BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

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

DECEMBER, 1939.

Second spectrum of chlorine and its structure. C. C. KIESS and T. L. DE BRUIN (J. Res. Nat. Bur. Stand., 1939, 23, 443—470).—From observations using Geissler tubes and electrodeless discharges as light sources, new $\lambda\lambda$ of Cl II between 9483 and 2100 A. have been derived and used to extend the analysis of the term system of Cl II. An ionisation potential of 23.70 v. is derived for Cl⁺.

J. W. S. Arc spectrum of europium. H. N. RUSSELL and A. S. KING (Astrophys. J., 1939, 90, 155—203; cf. A., 1939, I, 502).—The lowest level is $f^{7}s^{2} \, {}^{8}S^{0}$, the no. of classified lines is 1156, and the ionisation potential is $5 \cdot 64 \pm 0 \cdot 01$ v. Tables showing the terms and unclassified levels, the electron configurations, the series relations, multiplet intensities, and a complete list of classified lines are given. L. S. T.

Influence of temperature on the pressure broadening of spectral lines. H. HORODNICZY and A. JABLOŃSKI (Nature, 1939, 144, 594; cf. A., 1939, I, 112).—A rise in temp. increases slightly the width and decreases the asymmetry of the Hg line 2537 A. broadened by A. The effect is < that predicted by the theories of Lorentz and of Weisskopf. L. S. T.

Interpretation of the red shifts of the light from extra-galactic nebulæ. M. E. J. GHEURY DE BRAY (Nature, 1939, 144, 285).—The calc. velocities of recession of these nebulæ are so large that their reality is doubted. An alternative explanation of the red shift, based on the fact that vals. of c determined since 1900 show a steady decrease with time, is proposed. L. S. T.

Nature of the nebular red shift. E. SCHRÖ-DINGER (Nature, 1939, 144, 593). L. S. T.

Forbidden ${}^{3}P_{0}$ — ${}^{1}D_{2}$ line of O III in the nebular spectrum of Nova Herculis 1934. J. DUFAY and M. BLOOM (Nature, 1939, 144, 593—594).—The faint radiation observed at $4932 \cdot 2 \pm 0.6$ A. in the spectrum of this nova is attributed to the above transition. L. S. T.

X-Ray K absorption edges of the elements Fe (26) to Ge (32). W. W. BEEMAN and H. FRIED-MAN (Physical Rev., 1939, [ii], 56, 392-405).—In view of unsatisfactory available data on absorption limits, structures of the edges were measured with a double-crystal spectrometer. Results are plotted and new max. and min. in the regions of secondary structure are resolved; intensity measurements show marked disagreement with those obtained photographically. Widths of energy levels and of K states, and $\lambda\lambda$ of absorption limits, are determined. The shapes of emission lines and absorption edges are explained on the basis of distributions of states in the electronic energy bands of the metals; quant. agreement in the case of Cu is obtained. N. M. B.

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Intensities of the K-series of X-ray lines of tungsten and platinum. W. H. KLIEVER (Physical Rev., 1939, [ii], 56, 387–391).—Measurements are reported for the relative intensities of $K\alpha$ and $K\beta$ lines of $_{74}$ W and $_{78}$ Pt made with a double-crystal spectrometer, high-pressure A ionisation chamber, and amplifier by measuring the areas under the curves of the lines plotted against Bragg angle. Results are discussed in relation to calc. data. N. M. B.

Element 93 in the natural state. H. HULUBET and (MLLE.) Y. CAUCHOIS (Compt. rend., 1939, 209, 476—479; cf. A., 1938, I, 488).—The natural existence of element 93 is confirmed by a detailed examination of the L X-ray spectrum of material isolated from a no. of minerals. The final enrichment is effected by co-pptn. with PtS₂ and progressive elimination of the Pt. The best results were obtained with a tantalite from the Haute-Vienne, columbo-tantalites, Pt metals, and certain Madagascar betafites. The preps. emit short-range α -rays. The existence of Ma (43) is unconfirmed. A. J. E. W.

Weak lines in the molybdenum L spectrum. W. VEITH and P. KIRKPATRICK (Physical Rev., 1939, [ii], 56, 705).—Using improved apparatus, attempts to detect non-diagram lines in the L group of Mo, analogous to those of Ag found by Burbank (cf. A., 1939, I, 502), were unsuccessful. N. M. B.

Zeeman effect in the hyperfine structure of I II. A. S. FRY and R. A. FISHER (Physical Rev., 1939, [ii], 56, 669—674).—Observations of the Zeeman effect in the hyperfine structure of I II lines for fields of 4000—16,000 gauss confirm the val. 5/2 for the spin of the I nucleus. The patterns observed in intermediate fields are interpreted on the Goudsmit-Bacher theory. Evidence of a nuclear quadrupole interaction is detected in some Zeeman patterns. N. M. B.

Periodic deviation from the Schottky line. I. R. L. E. SEIFERT and T. E. PHIPPS. II. D. TURN-BULL and T. E. PHIPPS. (A) H. M. MOTT-SMITH (Physical Rev., 1939, [ii], 56, 652—663, 663—667, 668—669).—I. Data are reported and plotted for a periodic deviation observed for W and Ta, increasing above experimental error for fields $>4 \times 10^4$ v. per cm. The magnitude of the deviations decreases with increasing temp.

II. The deviation reported above, studied in greater detail for W up to fields of 6.5×10^5 v. per cm., continued with increasing period and amplitude up

to the highest fields. The characteristic Schottky distance from the surface is calc. for all vals. of the field at which max. and min. vals. of the deviation occur.

(A) An explanation based on partial reflexion of the emitted electrons at the potential barrier formed by the combination of the Schottky image force with the external field is briefly developed. N. M. B.

Energy distribution of secondary electrons at low temperatures. A. BOJINESCO (Compt. rend., 1939, 209, 512—513).—The secondary emission of Al bombarded with 300 e.v. electrons at 90.5° and 293° K. consists of elastically reflected electrons, diffused electrons (energies 45—280 e.v.), and true secondary electrons with energies <45 e.v. These last are partly of thermal origin, but their persistence at 90.5° K. indicates a new emission mechanism in which the secondary electrons are emitted from Al atoms, and their velocity depends on the depth of penetration of the primary electrons. The data for the higher energies indicate a minor modification of cryst. structure in Al at low temp. A. J. E. W.

Secondary emission. D. E. WOOLDRIDGE (Physical Rev., 1939, [ii], 56, 562—578).—Mathematical. A quantum-mechanical treatment of the production of secondary emission by the interaction of bombarding electrons with the valency electrons of a metal target leads to yield-bombarding energy curves in approx. agreement with experiment. A semi-quant. derivation of the primary voltage for max. yield, the effect of work function on the emission, and the energy range of the secondary particles is obtained in terms of the properties of the target material. N. M. B.

Multiple scattering of fast electrons. N. L. OLESON, K. T. CHAO, J. HALPERN, and H. R. CRANE (Physical Rev., 1939, [ii], 56, 482).—Approx. identical scattering curves are obtained from cloud-chamber measurements of the scattering (observed deflexions being mainly due to multiple scattering) of 2—8-Me.v. electrons in Pb and C sheets of such thickness that NtZ^2 was the same for both (N = no. of nucleiper c.c.; t = thickness of sheet; Z = at. no.). Results confirm the dependence of scattering on Z^2 for Z = 6—82. Experimental vals. of $H_{c}\theta$ ($\theta =$ scattering angle) are only 58% of theoretical vals. (cf. Fowler, A., 1938, I, 546; 1939, I, 2). N. M. B.

Elastic electron scattering in gases. J. H. McMILLEN (Rev. Mod. Physics, 1939, **11**, 84—110).— A review of the experimental and theoretical results which have been obtained for 25 different gases since 1927. A. E. M.

Reflexion of electrons by metals. L. A. MACCOLL (Physical Rev., 1939, [ii], 56, 699—702).— Mathematical. The specular reflexion of electrons by metallic surfaces is considered. The reflexion coeff. R is calc. for a practical range of vals. of the potential energy of an electron, and for the range of vals. of energy of the electrons in which R is appreciable.

N. M. B. Extremely bright spots on a Coolidge tube target. (A) I. KOGA and M. TATIBANA. (B) J. FORMAN (Nature, 1939, 144, 511).—(A) Brilliant spots and scratch markings observed on the Mo target of a Coolidge tube emitting X-rays may be due to electronic bombardment of minute protrusions on the target surface.

(B) Similar effects have been noted when using multi-segment magnetrons, and in a Farnsworth coldcathode multiplier. L. S. T.

Formation of ions in the cyclotron. R. R. WILSON (Physical Rev., 1939, [ii], 56, 459—463).— Initial ionisation in a cyclotron, produced by the use of a filament, is plotted as a function of pressure, electron emission, and dee voltage. The ionisation is too great to be simply explained by an electron passing between dees only once, and an experimentally supported theory is proposed whereby some of the electrons are caught by the changing electric field between the dees and oscillate many times during a cycle of the dee voltage. N. M. B.

Helium and hydrogen of mass 3. L. W. ALVAREZ and R. CORNOG (Physical Rev., 1939, [ii], 56, 613; cf. A., 1939, I, 545).—The isotopic ratio ³He/⁴He of spectroscopically pure (atm.) He is ~12 times that for tank (gas-well) He. When a cyclotron chamber is filled with atm. He, the ³He beam has sufficient intensity to induce a 2.5-min. activity in Si, probably ³⁰P formed in the reaction ²/₁₈Si + ⁵/₂He \Rightarrow ³⁵/₁₆P + ¹H; ³⁵/₁₆P \Rightarrow ³⁰/₁₈Si + e⁺. In a search for the radioactivity of ³H, D₂ gas was bombarded with deuterons and passed into an ionisation chamber connected to an amplifier. The gas showed an activity of long half-life and was shown, by diffusion through hot Pd, to have the properties of hydrogen. N. M. B.

Nuclear magnetic moments of the isotopes of rubidium and chlorine. P. KUSCH and S. MILL-MAN (Physical Rev., 1939, [ii], 56, 527—530).—The nuclear gyromagnetic ratios of ⁸⁷Rb, ⁸⁵Rb, ³⁷Cl, and ³⁵Cl, measured by the mol. beam magnetic re-sonance method, are 1.820±0.006, 0.536±0.002, 0.454 ± 0.002 , and 0.546 ± 0.002 , respectively. These vals., with the known nuclear spins, give magnetic moments ⁸⁷Rb 2.741+0.009, and ⁸⁵Rb 1.345+0.005, compared with 2.67 and 1.32 calc. from the hyperfine structure of the ground state. The moment ratio 2.038 compares with 2.026 from at. beam measurements (cf. A., 1936, 1168), indicating that any contribution to hyperfine structure by a form of interaction, not electromagnetic in character, between electrons and nucleus is very small. The nuclear moment of ${}^{35}Cl$ is 1.365 ± 0.005 , assuming a band spectra spin of 5/2 for the nucleus. No information on the spin of ³⁷Cl is available. N. M. B.

Radioactive isomer of ⁸⁷Sr. L. A. DU BRIDGE and J. MARSHALL (Physical Rev., 1939, [ii], 56, 706— 707).—Evidence is given that the 3-hr. activity produced by Sr + d and Sr + n (slow), attributed to ⁸⁹Sr by Stewart *et al.* (cf. A., 1938, I, 8), is due to an excited state of stable ⁸⁷Sr; it is found to be produced strongly by Rb + p at 6 Me.v., and there is also a strong period of ~60 days, probably due to ⁸⁵Sr. The electron spectrum in each case consists only of a strong line at 360 ke.v., and this is also shown by an 85 ± 5 -hr. Y activity produced by Sr + p or Sr + d. Sr extracted from an aged sample of this activity shows a 2.7-hr. period. It is concluded that the 85- and 2.7-hr. periods are due to isobars of mass 87. ⁸⁷Y decays by K electron capture to ⁸⁷*Sr, which goes to the ground state ⁸⁷Sr with the 2.7-hr. period and the emission of a partly converted 370-ke.v. γ -ray. The same ⁸⁷*Sr is also produced directly by ⁸⁷Rb (p, n) and ⁸⁶Sr (n, γ) . N. M. B.

At. wt. of the chlorine isotopes ³⁵Cl and ³⁷Cl isolated by Clusius and Dickel. O. HÖNIGSCHMID and F. HIRSCHBOLD-WITTNER (Z. anorg. Chem., 1939, 242, 222—224).—At. wt. determinations of the Cl in two fractions of HCl separated by the method of Clusius and Dickel (A., 1939, I, 442) gave vals. of 36.956 and 34.979 for the heavy and light fractions, respectively. This shows that an almost 100% separation of the Cl isotopes was achieved.

O. J. W.

Micro-calorimetric measurement of the mean energy of disintegration of radium-E. M. LECOIN and I. ZLOTOWSKI (Nature, 1939, 144, 440—441).— The method described gives a val. of 320 ± 5 ke.v. for the mean energy of this disintegration. The most probable val. is near the lower limit. L. S. T.

Study of the radiation intensity in the neighbourhood of radioactive preparations with thinwalled ionisation chambers. H. SMEREKER (Strahlenther., 1937, 58, 267—285; Chem. Zentr., 1937, i, 3001).—The effects of the form of the Ra prep., filters, the distance from the source, and other factors are studied. A. J. E. W.

β Spectrum of actinium-K. (MLLE.) M. PEREY and M. LECOIN (Nature, 1939, 144, 326; cf. A., 1939, I, 170).—Characteristics of the spectrum are tabulated and recorded graphically, and compared with those of Ac-B and Ac-C''. Ac-K may emit an intense γ-radiation of >3 Me.v. The upper limit of the spectrum lies at 1.2 Me.v. L. S. T.

Stability of the isobars Cd-In, In-Sn, Sb-Te, Re-Os. P. SCHERRER and E. ZINGG (Helv. Phys. Acta, 1939, 12, 283—285).—The pairs $^{14}_{9}$ Cd- $^{113}_{9}$ In, $^{145}_{9}$ In- $^{155}_{76}$ Sn, $^{123}_{67}$ Sb- $^{123}_{77}$ Te, $^{157}_{77}$ Re- $^{157}_{77}$ Os show neither positron- nor electron-activity, nor internal electronic transitions giving rise to K- or L-radiation corresponding with a half-val. period of $<10^{12}$ years. This stability is explained by Dempster's empirical packing curve. L. J. J.

Scattering of D–D neutrons. W. D. ALLEN and C. HURST (Nature, 1939, 144, 509–510).—Using P as a fast neutron detector, the vals. obtained for the scattering cross-sections, σ , of various elements for D–D neutrons are \sim one half the vals. obtained by previous observers. The periodic variation of σ with Z, shown graphically as far as Z = 53, supports the results of Kikuchi and Aoki (A., 1939, I, 171).

L. S. T.

Collimation of fast neutrons. R. F. BACHER and D. C. SWANSON (Physical Rev., 1939, [ii], 56, 483-484).—Photographs are given of the tracks of the recoils in CH₄ produced by a collimated beam of neutrons from Li and from Be targets. The neutrons were collimated by a tunnel through a wall of H₂O 75 cm. thick. N. M. B. β-Decay and spin of light nuclei. B. O. GRÖN-BLOM (Physical Rev., 1939, [ii], 56, 508—511).— Mathematical. The β-decay of the nuclei ⁶He, ⁷Be, ¹³N, ¹⁵O, and ¹⁷F is investigated on the basis of the Gamow-Teller modification of the Fermi theory (cf. A., 1936, 1045). The val. obtained for the decay time const. is $\sim 3 \times 10^3$ sec. compared with the upper limit 11 × 10³ sec. calc. by Bethe (cf. A., 1938, I, 550). N. M. B.

β-Radiation of ⁷⁶As. G. L. WEIL and W. H. BARKAS (Physical Rev., 1939, [ii], 56, 485–486; cf. Brown, A., 1936, 1441).—Using a H₂-filled expansion chamber in magnetic fields of 800 and 342 oersteds, the momentum distribution of electrons from ⁷⁶As was measured. The observed upper limit was at $2 \cdot 71 \pm 0 \cdot 14$ Me.v., and the average energy of the β-particles was 0.93 Me.v. The decomp. of the experimental curve into components and comparison with theory are discussed. The half-life of chemically separated ⁷⁶As is $26 \cdot 75 \pm 0 \cdot 15$ hr. N. M. B.

Coincidences between β - and γ -rays in manganese. L. M. LANGER, A. C. G. MITCHELL, and P. W. MCDANIEL (Physical Rev., 1939, [ii], 56, 422—425; cf. A., 1937, I, 489).—Coincidences were recorded between β - and γ -radiations from ⁵⁶Mn (148 min.) formed by slow neutron capture. By interposing various thicknesses of Al between the source and the β -ray counter, the ratio of β - γ coincidences to single β counts was observed as a function of β -ray energy. Results indicate that ⁵⁶Fe is formed in two excited states from the disintegration of ⁵⁶Mn, and that one γ -ray per disintegration is associated with the high-energy group and ~2 γ -rays per disintegration with the low-energy group.

N. M. B.

Induced radioactivity in (A) europium. K. FAJANS and D. W. STEWART. (B) Strontium and yttrium; nuclear isomers in strontium. D. W. STEWART (Physical Rev., 1939, [ii], 56, 625—628, 629—632).—(A) Eu₂O₃ bombarded for long periods with slow neutrons from a cyclotron and with 7-Me.v. deuterons for shorter periods gives, in the first case, two periods of induced radioactivity. The first, with a half-life of $9\cdot4\pm0\cdot2$ hr., is assigned to 152 Eu (cf. Pool, A., 1938, I, 291), which decays probably by emission of negative electrons and by the capture of K electrons; the upper limit of the β spectrum is 1.83 Me.v. The second period, assigned to 154 Eu, and produced only after long exposure, showed no appreciable decay in 6 months; the upper limit of the β -spectrum is $1\cdot0\pm0\cdot1$ Me.v. The 9-hr. period was produced also by deuteron bombardments together with new 12 ± 4 - and 105 ± 5 -min. periods which could not be separated chemically from the 9-hr. period and are probably due to isomeric forms of 152 Eu and 154 Eu.

