 1933, 29); the process $2H^* + 2\Theta +$ $0.5O_2 = H_2O$ has no such effect. R. C.

Relation between temperature and current density at constant overvoltage and significance of change of potential at constant current density. V. SHVONEN (Suomen Kem., 1939, **12**, **B**, 15—17).— For both salt melts and aq. solutions the variation of c.d. with temp. for const. overvoltage (η) is given by : log (c.d.) = $K_1 e^{(-q + K_s n E \eta)/RT}$, where q is the activation energy and K_1 , K_2 are const. for a given cell. Usually $K_1 \propto C_1 C_D$, where $C_1 = \text{concn. of the electrolyte and } C_D$ that of the depolariser. In aq. solutions $K_2 = 0.5$, and in salt melts $K_2 = 1$. The effect of sudden change of potential on η is discussed.

M. H. M. A.

Thermodynamic significance of polarographic half-wave potentials of simple metal ions at the dropping mercury electrode. J. J. LINGANE (J. Amer. Chem. Soc., 1939, **61**, 2099—2103).—Mathematical. In the electrodeposition of metal ions at the dropping Hg electrode, solubility of the reduced metal in Hg causes only concn. polarisation at the electrode. An equation has been derived relating the half-wave potential of a simple metal ion to the ordinary standard potentials is a function of the affinity of the metal for Hg, the solubility of the metal in Hg, and the kinetics of the diffusion processes in the solution and in the Hg drops. Experimental data show that the half-wave potential is shifted to more negative vals. as the ionic strength of the solution increases.

W. R. A. Electrical method of measuring the diffusion of salts. O. LAMM (Svensk Kem. Tidskr., 1939, 51, 139-148).—The method suggested involves measurements of the resistance between electrodes placed at the ends of the vertical diffusion column. Mathematical relationships for the interpretation of the results are derived. J. W. S.

Aerodynamics of reacting substances. H. BATEMAN (Proc. Nat. Acad. Sci., 1939, 25, 388– 391).—Mathematical. W. R. A.

Conditions of inflammation of gaseous mixtures. XIV. Effect of admixtures of acetone on cold and hot flame of butane. V. I. AVRA-MENKO and M. B. NEUMANN (J. Phys. Chem. Russ., 1939, 13, 356-365).-The rate of reaction of a mixture of $COMe_2$ and O_2 is $\propto p^3$, where p is the pressure of the mixture. The temp. coeff. varies with the experimental conditions. COMe₂ slightly widens the regions of the hot and cold flames of C_4H_{10} (cf. A., 1939, I, 205). COMe₂ shortens the period of induction of the cold flame according to the equation previously given, indicating that the mechanism is the same in both cases; the COMe, hinders the diffusion of the active centres to the wall, and so lengthens the reaction chains. The effect on the period of induction of the hot flame is similar to that of inert gases. It is inferred that ketones do not inhibit the oxidation of hydrocarbons. R. C.

Application of the nitric oxide method to the investigation of reaction chains in the decomposition of hydrocarbons. L. A. K. STAVELEY and C. N. HINSHELWOOD (Trans. Faraday Soc., 1939, 35, 845—849).—A summary of the authors' work on chain lengths in org. reactions as measured by the inhibition of the reactions by NO (cf. A., 1939, I, 30). F. R. G.

Decomposition of hydrocarbons induced by free radicals. F. O. RICE and O. L. POLLY (Trans. Faraday Soc., 1939, 35, 850—854).—Thermal decomp. of n-C₄H₁₀ is promoted by small amounts of O₂ which produce chain reactions of up to several hundred links. The chain reactions are considered to be initiated by formation of free radicals and alternative schemes for their termination, depending on the nature of the reaction, are tabulated (cf. Rice and Herzfeld, A., 1934, 369). F. R. G.

Kinetics of the thermal decomposition of tetramethylmethane (neopentane). T. J. GRAY and M. W. TRAVERS (Trans. Faraday Soc., 1939, 35, 868—870).—Thermal decomp. of CMe_4 at 500—520° gives CH_4 at a rate which first diminishes and subsequently increases and is slowed down by packing the reaction tube. The crit. increment is 60 kg.-cal. It is concluded that, contrary to the case of C_2H_6 but in analogy with that of NMe₃, the primary decomp. involves the formation of Me. F. R. G.

Activation energies of reactions involving conjugated systems. M. G. EVANS (Trans. Faraday Soc., 1939, 35, 824—834).—Activation energies of diene association reactions are much lower than for reactions involving ring and diradical formation which require the same repulsive forces between C centres and similar heats of reaction. This is attributed to the mobile electrons giving a large resonance energy in the transition state. F. R. G. Calculation of base rate constants from acid rate constants. S. H. MARON and V. K. LA MER (J. Amer. Chem. Soc., 1939, 61, 2018-2021). W. R. A.

Macromolecular compounds. CCXIX. Kinetics of chain polymerisation. VII. Thermal polymerisation of styrene in various solvents. G. V. SCHULZ, A. DINGLINGER, and E. HUSE-MANN (Z. physikal. Chem., 1939, B, 43, 385-408).-Additional data for the polymerisation of styrene (I) in various hydrocarbons confirm, on the whole, earlier data and conclusions (cf. A., 1937, I, 86, 522 and subsequently). The increase in degree of polymerisation (P) with concn. of (I) does not exactly follow the rule $P \propto \sqrt{[(I)]}$ as stated earlier. The data agree well with the equation $v_{\rm A} = k_1 c_{\rm st}^2 + k_2 c_{\rm L} c_{\rm st}$ $v_{\rm A}$ = velocity of primary or activation stage, $c_{\rm st}$ and $c_{\rm L} = {\rm mol.}$ of (I) and solvent per l., respectively, k_1 and k_2 = reaction consts. in pure (I) and in solvent respectively]. The energy of activation and the reaction const. are the same with (I) or polystyrene as solvent, indicating that polymerisation is a firstorder reaction. The mechanism of the activation and subsequent polymerisation stages is further C. R. H. discussed.

Kinetics of exchange reactions. I. *n*-Butyl bromide. L. J. LE ROUX and S. SUGDEN (J.C.S., 1939, 1279—1283).—The velocity of the exchange reaction between radioactive Br' ions and Bu^aBr has been measured in aq. $COMe_2$ (90 vol.-%) at $0-65^\circ$. The reaction is bimol. and is not catalysed by acids or bases. The energy of activation is $18\cdot87\pm0.14$ kg.-cal. per g.-mol., and the velocity of reaction is of the order predicted for a gaseous system on the collision hypothesis. J. W. S.

Influence of the structure of alcohols on the velocity of certain chemical processes. V. D. BOGATSKI (Chimia, 1936, 25-55).-HCl combines with COMe_2 , at a velocity ∞ temp., to yield com-pounds decomposed by EtOH, but not by H₂O. The velocity of esterification of CCl₃·CO₂H with alcohols in $COMe_2$ solution falls in the order $EtOH > Bu^{\gamma}OH > Pr^{\beta}OH$ at 12° and 15°, and in the order $Bu^{\gamma}OH > Pr^{\beta}OH > EtOH$ at 56°. The difference in reactivity of alcohols is related to the behaviour of their OH group, which tends to be detached as a whole during esterification in the case of tert. alcohols, but to eliminate H only in the case of primary alcohols. This view is supported by the observations that the rate of evolution of H₂ from alcohols and Na or Mg falls in the order primary > sec. > tert. alcohol, and that the velocity of ester formation with Ac₂O in COMe₂ is approx. the same for primary and tert. alcohols. R. T.

Effect of solvents on kinetics. A. S. SELIVA-NOVA and J. K. SIRKIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 45–49).—The kinetics of the hydrolysis of EtOAc in presence of NaOH have been investigated with H₂O to which variable quantities of MeOH, $(CH_2 \cdot OH)_2$ (I) (20-40%), glycerol (II) (5-80%), erythritol (III) (10-20%), or mannitol (IV) (5-15%) were added. The velocity was determined at 15°, 25°, and 35°. The rate in a solution containing a polyhydric alcohol is < that in H₂O. The equation $k = k_0 G^{-\epsilon}$ (k is velocity coeff. in a solution having a concn. of alcoholic OH equal to c, k_0 is velocity coeff. in H_2O , G is const.) holds for (I), (II), and (III). In solutions containing (IV) or MeOH the rate of hydrolysis is also reduced but the same relationship does not hold. The Arrhenius equation is only approx. accurate for these mixed solvents. For the reaction in H_2O the energy of activation is ~11,200 g.-cal. whilst in a solvent containing a polyhydric alcohol it is ~11,800 g.-cal. The viscosities of the solutions were also determined. The viscosities of solutions of (I), (II), (III), and (IV) in H_2O are practically the same for all solutions which have the same [OH]. A. J. M.

Medium effects in the prototropy of ketones. Kinetics of the bromination of acetone and acetophenone in aqueous acetic acid. T. G. BONNER, D. P. EVANS, and H. B. WATSON (J.C.S., 1939, 1353—1356).—A kinetic study of the bromination of COMe₂ and COPhMe in mixtures of H₂O and AcOH (0—90% AcOH) and catalysed by 0.5N-HCl or 0.147N-NaOAc indicates that the changes in velocity with varying [AcOH] are due to variations in both the *E* and *PZ* terms of the kinetic equation $k = PZe^{-E/RT}$. For both the acid- and base-catalysed reactions *E* and *PZ* each tend to fall and then rise again with increasing [AcOH]. For the base-catalysed reaction *E* varies almost linearly with *PZ*. J. W. S.

ortho-Effect. IV. Kinetics of the formation of o-substituted phenyltrimethylammonium iodide in methyl-alcoholic solution. D. P. EVANS H. B. WATSON, and R. WILLIAMS. V. Alkaline hydrolysis of ethyl anthranilate. J. J. GORDON and H. B. WATSON (J.C.S., 1939, 1348-1353, 1364-1365; cf. A., 1937, I, 516).-IV. The velocities of reaction of MeI with o-substituted derivatives of NPhMe₂ have been measured at various temp. o-Ph, -OMe, -NO₂, -Cl, -Me, or -Ph groups cause an increase in both the *E* and *PZ* terms of the kinetic equation $k = PZe^{-E/RT}$, but o-F causes no change in PZ. The largest effects are observed with Me and Ph as substituents, and it is suggested that in the transition complex these groups become linked to the N by a H-bond. The smaller effects due to other groups are attributed to their interaction with the unshared electrons of the N without linkage formation. Such interaction would increase E by decreasing the electron availability of the N and increase PZ by imposing a charge on the reactive portion of the complex. Such interaction is impossible with the o-F-compound, since F cannot expand its valency

V. The alkaline hydrolysis of m- (I) and o-NH₂·C₆H₄·CO₂Et (II) in 85% EtOH has been studied at various temp. E for the hydrolysis of (I) is slightly >, and P is almost the same as, for EtOBz. For (II), E is the same as for p-NH₂·C₆H₄·CO₂Et, but P is high. It is inferred that in (II) chelation between the NH₂ and CO₂Et sets up a demand on the electrons of the N which causes the electromeric effect so to operate that the loss of negative charge by the reactive part of the complex is more than counteracted. J. W. S.

Carbonium ions and the hydrolysis of alkyl halides. R. A. OGG, jun. (J. Amer. Chem. Soc., 1939, 61, 1946—1949).—The dissociation of a Me halide in aq. solution into a Me ion with an open sextet (incomplete valency shell) and a halide ion is endothermic by >50 kg.-cal. per mol., whilst the reaction with H_2O to give a halide ion and the coordinated ion MeOH₂⁺ is approx, thermo-neutral. Experimental data for Me halide hydrolysis favour the Olson-Halford mechanism (MeOH₂⁺) rather than that of Hughes and Ingold (Me⁺). The rôle of carbonium ions with an open sextet in org. reactions is probably negligible. W. R. A.

Formation of aryltrimethylammonium iodides in methyl-alcoholic solution. D. P. EVANS, H. B. WATSON, and R. WILLIAMS (J.C.S., 1939, 1345-1348).-Measurements of the velocity of reaction between MeI and substituted NPhMe₂ in MeOH at 25° indicate that substituents (Me, OMe, OPh, Ph, F, or Cl) in the p- or m-positions influence the reaction velocity by changing the energy of activation (E), whilst the non-exponential (PZ) term of the Arrhenius equation remains almost const. Comparison with the results of Laidler (A., 1939, I, 31) and of Hawkins (J.C.S., 1922, 121, 1170) indicate that for a given solvent E is not greatly changed by replacing C_5H_5N by NPhMe₂ or by replacing C_2H_3Br by MeI, but the PZ term falls appreciably. The change in solvent from PhNO₂ to MeOH or EtOH causes increases in E and PZ. J. W. S.

Oxidation of ethyl disulphide by hypobromite ion. Rate of the reaction. H. A. YOUNG and M. B. YOUNG (J. Amer. Chem. Soc., 1939, **61**, 1955— 1959).—The oxidation of Et_2S_2 in CCl₄ solution by OBr' ions (aq. NaOBr) follows at least two independent courses with the production of Et sulphonate and SO₄" ions respectively. No evidence was obtained for the formation of a sulphenic acid according to $\text{Et}_2\text{S}_2 + \text{H}_2\text{O} = \text{EtSH} + \text{EtSOH}$. The rate of the oxidation at 25° follows the law $-d[\text{OBr'}]/dt = k[\text{Et}_2\text{S}_2][\text{OBr'}]/[\text{OH'}]$, where k = 0.028 ± 0.002 . W. R. A.

Calculation of the kinetics of hydrolysis of polysaccharides. Mathematical expressions and results. G. BLOMQVIST (Sitzungsber. Heidelberg. Akad. Wiss., Math.-nat. Kl., 1936, No. 7, 11 pp.; Chem. Zentr., 1937, i, 2178).—Published formulæ are summarised, and further expressions are deduced. A. J. E. W.

Reduction of carbon dioxide by graphite and coke. M. A. MAYERS (J. Amer. Chem. Soc., 1939, 61, 2053—2058).—The rates of reaction (k) of CO₂ with natural (I) and artificial (II) graphite and with various high-temp. cokes (III) have been measured. (II) and (III) behave as porous substances the internal surfaces of which contribute to k. The heats of activation are : with (I) ~44, (II) ~52 kg.cal. The results which give k per unit vol. of (I), (II), or (III) are liable to errors of ~20%. W. R. A.

Velocity of dissolution of comminuted substances. XI. Velocity of dissolution of alabaster in water. W. JACEK (Rocz. Chem., 1939, 19, 463-470).—The velocity of dissolution of alabaster in H_2O at $12.5-24^{\circ}$ has been determined. The temp. coeff. is 1.36. R. T.

Rate of dissolution of calciferous inorganic and organic substances in an aqueous medium. H. KLÄHN (Zentr. Min., 1936, A, 328—348, 369— 384; Chem. Zentr., 1937, i, 2343).—The rate of dissolution of powdered Ca(OH)₂ in H₂O in equilibrium with atm. CO₂ is studied; linear relations exist between the time of dissolution or the amount of H₂O and the wt. of dissolved solid. The wt. dissolved in a given vol. of H₂O is independent of the wt. of Ca(OH)₂ present after 1 hr., but increases with this wt. after 3 days. With compact calciferous substances the rate is ∞ surface area. A. J. E. W.

Oxidation of zinc sulphide and transference of zinc into aqueous or alkali solution at air pressure. V. G. TRONEV and S. M. BONDIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 541-543).— The rate of dissolution of ZnS in H_2O and 4n-NaOH, but not in 0-1n- H_2SO_4 , was increased in air at pressures >85 atm. In H_2O the rate of dissolution increased with temp. from 25° to 200°. L. J. J.

Oxidation of cupric sulphide and transference of copper into aqueous solution at air pressure. O. E. ZVJAGINTZEV and V. G. TRONEV (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 537—540).—The rate of dissolution of CuS in H₂O in contact with air has been studied at pressures ≥ 100 atm. and temp. $\geq 250^{\circ}$. CuSO₄,2Cu(OH)₂ is formed in the course of the reaction as an additional solid phase. The rate is ∞ the partial pressure of O₂, and at 100 atm. is a max. at ~200°. L. J. J.

Passivity of iron. I. Kinetics of dissolution of iron in nitric acid. M. S. GOLOMBIK, M. M. LEVINA, and N. N. PETIN (J. Phys. Chem. Russ., 1939, 13, 425–435).—In HNO_3 of concn. c =3-7N., Fe dissolves readily at 20°, the reaction being formally unimol. The rate, v, is increased by stirring and the temp. coeff. is 1.3, indicating that the ratedetermining process is diffusion. If c = 8 - 12 N. the reaction is pulsating, and with increasing c the period of induction, period of pulsation, and time between successive pulsations fall, although the no. of pulsations is const. When c = 13 - 15.7 n. passivation is complete. In the active region v runs approx. parallel to the sp. conductivity of the solution, both being a max. at 6.8N., suggesting that v is determined by the H[•] ion activity. Assuming that an intermediate product in dissolution is Fe(NO)(NO₃)₂ (cf. A., 1937, I, 250), the pulsations may be due to temporary exhaustion of the HNO3 at the metal surface. In addition, the HNO₃ presumably forms a protective coating on the surface of the Fe, so that the periodicity of reaction represents competition between H and O for the Fe surface. R. C.

Sensitised explosions. IV. Carbon monoxide-oxygen reaction catalysed by nitrogen peroxide. E. J. BUCKLER and R. G. W. NORRISH (Proc. Roy. Soc., 1939, A, 172, 1–28; cf. A., 1938, I, 626).—NO₂ does not sensitise the ignition of pure dry CO and O₂, but in presence of NO₂ and H₂ explosion occurs 300° below the temp. required to ignite the pure gases. The variation of induction period with $[H_2]$ has been studied and leads to the view that explosion is due to a chain-branching mechanism. The ignition of $CO-O_2-NO_2$ mixtures containing H_2O vapour was also investigated. G. D. P.

Kinetics of the thermal decomposition of the methylamines. II. M. W. TRAVERS and J. A. HAWKES (J.C.S., 1939, 1360-1364; cf. A., 1939, I, 326).-Low concns. of NO cause a greater relative inhibition of the formation of H₂ than of CH₄ in the thermal decomp. of NMe₃ but higher [NO] causes considerable decrease in the CH₄ formation. This is attributed to the reversibility of the reaction between the free radicals and NO, *i.e.*, of the inhibition process. With NHMe, little inhibition of either H₂ or CH_4 formation occurs until ~1.2% of NO is added. This may be due to formation of an additive compound which changes irreversibly into decomp. products with removal of NO. The decreases in yields of CH₄ and H₂ proceed in a parallel manner, suggesting that they are produced by processes initiated by the same free radical or that the effect of the NO is the same in each case. With NH₂Me increasing amounts of NO decrease the amount of H₂ formed until it equals the amount of CH₄ formed, but have no effect on the latter. It is inferred that there are two re-actions, one, probably $NH_2Me \rightarrow HCN + 2H_2$, re-sulting in formation of H_2 and suppressed completely by NO, the other resulting in the formation of equal vols. of CH_4 and H_2 and unaffected by NO. NO simply dissolves in NH₂Me but appears to form loose compounds with NHMe2 and NMe3. NO reacts with NHMe2 and NMe3 at 420°, with formation of N2 and N₂O, respectively, H₂O and condensation products being also formed in each case. Only traces of N2 and CH₄ are produced. J. W. S.

Inhibition phenomena in the catalysed oxidation of iodide ion by chlorate. II. Ruthenium chloride as catalyst. K. WEBER and R. VALIČ (Ber., 1939, 72, [B], 1488—1495; cf. A., 1938, I, 404). —Although with VOSO₄ as catalyst, or in the absence of a catalyst, the reaction velocity increases with increasing [H^{*}], with RuCl₃ as catalyst the reverse is true. The results accord with the view that the true catalyst is the ion [Ru(OH)]^{**}, resulting from hydrolysis which is repressed by acid, and that the rate ∞ [Ru(OH)^{**}][HCl]⁴. SO₄^{**} ions also retard the reaction, probably owing to the formation of slightly-dissociated basic Ru sulphates and consequent removal of the catalyst ion. The temp. coeff. is 1.9 for 10°.

F. J. G.

Reactions in concentrated sulphuric acid. XVI. Selenium and tellurium as catalysts. J. MILBAUER (Chem. Obzor, 1939, 14, 105—111).—The behaviour of equiv. amounts of Se, SeO₂, and mixtures of the two on the reaction between C_2H_2 and conc. H_2SO_4 is traced. The oxide is in excess at the equilibrium point owing to the more rapid oxidation of Se by H_2SO_4 than reduction of SeO₂ by C_2H_2 . This is especially evident at 100°. Te is oxidised much more slowly than Se at lower temp. but both are very rapidly oxidised at 200° in a stream of N₂. That an equilibrium is attained between the Se and the SeO₂ was proved by a colorimetric study of the action at 228° showing the presence of 1.5% Se at equilibrium with H₂ gas and 7.4% Se with CO₂. When using Se or SeO₂ alone as catalyst the reaction velocity increases to a max. corresponding with the equilibrium $xSe + ySeO_2$, when the results remain const. It is necessary to pass a mixture even of H₂ and air through the acid for a long time to obtain const. and max. results, but with CO₂ and air const. results are obtained immediately the temp. is const. The phenomenon is not caused by traces of H₂O or SO₂ formed in reaction or by the effect of light. F. R.

Effect of acetone on optical rotation of tartaric acid and on the rate of its reaction with ethyl alcohol. A. P. TROFIMENKO and S. F. BABAK (J. Phys. Chem. Russ., 1939, **13**, 417–420).—The sp. rotation is reduced and the reaction retarded.

R. C.

Homogeneous catalytic hydrogenation. M. CALVIN (J. Amer. Chem. Soc., 1939, 61, 2230—2234). —From an investigation of the kinetics of the hydrogenation of benzoquinone in quinoline solution using dissolved $Cu_2(OAc)_2$ as homogeneous catalyst (A., 1938, I, 628) it is concluded that a dimeride of the $Cu_2(OAc)_2$ -quinoline complex is probably responsible for the activation of the mol. H₂. The previously proposed mechanism of the hydrogenation is confirmed. W. R. A.

Effect of polar groups on esterification velocities of substituted benzoic acids with cyclohexanol. R. J. HARTMAN, L. B. STORMS, and A. G. GASSMANN (J. Amer. Chem. Soc., 1939, 61, 2167—2169; cf. A., 1938, I, 36).—The effect of polar substituents (Me, NO₂, Br, Cl) on the reaction velocity of H[•] ion-catalysed esterification of BzOH with cyclohexanol has been investigated at 55°, 60°, 70°, and 75°. The velocity coeff. decreases in the order m-NO₂ > m-Cl > m-Br > p-Cl > m-Me > p-Me. Experimental vals. for log k for the esterification reactions agree with those calc. on the basis of Hammett's equations. The significance of the energy of activation in determining the velocity of esterification is discussed. W. R. A.

Energy of activation of hydrolysis of sodium β -glycerophosphate by bone-phosphatase at optimal p_{H} .—See A., 1939, III, 872.

Activation of hydrogen in catalytic reactions of hydrocarbons. A. FARKAS (Trans. Faraday Soc., 1939, 35, 906-917).—A review of the reactions of hydrocarbons catalysed by metals which do not involve breakage of C-H bonds. It is concluded that catalytic hydrogenation consists in the simultaneous addition of the atoms of a H, mol. to a single or double bond and necessarily in the *cis* position. In hydrogenation by nascent H and at high temp. the thermodynamically stable isomerides (usually trans or meso) are formed by addition of independent H atoms, which is in agreement with known data. The catalytic exchange reaction between H_2 and hydrocarbons is considered to proceed by a dissociative mechanism according to which the hydrocarbons are partly split into H atoms and hydrocarbon radicals on the surface of the catalyst, affording an explanation for the kinetics of the exchange reaction of various saturated

and unsaturated hydrocarbons, catalytic *cis-trans* conversion, racemisation, migration of double bonds, disproportionation of *cyclohexanes* and related compounds, and for some polymerisation reactions.

F. R. G.

Catalytic exchange of hydrogen atoms between molecular deuterium and *n*-hexane and cyclohexane. A. FARKAS and L. FARKAS (Trans. Faraday Soc., 1939, **35**, 917—920).—*n*-C₆H₁₄ was equilibrated at 75° with 98% D₂ giving a distribution ratio of (H/D)_{hydrogen}. (D/H)_{hexane} = 1.94. The half-period of the exchange is recorded over the range $31-124^{\circ}$. For the exchange between cyclohexane and D₂ the results between 15° and 98° are similar. The rate of dehydrogenation of cyclohexane to C₆H₆ (cf. Schultze, B., 1936, 535) is too slow to account for the rate of the exchange. It is suggested that the exchange of both hydrocarbons involves the dissociation of the hydrocarbons into H atoms and radicals on the surface of the eatalyst. F. R. G.

Mechanism of catalytic exchange reactions between deuterium and olefines.—See A., 1939, II, 465.

Hydrogenation of nickel carbonyl. (A) M. K. CHAKRAVARTY. (B) E. E. LITKENHOUS (Ind. Eng. Chem., 1939, **31**, 1059—1060, 1060).—(A) Results of Litkenhous and Mann (A., 1937, I, 521) obtained during the hydrogenation of CO in presence of Ni, using Ni(CO)₄ and H₂ as reactants, lead to the conclusion that the main reactions occurring after complete decomp. of Ni(CO)₄ are : CO + H₂ \Longrightarrow C + H₂O and 2CO + 2H₂ \Longrightarrow CO₂ + CH₄ and not 2C + 2H₂O \Longrightarrow CH₄ + CO₂ as suggested by the authors. (B) A reply to the above. F. H.

Determination of activity of nickel catalysts. A. ZINOVIEV (Maslob. Shir. Delo, 1939, No. 3, 10–13). —The velocity coeff. k of the reaction of hydrogenation of unsaturated acids is calc. from the formula $k = [2\cdot303/(t_2 - t_1)] \log I_{t_1}/I_{t_2}$, where $t_2 - t_1$ is a time interval $(t_1 < 1 \text{ hr.}, t_2 2 - 2\cdot5 \text{ hr.})$, and I_{t_1} and I_{t_2} are the I vals. at the beginning and end of this interval. The activity of Ni catalysts is expressed as k_2/k_1 , where k_1 and k_2 are the vals. found for a reference catalyst and for the catalyst under examination, respectively. R. T.

Active iron and copper compounds as inorganic catalysts in reactions of peroxidative oxidation, in the light of the theories of oxygen and hydrogen activation. A. KRAUSE (Rocz. Chem., 1939, **19**, 481–486).—Activation of ortho-ferric oxide by CuO in the reaction of oxidation of HCO_2H by H_2O_2 is represented by the reactions: $Cu(OH)_2 +$ $H_2O_2 \rightarrow CuO_2 + 2H_2O$; $\cdot Fe(OH) \cdot O \cdot Fe(OH) \cdot (I) +$ $CuO_2 \rightarrow O < Fe \cdot O = (II) + Cu(OH)_2$; $(II) + HCO_2H \rightarrow$ $(I) + CO_2$. The process is thus one of activation of oxygen. R. T.

Dispersion of platinum catalysts. A. M. RUBINSTEIN (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 57—60).—The structure of three preps. of Pt on activated C and one of Pt on Al_2O_3 has been studied by X-ray methods. The X-ray diagram of Pt- Al_2O_3 shows lines due to both components, but that of Pt-C shows lines due to Pt only. The greater activity in dehydrogenation and dehydration reactions of preps. obtained by thermal decomp. of H_2PtCl_6 on C seems to depend on the slightly deformed unit cell of Pt in these catalysts, as the dispersion of all the preps. was the same. Work on the effect of the degree of dispersion on the activity of Pt catalysts is summarised, and confirms the existence of an optimum degree of dispersion for mixed catalysts. A. J. M.

Fundamentals in the catalytic ring closure of open-chain hydrocarbons. H. S. TAYLOR and J. TURKEVITCH (Trans. Faraday Soc., 1939, 35, 921— 934).—n-C₇H₁₆ with Cr₂O₃ gel at 468° yields a liquid product containing 100% of aromatics which is essentially PhMe. The catalyst is poisoned by H₂O and C₂H₄ and regenerated by O₂. Olefines with Cr₂O₃ gel show initially a higher rate of conversion into aromatics but there is more rapid deterioration of the catalyst owing to side reactions. The ring closure of hydrocarbons is discussed from the thermodynamic point of view and it is concluded that oxides are the most suitable catalysts as they activate the C-H bond, and that temp. should be >300°. F. R. G.