(B) An extension of previous work (cf. A., 1938, I, 8) with stronger activation by deuterons and neutrons gave periods of $2 \cdot 0 \pm 0 \cdot 2$, 14 ± 2 , and 82 ± 4 hr. in Y separated from Sr bombarded with 7-Me.v. deuterons. The first is assigned to ⁸⁸Y and the others either to ⁸⁵Y and ⁸⁷Y or to isomeric forms of these. Sr bombarded with deuterons and neutrons gave periods of $3 \cdot 0 \pm 0 \cdot 1$ hr. and 55 ± 5 days, assigned to the decay of isomeric forms of ⁸⁹Sr. The max. energies of the β ray spectra were 0.60 and 1.50 Me.v., respectively. The γ -radiation accompanying the 3-hr. period had components of 0.55 and 1.10 Me.v. A tentative energy level diagram suggests that the metastable state of ⁸⁹Sr decays first by β -emission and then by emission of either one or two γ -rays. The ground state of ⁸⁹Sr decays directly to the ground state of ⁸⁹Y without γ -ray emission. N. M. B.

Induced radioactivity produced by bombarding aluminium with protons. G. KUERTI and S. N. VAN VOORHIS (Physical Rev., 1939, [ii], 56, 614-615).—All attempts to produce ²⁷Si (6.5 min.) by proton bombardment of Al were unsuccessful (cf. Henderson, A., 1939, I, 505). An activity of 3.7 sec. half-life was, however, produced, and assuming a (p, n) reaction, evidence indicates that it is due to ²⁷Si produced in its ground state at the observed threshold 6.1 Me.v. The calc. mass is 26.9956 (²⁷Al = 26.9989) compared with the val. 26.9944 predicted by Barkas (cf. A., 1939, I, 297).

N. M. B.

Short-lived radioactivities induced in fluorine, sodium, and magnesium by high-energy protons. M. G. WHITE, L. A. DELSASSO, J. G. FOX, and E. C. CREUTZ (Physical Rev., 1939, [ii], 56, 512— 518; cf. A., 1939, I, 397).—Bombardment, with 6-Me.v. protons, of F (as PbF₂), Na (as NaCl), and Mg (metal) gave rise, respectively, to short-lived positron emitters ¹⁹Ne (20.3 ± 0.5 sec.), ²³Mg (11.6 ± 0.5 sec.), and ^{25, 26}Al (7.0 ± 0.5 sec.). Decay curves, positron spectra, and threshold data are given, and results are in good agreement with theory. It is concluded that for isobars of the type $(n-p) = \pm 1$ the difference in binding energy is due solely to the effect of Coulomb forces up to at least mass no. 25. The half-lives depend on the inverse fifth power of the upper limit of the positron spectra, in agreement with theory.

N. M. B.

Proton activation of indium and cadmium. S. W. BARNES (Physical Rev., 1939, [ii], 56, 414–421; cf. A., 1939, I, 173).—New isotopes ¹¹⁰In (66 ± 5 min.), ^{113*}In (105 ± 10 min.), and ¹¹³Sn (105 ± 15 days) are reported. In activated by 7·2-Me.v. protons gives rise to ^{115*}In and ¹¹³Sn; the latter decays by K-electron capture emitting In K X-rays. ^{113*}In was chemically separated from aged ¹¹³Sn and was also formed by proton bombardment of Cd; it decays to ¹¹³In with emission of a 0·39-Me.v. γ -ray. In addition, bombarded Cd shows the expected ¹¹¹In 20 min. (+), ¹¹⁴In 48 days (-), and ¹¹⁶In 54 min. (-). The provisionally assigned ¹¹⁰In (66 ± 5 min.) emits positrons of max. energy 1.6 ± 0.3 Me.v. Activities of 72 sec. (-) and 2.7 ± 0.2 days (-), the latter accompanied by 170- and 250-ke.v. γ -rays, are ascribed to isomeric states of ¹¹²In. N. M. B.

Deuteron bombardment of silver. (A) R. S. KRISHNAN and D. H. T. GANT. (B) N. FEATHER (Nature, 1939, 144, 547).—(A) Ag bombarded by 9-Me.v. deuterons from a cyclotron shows a negative electron activity of 2.4 min. due to 108 Ag formed by the reaction 107 Ag (d, p) 108 Ag. Chemical separation of the irradiated Ag into Ag and Cd fractions has been effected. The latter contains a 6.8-hr. body emitting

soft negative electrons, X-rays, and a very weak γ radiation. The reaction is ¹⁰⁷Ag (d, n) ^{108*}Cd, or ¹⁰⁹Ag (d, n) ^{110*}Cd. The Ag fraction contains a 26min. body emitting positrons, and also gives a negative electron activity with a half-life of several weeks.

(B) The method of crit. absorption applied to the radiations from Ag, bombarded as described above, supports some of the above conclusions. L. S. T.

Nuclear transformations of nitrogen with fast neutrons. E. BALDINGER and P. HUBER (Helv. Phys. Acta, 1939, 12, 330–348).—See A., 1939, I, 443. For angles of observation 0° and 90° the difference between neutron energies observed is 0.39 Me.v. L. J. J.

Disintegration of ¹⁴N and ¹⁵N produced by deuteron bombardment. M. G. HOLLOWAY and B. L. MOORE (Physical Rev., 1939, [ii], 56, 705— 706).—A 4 : 1 mixture of ¹⁴N₂ and ¹⁵N₂ was bombarded with 1.07-Me.v. deuterons from a cyclotron and the ranges of protons and α -particles emitted at 90° to the deuteron beam were measured. A new group of protons of 66.1 cm. range, attributed to the ¹⁴N (d, p) ¹⁵N reaction, was observed. A new group of α -particles of range 5.09 cm. is attributed to the ¹⁵N (d, α) ¹³C reaction; the Q val. is 7.40 compared with 7.55 Me.v. calc. from mass vals. N. M. B.

Fission of thorium by neutrons. Y. NISHINA, T. YASAKI, H. EZOE, K. KIMURA, and M. IKAWA (Nature, 1939, 144, 547—548).—Th $(NO_3)_4$ bombarded with fast neutrons from Li + 3-Me.v. deuterons from a cyclotron gives active Bi, Hg, Sb, Sn, Ag, and other elements as yet unidentified. Active Pb and As were absent. Similar bombardment of U gave radioactive ppts. of Bi, Hg, Ag, Sb + Sn, and Cu + Cd fraction. L. S. T.

Energies released in the reactions ⁷Li (p, α) ⁴He and ⁶Li (d, α) ⁴He, and the masses of the light atoms. N. M. SMITH, jun. (Physical Rev., 1939, [ii], 56, 548—555).—Using improved technique, the energies of the α -particles arising from the reactions were measured by stopping the particles in a calibrated, variable-pressure, air-filled absorption cell. The vals. found were $17\cdot28\pm0.03$ and $22\cdot20\pm0.04$ Me.v., respectively. These vals., with the energies of the Be-proton disintegrations (cf. Allison, A., 1938, I, 489), lead to the following at masses: ⁶Li $6\cdot01682\pm0.00011$, ⁷Li $7\cdot01784\pm0.00009$, ⁸Be $8\cdot00766\pm$ $0\cdot00015$, ⁹Be $9\cdot01486+0.00013$. N. M. B.

Particular mode of fission of the uranium nucleus. V. G. CHLOPIN, M. A. PASSVIK-CHLOPIN, and N. F. VOLKOV (Nature, 1939, 144, 595-596).— Experiments showing that two new fission processes exist in the bombardment of U by slow neutrons, and that radioactive isotopes of Kr and Xe are intermediate products of the fission, are described.

L. S. T.

Rupture of the uranium nucleus into very light atoms. J. THIBAUD and A. MOUSSA (J. Phys. Radium, 1939, [vii], 10, 388—390).—An extension of work already noted (A., 1939, I, 234). The formation of a halogen element different from I is indicated in the products from the disruption of U by neutrons.

W. R. A.

Emission of neutrons by uranium. W. H. ZINN and L. SZILARD (Physical Rev., 1939, [ii]. 56, 619-624; cf. A., 1939, I, 294).-Fast neutrons emitted from U by thermal neutrons, using a Ra-Be photo-neutron source, were investigated. The upper limit of the spectrum of the U fission neutrons is 3.5 Me.v. The no. of neutrons emitted is estimated by analysing the pulse distribution of H atoms projected by U neutrons in an ionisation chamber filled with H_2 and A, and this no. is related to the no. of fissions, comparably observed, in an ionisation chamber lined with U_3O_8 film. Hence the no. of neutrons emitted per fission is 2.3. This val., with fission cross-section 2×10^{-24} sq. cm. (cf. Anderson, *ibid.*, 235), and crosssection for radiative capture 1.3 or 1.2×10^{-24} sq. cm. (ibid., 398), leads to 1.4 for the no. of neutrons emitted by U per thermal neutron absorbed, compared with 1.5 obtained by another method (ibid., 504).

N. M. B.

Heat of fission of uranium. M. C. HENDERSON (Physical Rev., 1939, [ii], 56, 703).-The heat produced in 13 g. of U bombarded with slow neutrons from a cyclotron was measured by a resistance thermometer, and the no. of fissions in 0.07 mg. of U was measured with a pulse amplifier. The calc. energy liberated per fission is $175\pm10\%$ Me.v.

N. M. B.

Angular distribution of cosmic-ray particles scattered in 1 cm. of platinum. J. A. VARGUS, jun. (Physical Rev., 1939, [ii], 56, 480-481).-Calc. data are plotted and compared with vals. obtained from measurements of cloud-chamber photographs.

N. M. B.

Upward radiation produced by cosmic rays at high altitudes. S. A. KORFF and E. T. CLARKE (Physical Rev., 1939, [ii], 56, 704).—Experiments are described in which a Geiger counter at heights up to 80,000 ft. was caused to occupy four positions relative to Pb blocks in order to investigate the effect of Pb on cosmic radiation at high altitudes. Results are analysed and indicate that ionising radiation is ejected upwards from the Pb by downward rays; this effect is probably due to reflexion of electrons, to nuclear disintegrations, and to wide-angle showers in the Pb. A large effect due to reflexion suggests the presence of many low-energy electrons in the radiation at high altitudes. N. M. B.

Seasonal cosmic-ray effects at sea level. R.A. MILLIKAN, H. V. NEHER, and D. O. SMITH (Physical Rev., 1939, [ii], 56, 487-490).-Results obtained by sending a self-recording electroscope repeatedly on an extensive sea voyage are reported. N. M. B.

New evidence for a change with time of the total energy brought into the earth by cosmic rays. R. A. MILLIKAN and H. V. NEHER (Physical Rev., 1939, [ii], 56, 491-493; cf. Forbush, A., 1939, I, 116).—Seasonal or atm. temp. effects at very high altitudes are masked by changes with time of the total energy brought into the earth by cosmic rays.

N. M. B.

Penetrating component of large cosmic-ray showers. P. AUGER and J. DAUDIN (Compt. rend., 1939, 209, 481-483; cf. A., 1938, I, 595; 1939, I, 55, 175).-Experiments at an altitude of 3500 m.,

using a Wilson chamber in conjunction with coincidence counters, are described. The showers consist chiefly of electrons of energy $\sim 10^{10}$ e.v., which produce dense local showers in Pb screens; the energy of the primary particles is $<10^{13}$ e.v. The penetrating component contains occasional slow protons produced by nuclear disintegration; these indicate the presence of a component which interacts strongly with at. nuclei. The density of the penetrating rays (~40 per sq. m.) is uniform over an area >20 sq. m.

A. J. E. W.

Intensity of penetrating terrestrial radiation in Auvergne. J. BRICARD and J. JUNG (Compt. rend., 1939, 209, 485-488).-The intensity of ionisation due to penetrating radiation in the neighbourhood of various strata and mineral springs is studied. Very high vals., possibly due to H₂O associated with petroleum deposits, are obtained over a disused boring A. J. E. W. in Limagne.

Variations of large cosmic-ray showers as a function of barometric pressure, altitude, and time. P. AUGER, ROBLEY, and PLUVINAGE (Compt. rend., 1939, 209, 536-538).-Coincidence counter measurements at high altitude (Pic du Midi, p = 7.3m. of H_2O indicate the occurrence of ~180 large showers per hr., each containing ~ 40 trajectories per sq. m. The corresponding vals. in Paris (p = 10.3 m. of H_oO) are 67 and 20. A correlation of double coincidence counter data with barometric pressure gives a mass coeff. of -0.009 sq. cm. per g., which is also the val. obtained from the altitude effect. A temp. or diurnal variation is not observed.

A. J. E. W.

Cosmic-ray ionisation bursts. H. CARMICHAEL and C. N. CHOU (Nature, 1939, 144, 325-326).-Measurements of cosmic-ray ionisation bursts at sealevel and under 30 m. of London clay are discussed. For the underground bursts, the distribution curve calc. for cascade showers produced by electrons knocked on by mesons shows fair agreement with the observed curve. The bursts at sea-level provide evidence of extensive showers originating in the atm. but not produced by mesons. L. S. T.

Production of the hard component of cosmic radiation. I. Photon hypothesis. L. W. NORD-HEIM and M. H. HEBB. II. Protons or neutral particles as primaries. L. W. NORDHEIM (Physical Rev., 1939, [ii], 56, 494-501, 502-507).-Mathematical. I. With the help of the known energy distribution of the electrons coming from the outside, the energy distribution of photon lengths in the higher atm. is obtained. The hypothesis that mesons are created by photons is deduced from a comparison of the no. and energy distribution of mesons with the calc. photon lengths. Difficulties of the hypothesis are examined.

II. The general requirements for understanding the hardening of the cosmic radiation underground, together with a terrestrial origin of the hard component, are discussed. The inversion of the meson production processes, *i.e.*, absorption of mesons by production of photons or protons accompanied by multiplication of the mesons, must have cross-sections smaller by a factor ~ 10 compared with the production processes.

To avoid this difference, the possibility of neutral mesons as additional primaries is discussed. N. M. B.

Time distribution of cosmic-ray bursts. P. S. GILL (Physical Rev., 1939, [ii], 56, 632-634).—An analysis of recordings of cosmic-ray bursts, produced under 12 cm. of Pb shielding at three widely separated stations, shows that the bursts form a random series of events with possible systematic diurnal variations. N. M. B.

Transition effect for large bursts of cosmicray ionisation and the number of primary electrons of very high energy. C. G. MONTGOMERY and D. D. MONTGOMERY (Physical Rev., 1939, [ii], 56, 640—643).—Bursts were observed in the open and under heavy roofs, with and without a 1-cm. Pb plate over the ionisation chamber. The increase in the no. of bursts in presence of Pb under heavy roofs is interpreted as an increase in the no. of rays in the showers from the roof, while in the open, bursts from the Pb probably originate largely from the action of high-energy electrons which are not members of cascade showers starting at the top of the atm. The no. and energy distribution of primary cosmic-ray electrons of energies $\sim 2 \times 10^{15}$ e.v. are derived.

N. M. B.

Nuclear disintegration induced by cosmic radiation. I. ZLOTOWSKI (Physical Rev., 1939, [ii], 56, 484—485).—A detailed discussion of a cloudchamber photograph showing a Po α -particle track together with two tracks produced by cosmic rays in the cloud chamber shows that the longer of the two tracks must be due to a $6\cdot3\pm0\cdot2$ -Me.v. proton and the shorter track either to a $3\cdot7\pm0\cdot8$ -Me.v. proton or to a $2\cdot0\pm0\cdot3$ -Me.v. deuteron. Energy considerations show that the observed nuclear process must be induced chiefly by the soft component of cosmic radiation. N. M. B.

Heavy cosmic-ray particles at Jungfraujoch and sea level. W. HEITLER, C. F. POWELL, and G. E. F. FERTEL (Nature, 1939, 144, 283—284).— Absorption experiments in air and in Pb at Jungfraujoch and at Bristol show that the primary radiation responsible for the heavy component of cosmic rays consists neither of electrons nor of mesotrons. The heavy tracks are produced by a third component, probably neutrons (A., 1937, I, 491). L. S. T.

Slow mesons in the cosmic radiation. C. G. MONTGOMERY, W. E. RAMSEY, D. B. COWIE, and D. D. MONTGOMERY (Physical Rev., 1939, [ii], 56, 635–639). —An experiment for measuring the disintegration time of cosmic-ray mesons is described. The no. of disintegration electrons found was \ll the expected 23 per hr. Explanations of the discrepancy are discussed. N. M. B.

Intensity and rate of production of mesotrons as a function of altitude. M. SCHEIN, W. P. JESSE, and E. O. WOLLAN (Physical Rev., 1939, [ii], 56, 613— 614).—Results of experiments with Geiger-Müller counters and Pb absorbers in free balloons are described. The mesotron intensity increases by a factor of 11 between sea level and 17.6 km., with no evidence for a max. in the mesotron intensity up to the highest altitude. Data indicate that mesotrons

can be created by photons, and from the known intensity of the soft component the calc. cross-section for the creation of a mesotron by a photon is 1.7×10^{-27} sq. cm. per proton in the Pb nucleus (cf. Schein and Wilson, A., 1938, I, 549). N. M. B.

New representation of the periodic system. H. G. S. SNIJDER (Chem. Weekblad, 1939, 36, 676— 677).—The electronic structures of the atoms are shown in a periodic table by coloured dots placed on orbits around a central nucleus. S. C.

Atom model which explains quantum conditions and permits the derivation by means of classical physics of Bohr's radiation laws. D. RADULESCU (Bull. Soc. Chim. România, 1938, 20, 39-48).—Theoretical. F. L. U.

Quantisation under two centres of forces. I. The H_2^+ ion. S. K. CHAKRAVARTY (Phil. Mag., 1939, [vii], 28, 423—434).—A mathematical analysis of the most general case of two unequally charged nuclei with one electron in their field, so that the energies of homonuclear as well as heteronuclear mols. in all their different states can be calc. The results have been applied to the $1s\sigma$, $2s\sigma$, and $3d\sigma$ states of H_2^+ . T. H. G.