Heavy metal sulphides as catalysts for polymerisation of olefine hydrocarbons. E. H. IN-GOLD and A. WASSERMANN (Trans. Faraday Soc., 1939, 35, 1022—1024; cf. A., 1938, I, 145; 1939, I, 269).—The dimerisation of *cyclopentadiene* becomes heterogeneous in presence of heavy metal sulphides. Only black sulphides are effective. Results of experiments with 17 olefines are tabulated. The efficiency of the catalyst (CuS) depends markedly on its mode of prep. and on admixtures. A mechanism is suggested. F. L. U.

Activation process and nature of active centres in catalysed electrolytic hydrogenation. V. V. MONBLANOVA, N. I. KOBOZEV, and P. S. FILIPPOVITSCH (J. Phys. Chem. Russ., 1939, 13, 326-340).---The effect of catalyst poisons present in the solution and on the electrode on the cathodic reduction of dissolved CHPh:CH·CO₂H at 20° has been studied. Hg and As retard hydrogenation on electrodes with a high H overvoltage (Sn, Pb, and Hg), but they activate electrodes with a low overvoltage (Pt and Fe) by an amount which passes through a max. with increasing concn. of poison. These results accord with the theory that H overvoltage rises as the energy of linking of H atoms to the electrode falls, and that the activating action of poisons is due to depression of the activation barrier. Temp. coeff. measurements show that the more the cathode surface is poisoned, the lower is the energy of activation of the reaction. The active centres seem to be points of depressed adsorption potential for H and contain, in Pt and Fe, on the average, 2 atoms. Both bright and platinised Pt after being covered with the same electro-deposited film of Hg are equally active, showing that despite the large difference between the surface areas there is no difference in "polarisation" surface. This observation throws doubt on the experimental basis of the electrostatic theory of overvoltage. R. C.

Catalytic hydrogenation of phenolic oil in low-temperature tar.—See B., 1939, 903. Production of ethane, quinhydrone, and potassium cupric cyanide by a.c. electrolysis. J. W. SHIPLEY and M. T. ROGERS (Canad. J. Res., 1939, B, 17, 167—177).—The electrolytic production of C_2H_6 from KOAc, of benzoquinone (I) from quinol, and of $K_3Cu(CN)_4$ from Cu electrodes in KCN, by means of a.c., and the dependence of the yield on the conditions, have been studied. A good yield of (I) is obtained at moderately high c.d. F. J. G.

Electrolysis of sodium sulphate solution.—See B., 1939, 957.

Anodic oxidation of aluminium.—See B., 1939, 949.

Mechanism of photochemical production of hydrogen peroxide. K. YAMAFUGI, N. NISHIOEDA, and H. IMAGAWA (Biochem. Z., 1939, **301**, 404—417; cf. A., 1939, III, 622; Baur and Neuweiler, A., 1928, 30).—Evidence is adduced to support the view that the mechanism is expressed by the equations: $2H_2O \Rightarrow H_2O_2 + 2H$, $2H + O_2 = H_2O_2$, and $AH_2 + O_2 \Rightarrow H_2O_2 + A$ (A = an oxidisable substance) and experiments in which ZnO, eosin, glucose, hæmatoporphyrin, chlorophyll, and other substances are used as sensitisers are described. W. McC.

Colour change in barytes under the action of X-rays. M. KOŁACZKOWSKA (Arch. Min. Soc. Sei. Varsovie, 1936, 12, 181—186; Chem. Zentr., 1937, i, 1376).—Colourless Přibrám barytes becomes blue on exposure to X-rays, and emits secondary radiation. Sunlight destroys the colour in 15—20 min. The coloration is due to intra-at. processes. A. J. E. W.

Electrolytic development of the latent image. R. S. MORSE (J. Franklin Inst., 1939, 228, 169–175). —If photographic material of the Ag halide type is exposed and bathed in aq. NH₃ or in aq. NH₃ containing a trace of a suitable metallic salt and then placed in intimate contact with a clean Cu plate a visible image is produced. Addition of the salt to the aq. NH₃ diminishes fogging. The images produced are similar to those produced by chemical development and are obtained by pre- and post-fixation treatment. The grain structure has been examined at various depths throughout the emulsion and the reaction is not of the surface type. The image is essentially Ag, A theoretical explanation is advanced. W. R. A.

Action of ultra-violet rays on glyceryl nitrate. T. URBANSKI, W. MALENDOWICZ, and K. DYBOWICZ (Compt. rend., 1939, 209, 103—105; cf. B., 1939, 782).— $p_{\rm H}$ measurements show that glyceryl nitrate (I) undergoes slow spontaneous decomp. for some hr. after exposure to ultra-violet light, the ultimate degree of decomp. increasing with the light intensity. The irradiated (I) explodes after a shorter period on heating, and gives a shorter Taliani–Goujon test than ordinary (I). Similar effects are observed with erythritol and mannitol nitrates. A. J. E. W.

Anaërobic photochemical reduction of redox dyes by pyruvic acid, lactoflavin, and quinine. W. SETZ (Z. Vitaminforsch., 1939, 9, 32–38).— Photochemical degradation of $AcCO_2H$ (I) occurs in presence or absence of O_2 . (I) and, to a > stoicheiometric extent, lactoflavin (II) photochemically reduce Capri-blue. Reduction of the dye by (I) is accelerated catalytically by (II) (e.g., 30-fold by $0.5 \mu g$.). Quinine sensitises only (II)-acceptor systems. All the above reactions are inhibited by pyramidone. F. O. H.

Influence of irradiation with radon on different types of glass. J. WIESTHAL (Sitzungsber. Akad. Wiss. Wien, 1936, IIa, 145, 239-260; Chem. Zentr., 1937, i, 1369).—The solubility of seven glasses in H₂O at 90° is increased by irradiation with α - and γ -rays from Rn, although the effect is not \propto the quantity of Rn; the solutions contain Si, B, Al, Na, Ca, Ba, Mg, and K. Various related effects are detailed. Irradiation causes attack of the glass structure, which is particularly marked with glasses containing Al₂O₃. The solubility of unirradiated glasses increases with the alkali content, although SiO₂, Al₂O₃, and B₂O₃ are dissolved at the beginning of the H₂O treatment.

A. J. E. W.

Mechanism of Wagner-Meerwein rearrangement. Exchange of deuterium between camphene hydrochloride and hydrogen chloride.-See A., 1939, II, 434.

Crystallisation of vitreous sodium and calcium metaphosphates. R. PARIS and A. BOULLÉ (Compt. rend., 1939, 209, 223-225) .- The transformation points of NaPO₃ and Ca(PO₃)₂ are shown by thermal analysis to be 280° and 520°, respectively, coinciding closely with the softening temp. (295°, 530°). Crystallisation (which is accompanied by marked heat absorption) commences at approx. the same temp. $(315^\circ, 560^\circ)$, at which it is very slow; the max. rate is reached at 440° or 760° . Ca(PO₃), can be heated rapidly to $\sim 580^{\circ}$ without crystallisation, and shows the reversibility of the thermal anomaly at the transformation temp. A. J. E. W.

Exchange of sodium and calcium ions on glauconite. P. M. TSCHULKOV (J. Gen. Chem. Russ., 1939, 9, 571—574).—The expression $Y_{\text{Na}}/Y_{\text{Ca}}^{1}$ = $0.273C_{\text{Na}}/C_{\text{Ca}^{\frac{1}{2}}}$ (Y and C are g.-mol. of Na or Ca per kg. of glauconite or H₂O, respectively) is derived and verified. R. T.

Reactions of olefines with solid cuprous halides. E. R. GILLILAND, J. E. SEEBOLD, J. R. FITZHUGH, and P. S. MORGAN (J. Amer. Chem. Soc., 1939, 61, 1960–1962).—At low temp. C₂H₄, C₃H₆, and $iso-C_4H_8$ react with Cu_2Cl_2 and give practically identical equilibrium pressure curves. C_2H_4 reacts with Cu_2Br_2 . The compounds formed are Cu_2X_2, C_nH_{2n} . Dissociation pressure curves have been obtained. No reaction takes place at temp. > those corresponding with the intersection of the dissociation curve and the v.p. curve of the olefine. Heats of reaction varied from 11,000 g.-cal. per mol. at low temp. to 7000 at high temp. Olefines may be recovered from liquid or gaseous mixtures by Cu^I halides and a method of calculating the theoretical max. recovery is outlined. W. R. A.

Basic phosphates of beryllium and zinc. A. A. SANFOURCHE (Compt. rend., 1939, 209, 107-109) .--No Be or Zn hydroxyapatites are obtainable by the methods applied with Mg salts (A., 1939, I, 210). The action of Na₃PO₄ on aq. Be(NO₃)₂ containing dissolved Be(OH), yields mixtures of hydrated Be(OH), and $Be_3(PO_4)_2$. Treatment of $Be_3(PO_4)_2, 5.75H_2O$ with

successive quantities of boiling 0.1N-NaOH until alkaline (phenolphthalein) (cf. Klement, A., 1938, I. 320) gives a double salt, $Be_3(PO_4)_2$, 2NaOH, $2.5H_2O$, which loses all its H_2O at $<500^{\circ}$. The corresponding reactions with Zn salts yield mixtures, the product from Zn₃(PO₄)₂ and NaOH containing a tetrabasic Zn Na orthophosphate. A. J. E. W.

Perchlorates. V. Ammoniates of alkalineearth perchlorates. C. SMEETS (Natuurwetensch. Tijds., 1939, 21, 149-158).-Alkaline-earth perchlorates react with gaseous NH₃ to form the following ammines (heats of formation, where determined, are given in parentheses) : Mg(ClO₄)₂,2NH₃;

 $Mg(ClO_4)_2, 6NH_3$ (99,100); $Ca(ClO_4)_2, 2NH_3$;

 $\begin{array}{l} \operatorname{Lig}(\operatorname{ClO}_4)_{2:}\operatorname{SIM}_3 \; (33,100); \; \operatorname{Ca}(\operatorname{ClO}_4)_{2:}\operatorname{ZIM}_3; \\ \operatorname{Ca}(\operatorname{ClO}_4)_{2:}\operatorname{SIM}_3; \; \operatorname{Ca}(\operatorname{ClO}_4)_{2:}\operatorname{6NH}_3 \; (72,600); \\ \operatorname{Sr}(\operatorname{ClO}_4)_{2:}\operatorname{ZNH}_3; \; \operatorname{Sr}(\operatorname{ClO}_4)_{2:}\operatorname{6NH}_3 \; (64,900); \\ \operatorname{Sr}(\operatorname{ClO}_4)_{2:}\operatorname{7NH}_3 \; (74,200); \; \operatorname{Sr}(\operatorname{ClO}_4)_{2:}\operatorname{10NH}_3; \\ \operatorname{Sr}(\operatorname{ClO}_4)_{2:}\operatorname{12NH}_3; \; \operatorname{Ba}(\operatorname{ClO}_4)_{2:}\operatorname{2NH}_3; \; \operatorname{Ba}(\operatorname{ClO}_4)_{2:}\operatorname{5NH}_3; \\ \operatorname{Ba}(\operatorname{ClO}_4)_{2:}\operatorname{6NH}_3 \; (54,300 \; \operatorname{cal.}); \; \operatorname{Ba}(\operatorname{ClO}_4)_{2:}\operatorname{9NH}_3. \\ \end{array} \right.$ heat of formation of these complex amines is the smaller the greater is the size of the cation. S. C.

Reactions [taking place] on carbon. V. SIHVONEN (Suomen Kem., 1939, 12, B, 15).—The primary reaction in the oxidation of graphite by N_2O is: $C_{n+1} + N_2O \rightarrow C_{n+1}O + N_2$, followed by: $C_{n+1}O \rightarrow C_n + CO$. CO is preferentially adsorbed and inhibits further reaction at low temp., but at high temp. N₂O reacts with the absorbed CO: $C_n \cdot CO + N_2O \rightarrow C_n + CO_2 + N_2$, followed by the primary reaction again. Between 770° and 1120°, at pressures <50 mm. Hg, HCO₂H decomposes bi-molecularly on both Pt and graphite : 2HCO₂H \rightarrow $H_2 + CO + CO_2 + H_2O$. There was no reaction between graphite and H₂. M. H. M. A.

Coloured Tl^{III} oxides. S. KRZYŻAŃSKI (Rocz. Chem., 1939, 19, 419-425).-Grey, yellow, red, purple, violet, blue, and green ppts. of Tl₂O₂ are obtained by adding LiOH and H₂O₂ to aq. TINO₃, at room temp.; the colour of the ppts. changes with time in a definite sequence. The colours are due to interference effects given by the laminar micro-crystals of Tl2O3. R. T.

Crystalline lead orthophosphate. E. J. ROEHL (J. Amer. Chem. Soc., 1939, 61, 2249).-When a 1% solution of Na_2HPO_4 is separated by a Cellophane membrane from a slightly acidified 0.2% solution of $Pb(OAc)_2, 3H_2O$ amorphous $Pb_3(PO_4)_2$ forms immediately, and after about 1 min. tiny white crystals separate. These crystals are uniaxial hexagonal prisms exhibiting strong birefringence and an optically negative character. W. R. A.

Oxidation of phosphorus at solid surfaces. T. A. KRIUKOVA (J. Gen. Chem. Russ., 1939, 9, 577-586).-The process of oxidation by atm. O₂ or ozonised air of yellow P finely distributed on SiO, powder at 20° involves the stages $P \rightarrow P_4 O \rightarrow P_4 O_2 \rightarrow$ $P_4O_6 \rightarrow P_4O_{10}$. The ratio of P_4O to P_4O_{10} in the final reaction product is 2:3. The mechanism of the reaction is discussed. R.T.

Complex compounds P(OH)₄ClO₄ and Se(OH)₃ClO₄. E. J. ARLMAN (Rec. trav. chim., 1939, 58, 871-874).-The compound H₂SeO₃,HClO₄, or [Se(OH)₃]ClO₄, is described. On electrolysis of its solution in MeNO₂, Se migrates to the cathode. Vals. of A for this solution, and for that of $[P(OH)_A]ClO_A$ (A., 1937, I, 628), resemble vals. for other perchlorates, confirming the view that dissociation to $[P(OH)_4]^+$ or $[Se(OH)_3]^+$ and ClO_4^- occurs. F. J. G.

Salts derived from triphosphoric acid. P. BONNEMAN (Compt. rend., 1939, 209, 214-216).--The following sparingly sol. salts have been prepared by mixing dil. solutions of Na5P3010,6H20 (A., 1937, I, 195) and a salt of the metal, in the proportions shown by conductometric titration to yield definite compounds : $Zn_2NaP_3O_{10}, 9.5H_2O$; $ZnNa_3P_3O_{10}, 11.5H_2O$

pounds: $Zn_2NaP_3O_{10}$, $9.5H_2O$; $ZnNa_3P_3O_{10}$, $11.5H_2O$ (H_2O readily lost at 80°); $5CaO, 3P_2O_5$; $Ca_2NaP_3O_{10}$, $4H_2O$; $5SrO, 3P_2O_5$; $Sr_2NaP_3O_{10}$, $7H_2O$; $5BeO, 3P_2O_5$; $Be_2NaP_3O_{10}$, $5H_2O$; $5PbO, 3P_2O_5$; $PbNa_8(P_3O_{10})_2$, $14H_2O$; $CdNa_3P_3O_{10}$, $12H_2O$; $Cd_2NaP_3O_{10}$, $7H_2O$; $MnNa_3P_3O_{10}$, $12H_2O$; $5MnO, 3P_2O_5$; and $CoNa_3P_3O_{10}$, $12H_2O$. The exist-ence of $CaNa_3P_3O_{10}$ and $SrNa_3P_3O_{10}$ is indicated by the titration curves but these salts were not isolated

the titration curves, but these salts were not isolated.

A. J. E. W.

Mechanism of the genesis of polymorphous forms. M. C. BLOOM (Amer. Min., 1939, 24, 283-292).-Solubility measurements show that valentinite (1), the high-temp. form of Sb_2O_3 , is not a thermodynamically stable phase, except in the sense that it is apparently in equilibrium with the solution from which it is grown. Passive resistance to reorganisation of the structure allows equilibrium to exist at a higher free energy than the min. for the system. Sb₂O₃ prepared by atm. oxidation of Sb under H₂O is in the form of senarmontite (II), but pptn. from 0.01n-HCl, 0.01n-H2SO4, or 0.06n-HClO4 yields (I); from 0.01 n-HClO₄ a mixture of (I) and predominating (II) is formed. These results are explained in terms of interstitial accommodation of the foreign anion in the Sb₂O₃ structure. Anomalies connected with the genesis of unstable polymorphous forms are discussed.

L. S. T.

Salts of thiolbenziminazole. M. KURAŠ (Chem. Obzor, 1939, 14, 49-51).-Thiolbenziminazole (I) forms with cations of the H_2S group insol. compounds suitable for quant. analysis. From the corresponding mineral acid solution M3Bi,3H2SO4 (orange-yellow), $M_3Bi,3HNO_3$ (cinnabar-red), and $M_3Bi,3HCl$ (chrome-yellow) are pptd. ($M = C_7H_5N_2S$). From ammoniacal solution, Pb^I salts give quantitatively a white basic ppt., MPbOH; Cd^I salts a white microcryst. ppt. of MCd(OH),NH₃, and Cu^I salts a dark grey-blue ppt. of basic salt MCu(OH). Cu^I salts in EtOH solution give a yellow-ochre Cu^I salt whilst an excess of (I) gives complex violet salts sol. in EtOH as a red solution. F. R.

Synthesis and analysis of vanadium sulphides. J. I. GERASIMOV and I. K. TSCHUNICHINA (J. Gen. Chem. Russ., 1939, 9, 481-483).-V₂S₂ is obtained from V_2O_5 and S at 400° in a CO₂ atm., or by passing H_2S over V_2O_5 at 400—550°; V_2S_3 by passing CS₂ vapour over V_2O_5 at 700°, and V_2S_5 from V_2S_3 and S at 400°. The sulphides are analysed by Lunge's R. T. method.

Radioactive sulphur for biochemical experiments. J. L. TUCK (J.C.S., 1939, 1292-1294).-Radioactive ³⁵S in the form of aq. H₂S shows no

exchange reaction with cysteine hydrochloride, $SH \cdot CH_2 \cdot CO_2H$, allylthiocarbamide, or $CS(NH_2)_2$. $CS(NH_2)_2$ also shows no exchange with radioactive S in aq. NaSH alone or in presence of Cu", Fe", and Mn" which often catalyse reactions of org. thiocompounds. It is concluded that the thiol group in cysteine and allied compounds is firmly bound and that radioactive S can be used as indicator in such compounds. It is also inferred that the nitroprusside reaction with •SH is non-ionic. J. W. S.

New class of ammines. Complex thiomolybdates and thiotungstates. G. SPACU and A. POP (Bull. Acad. Sci. Roumaine, 1939, 21, 188-198).-The following complex salts have been obtained by double decomp.: $[MoS_4][Ni en_3]$; $[MoS_4][Zn en_3]$; $[MoS_4]_3[Cr en_3]_2$; $[MoS_4]_3[Co en_3]_2$; $[MoS_4]_3[Cr(urea)_6]_2, 4H_2O$; $[MoS_4]_3[Cr(antipyrine)_6]_2$; $[WS_4][Ni en_3]$; $[WS_4][Zn en_3]$; $[WS_4]_3[Cr en_3]_2$; $[WS_4]_3[Co en_3]_2$; $[WS_4]_3[Cr(urea)_6]_2, 4H_2O$; F. J. G. $[WS_4]_3[Cr(antipyrine)_6]_2.$

Sulpho-ceruleomolybdic acid and its salts. V. AUGER and (MLLE.) N. IVANOFF (Compt. rend., 1939, 209, 216–218).—Solutions containing sulpho-ceruleomolybdic acid, $H_5(MoO, Mo_2O_8)SO_4, nH_2O$ (I), are obtained by hydrolysis of the blue-violet H₂SO₄ solution containing the calc. proportions of MoO₃ and Mo^{v} (details given), by reduction of a H_2SO_4 solution of MoO₃ with SO₂, or more conveniently by hydrolysis of the tetra-acetate (A., 1936, 691) with boiling H_2O . Impure cryst. (1) $(n \sim 12)$ is obtained by evaporation of the BuOH extract of the acid aq. solution. (I) is very sol. in H_2O , and is rapidly oxidised in air. Aq. alkalis (or NaOAc etc.) remove all the (I) from its BuOH solutions, but none is extracted by aq. acids. Addition of NH₄Cl to aq. (I) affords a bluish-black $(NH_4)_3H_2$ salt; excess of aq. NH₃ in presence of NH₄Cl ppts. a bright blue-green $(NH_4)_5$ salt. Similar K salts exist, but have not been isolated. A. J. E. W.

Chemical methods of concentrating radioactive halogens. C. S. LU and S. SUGDEN (J.C.S., 1939, 1273-1279).-After C₂H₄Br₂, PhCl, PhBr, PhI, Bu^aBr, Bu^aI, or CCl₄ has been irradiated with neutrons from RaSO₄ and Be a large proportion of the radioactive halogen formed can be extracted with H₂O, aq. solutions, or finely divided metals. The fraction of the activity extracted by aq. solutions is increased by the addition of NH_2Ph (4%) or other org. base before irradiation. Radioactive I is separated mainly as the element, but Cl and Br are extracted prin-cipally as ions. The presence of free halogen increases the amount of radioactive isotope obtained from aliphatic halides, but not that from aromatic halides. A method permitting extraction of radioactive Br from C₂H₄Br₂ with a concn. factor of 31,000 is described. J. W. S.

Chemistry of manganese salt melts. I. Reaction of manganese chloride with chlorides of univalent metals. E. R. NATZVLISCHVILI and A. G. BERGMAN (J. Gen. Chem. Russ., 1939, 9, 642-646).-A 1:1 compound, m.p. 497°, is formed in the system MnCl₂-TlCl, and 1:1 and 1:2 compounds, m.p. 552° and 466°, respectively, in the system MnCl₂-RbCl.

R. T.

Hydrates of manganous sulphate. J. PERREU (Compt. rend., 1939, 209, 167—169).—MnSO₄,4H₂O gives the anhyd. salt on heating to const. wt. at 280°; the monohydrate is obtained at 110°, or at room temp. over H_2SO_4 in a vac. Tensimetric measurements during isothermal dehydration (22°; P_2O_5 , in vac.) confirm the existence of the monohydrate, but there is no evidence of definite hydrates with 2 or $3H_2O$ (cf. de Forcrand, A., 1914, ii, 658, 659). Products of this composition prepared by controlled dehydration are shown by X-ray analysis to be mixtures. A. J. E. W.

Relative dissymmetric synthesis and rotation dispersion in cobaltic complexes of the α -aminoacids. I. LIFSCHITZ (Rec. trav. chim., 1939, 58, 785—799; cf. A., 1939, I, 212).—The prep. of the following compounds is described (A = d-alanine, B = l-leucine): [Co en₂A](NO₃)₂,1·5 and 3 H₂O; d- and l-[Co en₂A](d-C₁₀H₁₅O₄BrS)₂,H₂O; [Co en₂B]Cl₂; [Co en₂B]I₂,H₂O; d- and l-[Co en₂B](d-C₄H₄O₆),3H₂O. F. J. G.

Cobaltammine salts of 12-molybdophosphoric acid. H. A. HORAN (J. Amer. Chem. Soc., 1939, 61, 2022—2025).—The compositions of the pentamminoand hexammino-cobaltic salts of 12-molybdophosphoric acid are $[Co(NH_3)_5H_2O]PMo_{12}O_{40}.4H_2O$ and $[Co(NH_3)_6]PMo_{12}O_{40}.3H_2O$ (I). In both types the H_2O of crystallisation is principally lattice H_2O . Owing to the intermediate reaction $[Co(NH_3)_5X]^{"}$ + $H_2O \rightarrow [Co(NH_3)_5(H_2O)]^{""}$ + X (X = Cl, NO) the same pentammine product is always obtained. The use of (I) as a reagent for the determination of $PO_4^{""}$ is recommended. W. R. A.

Complex compounds of platinum and butadiene (divinyl). A. GELMAN (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 532–536).—The prep. and properties of the following butadienoplatinous compounds are described: $(NH_4)_2[C_4H_6(PtCl_3)_2]$; $[Pt(NH_3)_4][C_4H_6(PtCl_3)_2]$; $C_4H_6(PtCl_2,NH_3)_2$: transtrans-, n 1·77–1·78, decomp. 185–188°; cis-cis-, decomp. 202–204°; $C_4H_6(PtCl_2,C_5H_5N)_2$: transtrans-, m.p. 138–140°; $PtCl_2,C_4H_6,C_5H_5N$: cis-, m.p. 155–158° (decomp.); trans-, m.p. 125–130°; $PtCl_2,C_4H_6,NH_3$: trans-, m.p. 172–174° (decomp.). Each double bond of the butadiene mol. has a high trans-activity; either one or both may form coordinate links. L. J. J.

Mixed platinum hydroxylamine tetrammines. V. I. GOREMIKIN and K. A. GLADISHEVSKAJA (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 544—547).— The prep. of the following hydroxylamino-amminoplatinous compounds is described :

 $\begin{array}{c} trans-\mathrm{PtCl}_{2}, 2\mathrm{NH}_{2}\mathrm{OH}, \mathrm{NH}_{3}, \mathrm{C}_{5}\mathrm{H}_{5}\mathrm{N} ;\\ trans-\mathrm{PtCl}_{2}, \mathrm{NH}_{2}\mathrm{OH}, 2\mathrm{NH}_{3}, \mathrm{C}_{5}\mathrm{H}_{5}\mathrm{N} ;\\ [\mathrm{Pt}(\mathrm{NH}_{2}\mathrm{OH})_{2}, \mathrm{NH}_{3}, \mathrm{C}_{5}\mathrm{H}_{5}\mathrm{N}] \mathrm{PtCl}_{4} ;\\ [\mathrm{Pt}\mathrm{NH}_{2}\mathrm{OH}(\mathrm{NH}_{3})_{2}, \mathrm{C}_{5}\mathrm{H}_{5}\mathrm{N}] \mathrm{PtCl}_{4} ;\\ [\mathrm{Pt}\mathrm{NH}_{2}\mathrm{OH}, \mathrm{NH}_{3}(\mathrm{C}_{5}\mathrm{H}_{5}\mathrm{N})_{2}] \mathrm{PtCl}_{4} ;\\ [\mathrm{Pt}\mathrm{NH}_{2}\mathrm{OH}, \mathrm{NH}_{3}, \mathrm{C}_{5}\mathrm{H}_{5}\mathrm{N}] \mathrm{PdCl}_{4} ;\\ [\mathrm{Pt}\mathrm{NH}_{2}\mathrm{OH}(\mathrm{NH}_{3})_{2}, \ \mathrm{C}_{5}\mathrm{H}_{5}\mathrm{N}] \mathrm{PdCl}_{4} ;\\ [\mathrm{Pt}\mathrm{NH}_{2}\mathrm{OH}, \mathrm{NH}_{3}, (\mathrm{C}_{5}\mathrm{H}_{5}\mathrm{N})_{2}] \mathrm{PdCl}_{4} ;\\ [\mathrm{Pt}\mathrm{NH}_{2}\mathrm{OH}, \mathrm{NH}_{3}, (\mathrm{C}_{5}\mathrm{H}_{5}\mathrm{N})_{2}] \mathrm{PdCl}_{4} ;\\ [\mathrm{Pt}\mathrm{NH}_{2}\mathrm{OH}, \mathrm{NH}_{3}, (\mathrm{C}_{5}\mathrm{H}_{5}\mathrm{N})_{2}] \mathrm{PdCl}_{4} .\\ \end{array}$

Physical phenomena of the arc discharge and their importance in spectro-analytical methods of investigation. W. ROLLWAGEN (Spectrochim. Acta, 1939, 1, 66—81).—The physical processes in the arc discharge and the contributions of the cathode region and of the column to the radiation emitted are discussed. In the column there is practically a thermal equilibrium, the temp. being dependent on the ease of ionisation of the carrier vapour. This is illustrated by variations in the intensities of the Ca and Sr lines in different carrier vapours. The effects of the experimental conditions on the arc spectra are also discussed. Preliminary investigations are also described which indicate that Tl can be determined by using an interrupted arc discharge between C electrodes impregnated with Na salts, In being used as comparison element. J. W. S.