Relative intensities of singlet-singlet and singlet-triplet transitions. G. W. KING and J. H. VAN VLECK (Physical Rev., 1939, [ii], 56, 464—465). —The intensity ratios can be calc. by Houston's formula (cf. A., 1929, 480) from the deviations from the interval rule and also from the distance of the singlet level from the centre of gravity of the triplet levels. The discrepancy of the two calculations indicates that singlet-triplet and triplet-triplet radial function integrals differ by a factor ~0.75; intensity ratios in good agreement with observed vals. are calc. N. M. B.

Calculation of energies of two-electron configurations from Hartree functions. Application to $2p^2$ terms in O III. A. F. STEVENSON (Physical Rev., 1939, [ii], 56, 586—593).—A simplification and improvement of a generalisation of the method of the self-consistent field previously reported (cf. A., 1937, I, 441) is given. Application leads to an improved separation ratio for the O III terms. N. M. B.

Variational atomic wave functions. L. GOLD-BERG and A. M. CLOGSTON (Physical Rev., 1939, [ii], 56, 696—699).—Mathematical. The tables constructed by Morse *et al.* (cf. A., 1936, 133) are extended to include 3p and 3d electrons. Data for He, Li, Be, B, C, N, O, F, and Ne are tabulated. N. M. B.

Elastic scattering of fast electrons by heavy elements. J. H. BARTLETT and R. E. WATSON (Physical Rev., 1939, [ii], 56, 612—613).—Relative scattering intensities (for angle of scattering 15—180°) and polarisation vals. are calc. for Hg from Mott's expression for the scattering of a Dirac electron in a Coulomb field (cf. A., 1932, 441). N. M. B.

Problem of mass of an elementary particle. K. NIKOLSKI (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 481–485).—Mathematical. F. J. G. The meson and cosmology. D. S. KOTHARI (Nature, 1939, 144, 548).—Theoretical. L. S. T.

Connexion between the life-time of the meson and the β -decay of light elements. C. MøLLER, L. ROSENFELD, and S. ROZENTAL (Nature, 1939, 144, 629).—The quant. discrepancy between the observed and theoretical ratio of the life-time of the free meson to that of a light β -radioactive element can be eliminated by considering a mixture of independent meson fields. L. S. T.

 β -Ray selection rules and the meson theory. M. SCHÖNBERG (Physical Rev., 1939, [ii], 56, 612).— Mathematical. The significance of the Fermi and Gamow-Teller selection rules (cf. A., 1936, 1045) is discussed from the point of view of the Yukawa theory of β -emission. N. M. B.

Coupling conditions in light nuclei and the lifetimes of β -radioactivities. E. P. WIGNER (Physical Rev., 1939, [ii], 56, 519–527).—Mathematical. N. M. B.

Electric quadrupole moment of the deuteron and the field theory of nuclear forces. C. Møller and L. ROSENFELD (Nature, 1939, 144, 476–477; cf. A., 1939, I, 237). L. S. T.

Electron-positron field theory of nuclear forces. E. P. WIGNER, C. L. CRITCHFIELD, and E. TELLER (Physical Rev., 1939, [ii], 56, 530-539; cf. A., 1938, I, 383).—Mathematical. A simple spinindependent interaction between heavy particles (neutrons and protons) and electrons is assumed. Saturation of resulting forces between heavy particles is assured by choosing a bounded interaction. The change in energy of electrons in negative levels which is caused by the presence of a heavy particle is calc. General restrictions on the choice of interactions are discussed. N. M. B.

Spin-dependence in the electron-positron theory of nuclear forces. C. L. CRITCHFIELD (Physical Rev., 1939, [ii], 56, 540—547).—Mathematical. Previous theory (cf. preceding abstract) is extended to account for spin-dependent phenomena. The anomalous magnetic moments of the neutron and proton can be accounted for by an adjustment of consts. Correct spin-dependence in the interaction of two heavy particles can be obtained only through an angular dependence of forces, an estimate of which, in this theory, is of correct magnitude. N. M. B.

Binding energies of ³H and ⁵He. (MISS) K. WAY (Physical Rev., 1939, [ii], 56, 556-561).---Mathematical. An approx. application to the nuclei ³H and ⁵He of Wheeler's method of resonating groups (cf. A., 1938, I, 57) leads to an evaluation of the magnitude of different contributions to the total energy. N. M. B.

Phase shifts (K_1) for (A) the square well, (B) the error well. A. M. MONROE and H. M. THAXTON (Physical Rev., 1939, [ii], 56, 616; cf. Breit *et al.*, A., 1939, I, 395).—Mathematical.

N. M. B.

Sommerfeld's fine structure constant and Born's reciprocity. A. LANDÉ (Physical Rev., N N* (A., I.) 1939, [ii], **56**, 482–483, and J. Franklin Inst., 1939, **228**, 495–502).—Mathematical. N. M. B.

Structure of electric particles and the number 137. A. LANDÉ (Physical Rev., 1939, [ii], 56, 486).— Mathematical. N. M. B.

Mechanism of nuclear fission. N. BOHR and J. A. WHEELER (Physical Rev., 1939, [ii], 56, 426— 450).—The mechanism is described on the basis of the liquid drop model of at. nuclei; conclusions are drawn regarding the variation from nucleus to nucleus of the crit. energy required for fission and the dependence of fission cross-section for a given nucleus on exciting energy. Theory and experiment agree. N. M. B.

Interaction between nuclear particles. E. C. G. STUECKELBERG and J. F. C. PATRY (Helv. Phys. Acta, 1939, **12**, 300–303).—Theoretical. L. J. J.

Nuclear reactions in stellar evolution. G. GAMOW (Nature, 1939, 144, 575-577, 620-622). L. S. T.

Behaviour of matter at extremely high temperatures and pressures. F. CERNUSCHI (Physical Rev., 1939, [ii], 56, 450-455).—Mathematical. It is suggested that an assembly of neutrons can form, under specified circumstances, two different phases by reason of the attracting forces between neutrons. The hypothetical transition from the dil. to the condensed neutron phase affords a physical basis for the idea that supernovæ originate from the sudden transition of an ordinary to a centrally condensed star. N. M. B.

Phase transitions of nuclear matter. I. GURE-VICH (Nature, 1939, 144, 326—327).—Theoretical. The properties of excited nuclear matter may change at a certain temp. This phase transition may be analogous to those in liquid He and conductivity electrons in metals. L. S. T.

Atomic constants. Revaluation and analysis of the discrepancy. F. G. DUNNINGTON (Rev. Mod. Physics, 1939, 11, 65–83).—At. consts. and auxiliary consts. are critically reviewed. The most reliable val. for $e(4\cdot8025\pm4\times10^{-10} \text{ e.s.u.})$ appears to be obtained with the X-ray/ruled grating method. $m_0 = 9\cdot1071\pm14\times10^{-28}$ g., $h = 6\cdot6200\pm33\times10^{-27}$ erg sec.; N derived from these data is $6\cdot025\pm1\times10^{23}$ on the physical scale. There are indications that the Rydberg and inverse photo-electric equations are not quite exact, since discrepancies exist between vals. of physical consts. obtained from them and vals. derived independently. A. E. M.

Apparent anomalous isotopic effect in some bands associated with the Swan bands. C. H. Townes (Nature, 1939, 144, 631).—The weak bands $\lambda\lambda$ 4770, 4836, 4911, 4997, etc., tentatively identified as tail-bands of the Swan system, are due to C combined with a very persistent impurity. Measurements of the isotopic heads of these bands obtained from ¹²C enriched with ¹³C revealed an anomalously large isotopic shift. L. S. T.

Absorption spectrum of heavy acetone in solution in hexane. L. V. KORTSCHAGIN and M. A. PIONTKOVSKAJA (Acta Physicochim. U.R.S.S., 1939, 10, 881-884).—The ultra-violet (~2790 A.) absorption spectrum of heavy $COMe_2$ is the same as that of ordinary $COMe_2$, both in C_6H_{14} . O. J. W.

Interferometer wave-lengths of certain lines in the secondary spectrum of hydrogen. L. S. COMBES, R. M. FRYE, and N. A. KENT (Physical Rev., 1939, [ii], **56**, 678—679).—Data for 24 lines of the mol. spectrum of H_2 in the region 4900—5900 A., determined with an etalon crossed with a Littrow spectrograph, are reported. A least-squares method for calculating the $\lambda\lambda$ is described. N. M. B.

Molecular spectra of the hydrogen isotopes. II. Assumption of a common potential function for the isotopic states. I. SANDEMAN (Proc. Roy. Soc. Edin., 1939, 59, 130-140; cf. A., 1939, I, 400).-Using the data of Dieke and Blue (A., 1935, 555) on HD and D2, analysis by the Dunham method (Physical Rev., 1932, 41, 721) of the $1s\sigma 2s\sigma^{3}\Sigma$ state of the isotopes H₂, HD, and D₂ indicates that whilst the lowest-quantum term-differences of the three isotopic states can be represented fairly accurately by application of the ordinary mass-effect theory of mol. isotopes, such representation of the higher-quantum term-differences is not possible. Thus while the internuclear distances in the three isotopic modifications cannot differ much, the potential functions differ and show that the field of a deuteron differs appreciably from that of a proton. W. R. A.

Absorption of solid mixtures of oxygen with nitrogen and with argon in the region 2800— 2400 A. A. PRICHOTKO (Acta Physicochim. U.R.S.S., 1939, 10, 913—934).—The prep. of transparent cryst. mixtures of O₂ and N₂ and of O₂ and A is described. The absorption spectra of these mixtures at the temp. of liquid H₂ coincide with the spectrum of solid O₂, and the general structure of the absorption spectrum is the same as that of gaseous O₂ at high pressures. In the crystal a phenomenon exists which is analogous to dissociation in a gas. From the spectrographic data the energy of dissociation of O₂ in the crystal is calc. to be 5.2 v. O. J. W.

Mechanism of nitrogen excitation in the night sky. J. CABANNES and R. AYNARD (Nature, 1939, 144, 442). L. S. T.

Transparency of the atmosphere. III. Calculation of former measurements. J. DU-CLAUX (J. Phys. Radium, 1939, [vii], **10**, 367—374; cf. A., 1937, I, 341).—Re-examination of the measurements of Müller and Kron, previously presented as a verification of Rayleigh's theory, leads actually to a different absorption law, and yields no information either on the thickness of the O_3 layer or on the no. of mols. per unit vol. of air under normal conditions. The difference between the experimental absorption law and that of Rayleigh is discussed. W. R. A.

Atmospheric [light] absorption. II. (MME.) A. VASSY and E. VASSY (J. Phys. Radium, 1939, [vii], 10, 403—412; cf. A., 1939, I, 167).—Data obtained on the total atm. absorption and on the absorption by the lower atm. are presented as curves which express the optical density of 1 km. of air at n.t.p. as a function of λ . The selective absorption of various constituents of the atm. has been investigated, and some principal bands have been identified. Three bands previously unknown have been attributed to H_2O vapour. The mol. diffusion has been determined accurately, and the absorption law of Rayleigh and Cabannes verified. W. R. A.

Molecular spectrum of thallous chloride. E. MIESCHER (Helv. Phys. Acta, 1939, 12, 296–297).— Data are recorded for a series of bands on the long- λ side of the TlCl 1—1 Σ^+ spectrum, of abnormally great intensity and with an abnormal isotope effect. The bands are associated with a common upper level and the levels v'' 8—14 of the ground state. The bands show the isotope effect ²⁰³Tl, ²⁰⁵Tl, but not the Cl isotope doublet. L. J. J.

Biological detectors for the spectral analysis of rays emitted by rock-salt after irradiation with X-rays. M. V. FILIPPOV (Acta Physicochim. U.R.S.S., 1939, 10, 725—728).—The rays (1900—2500 A.) emitted from rock-salt crystals after irradiation with X-rays have been investigated, using the biological method previously described (A., 1939, I, 24). The results agree with those obtained by Kudrjavzeva (A., 1934, 1155) with a photo-electric counter.

A. J. M. **Structure of the tetrachloroethylene molecule.** J. DUCHESNE and M. PARODI (Nature, 1939, 144, 382; cf. A., 1938, I, 494).—The absorption curve near 30 μ . for C₂Cl₄ in paraffin shows two bands at 387 and 332 cm.⁻¹, in agreement with the theoretical vals. The val. of the C=C force const. may be $\ll 8.5 \times 10^5$ dynes per cm. and the suggested structure arising from resonance between the C:C linkings is not to be excluded. L. S. T.

Infra-red studies of some glycols and ethoxyalcohols. F. T. WALL and W. F. CLAUSSEN (J. Amer. Chem. Soc., 1939, 61, 2679—2683).—Infra-red absorption spectra near 2·8 μ . have been measured for CCl₄ solutions of OEt·[CH₂]_n·OH (n = 1—5), and the following glycols: ethylene, propylene, butylene, penta-, hexa-, deca-, and octadeca-methylene. Results for the glycols are difficult to interpret but there is some evidence of H-bonding. Ethoxy-alcohols associate by forming intermol. H-bonds; OEt·[CH₂]₃·OH and OEt·[CH₂]₄·OH form rings. W. R. A.

Infra-red absorption studies. VIII. Hydrazoic acid. A. M. BUSWELL, G. W. MCMILLAN, W. H. RODEBUSH, and F. T. WALL (J. Amer. Chem. Soc., 1939, 61, 2809—2812).—DN₃ was prepared by shaking a CCl₄ solution of HN₃ with D₂O and 75—80% conversion resulted. The infra-red absorption of HN₃ and DN₃ has been investigated and $\nu\nu$ assigned to the vibrations of groups in the mols. HN₃ shows no evidence of association through N–H→N bonding but certain peculiarities in the $\nu\nu$ associated with linkings containing H are attributed to the nonlinear character of HN₃. The high solubility in Et₂O is attributed to N–H→O bonding. There is some evidence of N–D→N bonding. W. R. A.

Infra-red absorption spectra of some carboxylic acids and of dibenzoylmethane and related molecules. F. T. WALL and W. F. CLAUSSEN (J. Amer. Chem. Soc., 1939, 61, 2812–2815).—The infra-red absorption between 2.5 and 5.0 μ . has been recorded for CCl₄ solutions of AcOH, AcOD, EtCO₂H, EtCO₂D, BzOH, BzOD, azelaic (I) and diethylmalonic (II) acids, CH₂Bz₂, CH₂Ph₂, and Bz₂. For the monobasic "light" acids the absorption between 3 and 4 μ . arises from H-bonds and deuteration diminishes this absorption considerably. Curves for (I) and (II) are similar to that for EtCO₂H. The data for CH₂Bz₂ suggest that it undergoes enolisation followed by H-bonding. W. R. A.

Effects of alkali halides on the 4.7 μ . water band. T. N. GAUTIER and D. WILLIAMS (Physical Rev., 1939, [ii], 56, 616—617; cf. Plyler and Barr, A., 1938, I, 385).—Measurements are reported and discussed for the effects of LiCl, NaCl, KCl, RbCl, KF, KBr, and KI on the absorption coeff. of H₂O at the position of max. absorption in the 4.7 μ . association band. Vals. of the relative polarising powers of the various ions are given, and results are discussed with reference to the Bernal–Fowler theory of liquid H₂O. N. M. B.

Elementary processes in the sensitised fluorescence of OH molecules. (MISS) E. R. LYMAN (Physical Rev., 1939, [ii], 56, 466—470; cf. A., 1938, I, 226).—The processes involved were investigated by photometric measurements of the intensities of lines of the (0, 0), (1, 0), and (1, 1) OH bands. Collisions between metastable ${}^{3}P_{0}$ Hg atoms and H₂O mols. produce unexcited OH mols., which are then excited by further collisions with ${}^{3}P_{0}$ Hg atoms to levels with energies \ll the energy of the ${}^{3}P_{0}$ Hg atoms. Abnormal rotational energy is produced in the excitation of the OH mols. Collisions between N₂ and OH mols. transform vibrational energy of the OH mols. into rotational energy, and also reduce the rotational energy of the OH mols. towards thermal vals. Collisions between He and OH mols. are much less effective in transferring energy. N. M. B.

Fluorescence of the CN radical from the photodissociation of cyanogen molecules. A. V. JAKOVLEVA (Acta Physicochim. U.R.S.S., 1939, 10, 433-440).-(CN)₂ vapour, when subjected to irradiation in the Schumann region (H2 discharge tube), dissociates with the emission of blue bands of the CN radical. The temp. corresponding with the amount of rotational energy of the CN radical, calc. by the formula previously given (A., 1939, I, 178), is 1500° K. Comparison with data on the dissociation of ICN indicates that the CN radical possesses in both cases the same amount of rotational and vibrational energy. The influence of collisions with foreign gas mols. (A, N_2 , CO) on the fluorescence of the CN radical due to photodissociation has been investigated. Such collisions cause an increase in the amount of rotational energy depending on the mass of the foreign mol.

W. R. A.

Simplification of the fluorescence spectrum of HgBr by addition of foreign gases. K. WIELAND (Helv. Phys. Acta, 1939, 12, 295—296).—In the presence of 400 mm. of N₂, the lower vibrational terms in the fluorescence spectrum of HgBr from 5100 to 3900 A. are favoured at the expense of the higher terms to such an extent that the band series corresponding with v' = 0, which in the absence of foreign

gas is scarcely visible, has max. intensity, while vibrational terms >v' = 11 are not observed.

L. J. J. Influence of ionic strength on the quenching of fluorescence in aqueous solutions. R. W. STOUGHTON and G. K. ROLLEFSON (J. Amer. Chem. Soc., 1939, 61, 2634-2638).—The quenching consts. have been determined at various ionic strengths for the quenching of the fluorescence of quinine sulphate by KCl, KBr, and AgNO₃; fluorescein by KI in acid and basic solutions; acridone by KI and AgNO3; anthracenesulphonic acid by KI and AgNO3; acridonesulphonic acid by KI, KCNS, and AgNO3. Measurements of absorption on the dye solutions, in presence and absence of quenching ions, exclude the possibility of complex formation between the dye and the quencher. The quenching appears to arise from a bimol. reaction between the quenching ion and the activated dye mol. W. R. A.