Electro-titrations: review of recent trends. N. H. FURMAN (Trans. Electrochem. Soc., 1939, 76, Preprint, 237-251).

Volumetric analysis. Cause of error often overlooked. Liquids should not be measured by volume. R. MEURICE (Ann. Chim. Analyt., 1939, [iii], 21, 202—203).—Climatic variations in temp. such as may occur overnight may lead to surprisingly large changes in the vols. of liquids, with consequent errors in determinations. Analyses etc. by titration should therefore be carried out on weighed portions and the amount of liquid added should be found by weighing. Full manipulative details are given. The results are comparable with, or better than, those obtained by use of the micro-burette. Evaporation of aq. solutions during titration is negligible. T. H. G.

Use of the antimony electrode for determining hydrogen-ion concentration. R. SPYCHALSKI (Rocz. Chem., 1939, **19**, 441—462).—Accurate and reproducible results are given by Sb electrodes in stirred systems, with exclusion of CO_2 , when a const. relation between the surface of the electrode and the vol. of the solution is maintained. The temp. coeff. $p_{\rm H}$ curve is given. Salts (NaCl, NaNO₃, Na₂SO₄, KNO₃) considerably modify the potential given by Sb electrodes, to a greater extent than for H electrodes. Gelatin and agar (3%) do not affect the results. Under conditions favourable for oxide formation the Sb electrode behaves as an irreversible electrode of the 2nd order, whilst under reducing conditions it behaves similarly to a Pt electrode.

R. T. s-Diphenylguanidine as an acidimetric standard. J. W. YOUNG (Canad. J. Res., 1939, 17, B, 192-197).—Three methods of preparing borax containing exactly $10H_2O$ have been compared. The H_2O content is always slightly low, and the material is not stable on keeping. NaHCO₃ can be kept for long periods without change. s-Diphenylguanidine is a satisfactory standard; it has ρ_4^{20} 1·19.

F. J. G.

Concentration cell in quantitative analysis. II. Determination of fluoride. G. W. Low, jun., and E. H. PRYDE (J. Amer. Chem. Soc., 1939, 61, 2237—2246).—The technique involved in the determination of Cl' by means of a simple concn. cell (cf. A., 1935, 1336) has been applied to the rapid and accurate determination of F' ions. The effect of other ions has been completely eliminated. The method has been applied to the determination of F'in H_2O and phosphate rock. W. R. A.

Detection of fluorine in minerals. F. C. FOLEY and P. W. WEST (Amer. Min., 1939, 24, 398—399).— The fading of the Zr-alizarin lake is utilised after fusion of the sample with Na₂CO₃ in a Pt loop, dissolution in 1:1 HCl, and dilution with H₂O. Large amounts of SO₄'', AsO₄''', and S'' interfere, and in presence of PO₄ the fused mass must be dissolved in 1:1 H₂SO₄ and any F removed by distillation. L. S. T.

Determination of fluorine in wine,—See B., 1939, 983.

Determination of oxygen in metals.—See B., 1939, 952.

Rapid determination of sulphuric and hydrochloric acids in presence of each other by means of conductometric neutralisation analysis. K. SANDERA and E. SOMMER (Z. anal. Chem., 1939, 117, 265-268).—The mixture of HCl and H_2SO_4 is diluted to 0.05-0.25N. and 10 c.c. of this solution are titrated (phenolphthalein) with 0.1N-Ba(OH)₂, giving the total acidity. The titrated solution is diluted accurately to 100 c.c. and its conductivity is determined without previous filtration. Reference to a graph or to the table reproduced gives the [HCl]. L. S. T.

Determination of sulphur in titaniferous coal ash. Precipitation of barium sulphate in presence of titanium salts.—See B., 1939, 900.

Determination of sulphur in ferro-phosphorus. --See B., 1939, 944.

Determination of volatile sulphur compounds in foods.—See B., 1939, 988.

[Determination of] selenium. R. A. OSBORN (J. Assoc. Off. Agric. Chem., 1939, 22, 346—349).— On the basis of satisfactory collaborative analyses it is recommended that the simplified procedure described previously be tentatively adopted (cf. A., 1938, I, 471). E. C. S.

Conductometric analysis of sodium selenite and mercurous nitrate. J. KAMECKI (Rocz. Chem., 1939, 19, 433—440).—Good results are obtained in the electro-titration of Na_2SeO_3 with HgNO₃; the reverse titration is best effected in presence of HNO₃. R. T.

Kjeldahlisation in laboratories not equipped with well ventilated fume cupboards. A. ERNEST (Chem. Listy, 1939, 33, 225—226).—The fumes are aspirated through aq. NaOH. R. T.

Determination of nitrogen in stainless steels. —See B., 1939, 945.

Ferro-molybdate reagent for the detection of small quantities of phosphoric acid, silicic acid, arsenic acid, and arsenious acid. J. H. VAN DER MEULEN (Rec. trav. chim., 1939, 58, 841—846).— Under suitable conditions of concn. and $p_{\rm H}$, a solution of FeSO₄ and Na₂MoO₄ in dil. H₂SO₄ remains colourless, but is coloured blue by traces of H₂PO₄, H₂SiO₃, H_3AsO_4 , or H_3AsO_3 . No reaction is given with $H_4P_2O_7$. The presence of F' is advantageous. F. J. G.

Determination of phosphate by photo-electric colorimetry. G. R. SMITH, W. J. DYER, C. L. WRENSHALL, and W. A. DE LONG (Canad. J. Res., 1939, 17, B, 178—191; cf. A., 1938, I, 369).—The effects of the concn. of Sn^{**} and Sn^{****}, of other salts, of Fe^{***}, and of temp. on the reaction have been studied. The SnCl₂ solution must be protected against oxidation. The interference by Fe^{***} can be reduced by dilution of the solution and by the use of a larger concn. of Sn^{**}. F. J. G.

Application of salts of complex cations to the microscopic detection of anions. VIII. 1:2-Chloroaquotetramminocobaltic chloride. L. K. YANOWSKI and W. A. HYNES (Mikrochem., 1939, 27, 161—164).—The reagent has been prepared by a modification of Werner's method (A., 1908, ii, 42). Cryst. products are obtained with HPO₄" and P₂O₇"" ions, the min. amounts detactable by the method being 67 and 200 µg., respectively. With HPO₄" the form of the product depends to some extent on the $p_{\rm H}$ of the solution. Other ions which give turbidities with the reagent are listed. J. W. S.

Spectrophotometric determination of phosphoric acid by means of the cœruleo-molybdic reaction.—See A., 1939, III, 886.

Rapid volumetric micro-method for determining arsenic. C. C. CASSIL and H. J. WICHMANN (J. Assoc. Off. Agric. Chem., 1939, 22, 436–445).— The method, which is suitable for apple strip solutions, or for material submitted to wet digestion, is described in greater detail than in the previous account (cf. A., 1938, I, 471). With 5–500 μ g. of As₂O₃ the recovery of As is 99.5%, standard deviation 0.85%. The determination requires <10 min. E. C. S.

Determination of carbon dioxide content of ammoniacal liquors.—See B., 1939, 935.

Colorimetric determination of carbon disulphide [in benzoles].—See B., 1939, 903.

Determination of silicon [in light alloys].—See B., 1939, 951.

Microchemical detection of certain cations with the aid of hexanitrodiphenylamine. O. G. SCHEINTZIS (Chimia, 1936, 103—111).—2% aq. NH[C₆H₂(NO₂)₃]₂ gives characteristic micro-crystals with K (<0.012N.; NH₄ interferes, but not Na, Li, Mg, Ba, Sr, or Ca, whilst Al, Fe^{III}, Cr^{III}, Ni, Co, Bi, and Hg^I give amorphous ppts.), with Cs (<0.0005N.), with Rb (<0.0015N.), with Pb^{II} (<0.0015N.), and with Hg^{II} (<0.002N.). R. T.

Determination of total and free alkali in sodium stannate solutions.—See B., 1939, 935.

Drop tests for some ions. E. A. Kocsis (Mikrochem., 1939, 27, 180–184),—In drop reactions with neutral solutions benzopurpurin 4B yields a brown ring and red central spot with Ag[•] (<0.03 mg.), a red-violet spot with Hg₂^{••} (<0.04 mg.), a bluishgrey ring and violet-red inner spot with Hg^{••} (<0.025 mg.), a bright brown ring and reddish-yellow centre spot with UO₂^{••} (<0.035 mg.), and a reddish-brown

spot with Al^{...} (<0.005 mg.). Bromophenol-blue yields a sharp violet-red ring and violet spot with Pb (<0.025 mg.), a reddish-brown spot with Hg₂... (<0.015 mg.), an ochre-yellow spot and bright blue outer ring with Hg^{...} (<0.02 mg.), and a red-brown ring with UO₂^{...} (<0.025 mg.). Al ($<0.001 \mu$ g.) can be detected by treating the test solution with a drop of morin (in EtOH) and irradiating with an ultraviolet lamp, when a bright green fluorescence is obtained in transmitted light. J. W. S.

Micro-determination of calcium and phosphate. R. S. MANLY (Mikrochem., 1939, 27, 145– 153).—Tables are given summarising methods for determining >1 mg. of Ca and P. The wt. of constituent determined, special reagents and apparatus used, and the principles, use, accuracy, and precision of the methods are summarised. J. W. S.

Winkler's semi-microchemical analytical method in technical analysis. V. MAJER and J. MACEK (Chem. Obzor, 1939, 14, 53—55).—Winkler's method for the determination of Ca^{**}, SO₄^{''}, Pb^{**}, and PO₄^{'''} requires experience, and is of use only for a series of determinations. F. R.

[Determination of] zinc. E. B. HOLLAND and W. S. RITCHIE (J. Assoc. Off. Agric. Chem., 1939, 22, 333–339).—The dithizone method has been modified in numerous details and extended to permit determination of Cu and Pb. The full procedure is described and the colour reactions of 28 metals with dithizone, $NEt_2 \cdot CS_2Na$, and a mixture of the two reagents, in both 0.02N-HCl and 0.02N-NH₃ in every case, are tabulated. E. C. S.

Determination of cadmium, and its separation from bismuth, by means of potassium iodide and hydrazine hydrate. A. JfLEK and B. KOHUT (Chem. Listy, 1939, 33, 252—256).—10 c.c. of 10%KI are added to 100 c.c. of hot solution, containing >0.2 g. Cd, followed by 10 c.c. of 10% N₂H₄,H₂O, and the ppt. of CdI₂,2N₂H₄ is collected, washed (special solution), dried at 110°, and weighed. In presence of Bi (>0.1 g. each of Cd and Bi in 150 c.c.), 8 c.c. of 2N-NH₄NO₃ and 40 c.c. of neutral 10% Na tartrate are added, followed by 35 c.c. of 10% KI, and 30 c.c. of 10% N₂H₄,H₂O are added gradually to the hot solution. The ppt. separating from the cooled solution is washed (special solution), dried, and weighed. Bi is determined in the filtrate, by the usual methods. R. T.

[Polarographic] determination of cadmium in blende.—See B., 1939, 947.

Absolute colorimetric metal analysis.—See B., 1939, 952.

Determination of small amounts of lead in presence of copper, iron, and tin. J. P. GOCHSCHTEIN (Chimia, 1936, 127—132).—Pb is pptd. as PbCr₂O₇, the washed ppt. is dissolved in conc. HCl, 10% KI is added, and I is titrated with 0.01N-Na₂S₂O₃. Fe interferes, and should be removed, together with Cu, by pptn. with excess of KOH. The filtrate + washings are made acid with AcOH, and Pb is determined by the above method (12— 30 mg.-%). R. T. (A) Micro-titration of lead. M.V. GAPTSCHENKO. (B) Determination of lead in alloys. M. V. GAPTSCHENKO and O. G. SCHEINTZIS (Chimia, 1936, 113—118, 119—125).—(A) 10% NaHSO₃ is added to the solution (<0.05 mg. Pb) in a centrifuge tube, and the ppt. of PbSO₃ is washed on the centrifuge and dissolved in 2N-NaOH. I in KI is added, the solution is made acid, and excess of I is titrated. Fe and Cu do not interfere in neutral solutions.

(B) The alloy, containing Sn, Sb, Pb, and Cu, is dissolved in HNO_3 , the solution is filtered, excess of aq. NH_3 is added to the filtrate, the ppt. of $Pb(OH)_2$ is dissolved by adding NH_4OAc , and Pb is determined by the above method. R. T.

Determination of free lead oxide in red lead. —See B., 1939, 966.

Determination of lead tetraethyl in gasoline. —See B., 1939, 904.

[Determination of] copper. D. L. DRABKIN (J. Assoc. Off. Agric. Chem., 1939, 22, 320-333).-The dithizone method is improved in respect of ashing of the sample, the use of a new solvent, viz., iso-C₅H₁₁·OAc, and the use of several monochromatic filters for the photometry of the coloured solution. Procedures are given for ashing samples of milk, elixirs, and animal tissues. The absorption spectra of the Cu, Ni, Co, and Bi dithizone complexes and of CuSO₄,4NH₃,H₂O are reproduced. Three filters of which the max. transmissions are at 640, 535, and 480 m μ ., respectively, are specified and recommended for this and other photometric determinations. The separation of Cu from Ni and Co and the correction for contamination with Bi are discussed. E. C. S.

Thiolbenziminazole as an analytical reagent. M. KURAŠ (Chem. Obzor, 1939, 14, 51–52).—Cu^{**}, Cd^{**}, and Pb^{**} may be determined by pptn. with thiolbenziminazole. Pb^{**} and Cd^{**} may be weighed directly as the ppts. $C_7H_5N_2SPbOH$ and

 $C_7H_5N_2SCdOH,NH_3$ respectively, but the Cu^{**} ppt. must be converted first by ignition into CuO.