Light output and secondary emission characteristics of luminescent materials. S. T. MARTIN and L. B. HEADRICK (J. Appl. Physics, 1939, **10**, 116—127).—Light output (L), c.d., and persistence characteristics of willemite, ZnS, CaWO₄, and other silicate and sulphide phosphors are analysed. L has been obtained as a function of beam c.d. and of screen voltage at const. c.d. The sulphides and CaWO₄ have a much shorter persistence than the silicates. Approx. $L = Af(i).V^n$ (i = c.d., V =electron energy at the screen, A = const.). For willemite and other silicates nis < 2, for sulphides n = 2, and for CaWO₄ and a fused layer of willemite n is > 2. The abnormality of willemite when fused is discussed. C. R. H.

Structure of *p*-diphenylbenzene and its Raman spectrum. S. K. MUKERJI and L. SINGH (Nature, 1939, 144, 382–383; cf. A., 1938, I, 555).—24 new lines for solid p-C₆H₄Ph₂ (I) are recorded. Comparison with the Raman spectrum of Ph₂ supports the view (A., 1933, 1235) that the mol. of (I) is planar. L. S. T.

Raman effect of pyrone compounds and electronic resonance. M. V. VOLKENSTEIN and J. K. SIRKIN (Acta Physicochim. U.R.S.S., 1939, 10, 677— 706).-The Raman spectra of 2:6-dimethylpyrone (I), coumarin (II), xanthone, coumarone, and dioxan, and oxonium compounds of (I) with HCl and HBr and of (II) with HCl have been investigated. The addition of a H halide produces no considerable effect on the spectrum of (I), thus indicating that there is no O^{IV} in these oxonium compounds. The Raman spectrum of (II) resembles those of $C_{10}H_8$ and coumarone. The effect of electronic resonance on the Raman spectrum is discussed with particular reference to the CO group. The oxonium bond is a result of intermol. interaction stabilised by the presence of a resonance state in the form of the H bond. The dipole moments of (I) and xanthone are calc. from the frequencies of oscillation of the CO group, which are < normal in these compounds. A. J. M.

Raman spectra of nitric acid in solution in ether and chloroform. J. DESMABOUX, J. CHÉDIN, and R. DALMON (Compt. rend., 1939, 209, 455— 457).—The Raman spectra of HNO₃ and 30% soluDetermination of dipole moments in solution. D. J. DAVAR (Current Sci., 1939, 8, 414–416). It is suggested that the total polarisation P_2 of a solute in different solvents should not be extrapolated to $\epsilon = 1$ for the solvent, since it is likely that the extrapolation is justified only for the liquid state; the graph of P_2 against $(\epsilon - 1)/(\epsilon + 2)$ should become horizontal where the transition from the liquid to the gaseous state occurs. The corresponding transition dielectric const. ϵ_{θ} is given by $\epsilon_t = \epsilon_c +$ $(d\epsilon/d\theta)(\theta - T_c)$, where ϵ_c is the val. at the crit. temp. T_c . For C₆H₆ solutions at room temp. $\epsilon_0 = 1.88$ and extrapolation to this val. brings the differing results of Parts (A., 1931, 669) and of Groves and Sugden (A., 1937, I, 115) for some alkyl halides into good agreement. Similarly by taking a mean val. of $\epsilon_{\theta} = 1.7$ for a variety of solvents, the differing results of several authors for the nitrotoluenes have been brought into line. T. H. G.

Alleged geometrical isomerism in certain anils, and dipole moment of phenanthridine. V. DE GAOUCK and R. J. W. LE FÈVRE (J.C.S., 1939, 1392—1394; cf. A., 1938, II, 280).—Dielectric consts. and density of C_6H_6 solutions are determined for the yellow and red forms of *p*-homosalicylideneaniline. Dipole moments μ (~2·93 D.), also $[R_L]_D$, are the same for both forms; their differences are thus presumably due to dimorphism and not to geometrical isomerism of the Hantzsch–Werner type. Similar results are obtained with yellow and red forms of Et salicylidene-*p*-aminobenzoate (2·69 D.). Phenanthridine (I) has μ 1·5₀ (calc. 1·6), in agreement with its *cis*-structure; it is suggested that NPh:CHPh normally has a *trans*-structure, and that only at >700° [when (I) is first obtained pyrogenically] does this change to *cis*. CPh₂:NPh has μ 2·0₃ D.

E. W. W.

Parachor, dipole moment, and molecular refraction of selenophen. B. TAMAMUSHI, H. AKIYAMA, and S. UMEZAWA (Bull. Chem. Soc. Japan, 1939, 14, 310—317).—C₄H₄Se has d_4^{25} 1.6003, n_2^{25} 1.57689, $[R]_{\rm D}$ 27.12, σ_{25} 36.05 dynes per cm., [P]200.6, μ 0.78 D. (in C₆H₆) and 0.77 D. (in C₆H₁₄). L. J. J.

Dipole moment and structure of the isomeric selenophthens. B. TAMAMUSHI, H. AKIYAMA, and S. UMEZAWA (Bull. Chem. Soc. Japan, 1939, 14, 318—322).—The two trans-forms of $C_6H_4Se_2$ are solids with m.p. $51-51\cdot5^\circ$ and $\mu=0$; m.p. $123-124\cdot5^\circ$ and $\mu=1\cdot07$ D., respectively, and the *cis*-form is a liquid with b.p. $90-93^\circ/14$ mm. and $\mu=1\cdot52$ D.

L. J. J.

Molecular rotation and polymorphism in the tert.-butyl halides. W. O. BAKER and C. P. SMYTH (J. Amer. Chem. Soc., 1939, 61, 2798-2805).-The polymorphism exhibited by $Bu^{\nu}X$ (X = Cl, Br, I) has been studied thermally, optically, and by dielectric const. The observed dispersion, hysteresis, and supercooling effects are interpreted in terms of possible mol. processes. Supercooling is evident in solid state transitions of the first kind when the val. of ΔG between the metastable and stable phases below the transition is relatively small, and dielectric measurements indicate that it may be a function of the ordering ability of the mols. in the stable form. Results with the polarising microscope suggest a correlation of lattice symmetry with the mol. rotational freedom. It is also suggested that the isotropic lattices found previously for many org. mols. above the polymorphic transitions are associated with the development of rotational freedom at these transitions. Rotational "premelting" before a solid state transition is analogous to the premelting of W. R. A. solids near the m.p.

Magnetic rotatory power of deuterobenzene and deuterethyl deuteralcohol. Thermal variation. C. FERT (Compt. rend., 1939, 209, 479– 480).—Vals. of the Verdet const. (λ 5461 A.) are recorded for C₆D₆ (0.03643—0.03292 at 6.8—71°) and C₂D₅·OD (0.01330—0.01221 at 2.3—70.5°). The vals. at 20° are 0.03569 and 0.01304, respectively.

A. J. E. W. Rotatory magnetic dispersion of heavy benzene (C_6D_6) and heavy [ethy1] alcohol $(C_2D_5 \cdot OD)$. G. DUPOUY (Compt. rend., 1939, 209, 453—455).—The following rotation vals. are obtained at 5461 A. : C_6D_6 , 35·20°, 32·24° at temp. of 16·5° and 71°; $C_2D_5 \cdot OD$, 13·3°, 11·97° at temp. of 2° and 70°. Relative vals. of the dispersion at 4358, 4916, 5780, and 5893 A. are also given; no variation with temp. is detected. A. J. E. W.

New electro-optical effect. H. MUELLER and B. W. SARMANN (Physical Rev., 1939, [ii], 56, 615— 616; cf. A., 1939, I, 318; Norton, *ibid.*, 318).— Previous results on the dependence on concn. and particle size are confirmed for monodisperse sols. New data on the dependence of the birefringence on strength and frequency of the electric field in a monodisperse bentonite sol of average particle radius 29 mµ. and concn. 0.61% are reported. At low frequencies the behaviour is anomalous; the negative birefringence for small fields reaches a max. and the Kerr effect becomes positive above a crit. field strength. This result is analogous to that observed in the Majorana effect in colloidal "Bravais-Iron," and is believed to be the electric analogue of this magnetooptical effect. Explanations are discussed.

N. M. B.

Interrelation of dissociation energy and internuclear distance for some simple di-atoms in ground states. C. H. D. CLARK (Nature, 1939, 144, 285–286).—For ground states of simple diatoms of related type, e.g., LiLi, NN, and OO, $x = Dr_e^3 n^{1/2}$ (cf. A., 1939, I, 455), where n is group no., tends to constancy. Other functions involving bond const. and internuclear distance, r_e , are discussed.

L. S. T.

Application of the cage theory of liquids to the problem of ion mobilities. J. J. HERMANS (Rec. trav. chim., 1939, 58, 917-927).—The theory of Polissar (A., 1939, I, 82) is discussed and certain modifications are proposed. In the region under discussion neither classical nor quantum mechanics is strictly valid, and so the equation $v = (1/2a) \times \sqrt{(3kT/m)}$ (1) (v = frequency of oscillation, m = mass, and a = mean free path of an ion) can give only the order of magnitude. Instead the equation v = 6kT/h is used (reasons for the use of the factor 6 being given) and with this the temp. coeff. of the mobility is calc. for a no. of ions, in agreement with observation. With the H^{*} and OH' ions the agreement is poorer, as is to be expected, since for a proton the smallest cage is much larger than itself, and the potential energy has a min. near the walls of the cage instead of in the middle as for other ions. Application of equation (1) leads to results of the correct order of magnitude. F. J. G.

Structure of boron hydrides. II. L. E. AGRO-NOMOV (J. Gen. Chem. Russ., 1939, 9, 1389–1393).— Schlesinger's compound B_2H_6 ,2NH₃ (A., 1938, I, 207) should, on grounds of the electronic theory, be considered as being BH_3 ,NH₃. R. T.

Value of the co-ordination number and the chemical formulæ of complex compounds. B. ORMONT (Acta Physicochim. U.R.S.S., 1939, 11, 87-96; cf. A., 1939, I, 61).—A method of writing formulæ which is capable of representing the structure of complex compounds both in the cryst. state and in solution is proposed. O. D. S.

Extended co-ordination theory of valency. III. Valency bonds in carbon compounds. R. TSUCHIDA and M. KOBAYASHI (Rev. Phys. Chem. Japan, 1939, **13**, 61—73; cf. A., 1939, I, 358).—In the extended theory of valency, all C compounds are assumed to be formed by co-ordinating ions and mols. around the C^{****} cations. The types of linkages present (tetrahedral, trigonal, aromatic, digonal, double, triple) depend on the no. and nature of the groups. The nature of these bonds in C compounds is discussed quantum-mechanically. W. R. A.

Coriolis coupling terms in polyatomic molecules. H. A. JAHN (Physical Rev., 1939, [ii], 56, 680-683; cf. A., 1939, I, 119, 300, 552).—Mathematical. A method is given for determining, from the displacement vectors of the normal modes of vibration of any polyat. mol., which normal modes are coupled by Coriolis forces when the mol. rotates. The method is illustrated by reference to H₂O, CH₂O, C₂H₄, and CO₂ mols. N. M. B.

Size and shape of molecular swarms in anisotropic liquids. V. ZVETKOV (Acta Physicochim. U.R.S.S., **11**, 97—106).—Theoretical. Measurements of η of azoxyanisole in a rotating magnetic field show that groups of mols. (diameter of group 7×10^{-5} cm.) execute a disordered rotational movement of ~1°. 0, D. S.

Friction. G. W. HAMMAR and G. MARTIN (Science, 1939, 90, 179—180).—Experiments described indicate that a large fraction of the static friction between two clean, smooth glass surfaces in contact is due to mol. attraction between parts of the surfaces which are so close that mol. adhesions come into play. L. S. T.

Temperature dependence of Lindemann frequency. L. SIBAIYA and M. R. RAO (Current Sci., 1939, 8, 359).—Combination of the expression already deduced for γ (A., 1939, I, 406) with Eötvös' rule gives expressions for the variation of the Lindemann frequency, compressibility, η , and γ with temp. in terms of a new reduced temp. $(T_c - T)/(T_c - T_f)$, where T_f is the m.p. L. J. J.

Effect of temperature on the intensity of X-ray reflexions from copper. G. W. BRINDLEY and G. H. ATKINSON (Nature, 1939, 144, 477; cf. A., 1939, I, 50).—Examination of the intensities of reflexions from Cu at room and liquid air temp. gives for the Debye characteristic temp. of Cu a val. in agreement with that obtained from sp. heat data. L. S. T.

Effect of temperature on the intensity of X-ray reflexions from gold. E. A. OWEN and R. W. WILLIAMS (Nature, 1939, 144, 477-478).—Results obtained previously on Cu (A., 1939, I, 50) may be invalidated by tarnishing and need further investigation (cf. preceding abstract). The characteristic temp. for Au, kept at 445° K., deduced from X-ray measurements agrees with that found by other methods. L. S. T.

Fine structure of the dark-light X-ray diffraction line obtained by convergent X-rays. T. FUJIWARA (J. Sci. Hirosima Univ., 1939, 9, 233—239). —Using the improved method of convergent X-rays (*ibid.*, 115), radiographs have been obtained with a thin single-crystal of rock-salt. In addition to light and dark diffraction lines, many "dark-light" diffraction lines are exhibited and appear in pairs, with the side close to the centre of curvature of each line light and the opposite side dark. The reason for the existence of these lines is discussed. W. R. A.

Theory of the diffuse scattering of X-rays by crystals in the region of the K critical absorption wave-length. G. E. M. JAUNCEY (Physical Rev., 1939, [ii], 56, 644-651).—Mathematical.

N. M. B.

X-Ray dispersion and atomic electron cloud distortion in zinc crystals. E. M. McNATT (Phys-ical Rev., 1939, [ii], 56, 406-413).-Monochromatic X-rays of λ 1.54 (Cu Ka) and 1.433 A. (Zn Ka) were diffusely scattered at angles ϕ (24-120°) from single crystals of Zn ($\lambda_{K} = 1.28$ A.) with orientation angles $\psi 0$ and 90°. The intensity of the diffusely scattered rays varied with $(\sin \frac{1}{2}\phi)/\lambda$ as on Jauncey's formula close to the K crit. absorption λ of the scattering crystal. For Cu $K\alpha$ rays the decrement Δf of the at. structure factor is 2.5 (cf. Hönl's val. 2.3); the corresponding val. for Zn $K\alpha$ rays is 3.65 (2.8). A dip in the diffuse scattering ($\psi = 0^{\circ}$) is due to a corresponding dip in the at. structure factor $f(\psi = 0^{\circ})$ in the same region. The max. difference $f(\psi = 90^{\circ}) - f(\psi =$ 0°) is ~6 electrons compared with the former val. 2.4 electrons, and indicates a larger and deeper distortion of the electron cloud of a Zn atom in the crystal than previously imagined. N. M. B.

Allotropy of arsenic. H. STÖHR (Z. anorg. Chem., 1939, 242, 138—144).—X-Ray measurements confirm the rhombohedral structure of cryst. As (α -form); $a 4.123 \pm 0.008$ A., d_{calc} . 5.78. Three amorphous forms of As (β , γ , δ) obtained by sublimation under various conditions are also described. The following vals. of $\chi_{at.}$ ($\times 10^6$) are recorded : $\alpha - 5.5 \pm 1$ (20°), $+1\pm1.5$ (-183°); β -23.7 (20°), -22.6(-183°); γ -23.0 (20°), -22.4 (-183°); δ -23.0(20°), -22.8 (-183°). The vals. of d_{2}^{35} are: α 5.73 ± 0.01 ; β 4.73 ± 0.01 ; γ 4.97, 5.01, 5.04; δ 5.07, 5.07, 5.18. O. J. W.

Recrystallisation diagram of antimony. J. CZOCHRALSKI and E. PRZYJEMSKI (Wiadom. Inst. Met., 1936, 3, 113—115; Chem. Zentr., 1937, i, 2740).—The recrystallisation diagram of Sb cylinders, worked at room temp. (decrease of length 1—70%) and heated for 30 min. at 300—610°, shows a sharp max. of grain size for heating at 610°. A. J. E. W.

X-Ray examination of the structure of boron nitride. A. BRAGER (Acta Physicochim. U.R.S.S., 1939, 10, 902; cf. A., 1938, I, 605).—A correction. The space-group of the BN structure is C_{6v}^4 and not C_{3s}^4 . O. J. W.

X-Ray examination of titanium nitride. II. Structure of some intermediate products formed when obtaining titanium nitride. A. BRAGER (Acta Physicochim. U.R.S.S., 1939, **10**, 887–902).— β -TiCl₄,4NH₃ (prepared at -30° and heated to 20°) is cubic, with a 7.72 A., 2 mols. per unit cell, probable space-groups D_{2d}^{θ} , D_{2d}^{11} , $D_{4\pi}^{17}$, $C_{4\pi}^{\theta}$, α -TiCl₄,4NH₃ (prepared by heating the β -form to 200°) is cubic, with a 3.86 A., $\frac{1}{4}$ mol. per unit cell, space-groups the same as for NH₄Cl. The at. positions are given for both substances. TiCl₂(NH₂)₂ is cubic, with a 3.86 A., $\frac{1}{2}$ mol. per unit cell. O. J. W.

Isotope effect in potassium dihydrogen phosphate. A. R. UBBELOHDE and (MISS) I. WOODWARD (Nature, 1939, 144, 632).—Repeated crystallisation of KH₂PO₄ from 99.6% D₂O gives a new cryst. form probably identical with tetragonal KD₂PO₄. The crystals are monoclinic with a_0 7.37, b_0 14.73, c_0 7.17 A. (all ± 0.01 A.), β 92.0°, and 8 mols. per unit cell. Further evidence of the difference between H and D linkings in crystals is thus afforded. L. S. T.

Structure of potassium molybdocyanide dihydrate. Configuration of the molybdenum octacyanide group. J. L. HOARD and H. H. NORDSIECK (J. Amer. Chem. Soc., 1939, 61, 2853— 2863).—Crystals of potassium molybdocyanide dihydrate, K_4 Mo(CN)₈, 2H₂O, belong to the orthorhombic system, containing four mols. per unit cell, a 16.55, b 11.70, c 8.68 A.; space-group D_{24}^{16} —Pnma. Parameters and interat. distances are given. The Mo(CN)₈''' ion approximates to the symmetry of the point-group D_2^4 —42m. W. R. A.

Crystal structure of cæsium fluorochromate. J. A. A. KETELAAR and E. WEGERIF (Rec. trav. chim., 1939, 58, 948).—CsCrO₃F is isomorphous with KCrO₃F (A., 1939, I, 12) and has a 5.715, c 14.5 A.; spacegroup C_{44}^{e} ; 4 mols. in the unit cell. F. J. G.

Crystal structures of rubidium and cæsium sesquioxides. A. HELMS and W. KLEMM (Z. anorg. Chem., 1939, 242, 201—214).—X-Ray measurements give no evidence of an oxide K_2O_3 . Rb and Cs form the oxides Rb_4O_6 and Cs_4O_6 , which have a cubecentred lattice. Magnetic evidence indicates that these oxides contain one O_4'' and two O_2' ions. The prep. of the oxides is described. O. J. W. Redetermination of the fluorine—fluorine distance in potassium hydrogen fluoride. L. HELM-HOLZ and M. T. ROGERS (J. Amer. Chem. Soc., 1939, 61, 2590—2592).—Using Laue and oscillation photographs the redetermined val. of the parameter in KHF₂ yields $2 \cdot 26 \pm 0.01$ A. for the F—F distance in (F–H–F)' ions. This val. is $0 \cdot 29 \pm 0.06$ A. < that for the polymerides of gaseous HF and indicates that formation of additional H-bonds increases the F—F distance. W. R. A.

Structures of complex fluorides. Potassium hexafluogermanate and ammonium hexafluogermanate. J.L. HOARD and W.B. VINCENT (J. Amer. Chem. Soc., 1939, 61, 2849–2852).–(NH_4)₂GeF₆ and K₂GeF₆ are isomorphous, having a one-mol. hexagonal unit with a 5.85, 5.62; c 4.775, 4.65 A., respectively, space-group D_{3d}^3 —C3m. The structure consists of an aggregate of the univalent cations and approx. regular octahedral anions GeF_6'''' with Ge-F distance 1.77 A. Each cation is surrounded by nine nearly equidistant F atoms and three others at a greater distance. This hexagonal structure (I) is preferred to the cubic (NH₄)₂PtCl₆ structure (II). Crystals of Rb₂GeF₆ are hexagonal but do not have either structure (I) or (II). They contain two mols. per unit cell, $a \sim 5.96$, $c \sim 9.72$ A., and Rb[•] appears to have a co-ordination no. of 12. W. R. A.

Crystallographic study of the double copper potassium bromide. A. SILBERSTEIN (Compt. rend., 1939, 209, 540—542).— $KCuBr_3$ is obtained as black monoclinic-holohedral needles, d 3.92, by evaporating an aq. solution of KBr and excess of CuBr₂. The unit cell (a 4.28, b 14.43, c 9.71 A., β 108° 23'±10') contains 4 mols.; space-group, $C_{2h}^2 - P2_1/m$. A. J. E. W.

Structure of copper cyanide complexes. I. Structure of the double copper cobalt and copper chromium cyanides. M. A. ROLLIER and E. ARREGHINI (Gazzetta, 1939, 69, 499–508).—X-Ray measurements give a cubic structure, space-group O_h^s , for $\operatorname{Cu}_3[\operatorname{Co}(\operatorname{CN})_6]_2$ (I) (a 9·91±0·05 A., Z=2) and for the unstable $\operatorname{Cu}_2\operatorname{Cr}(\operatorname{CN})_6$ (a 10·22±0·05 A., Z=4). The prep. of these compounds is described. The magnetic susceptibilities of $\operatorname{Cu}_2\operatorname{Fe}(\operatorname{CN})_6$, $\operatorname{CuK}_2\operatorname{Fe}(\operatorname{CN})_6$, and of (I) have been measured. The vals. of $\mu_{\rm eff}$ in Bohr magnetons are 1·86, 1·81, and 1·91, respectively, indicating that all three substances contain $\operatorname{Cu}^{\rm H}$. The structure of complex cyanides is discussed. O. J. W.

Structure of bridged dipalladium derivatives. --See A., 1939, II, 536.

Molecular symmetry of monoisopropyl tritert.-butyl tetrathioorthosilicate. H. A. KLASENS and H. J. BACKER (Rec. trav. chim., 1939, 58, 941— 947; cf. A., 1935, 326, 1111).—NaSPr[§] and SiCl(SBu^γ)₃ give SPr[§]·Si(SBu^γ)₃; the crystals are tetragonal and isomorphous with those of Si(SBu^γ)₄, Ge(SBu^γ)₄, or Sn(SBu^γ)₄ (cryst. form and physical consts.; cf. A., 1933, 1274). RBu^γ groups are in tetrahedral arrangement about the central atom. Theoretical aspects are discussed. A. T. P.

Space groups of *p*-nitrophenol (metastable), phenacetin, and tribenzylamine. M. PRASAD, J. SHANKER, and P. N. BALJEKAR (J. Indian Chem. Soc., 1939, 16, 357–363).—Crystals of p-NO₂·C₆H₄·OH (metastable) (I), phenacetin (II), and N(CH₂Ph)₃ (III) belong to the monoclinic prismatic class, space-group C_{2A}^{5} , four asymmetric mols. per unit cell. The following vals. are recorded for (I), (II), and (III), respectively: a, 15·34, 13·78, 22·03; b, 11·15, 9·73, 8·92; c, 3·79, 7·82, 9·04 A.; ρ , 1·495, 1·202, 1·074.

W. R. A.

Stereoisomerides of γ -amino- β -hydroxybutyric acid and of *isoserine*.—See A., 1939, II, 495.

X-Ray investigation of the decamethylene series of polyesters. C. S. FULLER and C. J. FROSCH (J. Amer. Chem. Soc., 1939, 61, 2575— 2580).—X-Ray fibre patterns have been obtained for oriented fibres of decamethylene polyesters of oxalic, succinic, glutaric, adipic, suberic, azelaic, and sebacic acids. Measurements of these patterns indicate mols. of approx. planar zig-zag form. For all except the oxalic ester, the structures conform to the same lateral packing as the lower mol. chain compounds. For some esters the presence of different crystal forms is indicated, and a general qual. interpretation of these forms is given on the basis of Schoon's theory (A., 1938, I, 348). The origin of the different fibre patterns is discussed. W. R. A.

X-Ray and thermal examination of unsymmetrical mixed triglycerides.—See A., 1939, II, 531.

Structure of insulin. M. L. HUGGINS (J. Amer. Chem. Soc., 1939, 61, 2982).—If an electron density projection of insulin is made, using Crowfoot's hkO-X-ray data and assuming that the true projection has a centre of symmetry and that the structure proposed by Wrinch and Langmuir permits determination of the signs of the structure factors, the fit obtained by superimposing a projection of Wrinch's " C_2 octahedron" is fairly satisfactory and the cage or ring mol. hypothesis may be correct. If, however, it is assumed that the mol. is composed of six point atoms at the corners of a regular octahedron the resultant projection does not indicate a cage structure.

W. R. A.

Electron diffraction investigation of the molecular structures of ethyl chloride, ethyl bromide, isopropyl chloride, isopropyl bromide, methylchloroform, and isocrotyl chloride. J. Y. BEACH and D. P. STEVENSON (J. Amer. Chem. Soc., 1939, 61, 2643—2651).—An electron diffraction investigation of EtCl (I), EtBr (II), Pr[§]Cl (III), Pr[§]Br (IV), CMeCl₃ (V), and CMe₂:CHCl (VI) has yielded the following data : C—Cl distance, 1.76 ± 0.02 (I) and (V), 1.75 ± 0.03 (III), 1.72 ± 0.02 (VI); C—Br, $1.91\pm$ 0.02 (II), 1.91 ± 0.03 A. (IV); C–C-Cl angle, 111° $30'\pm2^{\circ}$ (I), $109\pm3^{\circ}$ (III), $109\pm2^{\circ}$ (V), $123\pm2^{\circ}$ (VI); C—H bond distance was assumed to be 1.09 A. as found for CH₄. The C–C–Cl angle in (V), as in Bu²Cl (A., 1938, I, 181), is < the tetrahedral val., indicating that the electrostatic repulsion of like groups and the attraction of unlike groups determines the direction of the distortion of the bond angles from the tetrahedral val. The steric repulsions between attached groups in these mols. must be approx. equal. The shortening of 0.04 A. of the C–Cl bond in (VI) is due to the effect of an adjacent double linking. W. R. A.

Molecular structure of acetaldehyde. D. P. STEVENSON, H. D. BURNHAM, and V. SCHOMAKER (J. Amer. Chem. Soc., 1939, 61, 2922—2925).—Electron diffraction investigation of MeCHO has given the following data : C—C distance, $1\cdot50\pm0\cdot02$ A.; C—O, $1\cdot22\pm0\cdot02$ A.; C—C–O angle, $121\pm2^\circ$. The val. for the C=O distance is in good agreement with those obtained previously for CH₂O (A., 1939, I, 554) and for glyoxal, and the mean val. is $1\cdot21\pm0\cdot02$ A., which is the val. deduced from other methods. An explanation of the shortening of the C—C bond distance from $1\cdot54$ to $1\cdot50$ A. is suggested. W. R. A.

Colour and magnetic properties of manganous sulphide. S. S. BHATNAGAR, B. PRAKASH, and J. SINGH (J. Indian Chem. Soc., 1939, 16, 313-320).-Different samples of pink MnS have the same magnetic consts., $\chi = 41.85 \times 10^{-6}$ at 34°, magneton no. 5.95 - 6.02 agreeing with the theoretical Van Vleck val. of 5.92 for Mn". Pink MnS is, in general, a mixture of two crystal modifications (A., 1933, 341), and the constancy of χ for different samples indicates that both modifications have the same χ . Consequently change in crystal structure cannot explain the divergence between the vals. of χ for pink MnS and green MnS ($\chi = 64.15 \times 10^{-6}$, magnetic moment 5.99— 6.01), which is of the NaCl lattice type. The cause of this divergence and the difference in colour may be due to differences in the type of linkings involved in the two instances. W. R. A.

Magnetic susceptibilities of metallic oxides, with special reference to those of chromium and manganese. S. S. BHATNAGAR, A. CAMERON, E. H. HARBARD, P. L. KAPUR, A. KING, and B. PRAKASH (J.C.S., 1939, 1433-1441).-Application of the Curie law to the best recorded vals. of the magnetic susceptibility, χ , of compounds of the transition metals gives poor results, but Weiss' modification of this law applied to the oxides of Cr and Mn gives vals. for the magnetic moments which agree with theory. Thus magnetic measurements can be used to find the structure of oxides, and the occurrence of Cr "" in a hydrated oxide is established. The decomp. of CrO₃, with variation of composition in non-stoicheiometric oxides, does not produce an appreciable effect on χ . The χ of Cr_2O_3 depends to a slight extent on the method of prep., probably due to the presence of impurities and to traces of chemisorbed gases. This view is supported by the fact that adsorption of O_2 or H_2 at 440° on Cr_2O_3 causes χ to vary, and hightemp. evacuation also produces a decrease in χ . Activated adsorption on oxides may be connected with the reduction of chemisorbed O2, and the use of magnetic measurements for following surface chemical processes on oxides is recommended. Magnetic measurements favour the formulæ O.Mn.O.Mn.O (Mn₂O₃), Mn:O (MnO), and O:Mn:O (MnO₂).

W. R. A.

Principal magnetic susceptibilities of tellurium crystal. S. R. RAO and S. R. GOVINDARAJAN (Current Sci., 1939, 8, 414).—Crystals prepared by slow cooling have susceptibilities of -0.329×10^{-6} parallel to the trigonal axis and -0.296×10^{-6} perpendicular to it. On heating, the former falls and the latter remains const. until they become equal at 220°. On melting at 450° the vol. susceptibility falls from -1.7×10^{-6} to -0.3×10^{-6} . Small amounts of Sn, Cd, Bi, or Pb reduce the diamagnetic susceptibilities by amounts which increase as the radius of the impurity element increases but are independent of the no. of valency electrons in the latter. The linkages of the six valency electrons in polycryst. Te are probably not metallic and the element is non-metallic from the magnetic point of view. This contention is supported by the high resistivity of the element. T. H. G.

Formula for the change of velocity of sound with temperature. A. E. BATE (Nature, 1939, 144, 479).—Between -40° and 100° , $v = 331 \cdot 5 + 0 \cdot 560$, where v is the velocity in m. per sec. at θ° .

L. S. T.

Relation between refraction coefficients of higher fatty acids, temperature, and their degree of unsaturation. V. J. ANOSOV and G. B. RAVITSCH (Compt. rend. Acad. Sci. U.R.S.S., 1939, 22, 496— 498).—Data on $n_{\rm D}$ for oleic, linoleic, and linolenic acids at 20—40° are given. *n* is a linear function of temp. and the I val. F. J. G.

Dependence on temperature of the refractive power of crystallised cellulose. A. FREY-WYSSLING and K. WUHRMANN (Helv. Chim. Acta, 1939, 22, 981—988).—Vals. of n_o and n_e for the F, D, and Clines over the temp. range $3.0-50.5^{\circ}$ are recorded for cryst. cellulose (ramie fibres). The temp.-dependence of n_o and n_{e} , and also of the coeffs. of thermal expansion, is intermediate between vals. characteristic of the liquid and solid states, indicating that there are very few cross valency-bonds between the fibre mols. F. J. G.

Effect of an excitation energy on the specific heat of liquid helium II and its relation to the exchange effect in a non-ideal Bose-Einstein gas. A. MICHELS, A. BIJL, and J. DE BOER (Nature, 1939, 144, 594-595). L. S. T.

Specific heat of methane under pressure. O. N. TRAPEZNIKOVA and G. A. MILJUTIN (Nature, 1939, 144, 632).—The sp. heat of CH_4 between 12° and 30° K. at pressures up to 2000 kg. per sq. cm. shows two max. which shift with changing pressure. Curves showing the change in temp. of these max. with a change in pressure are reproduced. The substitution of D for H has an effect similar to increasing the pressure on ordinary CH_4 . L. S. T.

Entropy of cyanogen. Heat capacity and vapour pressure of solid and liquid. Heats of fusion and vaporisation. R. A. RUEHRWEIN and W. F. GIAUQUE (J. Amer. Chem. Soc., 1939, 61, 2940—2944).—The m.p. and b.p. of C_2N_2 are $245\cdot27^{\circ}$ and $251\cdot95^{\circ}$ K., respectively. The v.p. (internat. cm. Hg) from 202° K. to the m.p. is $\log_{10} P = -1795\cdot9/T - 0.001464T + 9.42442$ and from the m.p. to 253° K. $\log_{10} P = -1525\cdot7/T - 0.0040842T + 8.96542$. C_p has been measured from $14\cdot89^{\circ}$ K. to the b.p. The molal heats of fusion and vaporisation are respectively 1938 ± 1 and 5576 ± 5 g.-cal. The entropy of the (ideal) gas at 1 atm. is $55\cdot43$ g.-cal./degree/mol. at

 251.95° K. and 57.64 at 298.1° K., in good agreement with the val. deduced from spectroscopic data.

W. R. A. Entropy of hydrogen cyanide. Heat capacity, heat of vaporisation, and vapour pressure. Hydrogen bond polymerisation of the gas in chains of indefinite length. W. F. GIAUQUE and R. A. RUEHRWEIN (J. Amer. Chem. Soc., 1939, 61, 2626-2633).-The m.p. and b.p. of HCN are 259.86° and 298.80° K., respectively. The v.p. of liquid HCN is $\log_{10} P$ (internat. cm. Hg) = -1600.8/T- 0.0017835T + 7.77114 and the triple point pressure is 14.048. Heat capacity data are given from 14° K. to b.p. Near 170° K. there occurs a narrow region of high C_p , whilst between 140° and 170° K. the attainment of thermal equilibrium is less rapid. The entropy change corresponding with the effect at 170° K. is 0.022 g.-cal./degree/mol. The heats of fusion and of vaporisation are 2009 and 6027 g.-cal. per mol., respectively. The entropy of an equilibrium mixture of HCN and its polymerides at 298.80° K. is 47.21 g.-cal./degree/mol. From available v.d. data the existence of polymerides is shown and the relative amounts of various associated forms up to the heptameride have been calc. Polymerisation occurs through straight chain H-bonding (this is also responsible for $\sim 3\%$ polymerisation in H₂O vapour at 100°). For HCN the polymerisation introduces a positive correction of 0.73 to the entropy val. For the monomeride the following vals. of $S_{298\cdot 1}$ are given : gas, from calorimetric data, 47.92; from spectroscopic data, 48.23; liquid, 26.97 g.-cal./degree/mol. W. R. A.

Entropy and heat capacity of propylene. B. L. CRAWFORD, jun., G. B. KISTIAKOWSKY, W. W. RICE, A. J. WELLS, and E. B. WILSON, jun. (J. Amer. Chem. Soc., 1939, **61**, 2980—2981).—Polemical against Powell and Giauque (A., 1939, I, 556). A revised set of $\nu\nu$ for C_3H_6 gives ~2120 g.-cal. for the potential barrier hindering rotation of the Me group. The entropy of the ideal gas at b.p. (225·35° K.) is 59·93 e.u. compared with a calc. val. of 59·87. W. R. A.

Measurements of heat capacity and heat of vaporisation of water in the range 0° to 100° . N. S. OSBORNE, H. F. STIMSON, and D. C. GINNINGS (J. Res. Nat. Bur. Stand., 1939, 23, 197—260; cf. A., 1937, I, 353).—Using improved apparatus the sp. heat and latent heat of vaporisation of H₂O have been redetermined at various temp. between 0° and 100° . The heat contents of both phases and the sp. vol. of the saturated vapour are deduced. Tables of these quantities are given. The results are compared with previous data. J. W. S.