F. R.

Determination of copper [in duralumin-type alloys].—See B., 1939, 950.

[Determination of] mercury. W. O. WINKLER (J. Assoc. Off. Agric. Chem., 1939, 22, 341—346).— Tests of various methods of proceeding after extraction with dithizone are recorded, none of them leading to final conclusions. E. C. S.

Microchemical detection of mercury. I. M. KORENMAN (Chimia, 1936, 133—135).—Equal vols. of saturated aq. $ZnSO_4$ and NH_4CNS are mixed, H_2O is added to dissolution of the ppt. of $Zn(CNS)_2$, and 0·1 g. of Fe alum is dissolved in the solution. The reagent gives characteristic crystals of $HgZn(CNS)_4$ with Hg^{I} or Hg^{II} (0·023 µg.), Cd (0·25 µg.), or Ag (0·4 µg.). Cu, Pb, Ba, and Sr interfere with the reactions, but not Sb, Sn, Bi, Mn, Fe, Co, or Ni. R. T.

Separation of praseodymium and terbium from mixtures of rare earths. G. BECK (Angew. Chem., 1939, 52, 536—537).—To remove Pr and Nd the rare earth mixture is fused with KOH; electrolysis of the product gives brown PrO, at the anode and metallic Nd at the cathode; decantation when the reaction is complete leaves a residue of PrO_2 , whilst hydrolysis of the KNdO₂ melt yields Nd(OH)₃ which is further extracted with 10% AcOH. The removal of Tb from Sm-Gd fractions is also based on fusion of the material with KOH, but with addition of KClO₃; impure TbO₂ is pptd. on cooling and the process is repeated. S. M.

Determination of very small amounts of europium in samarium. A. GATTERER and J. JUNKES (Spectrochim. Acta, 1939, 1, 31–46).—The Sm_2O_3 (0.05 g.) is dissolved in HCl (0.5 c.c.) and examined spectroscopically by a modified form of Scheibe and Rivas' method (A., 1936, 1084), a definite vol. of the solution being absorbed on the pure C electrodes after definite periods of operation of the arc. The intensities of the Eu 4129.73 and 3971.95 A. lines are compared with those of the Sm 4128.10 and of the 2971.35 and 3970.53 A. lines, respectively. The [Eu] is then deduced by comparison with the results of tests with solutions of similar [Sm] containing known [Eu]. The same standard solutions can be used to determine approx. the [Eu] in Gd by abs. intensity measurements. The method permits the determination of 0.01% of Eu in Sm with an accuracy of $\pm 5\%$. J. W. S.

Application of emission spectroscopy to local micro-analysis. I. (a) Apparatus. (b) Preliminary results. G. SCHEIBE and J. MARTIN (Spectrochim. Acta, 1939, 1, 47-65).-An electric discharge is produced between a rod electrode, contained in a tube terminating in a capillary jet, and a metallic surface in such a manner that the excited spot of the latter is of diameter >0.02 mm. Such a discharge permits the detection of local variations in the composition of the surface. By simultaneous movement of the surface and of the photographic plate a spectrogram can be obtained which indicates the composition of an alloy at all points along the line tested. The applicability of the method is discussed with reference to results obtained with Al alloys. J. W. S.

Determination of aluminium in steel.—See B., 1939, 945.

Potassium chlorate with sodium hydroxide as a dry reagent for manganese. G. DENIGÈS (Bull. Trav. Soc. Pharm. Bordeaux, 1936, 74, 148—152; Chem. Zentr., 1937, i, 1985).—0.2—0.25 g. of KClO₃ is treated with 1—2 drops of aq. NaOH, dried, and fused until gas bubbles appear. This reagent gives a green or blue-green bead on fusion in presence of Mn; the bead gives a green aq. solution, which becomes pink on addition of HNO₃. Cu, Co, and Ni also give green beads. A. J. E. W.

Colorimetric determination of ferrous and ferric iron in presence of aluminium, manganese, zinc, mercury, copper, phosphoric acid, or of organic substances, with special regard to medicinal preparations. E. SCHULEK and I. FLODERER (Z. anal. Chem., 1939, **117**, 176—195).— The application of the 2:2'-dipyridyl (I) method to the determination of Fe in presence of certain metals, org. substances, and in Fe-containing medicines has

been investigated, using the Pulfrich photometer. Extinction data show that with a suitable light filter (S50) and conditions the colour of Fe" with (I) obeys Beer's law, and that a tenfold excess of Al, Mn, Zn, Hg, Cu (in presence of KCN), and Fe^{***} (in presence of H_3PO_4) does not interfere with the determination of 50° and 100 µg. of Fe" per 100 c.c. by this method. Fe" can be determined as the Fe"-(I) complex after reduction to Fe" with a slight excess of H₂SO₃ by warming in slightly acid solution. In presence of H₃PO₄ reduction is incomplete under these conditions, but can be made complete by adding (I) during reduction, buffering with NH4OAc, and keeping for $\ll 24$ hr. With > a 1000-fold excess of H₃PO₄ only 50 µg. of Fe can be reduced completely. Details for the determination of Fe", and of Fe" in presence and absence of H_3PO_4 , are given. Amounts of Cu > a 10-fold excess must be removed as CuCNS. H₃PO₄ is an efficient stabiliser in the determination of Fe in liquid medicinal preps., and solid preps. are dissolved in 20% $\rm H_3PO_4$ and 38% HCl. The total Fe in org. materials and medicinal preps. containing them can be determined by the (I) method without prior destruction of the org. matter. The sample is warmed with dil. H₂SO₄, reduced with H₂SO₃, and then treated with (I) and NH₄OAc. Details of the various methods and typical results for a no. of medicinal preps. are given. Purification of the reagents from Fe is also described. L. S. T.

Spectrum analysis of solutions containing metals. P. JOLIBOIS and R. BOSSUET (Compt. rend., 1939, 209, 91—93).—Limiting conces. for the detection of 21 metals by the authors' technique (A., 1937, I, 374) are given. Solutions containing Fe give lines due to the neutral atom, and lines of non-metals, rare-earth metals, Nb, Ta, etc. cannot be obtained, confirming that the spectra are due to combustion of OH under the surface of the solution (cf. A., 1939, I, 29). A. J. E. W.

Photometric determination of iron and copper in aluminium and aluminium alloys.—See B., 1939, 949.

Potentiometric analysis of ferrovanadium.— See B., 1939, 944.

Potentiometric analysis of ferrotitanium.— See B., 1939, 944.

Determination of cobaltihexacyanide. L. GUZELJ (Bull. Soc. Chim. Yougoslav., 1938, 9, 185–200).—The solubility of $Ag_3Co(CN)_6$ (I) in H_2O at room temp. is $\sim 10^{-6}$ g.-mol. per l. $Co(CN)_6^{\prime\prime\prime\prime}$ is determined gravimetrically by pptn. of (I) with a small excess of $AgNO_3$, or volumetrically by titration with $AgNO_3$. Potentiometric titration with $AgNO_3$ gives low results, owing to adsorption of $Co(CN)_6^{\prime\prime\prime\prime}$ on the pptd. (I). R. T.

Determination of tin and copper in bronzes. —See B., 1939, 946.

Tin-phosphorus precipitate in bronze analysis.—See B., 1939, 946.

Volumetric and gravimetric determination of zirconium and hafnium, alone and in presence of each other, with selenious acid. A. CLAASSEN X, XI

(Z. anal. Chem., 1939, 117, 252-261).-The dil. acid solutions containing Zr or Hf are treated with excess of aq. H_2 SeO₃ (cf. A., 1931, 590) and the pptd. basic salts converted into Zr(SeO₃)₂ or Hf(SeO₃)₂ by long digestion (5-20 hr.) on the water-bath. The ppts. can be either dried at 120-200° and weighed as selenites, or dissolved in aq. NaF + dil. H₂SO₄, and the H₂SeO₂ determined iodometrically by van der Meulen's method (A., 1934, 744). The volumetric results for Zr are accurate, but for Hf they are 1.0-1.4% high, and the gravimetric results for Zr are high owing to a slight reduction of SeO_3'' to Se. By combining a determination of mixed oxides, $ZrO_2 +$ HfO_2 , with the volumetric determination as selenites, the Hf content in a mixture of the two metals can be found with an accuracy of $\sim 1\%$. L. S. T.

Analysis of slags containing vanadium.—See B., 1939, 944.

Rapid determination of traces of bismuth in lead.—See B., 1939, 948.

Colour reactions of polyphenols with niobium and tantalum salts. N. F. KRIVOSCHLIKOV and M. S. PLATONOV (J. Gen. Chem. Russ., 1939, 9, 539).—Polemical, in reply to Schemjakin *et al.* (A., 1939, I, 102) and to Zvjagintzev *et al.* (*ibid.*, 102). R. T.

Colorimetric determination of palladium with *p*-nitrosodiphenylamine. J. H. YOE and L. G. OVERHOLSER (J. Amer. Chem. Soc., 1939, **61**, 2058—2063).—*p*-NO·C₆H₄·NHPh (I) reacts with PdCl₂ in neutral or slightly acid solution to give either a deep red coloration or a purplish-brown ppt. of Pd[NHPh·C₆H₄·NO]₂Cl₂ (II), depending on the [Pd].

The test is extremely sensitive and will detect 1 part Pd in 2×10^8 . Au and Ag give colours but the sensitivity is \ll for Pd. Oxidising agents interfere; cyanides and iodides prevent the reaction. The sensitivity is influenced by $p_{\rm H}$ and by presence of salts. Absorption curves for (I) and (II) are given. The determinations of Pd in presence of Au and of Pt are outlined. W. R. A,

Micro-determination of rhodium with thionalide. H. KIENITZ and L. ROMBOCK (Z. anal. Chem., 1939, 117, 241—243).—The chloride-free Rh solution (30—50 c.c. containing 0.25—10 mg. of Rh) is treated with an excess of 1—2% thionalide (I) in glacial AcOH. The orange-yellow ppt. of Rh($C_{12}H_{10}ONS$)₃ produced on boiling is filtered hot, washed with glacial AcOH, and the excess of (I) in the filtrate is titrated with I, a small excess of which is back-titrated with Na₂S₂O₃. Since RhCl₃ gives a ppt. of ~ Rh($C_{12}H_{10}ONS$)₃.RhCl₃, Cl' must be removed by evaporation with H₂SO₄. The results are accurate to <1%. L. S. T.

Hydrocarbon flame temperatures. J. VAN DE POLL and T. WESTERDIJK (Compt. rend., 1939, 209, 158—160).—A modified Féry method of measuring high flame temp. (0) is described. A continuum afforded by a C arc is superposed on the *D*-lines produced by the flame, and the luminosities are matched by adjustment of an absorption trough in the arc optical system. The colour temp. of the arc image is then determined with a pyrometer. Accuracy to within 5° is claimed. 0 vals. for $C_3H_8-O_2$ flames are in accord with vals. calc. by Ribaud's method (B., 1938, 124), except when the O_2 is insufficient for complete combustion, when θ_{obs} is $> \theta_{calc}$, owing to interference by the secondary combustion zone. The efficiency of a welding flame is determined by the proportion of the evolved heat which represents primary combustion (35 and 75% with C_2H_2 and C_3H_8), the heat of secondary combustion being of no val. A. J. E. W.

Liquefaction of helium. A. VAN ITTERBEEK [with W. VAN DINGENEN] (Physica, 1939, 6, 728— 736; cf. A., 1939, I, 339).—A He liquefier-cryostat, based on the liquefier already described, has been constructed. The apparatus uses 3 l. of liquid H_2 , with initial pressure 80—100 atm. and temp. 14° K. The expansion operation gives 25—30 c.c. of liquid He, the time required being 0.75 hr. 50% of the He liquefied can be obtained in the cryostat.

L. J. J. Survey of the durability of aluminium-coated mirrors in astronomical use. R. C. WILLIAMS (Astrophys. J., 1939, 89, 611-622).—The chief cause of deterioration is the combined action of deposits of chemically-active dust and H₂O. L. S. T.

Absorption factor in crystal spectroscopy. G. ALBRECHT (Rev. Sci. Instr., 1939, 10, 221—222).— A graphical method for determining the absorption in a crystal of any size, shape, and absorbing power is described. D. F. R.

Cylindrical lens spectrograph for the optical determination of the concentration of ozone in atmospheric layers near the ground. M. W. CHIPLONKAR (Proc. Indian Acad. Sci., 1939, 9, A, 504-507).—The spherical camera lens of the objective prism spectrograph is replaced by a cylindrical lens with its axis parallel to the refracting edge of the prism, and an optical wedge of known consts. is added near the photographic plate with the slope of the wedge parallel to the length of the spectral lines. The application of the instrument and the method of calculating the amount of O_3 are outlined.

C. R. H.

Conoscopic determination of the position of the binormals in a triclinic crystal, without knowledge of the n_{β} index. A. SWARYCZEWSKI (Arch. Min. Soc. Sci. Varsovie, 1936, **12**, 1–7; Chem. Zentr., 1937, i, 1372).—The axes are determined by Wülfing's method, using the measured angles between the optic axes and the normals for two crystal faces, and plotting these angles in a spherical triangle. An example is given. A. J. E. W.

Apparatus for demonstrating X-ray fluorescence and phosphorescence. M. LENZI (Strahlenther., 1939, 65, 158-162). E. M. J.

Photography of interatomic distance vectors and of crystal patterns. M. J. BUERGER (Proc. Nat. Acad. Sci., 1939, 25, 383–388).—Suggestions for extending the range of application of Bragg's Xray microscope (A., 1939, I, 389) are made.

W. R. A.

Vertical illuminator for low-magnification photography of polished surfaces. J. A. LEGGE, jun. (Amer. Min., 1939, 24, 400–403). L. S. T. Photo-counters in the ultra-violet. A. DAUVIL-LIER and E. VASSY (Compt. rend., 1939, 209, 394— 397).— $\lambda\lambda$ (2000—3500 A.) of the upper and lower sensitivity (s) limits and the s max. are given for counters with variously treated Cu, Ag, Au, C, Ni, Mo, and Pt photo-cathodes in Kr and H₂. Treatment of the cathode with H₂ at 300°, or bombardment with H⁺ ions, displaces the s curve to higher $\lambda\lambda$. High s at 200—400 A. is produced by using cathodes heattreated with O₂, and a rare gas filling containing 0-1% of O₂. The construction of the counters, which are stable and give reproducible results, is outlined.

A. J. E. W. Photo-electric photometry. Photo-emissive cell specially designed for high precision measurements. G. A. BOUTRY and P. GILLOD (Phil. Mag., 1939, [vii], 28, 163–184).—The construction of a photo-emissive cell which gives a strictly proportional response over a large register of luminous flux variation is described. The cell has finite plane parallel electrodes with guard-rings, one electrode being transparent for the admission of light. This approximates to an ideal cell with infinite parallel plane electrodes. A much lower tension is employed than with most commercial cells and as a result the "noise-level" is extremely small when an amplifier is used. The cell has a low saturation potential (-0.1 v.) and a space-charge sufficiently small for current-potential characteristics to be quite straight and horizontal between saturation and the first excitation potential of the residual gas in the cell. C. R. H.

Two examples of the non-additivity of the photo-electric effects of simultaneous luminous fluxes. G. LIANDRAT (Compt. rend., 1939, 209, 101-103).—The effect of an intense continuous flux on the current variation produced by a superimposed alternating flux in "thalofide " and Se cells is studied and discussed (cf. Schönwald, Ann. Physik, 1932, 15, 419). A. J. E. W.

Photo-electric diffusion-absorption meter. A. DOGNON (Compt. rend. Soc. Biol., 1939, 130, 1481— 1484).—An apparatus to measure diffusion and absorption of systems absorbing feebly is described. H. G. R.

Dispenser cathode. New type of thermionic cathode for gaseous discharge tubes. A. W. HULL (Physical Rev., 1939, [ii], 56, 86—93).— Decrease in high electron emission with time of operation is eliminated by the use of initially uncoated cathode members to which a coating material is dispensed at uniform rate from a "dispenser" located within the common heat-shield. The dispenser consists of a closely woven structure of fine Mo wires, filled with granules of fused BaO-Al₂O₃ eutectic. It is maintained at 1150° by current through it, and serves as a radiation heater for the cathode. The electronemitting members are clean Mo. N. M. B.

Performance of the 60-inch cyclotron at the University of California. E. O. LAWRENCE *et al.* (Physical Rev., 1939, [ii], 56, 124).—An outline of initial adjustments and results. N. M. B.

Detection of radioactive contamination, using Geiger-Müller counters. L. F. CURTISS (J. Res. Nat. Bur. Stand., 1939, 23, 137–150).—A portable Geiger-Müller counter operated entirely from a.c. mains and capable of rapid and accurate detection of radioactive material equiv. to $0.5 \,\mu\text{g}$. of Ra per sq. m. is described. The instrument is suitable for detection of contamination by radioactive materials and for routine testing of workers, their garments, and materials handled by them. It can also be used for testing Ra ores and detecting lost Ra preps. J. W. S.

Investigation of the linear accelerator. P. L. HARTMAN and L. P. SMITH (Rev. Sci. Instr., 1939, 10, 223-231).—A linear resonance accelerator giving 3.5×10^5 e.v. is described. A theoretical discussion of the yield and velocity distribution of the particles and of focussing and high-frequency problems is included. The mass selection of the linear accelerator is not sufficient to separate cleanly ions of all masses. D. F. R.

Fog in Wilson cloud chambers. (MISS) N. M. MOHLER and (MISS) P. L. MORROW (Rev. Sci. Instr., 1939, 10, 242—243; cf. A., 1939, I, 390).—The fog density shows a max. at low light intensities, followed by a sharp increase at high intensities. No such effect is observed with yellow light. The fog increases with time. Variation in expansion rate, substitution of different alcohols, or removal of velvet in the chamber produces no appreciable change in the amount of fog. D. F. R.

Automatic registration of the course of chemical reactions. K. ŠANDERA (Chem. Obzor, 1939, 14, 89—90).—If a chemical change can be transformed into changes of electrical current (conductivity, photo-cells, thermocouples, etc.) it can be automatically registered. Examples are described.

F. R.

Simple arrangement for measuring specific resistance of liquids. V. NESSEL (Chem. Obzor, 1939, 14, 137—139).—The problem of simple conductivity measurement depends on a suitable electrode and current-measuring instrument. Satisfactory apparatus for these two requirements is described in detail. F. R.

Mounting for the antimony electrode. G. FLORENCE and A. DRILHON (Arch. Phys. biol., 1936, 13, 113-114; Chem. Zentr., 1937, i, 2221).

A. J. E. W.

Sector process for photographing electron interference. P. DEBYE (Physikal. Z., 1939, 40, 507—508).—It is shown that no improvement can result when plates already taken are copied by a sector process, but that the rotating sector must be used in front of the actual plate on which the original photograph is taken. A. J. M.

Intensity problems and resolving power of the electron microscope. M. VON ARDENNE (Z. Physik, 1939, **112**, 744—752).—The mutual dependence of image brightness and c.d. at different parts of the electron-optical train, and their relation to the resolving power of the electron microscope, are examined theoretically. H. C. G.

The use of a magnetic force for measuring small wts. is applied to an analytical and a vac. balance. The method is particularly suitable for measuring small changes of wt. in a vac. D. F. R.

Use of Hempel's gas pipette with four bulbs. L. WOLF (J. pr. Chem., 1939, [ii], 153, 263—264).— A modified pipette, which can be readily filled and in which the Cu gauze is replaced by a bundle of clean Cu wires, is described. H. W.

Simple inexpensive pipetting machine. J. H. MILLS (J. Lab. clin. Med., 1939, 24, 1082-1084). C. J. C. B.

Apparatus for determining surface tension and elasticity. A. DOGNON and M. ABRIBAT (Compt. rend. Soc. Biol., 1939, 130, 1000—1002).—The method described employs electromagnetic compensation to measure the force exerted on a Pt lamina roughened with emery. H. G. R.

Method of counting [dust] samples taken with the impinger. C. R. WILLIAMS (J. Ind. Hyg., 1939, 21, 226-230).—The new procedure employs an eye-piece of higher magnification than in the standard method, and a bright-line hæmocytometer cell. The results obtained agree with those determined by the standard method, and the process is more rapid and eliminates glare. E. M. K.

Determination of rate of evaporation of liquids. R. S. DANTUMA (Verfkronick, 1939, 12, 110—111).—The left-hand pan of a balance is replaced by a ring to which is fixed a filter-paper, and wts. are placed on the right-hand pan to secure a balance. A number of 50-mg. wts. are now placed on the pan to make a wt. slightly < that of 1 ml. of the liquid under test. 1 ml. of the liquid is then run on to the filter-paper from a pipette and the time when a balance is obtained is noted. One 50-mg. wt. is then removed and the time for balance to be restored by evaporation of the liquid is noted. The process is repeated until all the liquid has evaporated. From the readings, a curve showing the rate of evaporation is plotted.

D. R. D.

Rideal absorption hygrometer. H. W. HARK-NESS (Rev. Sci. Instr., 1939, 10, 237—241).—The errors due to adsorption on the containing walls of the hygrometer, presence of stagnant air, and temp. fluctuations have been studied theoretically and experimentally. By applying corrections for the first two errors and employing the hygrometer in a thermostat, very reliable determinations may be made.

D. F. R.

Portable motor-driven apparatus for depositing built-up molecular films. S. J. GREGG and E. E. WIDDOWSON (Rev. Sci. Instr., 1939, 10, 236-237). D. F. R.

Mounting thin celloidin sections. G. G. ROBIN-SON (J. Roy. Microscop. Soc., 1939, [iii], 59, 79).— Sections 3 μ . in thickness, and difficult to flatten, were floated in H₂O on slides previously smeared with albumin. After stretching on the hot-plate, the ribbons were put for some hr. in a closed glass vessel containing cotton-wool soaked in Et₂O and a dish of CaCl₂. These, respectively, flattened and dried the sections, which could be thus stored indefinitely. N. M. B.

Determination of mol. wt. by an ultra-centrifuge method, without an observation system. M. PAIÓ (Arh. Hemiju, 1939, 13, 33-41).—The use of the ultra-centrifuge of Henriot and Huguenard for mol. wt. determination is described. R. T.

F. H. [Vacuum filter apparatus.] A. SCHWEIZER (Chem. Weekblad, 1939, 36, 578).—A filter funnel is fitted into a double-chambered receiver, the two chambers of which can be evacuated, interconnected, separated from each other, or filled with air by means of glass taps. The apparatus is similar in principle to the Perkin triangle used in vac. distillations. S. C.

Filter apparatus for filtration and washing of precipitates on a microscope slide. H. JURÁNY (Mikrochem., 1939, 27, 185—188).—The filter comprises a glass tube, 2 cm. long and 1.5—2 mm. in diameter, constricted at two points. Between these points the tube is packed with asbestos with layers of fritted glass granules on each side. This tube is connected by rubber with the constricted end of a vertical tube, 8 mm. wide, which acts as filtrate receiver and the upper end of which is connected through a tap with a vac. pump. The device permits washing of a ppt. on a microscope slide, collection of the filtrate, and subsequent re-dissolution of the ppt. from the filter. J. W. S.

Handling of small amounts of precipitate. J. DONAU (Mikrochem., 1939, 27, 189-194).—An improved form of the author's filter (A., 1932, 828) is constructed of sheet Pt with spongy Pt as filtering medium. Methods of using the filter in conjunction with a shallow Pt pptn. dish for small amounts of liquid, and with a tap funnel pptn. vessel for larger quantities of liquid, are described. J. W. S.

Preparation of membranes for ultralfitration. P. GRABAR and J. A. DE LOUREIRO (Ann. Inst. Pasteur, 1939, **63**, 159—189).—A detailed account of the prep. and chemistry of graded collodion membranes.

G. P. G. Properties of membranes for ultrafiltration prepared on [Jena glass] funnels. A. BAUDOUIN and J. LEWIN (Compt. rend. Soc. Biol., 1939, 130, 879—882).—Details are given for the prep. of collodion membranes for use in the apparatus previously described (A., 1939, I, 434). The membranes have a varying permeability which is decreased by ageing and heat. H. G. R.

Additional device for avoiding sucking back with the Parnas-Wagner micro-Kjeldahl apparatus. P. E. LINDAHL (Mikrochem., 1939, 27, 195-196).-The device comprises a wide U-tube, closed at one side by a stopper carrying a narrower tube which terminates immediately below the stopper and is connected through a pinchcock, kept open during use, with the intermediate tube of the Parnas-Wagner apparatus. The other side of the U-tube is connected to a narrower tube, 100 cm. long, which passes to the bottom of the U-tube and is closed at the top by an S-shaped bulb-tube containing dil. H₂SO₄. During use the bottom of the U-tube is filled with distilled H₂O and serves to effect equalisation of pressure during the steam-distillation. To facilitate emptying, the U-tube also carries a side arm, J. W. S. closed by a pinchcock.

Distillation apparatus for determination of nitrogen in small amounts. M. NEDVED (Klin. Woch., 1939, 18, 912).—An apparatus for use in a micro-Kjeldahl method, applicable to series determinations, is described. E. M. J.

able-chamberst receives,

Purification of Clerici's solution and acetylene tetrabromide. K. RANKAMA (Bull. Comm. géol. Finlande, 1936, 9, 65-67; Chem. Zentr., 1937, i, 2343).—Clerici's solution is freed from brown decomp. products of malonic acid by treatment of the hot liquid, diluted to four vols., with 1 g. of wood C per 100 g. of conc. solution. Tl is pptd. from the filtrate as TICl, which is converted successively into Tl₂SO₄, TIOH, and Tl_2CO_3 , and used for the prep. of new solution. $\text{C}_2\text{H}_2\text{Br}_4$ is diluted with C_6H_6 and treated with C. A. J. E. W.

Nomogram for titration of carbonates. I. W. ARBATSKY (Z. anal. Chem., 1939, 117, 261-264).-A nomogram for obtaining the necessary corrections in the titration of carbonates using phenolphthalein or α -naphtholphthalein as indicator (A., 1939, I, 94) is L. S. T. given. no balanzo estal all eusean

Lecture demonstrations of action of uni- and multi-component catalysts in heterogeneous systems. A. KRAUSE (Rocz. Chem., 1939, 19, 477-479).-Indigo-carmine is rapidly decolorised by dil. H.O. in presence of a CuO-FeO.OH catalyst. hd a bright line hemory bounter call. The

the standard mothod, and the process t

R. T.

Geochemistry

Measurements of chloride, nitrate, and nitrite present in the water of the monsoon rains at Bombay. R. NARAYANASWAMI (Proc. Indian Acad. Sci., 1939, 9, A, 518-525).-Measurements during the 1938 season are recorded. H₂O collected at the times of thunder-showers contains more NO3' and NO2' than at other times, the excess of NO_2' being > that of NO3'. Light rain, as opposed to heavy rain, increases the Cl' content on account of the larger no. of drops able to bring down the Cl'-containing nuclei in the atm. The data are compared with records from other parts of the world. C. R. H.

Western Pacific Ocean. IV. Refractive index of sea-water. Y. MIYAKE (Bull. Chem. Soc. Japan, 1939, 14, 239–242). $-n_{\rm D}^{25} = 1.33249_7 + 0.000334 \times$ % Cl'. This result agrees well with that calc. from the ionic refractivities for a solution of the same T. H. G. composition.

Volcanoes of Japan. IX. Determination of the proportion of heavy water in the spring water found in the neighbourhood of the Asama Volcano. Y. SHIBATA, K. NOGUCHI, and O. KANEKO (Bull. Chem. Soc. Japan, 1939, 14, 274-279).-Assuming that in the beginning of geochemical time the lighter isotopes of the elements forming the mineral ingredients of the earth combined with greater ease than the heavier isotopes, deep-seated, juvenile H₂O supposedly of primeval origin, should contain less D and ¹⁸O than the surface waters and so should have a smaller d. The d of the waters from springs in the neighbourhood of the Asama volcano have been measured against Tokyo city tap-H₂O as a standard surface H_2O , and found to be $1-2 \times 10^{-6}$ less.