Thermal properties of saturated water and steam. N. S. OSBORNE, H. F. STIMSON, and D. C. GINNINGS (J. Res. Nat. Bur. Stand., 1939, 23, 261— 270).—From the authors' results (A., 1931, 31; 1932, 560; 1937, 353; and preceding abstract) the heat content, sp. vol., and entropy of both the liquid and saturated vapour phases have been deduced for various temp. between 0° and the crit. temp. (374·15°), and are presented in tabular form. J. W. S.

Specific heats of tantalum in the normal and in the superconducting state. W. H. KEESOM and M. DÉSIRANT (Proc. K. Akad. Wetensch. Amsterdam, 1939, 42, 536-537).-In the absence of a magnetic field, Ta (99.96%) appears to show a discontinuity in the sp. heat C at 4.075° K. (cf. 4.38° K. found by Meissner, A., 1929, 250), at which the difference ΔC (= $C_n - C_s$) in the superconductive and normal states = 0.00881 g.-cal. per degree mol. This val. agrees with that obtained from Rutgers' formula (cf. A., 1937, I, 451), but in a magnetic field ΔC is found to be much lower than calc. vals. With fields of 446.8 and 691.6 gauss, sp. heat discontinuities at 3.705 and 3.49° K., respectively, are higher than vals. obtained from the induction curve, but agreeing with the temp. obtained from the resistance curve of Mendelssohn and Moore (A., 1936, 556). The superconductive state may still persist at fields for which $B \neq 0$. $C_n = 464 \cdot 5(T/246 \cdot 5)^3 + 0.00141T$, in which the first term is due to the at. lattice and the second to conduction electrons. The Debye characteristic temp. is 246.5° in approx. agreement with Simon and Ruhemann (A., 1928, 40). W. R. A.

Specific heat anomaly of potassium dihydrogen phosphate at the upper Curie point. W. BANTLE (Helv. Phys. Acta, 1939, 12, 279–281).— The sp. heat of KH_2PO_4 has been measured from 100° to 120° K. with a vac. radiation-calorimeter. Outside the region 110–115° K. the sp. heat is ~28 g.-cal. per mol. per degree, but rises at the Curie point (113°) to 160 g.-cal. per mol. per degree. The energy absorbed in the disappearance of the internal electric field is 60 g.-cal. per mol., giving a val. 0.5 for the Lorentz factor. L. J. J.

Specific heat of a substance showing spontaneous electric polarisation. J. MENDELSSOHN and K. MENDELSSOHN (Nature, 1939, 144, 595).— The sp. heat of KH_2PO_4 , measured between 40° and 130° K., shows no anomaly at the so-called "lower Curie point," indicating that the apparent disappearance of spontaneous electric polarisation towards lower temp. is due to a freezing-in of the dipoles. A marked anomaly occurs at the Curie point (122° K.). L. S. T.

Latent heats of sublimation and evaporation of certain substances. W. HUME-ROTHERY (Phil. Mag., 1939, [vii], 28, 465—480).—For normal metallic elements the latent heat of fusion is small, and the ratio λ_s/λ_l of the latent heats of sublimation and evaporation at the triple point is ~1. For many substances λ_s/λ_l approximates to the ratio of small whole nos. and the significance of this is discussed. It is also suggested that simple relations exist between the latent heats of the different modifications of allotropic substances. T. H. G.

Cohesion of simple compounds. III. J. M. STEVELS (Rec. trav. chim., 1939, 58, 931-940; cf. A., 1939, I, 248).—The introduction of certain corrections improves the agreement between calc. and observed vals. for the b.p. of F compounds.

F. J. G. Density and pressure of vapour at low temperatures. II. Nitrobenzene. V. G. GUREVITSCH and K. K. SIGALOVSKAJA (J. Gen. Chem. Russ., 1939, 9, 1326-1328).—The density of PhNO₂ vapour was N N** (A., L) measured between 15° and 53°. Brückner's vals. (A., 1931, 1004) are too high. J. J. B.

Pressure, volume, temperature relations of ethylene in the critical region. II. R. L. McIN-TOSH, J. R. DACEY, and O. MAASS (Canad. J. Res., 1939, 17, B, 241—250; cf. A., 1939, I, 515).— Nine pressure isothermals for C_2H_4 at 8.92—10.00° have been determined. Evidence is given for the existence of a two-phase system at temp. above that of disappearance of the meniscus. At 9.50° (the classical crit. temp.) the val. of l is ~4.2 cal. per g. Hysteresis of liquid-phase ρ with temp. at const. vol. is attributed to a residual quantity of vapour remaining suspended in the liquid during cooling. A qual. description of the changes occurring in the transition region of liquid to gas is developed from experimental evidence. F. H.

Vapour pressure measurements by new dynamic and static methods. Comparative study of the applicability of the reaction isochore to measurement of heat of vaporisation. D. RADU-LESCU and M. ALEXA (Bull. Soc. Chim. România, 1938, 20, 89—113).—V.p. of MeOH, $Pr^{\circ}OH$, HCO_2Et , MeOAc, $Pr^{\circ}OAc$, $EtCO_2Et$, $CHCl_3$, CCl_4 , $CHBr_3$, $C_2H_4Cl_2$, $C_2H_4Br_2$, $COMe_2$, and C_6H_6 have been measured at several temp. between 0° and 25° by a static and/or dynamic method (cf. A., 1936, 930). $C_2H_4Br_2$ and certain other liquids give inaccurate results by the static method when Hg is used as the manometric liquid; in such cases a glycerol manometer gives more satisfactory vals. Heats of vaporisation of the liquids are calc. by the van't Hoff isochore. F. L. U.

Vapour pressures and accommodation coefficients of four non-volatile compounds. Vapour pressure of tri-*m*-cresyl phosphate over polyvinyl chloride plastics. F. H. VERHOEK and A. L. MARSHALL (J. Amer. Chem. Soc., 1939, **61**, 2737—2742).—The v.p. of (*m*- (I) and (p-C₆H₄Me)₃PO₄, o-C₆H₄(CO₂Bu)₂, and dibenzyl sebacate have been measured at ~100° by a static method and by three dynamic methods which are described. The accommodation coeffs. for these liquids are unity. The v.p. of the plasticiser in a polyvinyl chloride-(I) plastic is independent of concn. from 15 to 100% plasticiser. W. R. A.

Thermal properties of halides. XII. Measurement of vapour pressure, and the m.p. and saturation pressures of scandium, thorium, and hafnium halides. W. FISCHER, R. GEWEHR, and H. WINGCHEN. XIII. Saturation pressures of stannous halides. W. FISCHER and R. GEWEHR (Z. anorg. Chem., 1939, 242, 161–187, 188–192; cf. A., 1933, 560).—XII. An apparatus for measuring the v.p. (with an accuracy of 0·1—1 mm.) at high temp. of substances which attack quartz and porcelain is described, and used to measure the v.p. of Sc and Th halides. The following data, with some pre-liminary measurements for HfCl₄ and HfBr₄, are recorded: ScCl₃, m.p. 960±2°, b.p. 967°; ScBr₃, m.p. 960±2°, sublimation temp. 929°; ScI₃, m.p. 945±8°, sublimation temp. 909°; ThCl₄, m.p. 770±2°, b.p. 921°; ThBr₄, m.p. 679±3°, b.p. 857°; ThI₄; m.p. 566±2°, b.p. 837°. The results confirm

the previously derived rules concerning the thermal behaviour of halides.

XIII. By means of an apparatus previously described (A., 1933, 560) the v.p. of $SnCl_2$, $SnBr_2$, and SnI_2 between ~400° and 700° have been measured. The following data are recorded for the three substances, respectively : b.p. 652°, 639°, 714°; heat of evaporation 20.5, 24.5, 25 kg.-cal. per mol.; Trouton const. 22, 27, 25. O. J. W.

Anomalous thermal expansion of carbon disulphide at low temperatures. J. MAZUR (Nature, 1939, 144, 328—329).—Between 20° and -112° , the coeff. of thermal expansion of CS₂ (curve given) decreases rapidly with a fall in temp. to a min. at -80° , and then increases. L. S. T.

Relativistic thermodynamics. D. VAN DANT-ZIG (Proc. K. Akad. Wetensch. Amsterdam, 1939, 42, 601-607).—Mathematical. W. R. A.

Relativistic gas theory. D. VAN DANTZIG (Proc. K. Akad. Wetensch. Amsterdam, 1939, 42, 608— 625).—Mathematical. W. R. A.

Hildebrand's method of proving "what substances can obey Raoult's law at all pressures and temperatures." I. R. KRITSCHEVSKI (Acta Physicochim. U.R.S.S., 1939, **10**, 885—886).— Hildebrand's method of proving that only liquids having identical vals. of $(\partial p/\partial T)_v$ can form ideal solutions at all pressures and temp. is shown to be incorrect. O. J. W.

p-v-T relations and an equation of state for unsaturated vapour of methyl alcohol. L. M. LASCHAKOV (Acta Physicochim. U.R.S.S., 1939, 11, 107—116).—The compressibility of unsaturated MeOH vapour has been investigated at temp. from 170° to 290°, pressures from 10 to 95 atm., and sp. vol. from 8.0 to 100 c.c. per g. Results can be described by a Beattie-Bridgeman equation of state (cf. A., 1927, 819) with an error of 0.21%. O. D. S.

Forces associated with heat flow in helium II. J. F. ALLEN and J. REEKIE (Nature, 1939, 144, 475—476).—The force associated with the flow of heat in He II has two components, one a surface effect in which the liquid is forced against the direction of the heat flow, and the other a vol. effect in which the liquid in the centre of the channel is forced in the direction of the heat flow. An apparatus for observing these two effects simultaneously is described. At high heat inputs the surface component appears to become saturated. The results described also help to confirm the view that the fountain effect (A., 1939, I, 410) is associated with the surface of the channel (cf. *ibid.*, 191). L. S. T.

Thermal conductivity of liquid helium II. E. GANZ (Helv. Phys. Acta, 1939, 12, 294—295).—Heat impulses are transmitted through a capillary filled with liquid He II with a high velocity (>100 m. per sec.). L. J. J.

Thermal conductivity of solid helium. A. K. KIKOIN (Acta Physicochim. U.R.S.S., 1939, 10, 307—312).—The thermal conductivity of solid He below the λ -point is \sim 1.2 times that of liquid He I, but the data are not sufficiently accurate for conclusions to

be reached as to the influence of temp. on the conductivity of the solid. C. R. H.

Accommodation coefficient of helium on (MISS) B. RAINES (Physical Rev., 1939, [ii], nickel. 56, 691-695).-The thermal accommodation coeff. of He on gas-free "A" Ni, measured at 90°, 195°, 273°. and 369° K., was 0.048, 0.060, 0.071, and 0.077, respectively (+0.004). In the presence of the gas the coeff. rose rapidly to the equilibrium vals. 0.413, 0.423, 0.360, and 0.343, respectively (± 0.012). The calc. vals. of the two consts. of the interaction potential between a He and a Ni atom are (0.75 ± 0.05) × 10⁸ cm.⁻¹ for the exponential decay const., and 430 ± 60 cal. per mol. for the heat of adsorption of He on Ni. The thermal conductivity of " A " Ni, measured at 90° and 195° K., was 0.74 ± 0.04 and 0.71 ± 0.04 w. per sq. cm. per degree respectively. N. M. B.

Dunstan's law. A. H. NISSAN (Nature, 1939, 144, 383—384; cf. A., 1939, I, 411).—A more fundamental form of Dunstan's equation for η is deduced by combining Trouton's rule with the Clausius–Clapeyron and Andrade equations. Limitations of the law are discussed. L. S. T.

Limiting volumes of oxygen and hydrogen. G. P. LUTSCHINSKI (J. Gen. Chem. Russ., 1939, 9, 1310—1312).—From the viscosity of 8 compounds of O its limiting vol. is 0.54 c.c. per g. The limiting vol. of H from the η of H₂O between 82° and 100° is 4.40 e.c. per g. J. J. B.

Influence of an electric field on the streaming velocity of anisotropic liquid *p*-azoxyanisole in a capillary. G. M. MICHAILOV and V. N. ZVETKOV (Acta Physicochim. U.R.S.S., 1939, **10**, 415–432).— The velocity of flow of anisotropic liquid *p*-azoxyanisole through a capillary placed in an electric field is decreased by longitudinal fields, but in transverse fields is measurably increased if the streaming velocity is small and the frequency of the field is not too high. Electric fields are without effect when the temp. approaches the point of transition into the isotropic form. W. R. A.

Effect of magnetic and electric fields on the streaming velocity of anisotropic liquid p-azoxyanisole in a capillary tube. G. M. MICHAILOV and V. N. ZVETKOV (Acta Physicochim. U.R.S.S., 1939, 10, 775-788).-The effect of a transverse magnetic field on the streaming velocity of p-azoxyanisole (I) reaches a saturation val. for sufficiently strong fields. The coeff. of internal viscosity of (I) when the axes of the mol. are perpendicular to the stream and parallel to the velocity gradient is about four times the coeff. when the mols. are arranged parallel to the stream and perpendicular to the velocity gradient. The simultaneous action of a magnetic and an electric field has been investigated. The change in the streaming time from that in the magnetic field alone is due to the orientation of mols. by the electric field. A. J. M.

Viscosity of liquids at high hydrostatic pressures. R. B. Dow (Phil. Mag., 1939, [vii], 28, 403-422).—Abs. and relative methods of measurement, including a new apparatus for the rotatingcylinder method, are discussed. η has been measured for mixtures of CS₂ and CCl₄ since these are non-polar liquids having mols. with quite different force fields. Although η increases with the pressure p for all mixtures, both at 30° and 75°, the ratio η^{30}/η^{75} shows an initial fall as p increases to ~2000 kg. per sq. cm., followed by a rise up to the highest vals. of p employed 10,000 kg. per sq. cm.). Theoretical aspects of viscosity at high pressures are also discussed.

T. H. G.

Equation of state for gaseous mixtures. I. R. KRITSCHEVSKI and J. S. KAZARNOVSKI (Acta Physicochim. U.R.S.S., 1939, 10, 217—244).—Theoretical. A semi-empirical equation, $p = p_1^0 N_1 + p_2^0 N_2 + a \cdot N_1 N_2 (p_1^0 - p_2^0)$, where p = total pressure, p_1^0 and $p_2^0 =$ pressures of the pure components, N_1 and $N_2 =$ mol. fractions of the components, and a is a coeff. depending solely on temp., has been derived and successfully applied to compressibility data for six gaseous mixtures. C. R. H.

Phase equilibria in hydrocarbon systems. Joule-Thomson coefficient of gaseous mixtures of methane and ethane. R. A. BUDENHOLZER, B. H. SAGE, and W. N. LACEY (Ind. Eng. Chem., 1939, 31, 1288—1292).—The Joule-Thomson coeffs. for three mixtures of CH_4 and C_2H_6 have been determined at 70—220° F. and at pressures of 40—1500 lb. per sq. in. By combining the results with previous data the isobaric heat capacities of the mixtures under various conditions, and the isothermal enthalpy-pressure coeff. at 160°, have been deduced. J. W. S.

Gas-vapour solutions at high pressures. I.R. KRITSCHEVSKI and N. E. CHAZANOVA (Acta Physicochim. U.R.S.S., 1939, 10, 199-216).-Theoretical. The application of the Gibbs-Dalton law, the Lewis-Randall rule, and equations of state to gas-vapour solutions at high pressures is discussed. Components must possess parallel isometrics in order to form a regular gas solution. A derived equation enables other isotherms to be calc. from an experimentally determined isotherm. Published data for the system CO₂-I satisfactorily fit in with the equation. The electrostatic theory for solutions of polar vapour in non-polar gas has been developed and an equation has been derived which agrees with data for solutions of H₂O vapour in various gases. As pressure increases, the mol. fraction of vapour in the gas phase decreases to a min. val. and then increases. An equation expressing the conditions obtaining at this min. point has been derived but data confirming it are lacking.

C. R. H.

Density and viscosity of glycerol solutions at low tempeartures. E. GREEN and J. P. PARKE (J.S.C.I., 1939, 58, 319–320).—Aq. solutions of 30— 80% concn. have been examined at -5° to -40° . η were > vals. published previously. F. L. U.

Study of diffusion processes by electrolysis with micro-electrodes. H. A. LAITINEN and I. M. KOLTHOFF (Nature, 1939, 144, 549–550).—Equations for linear and spherical diffusion have been tested by determining current-time curves for the electrolysis of 0.001M-K₄Fe(CN)₆ in 0.1N-KCl at $25^{\circ}\pm0.02^{\circ}$ with various shapes of Pt micro-electrodes. Theoretical curves were obtained only in the case of linear diffusion of K₄Fe(CN)₆ when using one particular type of electrode. L. S. T. Devitrification temperatures of solutions of a carbohydrate series. B. J. LUYET (J. Physical Chem., 1939, 43, 881—885).—The time required for devitrification of the glasses formed by supercooling aq. solutions of glucose, sucrose, raffinose, and dextrin has been studied as a function of temp. For standard times of keeping the devitrification temp. decreases only slowly with increasing concn., and for the series investigated is the lower the smaller is the mol. wt. of the sugar. Preliminary results with solutions of gums, agar, gelatin, CH_2O , $(CH_2 \cdot OH)_2$, and glycerol indicate that the various radicals exert different influences on the devitrification temp. J. W. S.

Pressure-volume-temperature relations in solutions. III. Thermodynamic properties of mixtures of aniline and nitrobenzene. R. E. GIBSON and O. H. LOEFFLER (J. Amer. Chem. Soc., 1939, 61, 2877–2884).—Measurements have been made of the sp. vol. at 25° , the thermal expansions at 10° intervals from 25° to 85°, and the compressions to various pressures >1000 bars at 25° , 45° , 65° , and 85° of six solutions of NH₂Ph in PhNO₂ covering the whole range of concn. From the data $(\partial P/\partial T)_r$, $(\partial E/\partial V)_T$, and the vol. changes on mixing are computed, and the variation of these quantities when the temp. is changed at const. vol. has been studied. A correlation exists between the effect of temp. and of mixing on the mol. distribution in the liquids on the one hand and the internal pressures and vol. changes on mixing on the other. The attractive pressures of the solutions (cf. A., 1939, I, 558) are represented by $P_A = a'/V^{2\cdot737}$. Several equations for the vol. changes on mixing are considered. W. R. A.