T. H. G.

Volcanoes of Japan. XVIII. Density measurements on the waters obtained by condensing the vapours emitted from fumaroles. S. OANA (Bull. Chem. Soc. Japan, 1939, 14, 279-283).-The H₂O condensed at fumaroles invariably has a d > that of surface H_oO although further observations on H_oO from other hot springs confirm the smaller d found in the neighbourhood of the Asama volcano. It is suggested that the H₂O from fumaroles consists largely of H₂¹⁸O, for which two possible explanations are suggested : (i) an exchange reaction between ${}^{16}O$ from the H_2O and ${}^{18}O$ from the air catalysed by the surfaces of the rocks at the temp. of the fumarole, (ii) a separation of the isotopes by age-long distillation of the magmatic H₂O. T. H. G.

Geochemical investigation of the spreading of the Urov disease. A. P. VINOGRADOV (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 64-67).-An investigation of the drinking-H₂O in regions where the Urov disease (akin to rickets) is prevalent has been carried out. "Affected" waters (i.e., those in the region where the disease is prevalent) contain much less mineral matter, and particularly Ca, than "healthy" waters. A. J. M.

Ground waters of the Houston-Galveston [Texas] area. Chemical character and industrial utility. (MISS) M. D. FOSTER (Ind. Eng. Chem., 1939, 31, 1028-1034).-The results of a survey of the water resources of the area undertaken during 1932-1937 and previously published are discussed. C. R. H.

Analysis of the Marijano spring at Gabernik. S. MIHOLIČ (Bull. Soc. Chim. Yougoslav., 1938, 9, 201-204).-Analytical data are recorded. R. T.

Occurrence of germanium in hot springs of Senami. K. KURODA (Bull. Chem. Soc. Japan, 1939, 14, 303–304).—The Ge content, determined spectrographically, is ~0.03 p.p.m. F. L. U.

Occurrence of beryllium in hot springs of Matunoyama. K. KURODA (Bull. Chem. Soc. Japan, 1939, 14, 305—306).—The Be content, determined spectrographically, is 0.04—0.08 p.p.m.

Transport of dissolved salts by the Niger in 1938. M. G. ENIKEFF (Compt. rend., 1939, 209, 229—231).—The transport of salts between Banankoro and Kirango, estimated from electrical resistance measurements at Banankoro, is max. in June and October. The wt. of salts removed annually is ~70 kg. per sq. km. of river bed. A. J. E. W.

Analysis of hot-spring gases. S. H. WILSON (New Zealand J. Sci. Tech., 1939, 20, 233—248B).— Methods of collection and analysis of gas samples are described and discussed in detail. H_2S is determined by absorption in 0·1N-I and titration with $Na_2S_2O_3$. CO_2 is absorbed in aq. KOH and the vol. decrease measured, the method allowing retention of the residual gas. SO_2 , CS_2 , and COS were not detected; their occurrence is unlikely except in presence of active vulcanism involving rapid cooling from a magma. SO_2 can be determined by titrating the H_2SO_4 after the I titration. COS can be absorbed in ammoniacal CaCl₂ and determined as BaSO₄ after oxidation, or dissolved in 5% KOH and titrated with I. A. J. E. W.

Showings of gas in the Lower Niman region. N. A. NATIS (Compt. rend. Acad. Sci. U.R.S.S., 1939, 23, 68—70).—Issues of gas in the region of the Niman river consist mainly of N_2 and inert gases. The geology of the region is described and discussed with particular reference to the origin of the gases. A. J. M.

Helium content of rock-salt and sylvine. B. KARLIK (Mikrochem., 1939, 27, 216-230).—A review.

New data on volcanic gases : the 1938 eruption of Nyamlagira. J. VERHOOGEN (Amer. J. Sci., 1939, 237, 656-672).-Temp. measurements at various points in the lava stream and of the lava lake are recorded. The highest temp. observed is 1160°. The thermal effects of the burning gases are small, and the flames do not re-fuse the solid lava. Spectroscopic investigation of the flames showed the presence of Na, K, and N2 and unidentified bands near 4400 A. The amount of gas discharged compared with the amount of lava is probably <1%, and the activities of gases and lava appear to be independent of each other. The potency of the gases as thermal and mechanical agents is negligible. The probability that magmas inside volcanoes are not saturated with gases is discussed. L. S. T.

Evolution of [natural] gas at Keuruu [Finland]. V. OKKO (Suomen Kem., 1939, **12**, **A**, 88— 90).—Natural gas is evolved from >20 places in a shallow creek and contains CH_4 71, N_2 22·5, O_2 5·5, and CO_2 0·3%. It is formed from plant remains, laid down in shallow fresh H_2O in the Litorina period, which are rich in diatoms. M. H. M. A. Recent discovery of an important hydrocarbon deposit in the Petites Pyrenees, to the north of Saint-Goudens. L. BERTRAND and L. BARRABÉ (Compt. rend., 1939, 209, 399–401).—A geological description of the locality is given. Gas (CH₄ 82, higher paraffins 17.5%) has been found at a depth of 1520 m., and the occurrence of petroleum is predicted. A. J. E. W.

Geological thermometry. E. JENSEN (Tids. Kjemi, 1939, 19, 91–94).—A review of methods for the determination of temp. of rock formation.

M. H. M. A.

Diabase or dolerite—a question of nomenclature. T. KROKSTRÖM (Geol. Fören. Stockholm Förh., 1936, 58, 419—424; Chem. Zentr., 1937, i, 1910).—The use of the names "dolerite" for rocks of recent origin consisting chiefly of augite and plagioclase, and "diabase" for metamorphic rocks, is preferred. A. J. E. W.

Wiikite and its chemical composition. II. J. ANT-WUORINEN (Bull. Comm. géol. Finlande, 1936, 9, 213—229; Chem. Zentr., 1937, i, 2344).—Wiikites are shown by mechanical treatment to contain other minerals, SiO₂ and S occurring only in impurities. β - and α -wiikites have the compositions

 $2Y_2O_3,1.5Nb_2O_5,1.5H_2O$ and $3CaO,UO_3,1.5Nb_2O_5,1.5H_2O$, respectively. These minerals are the end members of a series, in which extensive replacement of the bi- and ter-valent elements and Nb occurs. Nuclaite is not a wikite. A. J. E. W.

Nephrite and asbestos from Paakila, Finland. E. RIMANN (Zentr. Min., 1936, A, 321—327; Chem. Zentr., 1937, i, 2344).—The anthophyllite-asbestos rocks contain veins of dense anthophyllitic nephrite. The primary anthophyllite belongs to the MgO-rich end-group of the series. The asbestos originates by metamorphosis from enstatitites and dunite rich in enstatite. A. J. E. W.

Dopplerite from Keuru, Central Finland. E. KIVINEN (Bull. Comm. géol. Finlande, 1936, 9, 69—73; Chem. Zentr., 1937, i, 2344).—The dopplerite occurs in a narrow vein under the peat layers as a soft black, amorphous mass, which shrinks considerably and loses $86\cdot16\%$ of its wt. on drying at 105° . The residue contains $12\cdot79\%$ of ash (largely Al_2O_3), and org. matter (C 45.56, H 6.10, N 1.78, O 46.47%).

A. J. E. W. Garnet-bearing cordierite-andesite from Hoyazo, near Nijar (Almeria Province, Spain). C. BURRI, I. PARGA-PONDAL, and A. HEIM (Schweiz. min. petr. Mitt., 1936, 16, 226—262; Chem. Zentr., 1937, i, 2343).—The mineral is of endomorphic origin, and consists of a garnet-biotite-sillimanite gneiss (20) with SiO₂ (5—15) in a monzonitic quartz magma (75-65%). A. J. E. W.

Calcareous shells replaced by beidellite. C. S. Ross and L. W. STEPHENSON (Amer. Min., 1939, 24, 393—397).—The replacement by a pure clay mineral of calcareous shells while enclosed among sand grains coated with Fe-rich material is described. The chemical analysis recorded for the mineral is that of the high-Al beidellite member of the montmorillonite

F. L. U.

group. The mechanism of the replacement is discussed. L. S. T.

Salesite, a new mineral from Chuquicamata, Chile. C. PALACHE and O. W. JARRELL (Amer. Min., 1939, 24, 388-392).—Salesite (I), CuIO₃(OH), orthorhombic, $a:b:c \ 0.4442:1:0.6241$, $a_0 \ 4.78$, b_0 10.77, c_0 6.70 A., ρ 4.77 \pm 0.05, hardness 3, α 1.786 \pm 0.005, β 2.070 \pm 0.01, γ 2.075 \pm 0.01, biaxial negative, has [F. A. GONYER] CuO 30.62, Na₂O 0.59, I₂O₅ 64.79, H₂O 3.68, total 99.68%. Basic Cu iodate, prepared artificially, and (I) differ in cleavage and optical L. S. T. properties.

Colusite-its occurrence, paragenesis, and genetic significance. R. NELSON (Amer. Min., 1939, 24, 369-376).-The mode of occurrence of colusite (I) in the Butte, Montana, mines is described. (I) is a primary mineral, occurring with minerals deposited at relatively high temp. It contains Cu, Sn, As, and S with minor amounts of V, Sb, and Fe probably in solid solution. p is 4.4-4.6. Structure revealed by iridescent filming is described, and photomicrographs are reproduced. Paragenesis is discussed. L. S. T.

Re-examination of colusite. H. BERMAN and F. A. GONYER (Amer. Min., 1939, 24, 377-381; cf. preceding abstract).—Colusite (I) is isometric, hexatetrahedral, with a_0 10.60 \pm 0.01 A., ρ_{obs} . 4.50, ρ_{calc} . 4.434, hardness 3-4, Cu 47.99, Fe 1.09, Sn 6.71, V 2.28, Te 1.26, Sb 0.19, As 9.54, S 30.65, total 99.71%. Other chemical analyses of (I) are discussed. (I) is a member of the tetrahedrite group, V,Te,Fe) $_4S_{16}$. half the cell contents is Cu_{12} (As,Sn,V,Te,Fe) $_4S_{16}$. L. S. T. member of the tetrahedrite group, and the formula for

Correlation of quartz deformation with its crystal structure. H. W. FAIRBAIRN (Amer. Min., 1939, 24, 351-368).-A discussion of gliding and rupture in quartz as related to cryst. structure.

L. S. T.

Occurrence of riebeckite in the Michipicoten district, Ontario. M. H. FROHBERG (Amer. Min., 1939, 24, 382-387; cf. A., 1938, 106).-Riebeckite (I) occurs as a hydrothermal alteration product accompanying lamprophyre dykes from which it was introduced locally into the Au-bearing and other quartz veins. (I) was not associated with the Aubearing solutions. L. S. T.

Stereochemistry and classification of silicates. F. PENTA (Annali Chim. Appl., 1939, 29, 241-252).-A discussion of the structure of the natural silicates, based on the conclusions of Bragg, Niggli, Strunz, et al. F. O. H.

Granitisation and associated processes. M. MACGREGOR and G. WILSON (Geol. Mag., 1939, 76, 193-215).-It is concluded that granitisation involves metasomatism and/or mechanical penetration by magma. L. S. T.

Black oolites in the Dogger of N.E. Yorkshire. R. H. RASTALL and J. E. HEMINGWAY (Geol. Mag., 1939, 76, 225-233).-Black oolite, a new type of rock from various localities, is described. The oolites are hard, dull black rocks with closely packed ooliths and a lustrous cryst. cement of siderite. Phosphatic grains occur frequently both as nuclei of the ooliths

and as isolated grains, and quartz grains >10%of the rock are also distributed throughout the rock. On ignition, the ooliths turn white and their black colour is due probably to org. material. The analysis [W. H. HERDSMAN] of the separated black ooliths is SiO₂ 74.85, Al₂O₃ 5.15, FeO 0.82, CaO 0.46, MgO 0.22, $Na_2O + K_2O 0.84$, $H_2O 14.15$, org. matter 2.95, total 99.44%. The origin of the rock is discussed.

L. S. T.

Neogenesis of minerals by heating in gases and water vapour under high pressures. Production of artificial metamorphic phenomena. A. MICHEL-LÉVY and J. WYART (Compt. rend., 1939, 209, 175-177).-Minerals were heated for 10 days at $\sim 600^{\circ}$ with H₂O or aq. alkali under the pressure (3000-4000 kg. per sq. cm.) of the detonation products of an explosive, the mineral being protected from the explosion wave. Mica, spinels, and a highly refringent and birefringent mineral resembling epidote were produced at the grain boundaries in large crystals of a chloritoschist. A finely cryst. schist gave sericite, the calcite plates being partly converted into an unidentified mineral. Halloysite in a clay was replaced by sericite with loss of plasticity. The changes are more pronounced in presence of alkali. The experiments emphasise the importance of mineralogical changes under the action of gases.

A. J. E. W.

Measurement of geological time by analysis of monazite. I. Determination of lead and thorium. E. KROUPA (Mikrochem., 1939, 27, 165-175).-Methods are given for the determination of Pb (as $PbSO_4$) and Th (as ThO_2) in 1 g. of monazite. Accurate determination of these elements is the best method of determining the approx. age of the mineral. J. W. S.

Torbanites of New South Wales. I. J. A. DULHUNTY (J. Proc. Roy. Soc. New South Wales, 1939, 72, 179-198).—For the various constituents of torbanite, distinguished microscopically, the names gelosite, retinosite, humosite, and matrosite are suggested. Some jet is also present, and secondary chalcedonic SiO₂ in part replaces the gelosite. The amounts of these, determined by micrometric measurements, are correlated with the physical properties of torbanites from several localities. These torbanites contain volatile hydrocarbons 14.60-82.17, fixed C 4.97-23.05, ash 3.52-80.43%; d 1.032 - 2.004.L. J. S.

Heavy minerals in coal measures of New South Wales. A. G. CULEY (J. Proc. Roy. Soc. New South Wales, 1939, 72, 75-105).-Records are given of the heavy minerals present in the sedimentary rocks of the Upper Coal Measures and the Upper Marine Series of the Kamilaroi System from several localities. L. J. S.

Volcanic tufas of the Carpathian foothills. M. KAMIENSKI (Arch. Min. Soc. Sci. Varsovie, 1936, 12, 16-57; Chem. Zentr., 1937, i, 1402).--A description and detailed study of the genesis of white to brightgreen vitreous tufas containing plagioclase, quartz, and biotite, with Fe oxides, amphibole, and zircon as accessory, and chlorite, muscovite, and calcite as secondary, constituents. A. J. E. W.