Properties of concentrated solutions of sodium carbonate. L. D. ROBERTS and G. B. MANGOLD, jun. (Ind. Eng. Chem., 1939, 31, 1293—1295).—The d, n, sp. conductivity, and $p_{\rm H}$ vals. of 1—6N. aq. solutions of Na₂CO₃ have been determined at various temp. and are tabulated. J. W. S.

Apparent ionic volumes in aqueous solutions and electrostriction by ionic fields. Y. KOBA-YASHI (J. Sci. Hirosima Univ., 1939, 9, 241–267).— The compressibility coeff. of H_2O has been investigated up to high pressures. An expression for the electrostriction of H_2O by an ionic field has been derived mathematically and is applied to data on uni- and bi-valent ions. The apparent ionic vol. of various ions at infinite dilution and the "ion space radii" have been evaluated. W. R. A.

Ions of europium distributed between different configurations in homogeneous solutions. S. FREED, S. I. WEISSMAN, F. E. FORTESS, and H. F. JACOBSON (J. Chem. Physics, 1939, 7, 824—828).— The structure of the absorption spectrum of Eu^{***} ions is a function of the environment of these ions in solution. Thus addition of KNO₃ to aq. EuCl₃ produces structures characteristic of Eu(NO₃)₃ in addition to the spectrum of EuCl₃, and the spectra of Eu salts in EtOH differ from those of aq. solutions of the corresponding salts. In a mixed H₂O-EtOH solvent EuCl₃ has a spectrum indistinguishable from the exactly superposed spectra of EuCl₃ in H₂O and in EtOH, the relative intensities varying with the relative amounts of the components. The lines of the spectrum of $Eu(NO_3)_3$ in the mixed solvent, however, are shifted from the positions which they occupy in the spectra of $Eu(NO_3)_3$ in the pure solvents, the extent of the shift varying continuously with the H_2O : EtOH ratio. These results are discussed with reference to the behaviour of electrolytes in mixed solvents. W. R. A.

Polarising properties of ions in aqueous solutions. I. I. SASLAVSKI (J. Gen. Chem. Russ., 1939, 9, 1094—1100).—The magnitude of the vol. change Δv associated with dissolution of electrolytes in H₂O depends both on the valency of the ions and on their individual properties. In general Δv varies parallel with Δk , the change in internal pressure. The vals. of Δv vary periodically with rising at. wt. in certain series of elements. R. T.

Viscosity of non-ideal binary liquid systems. M. K. SRINIVASAN (J. Indian Chem. Soc., 1939, 16, 305 ---307).—The cube root equation, which accurately expresses the η of ideal binary liquid mixtures as a function of the composition, has been modified for non-ideal systems by taking into account the variations of ρ which occur when the components are mixed. The proposed equation agrees as satisfactorily as others with recorded data on 11 binary liquid mixtures the η -composition curves of which either sag or show max. and min. W. R. A.

Viscosity in the systems: ketones-organic acids. I. V. V. UDOVENKO (J. Gen. Chem. Russ., 1939, 9, 1162—1166).—Composition- η and -d curves are given for the systems $COMe_2$ -R·CO₂H (R = H, Me, Pr, CH₂Cl, CCl₃) at 20—45°. Evidence of chemical reaction is given by the curves for the system COMe₂-AcOH. R. T.

Effect of complex formation in solutions on chemical kinetics. V. A. GOLDSCHMIDT and N. K. VOROBIEV (Trans. Ivanovo Chem. Tech. Inst., 1939, 5—12).—The η -composition curves of binary mixtures of NPhMe₂ with COMe₂, COPhMe, PhNO₂, MeOH, and CH₂Ph·OH, and of C₅H₅N with PhNO₂ and MeOH exhibit neither max. nor min. The curves for NPhMe₂ + MeOH and C₅H₅N + MeOH are the only ones which are convex upwards. Reactions proceeding by way of solvated mols. may have low vals. of the energy of activation and the *B* factor in Arrhenius' equation. R. C.

Properties of liquid amalgams. V. D. PONO-MAREV and S. M. GUBELBANK (J. Gen. Chem. Russ., 1939, 9, 1365—1368).—The cations of weakly dissociated salts, such as $HgCl_2$, or of sparingly sol. salts, such as HgCl, $PbSO_4$, AgCl, Ag_2S , etc., are readily replaced by Zn when the acid suspension or solution is shaken with Zn-Hg. R. T.

Solubility of nitrogen in molten iron-silicon alloys. J. C. VAUGHAN and J. CHIPMAN (Amer. Inst. Min. Met. Eng. Tech. Publ. No. 1109, 1939, 8 pp.; Met. Tech., 1939, 6, No. 7).—The solubility of N₂ at atm. pressure in liquid Fe-Si alloys containing up to 15.8% Si was determined at $1630\pm30^\circ$. The solubility increases from 0.041% in pure Fe to about 0.046% between 1% and 2% Si, and then decreases to about 0.01% at the highest [Si] employed. The

results indicate the formation of an Fe nitride and an Fe silicide in solution and a Si nitride of limited solubility in the melt. R. B. C.

Simultaneous diffusion of nickel and silicon in solid copper. R. F. MEHL and F. N. RHINES (Amer. Inst. Min. Met. Eng. Tech. Publ. No. 1072, 1939, 12 pp.; Met. Tech., 1939, 6, No. 5).—The rates of diffusion of Ni and Si when diffusing simultaneously into Cu were determined at 1000° and 850° and compared with those of Ni and Si when diffusing separately into Cu. The ternary Ni-Cu-Si system involves the quasi-binary system Cu-Ni Si; the solid solubility of Ni2Si in Cu decreases with falling temp. and the ppt. is Ni,Si. The rapid diffusion of Si in Cu is markedly slowed down by the presence of Ni, whereas the low rate of diffusion of Ni into Cu is little, if at all, affected by the presence of Si. The quasi-binary systems Al-MgZn₂ and Al-Mg₂Si exhibit a similar behaviour. The pronounced interaction of Ni and Si during simultaneous diffusion becomes more marked with increasing concn. Equality in the diffusion coeffs. of Ni and Si when these solutes diffuse from a core alloy containing Ni and Si in the proportions of Ni_oSi suggests the diffusion of mols. of Ni₂Si. The data can, however, best be explained by assuming the occurrence of momentary strong bonds between Ni and Si atoms when these are on adjacent lattice positions, with resultant retardation in the rate of movement of the more rapidly diffusing solute Si. aid to enotitulos anon R. B. C.

Thermodynamic study of the lead-antimony system. H. SELTZ and B. J. DEWITT (J. Amer. Chem. Soc., 1939, 61, 2594—2597).—The e.m.f. of cells of the type Pb (l)|PbCl₂ in KCl-LiCl (l)|Pb-Sb (l)have been measured up to 630°, and vals. for activities and relative heat contents of Pb and Sb in their liquid alloys have been calc. The system shows a simple eutectic with α - and β -solid solutions of Sb in Pb and Pb in Sb respectively as solid phases. The eutectic is at 250° and 12·1% Sb. The eutectic solids contain 3·86% Sb for the α -phase and 4·51% Pb for the β phase. W. R. A.

Transition-point diagram of the zirconiumtitanium system. J. D. FAST (Rec. trav. chim., 1939, 58, 973—983).—The transition points of a no. of Ti–Zr alloys have been determined and expressed in the form of an equilibrium diagram showing a min. at 545° for the at. ratio 1:1. The transition point of pure Ti is $885^{\circ}\pm10^{\circ}$. The m.p. of alloys with 50 and 70 at.-% Ti suggest a min. in the m.p. diagram at ~1575° for ~60 at.-% Ti. Lattice consts. for the alloys are recorded; they indicate a slight contraction on solid solution formation.

F. J. G.

Effect of high pressure on the order-disorder transformation in alloys. T. C. WILSON (Physical Rev., 1939, [ii] 56, 598-611).—With electrical resistance as an index of degree of order, the behaviour of the order-disorder transformation for CuAu, Cu_3Au , and CuZn under hydrostatic pressures up to 10,000 kg. per sq. cm. and over the temp. range 50-426° is reported. For temp. below the crit. point, observations are consistent with predictions from reported thermal expansion data and deductions from the Bragg–Williams theory. The crit. point of CuAu and of Cu_3Au is raised by pressure. Examination of α -brass (Cu_3Zn) indicates slight ordering of the constituents under high pressure. N. M. B.

Diffusion of hydrogen through iron at room temperature. J. H. DE BOER and J. D. FAST (Rec. trav. chim., 1939, 58, 984—993).—When thin Fe sheets are in contact with aq. solutions of such a $p_{\rm H}$ as to evolve H₂, diffusion of H through the Fe occurs. At. H, produced in the gas phase by a glowing W spiral, readily diffuses through Fe at room temp. F. J. G.

Solubility of gases. I. Inert gases in water. D. D. ELEY (Trans. Faraday Soc., 1939, 35, 1281-1293).-Theoretical. The energy and entropy changes accompanying dissolution of the inert gases in H₂O are calc., and are accounted for by assuming two consecutive processes, viz., (1) formation of a cavity and (2) entry of a gas mol. into the cavity. The entropy associated with (1) is zero at 4°, corresponding with a negative temp. coeff., but increases rapidly with rise of temp., so that at 80° the temp. coeff. has become positive, and H₂O then behaves like org. solvents towards the inert gases. At low temp., where the structure of H_2O is important, the gas mols. take up positions between the quasi-lattice points, whereas at higher temp. where the H_2O tends to become a close-packed liquid they share these points equally with other H₂O mols. F. L. U.

Solubility of double fluorides of aluminium and alkali metals. I. TANANAEV and S. TALIPOV (J. Gen. Chem. Russ., 1939, 9, 1155—1157).—The solubility of Na_3AlF_6 and K_3AlF_6 increases continuously with rising temp., from 0° to 100°. That of $(NH_4)_3AlF_6$ is max. at 50°. R. T.

Solubility of potassium chloride in antimony trichloride. D. I. SHURAVLEV (J. Gen. Chem. Russ., 1939, 9, 769—770).—Stratification takes place in systems containing 0—12.5% KCl at temp. >460°. B. T.

Solubility of KCl and NaCl in Al_2Br_6 , and of $BiCl_3$ in $SbCl_3$. E. L. STAROKADOMSKAJA (J. Gen. Chem. Russ., 1939, 9, 840—844).—The solubility -temp. curves for KCl and NaCl in AlBr₃ are given, and regions of immiscibility of the liquid phases are delimited. The fusion curve for $BiCl_3$ -SbCl₃ exhibits a break at 201° and 6 mol.-% $BiCl_3$. R. T.

Solubility of solids in binary solvent mixtures. I, II. E. I. ACHUMOV (J. Gen. Chem. Russs., 1939, 9, 1207-1219, 1220-1236).-I. Theoretical. The solubility of a substance in binary mixtures of solvents is expressed by $Y = Y_1[(100 - x)/100]^{n_1} + Y_2(x/100)^{n_2}$, where Y, Y_1 , and Y_2 are the solubilities in g.-mols. per 100 g.-mols. of mixture and of each constituent separately, x is the mol. concn. of one solvent, and n_1 and n_2 are indices, the vals. of which depend on (i) temp., (ii) the val. of x, and (iii) the extent to which each solvent is bound (by solvation) by the other.

II. The above formula is verified for the systems KCl, NaCl, Na₂SO₄, or sucrose-EtOH-H₂O and KCl, Na₂CO₃, or NaNO₃-NH₃-H₂O. R. T.

Ageing and coprecipitation. XXIX. Ageing of ortho-ferric hydroxide in the absence and presence of bivalent ions in ammoniacal medium. I. M. KOLTHOFF and L. G. OVERHOLSER (J. Physical Chem., 1939, 43, 909–922; cf. A., 1937, I, 457).-When Fe(OH)₃ formed at room temp. is aged in presence of aq. NH₃, NH₄Cl, and Zn", Ni", or Co" the amount of bivalent metal removed from the solution increases slowly on keeping at room temp. and rapidly at 98°, particularly at low [NH4Cl]. The effect is attributed to ferrite formation. Little change is observed in the amount of Mg^{**} removed from solutions, during ageing at either temp. During ageing in the presence of Ca" the amount of Ca" adsorbed decreases slowly at room temp. and rapidly at 98°. Ageing of Fe(OH)₃ in the absence of metals is accompanied by a decrease in adsorptive properties towards metal ions or dyes. The ageing is very slow in H_2O , more rapid in M-NH₃, and very rapid in 0.01M-NaOH, and is greater at 98° than at room temp. The ageing is inhibited by the presence of Zn", Ni", Co", and Mg", the effect being attributed to blocking of the OH groups. The amount of acid dye (Niagara-sky-blue) adsorbed by the Fe(OH)₃ increases with decreasing $p_{\rm H}$ of the solution, whilst the adsorption of a basic dye [methylene-blue (I)] shows a reverse effect. Alkali cations repress the adsorption of the (I) cation. J. W. S.

Selective absorption of hydrogen sulphide. D. V. BEZUGLI and M. M. RUDAKOV (J. Appl. Chem. Russ., 1939, 12, 697—703).—The absorption of H₂S and of CO₂ by falling films of conc. alkali carbonate and sulphide solutions in concentric glass tubes is investigated. At low gas velocities (0.03 m. per sec.) the H₂S absorption coeff. depends on the $p_{\rm H}$ and, if both gases are present, the H₂S coeff. decreases and that of CO₂ falls sharply. With high gas velocities (0.5—1 m. per sec.) the H₂S absorption coeff. rises sharply and is not affected by the $p_{\rm H}$, but CO₂ is not appreciably removed. Thus, 90—98% of the H₂S, but only 7—9% of the CO₂, were absorbed. Explanations for this selective absorption are given. D. G.

Degassing of hydrogen-charged palladium. F. D. BENNETT (J. Amer. Chem. Soc., 1939, 61, 2683— 2686).—Metallic Pd rod takes up a stable charge of H₂ during electrolysis of dil. acid, and H/Pd = 0.698, in agreement with recorded data. Degassing in a vac. at temp. $\leq 300^{\circ}$ removes most of the adsorbed H₂, whilst at $< 300^{\circ}$ the process is much slower and less complete. Subsequent degassing up to the m.p. of the product of the degassing at 300° gives only a trace of H₂. W. R. A.

Chemisorption of carbon dioxide by reduced iron. III. Thermodynamic consideration of the chemisorption. K. KAWAKITA (Rev. Phys. Chem. Japan, 1939, 13, 87—95; cf. A., 1936, 791).— From equations derived to express the free energy changes of all the reactions possible between reduced Fe and its chemisorbed CO₂, the vals. of ΔG_{300}^{c} have been calc. CO has been identified as an intermediate product formed from CO₂ chemisorbed on the Fe surface and experimental data justify representing the reactions on the Fe surface in the adsorbed state thus: Fe + (CO₂) = Fe_XO_Y + (CO), 2(CO) = C + (CO₂). The existence of Fe₃O₄ as a product of chemisorption has been confirmed chemically. The chemisorption, therefore, consists probably of the four reactions Fe + CO₂ = FeO + CO, 3FeO + CO₂ = Fe₃O₄ + CO, 3Fe + 4CO₂ = Fe₃O₄ + 4CO, 2CO = C + CO₂, of which the apparent reaction is 3Fe + 2CO₂ = Fe₃O₄ + 2C. W. R. A.

Heterogeneous recombination of atoms and calculation of the heat of adsorption of atoms on metallic surfaces. A. SCHECHTER (Acta Physicochim. U.R.S.S., 1939, **10**, 379–388).—The heterogeneous recombination of atoms is discussed generally, and the dependence of the coeff. of recombination on temp. for different mechanisms of recombination is considered. Experimental data on the temp. influence of the coeff. for N atoms on Ni agree with those given by theory. The heat of adsorption of N atoms on Ni and the min. val. of heat of adsorption of N atoms on Pt and of H atoms on Pt and W are calc., and indicate that for pressures of ≤ -0.05 mm. Hg the recombination of these atoms is due chiefly to collisions between free and adsorbed atoms.

W. R. A.

Adsorption of cations on platinised charcoal in a hydrogen atmosphere. S. PETROV, R. BUR-STEIN, and P. KISSELEVA (Acta Physicochim. U.R.S.S., 1939, **11**, 59–66).—The adsorption of Li⁺, Na⁺, K⁺, Ba⁺⁺, Cd⁺⁺, La⁺⁺⁺, and Th⁺⁺⁺⁺ from solutions of their chlorides and of Tl⁺ from TlNO₃ has been investigated. Cations are adsorbed by platinised charcoal of low activity in the order $K^+ > Ba^{++} > La^{+++}$, and by highly active charcoal in the reverse order $K^+ < Ba^{++} < La^{+++}$. This inversion is explained as an ultraporosity effect. Results agree with Stern's theory of the adsorption of cations. O. D. S.

Adsorption of barium, sodium, and lithium ions by glauconite and its dependence on the $p_{\rm H}$ of the equilibrium solution and on the ionic concentration. E. A. MATEROVA (J. Gen. Chem. Russ., 1939, 9, 1274—1278).—The change of $p_{\rm H}$ produced by glauconite in solutions of BaCl₂ + Ba(OH)₂, NaCl + NaOH, and LiCl + LiOH was measured, and the sorption of Ba^{**}, Na^{*}, and Li^{*} calc. The sorption increases with the $p_{\rm H}$ and seems to have an electrostatic character. J. J. B.

Adsorption of organic acids from single and mixed solvents. N. JERMOLENKO and S. LEVINA (Acta. Physicochim. U.R.S.S., 1939, **10**, 451-464).— The adsorption of o-OH·C₆H₄·CO₂H (I) and Pr^aCO₂H (II) from their mixture in various solvents (CCl₄-C₆H₆; CCl₄-PhMe, C₆H₆-PhMe, C₆H₆-CHCl₃; C₆H₆-EtOH, CCl₄-EtOH, CCl₄-COMe₂; H₂O-EtOH, COMe₂-EtOH, CHCl₃-COMe₂, CHCl₃-EtOH) on active animal C has been investigated. The presence of one acid in the mixed media does not affect fundamentally the character of the adsorption isotherm of the other, and Masius' rule, that the acid more strongly adsorbed when taken separately is the more strongly adsorbed from an acid mixture, is confirmed. The total adsorption of acids from media the components of which are \simeq in polarity, *e.g.*, COMe₂-EtOH, and media the components of which are chemically similar, e.g., C_6H_6 -PhMe, is approx. const. with change in the proportion of the components of the medium. The adsorption of (I) in presence of (II) from mixed media consisting of a polar and a non-polar component, e.g., C_6H_6 -EtOH, decreases with decreasing concn. of non-polar component. The adsorption of mixtures of (I) and (II) from pure solvents of the same homologous series falls gradually with decrease in the dielectric const. and with an increase in the mol. polarisation of the medium. W. R. A.

Absorptive properties of synthetic resins. III. S. S. BHATNAGAR, A. N. KAPUR, and M. S. BHATNAGAR (J. Indian Chem. Soc., 1939, 16, 261-268; cf. A., 1937, I, 234).-The adsorption by acidcondensed phenolic resins of a homologous series of mono- and di-basic aliphatic acids [HCO₂H, AcOH, $Pr^{\alpha}CO_{2}H$; $H_{2}C_{2}O_{4}$, $CH_{2}(CO_{2}H)_{2}$, $(CH_{2} \cdot CO_{2}H)_{2}$, adipic acid] increases with increasing mol. wt. of the acid, whilst in alkali-catalysed phenolic resins and aminoresins the order of adsorption is reversed. The adsorption of various substituted (Cl-, Cl2-, Cl3-, Ph-, CN-, NH_2 -, OH-) acetic acids on a m-C₆H₄(NH_2)₂ resin has been investigated. Introduction of acidic groups increases the adsorption of AcOH, whilst basic groups cause a decrease. The effect of the NH_2 group in lowering the adsorption is \gg that of the OH group, owing probably to the greater basicity of the NH₂ group. W. R. A.

Phenomena of adsorption between liquid phases. Analysis of curves. R. MÉRIGOUX and M. AUBRY (J. Chim. phys., 1939, 36, 221-233).--Interfacial tension (γ) -time curves have been recorded photographically for H₂O and solutions of oleic acid (I) in liquid paraffin and in CCl4. The families of curves obtained for different concns. of (I) in both solvents are tangential to the γ -axis at the origin. Equilibrium is reached in a few (<10) hr. with the CCl₄ solutions, but is not reached in 24 hr. with paraffin solutions. Formulæ giving the relation between [(I)] and the equilibrium val. of γ (CCl₄), or the val. of γ after a given time (paraffin), are developed. When a solution of (I) is brought into contact with H_2O already covered with a unimol. layer of (I), γ at first increases, reaches a max., and then more slowly decreases; this effect is attributed to desorption of the original unimol. film, and the subsequent F. L. U. adsorption of a multimol. film.

Capillary properties of a-amino-acids. J. W. BELTON (Trans. Faraday Soc., 1939, 35, 1293-1298). —Surface tensions (γ) of solutions of glycine (I), alanine (II), NH₂·CHEt·CO₂H (III), and valine (IV) have been measured in the absence and presence of varying amounts of NaCl. $\partial \gamma / \partial [acid]$ is positive for (I) and (II), and negative for (III) and (IV). When NaCl is present the val. of $\partial \gamma / \partial [\text{salt}]$ for const. acid concn. falls with increasing length of the C chain. $\partial \gamma / \partial [acid]$ at const salt concn. is const. and independent of salt concn. for (I); for (II) it is smaller, and falls with increasing salt concn., becoming 0 at 4M., and for (III) and (IV) it is negative and falls more rapidly with increasing salt concn. The surface structure of the solutions is deduced by the Gibbs equation. F. L. U.

Effect of salts on surface tensions of gelatin solutions. J. W. BELTON (Trans. Faraday Soc., 1939, 35, 1312—1316).—Measurements of γ by the bubble pressure method are recorded for gelatin solutions alone and in presence of varying conces. of NaCl, KCl, LiCl, KI, and BaCl₂. The results are interpreted in terms of surface structure. F. L. U.

"Breaks" in interfacial tension curves. C. C. ADDISON (Nature, 1939, 144, 249—250; cf. A., 1938, I, 355).—"Breaks" in the interfacial tension curves, usually associated with complex systems, occur in the simple system C_6H_6 -CH₂Ph·OH-H₂O. The two breaks may represent the beginning and end of interpenetration of two identical absorbed films. No break occurs in the curve for CH₂PhCl, which is sol. only in the C_6H_6 phase. L. S. T.

Wetting and spreading properties of aqueous solutions. Mixtures of sodium carbonate with n-hexoic, n-octoic, n-decoic, lauric, myristic, and palmitic acids. H. L. CUPPLES (Ind. Eng. Chem., 1939, 31, 1307-1308; cf. A., 1937, I, 512).-The surface tension (γ) , interfacial tension against mineral oil (σ), and spreading coeff. (s) of 1% solutions of the fatty acids have been determined in the presence of 0.5-3 mols. of Na₂CO₃ per mol. of acid. Curves of these properties against the mol. ratio Na₂CO₃/acid are generally similar in form and their relative positions follow approx. the order of increasing mol. wt. of the acid. For the lower acids the abrupt rise in γ occurs at mol. ratio 0.5, whereas for the higher acids it is at ~ 1.0 . This is attributed to the behaviour of Na₂CO₃ as a diacid base with the lower acids, but as a monacid base with the higher acids. For solutions of oleic acid γ , σ , and s vary only slightly with the [Na₂CO₃]. The high s of such solutions explains the good detergent and wetting action of oleates. J. W. S.

Linear phenomena. V. Linear phenomena on a two-dimensional paraffin colloid. T. A. KRASNOVA, P. F. POCHIL, and D. L. TALMUD (Acta Physicochim. U.R.S.S., 1939, 10, 347-352).-To fulfil conditions for the measurement of linear adsorption (A., 1938, I, 571) paraffin was used as a twodimensional colloid, and Me2 tetradecanedicarboxylate as adsorbate. Colloidal solutions prepared by dissolving paraffin in C_6H_{14} were placed on H_2O in an Adam trough. Ultramicroscopic investigations proved their high degree of dispersity, and the linear adsorption of the ester on the paraffin colloid was measured by comparing individual force-area curves for paraffin and ester on pure H₂O with those for ester on paraffin solution. The no. of linearly adsorbed mols. was calc., and saturation of the linear boundary was shown. W. R. A.

Comparison of the adsorption, electrolytic, and interference methods of measuring film areas. F. H. CONSTABLE (Nature, 1939, 144, 630).— Data for palmitic acid on metallic granules with activated surfaces and when covered with coloured oxide films, obtained by the three methods, are recorded. L. S. T.

Lateral cohesion in protein monolayers. L. FOURT (J. Physical Chem., 1939, 43, 887-899).-- The surface viscosity (η) of unimol. layers of cholesterol, casein, and nerve protein has been determined from the damping of a vane oscillating in the film, and an index of the surface elasticity deduced from the shortening of the period of oscillation. For the protein the η and elasticity of the film vary considerably with the p_{π} of the solution on which the film is spread, the film becoming elastic rapidly on solutions of p_{π} 5.0 and 4.3, but only slowly on solutions of p_{π} 2.0. This is interpreted as indicating that the linkages formed within the film are ionic. Quant. spreading into a unimol. film occurs only when the factors bringing about distribution of the protein precede or overbalance the effects of elastic film formation. J. W. S.

Technique for the spreading of proteins and the "spreading number." D. DERVICHIAN (Nature, 1939, 144, 629-630).—Proteins from aq. solution can be spread on H_2O by adding to the H_2O small amounts of an active substance, such as C_5H_{11} ·OH, BuOAc, or EtCO₂Bu, which lowers γ . Various types of proteins, particularly myosin, amandin, and edestin, have thus been spread on H_2O , dil. HCl, or dil. NaOH. A substance may have a very low spreading pressure and yet be spread by this method to give a film stable under relatively high pressures. The term "spreading no." is discussed. L. S. T.

Thickness of built-up films. G. I. JENKINS and A. NORRIS (Nature, 1939, 144, 441).—The thickness of built-up films of ~ 20 A. on metal is found from spectrophotometric determinations of the λ of light which gives an intensity min. for a given film thickness. Test data for Ba stearate deposited on stainless steel give thickness vals. in agreement with those obtained by other methods. L. S. T.

Evaporation of built-up molecular films. S. J. GREGG and E. E. WIDDOWSON (Nature, 1939, 144, 666—667).—The determination of the condensation coeff., α , of films of stearic (I) and arachidic (II) acids on stainless steel, and of the free acid content of built-up soap films [Ba stearate (III)] on stainless steel, by evaporation of the films in a high vac. are described. For (I) and (II), α is 0.01 ± 0.004 . The curve for (III) is reproduced. L. S. T.

Rules governing the removal [from aqueous surfaces] of multimolecular films of stearic acid (Langmuir films). (MLLE.) L. DENARD (J. Chim. phys., 1939, 36, 210-217).-The nature of films of stearic acid (I) deposited on a plate of polished Cr during the immersion and retraction of the latter through 0.01 N-HCl covered with a unimol. layer of (I) depends on the surface pressure (F) prevailing during the operation. For F > 1 < 10 dynes per cm. the layer removed by the Cr on immersion slips off and is re-spread on the H_2O on retraction; for $\bar{F} > 10 < 25$ the amount that slips off (F < 20) or becomes attached (F > 20) during retraction is > that removed on immersion; and for F > 25 complete layers are removed both on immersion and on retraction. Measurement of the area per mol. occupied by (I) in the deposited films, which correspond with Langmuir's Y- and X-films, shows that they are the counterpart, in two dimensions, of the polymorphic F. L. U. varieties of (I).

Interaction of two colloidal particles, using the complete Debye-Hückel equation. S. LEVINE (J. Chem. Physics, 1939, 7, 831-848).--Mathematical. Using the original Debye-Hückel equation an approx. method of calculating the mutual electrical energy of two colloidal particles has been developed. The method is applicable to binary electrolytes (symmetrical type) only. W. R. A.

Diffusion in colloidal media. J. M. REINER (Bull. Math. Biophys., 1939, 1, 143—149).—The retardation of the diffusion of a solute through a medium containing large colloidal particles, consequent on the adsorption of solute on them, is discussed, and its biological implications are considered. F. L. U.

Depolarisation of light scattered by colloidal solutions. A. BOUTARIC and (MLLE.) J. BRETON (J. Chim. phys., 1939, 36, 193—200).—In colloidal solutions of mastic, As_2S_3 , $Fe(OH)_3$, clay, and bentonite traversed by a beam of natural or vertically polarised light the corresponding coeffs. of depolarisation (ρ_n , ρ_v) of the light scattered at right angles increase with concn. For a given concn. ρ_n and ρ_v increase with the particle size, whether this is determined by the mode of prep., or changes spontaneously with time. Variations in ρ for horizontally polarised light are less definite. F. L. U.

Creaming of rubber latex.—See B., 1939, 1151.

Action of copper salts on emulsions stabilised by sodium oleate. A. R. MARTIN and R. N. HERMANN (Nature, 1939, 144, 479).—Addition of a Cu salt equiv. to the Na oleate (I) present in emulsions of C_6H_6 in H_2O stabilised by (I) separates C_6H_6 and a solute which colours the C_6H_6 green or blue. Evaporation of the C_6H_6 gives a dark green, waxy solid containing Cu : oleate in the ratio 1 : 3.4, and some Na. Cu oleate prepared from aq. CuSO₄ and aq. (I) is at first insol. in C_6H_6 and contains Cu : oleate in the ratio 1 : 2.05. The nature of the double layer around the oil droplets of the emulsion is discussed. L. S. T.

Electrochemistry of platinum sols. IV. Particle charge of hydrogen platinum sols. A. ZIMIN and N. BACH (Acta Physicochim. U.R.S.S., 1939, 11, 1-20; cf. A., 1938, I, 194).—The conductance titration curves of H_2 -Pt sols with NaOH and Ba(OH)₂ and the variation in cataphoretic velocity at different stages of titration have been investigated. The radius of the particles calc. from vals. of ζ by the method of Müller agrees with that calc. using vals. of the zero point charge obtained from adsorption data for Pt electrodes. O. D. S.

Coagulation of colloids by electrolytes. XIII. Electrochemical properties and coagulation of unidisperse silver sols. M. E. SCHISCHNIASCHVILI and A. J. RABINOVITSCH. XIV. Electrostatic theory of coagulation and the limits of its applicability to silver sols. A. J. RABINOVITSCH and M. E. SCHISCHNIASCHVILI (Acta Physicochim. U.R.S.S., 1939, 11, 185-205, 206-224).-XIII. Unidisperse Ag sols made by the nuclear method and purified by dialysis contain no Ag in the outer member of the double layer. The small amount of titratable Ag found in the sols is considered to be derived from a stabilising anionic complex. H' is displaced from the particles by addition of KNO_3 , $\text{Ba}(\text{NO}_3)_2$, and $\text{La}(\text{NO}_3)_3$ to the extent, respectively, of 0-15, 2·2, and $\sim 40\%$ of the added electrolyte. Data are recorded for the mobility of the particles during dialysis, and after the addition of varying amounts of K', Ba'', and La'''. Parallelism is observed between the displacement of H' by K', Ba'', and La''' and the effect of these ions on the ζ -potential.

XIV. Müller's theory of coagulation (Kolloid-Beih., 1928, **26**, 274) accords with the measurements of the ζ potential of unidisperse Ag sols when KNO₃ is used as coagulating electrolyte, but not when Ba(NO₃)₂ or La(NO₃)₃ is used. It is inferred that Müller's theory is applicable only when exchange adsorption is negligibly small; with coagulating ions of valency >1 this is generally not true. F. L. U.

Chemistry of colloid-colloid reactions. VIII. Mechanism of protection by higher carbohydrates. W. PAULI, J. SZPER, and S. SZPER (Trans. Faraday Soc., 1939, 35, 1316-1327).—The behaviour of Au sols towards dextrin, sol. starch, and gum arabic is completely analogous to that of Sb_2S_3 sols (A., 1939, I, 563). Congo-blue sols are not protected, but are apparently sensitised, by dextrin. Gum arabic when in the acidoid condition does not protect Congo-blue, but does so when neutralised with MgO. The behaviour of the three sols studied towards carbohydrate protectives is reviewed and interpreted in terms of interaction with ionogenic groups on the surface of the colloid particles.

F. L. U. Time of set of silica gels. III. Changing effects of alcohols over a $p_{\rm H}$ range. L. A. MUNRO and J. A. PEARCE (Canad. J. Res., 1939, 17, B, 266— 280, cf. A., 1939, I, 77).—The total effect and the individual variation of mono- and poly-hydric alcohols on the setting time of SiO₂ gels increases with increasing alkalinity of the gel. That ϵ of the alcohol is not a decisive factor in coagulation is shown by the const. effect obtained for an equal no. of alcohol mols. at $p_{\rm H}$ 7. In acidic systems all the alcohols studied retard the time of setting of the gel but in alkaline systems only the higher polyhydric alcohols behave in this way. The monohydric alcohols and (CH₂·OH)₂ change from accelerators to retarders at $p_{\rm H}$ 7.4 to 8.5 but the $p_{\rm H}$ at reversal for each alcohol does not coincide with the $p_{\rm H}$ at which the original gel shows min. setting time. F. H.

Swelling of xerogels and powdered disperse substances during sorption of water vapour. M. V. TSCHAPEK and P. V. SHURAVEL (Acta Physicochim. U.R.S.S., 1939, 10, 867—880).—A technique for studying the swelling of xerogels and powdered disperse substances during the sorption of H₂O vapour is described. Elastic gels and disperse substances with individual grains (e.g., clay, soil) swell during sorption and contract during desorption, whereas hard gels (e.g., charcoal, SiO₂ gel) undergo no change in vol. during either process. Swelling commences when the relative aq. v.p. is 0.5 and reaches a max. when it is 1. Rise of temp. increases the rate of swelling but does not affect its magnitude. The mechanism of the swelling process is discussed. O. J. W.

Elastic reactions of gels. F. MICHAUD (J. Chim. phys., 1939, 36, 201–209).—The reactions of rigid gels towards changes in their environment, whether mechanical or osmotic, are considered theoretically, and discussed with reference to the behaviour of living cells (cf. A., 1939, I, 469). F. L. U.

Binuclear ethylenediaminecobaltic complexes. H. BRINTZINGER and H. PLESSING (Z. anorg. Chem., 1939, 242, 193—196; cf. A., 1937, I, 184).—Mol. wt. measurements by a dialysis method indicate the existence of the ions $[Co_2\{en_4(NH_3)_4\}]^{6+}$, $[Co_2\{en_4(NH_3)_2Cl_2\}]^{4+}$, and $[Co_2\{en_2(NH_3)_4Cl_4\}]^{2+}$, in

Formato-complexes. H. BRINTZINGER, H. PLES-SING, and W. RUDOLPH (Z. anorg. Chem., 1939, 242, 197-200).—Mol. wt. determinations by means of a dialysis method show that the complex formatoanions of Co^{II}, Ni^{II}, Zn^{II}, Cd^{II}, Cr^{III}, and Fe^{III} have the same composition in solution as in the cryst. state (cf. Lossen and Voss, A., 1892, 140). Cu^{II}, however, forms the tetraformato-complex anion, [Cu(HCO₂)₄]", in solution. O. J. W.

Existence of chemical interactions between the hæms in ferrihæmoglobin (methæmoglobin) and the rôle of interactions in the interpretation of ferro-ferrihæmoglobin electrode potential measurements. C. D. CORYELL (J. Physical Chem., 1939, 43, 841-852).-Equilibrium data for reactions between ferrihæmoglobin (I) and SH' and N₃' ions indicate that stabilising interactions between hæms occur in these systems as in the ferrohæmoglobin (II) $-O_2$ system. The sigmoid coeff. *n* of Hill's equation for hæmoglobin saturation equilibria is correlated with the effective interaction const. α in Pauling's theory of interactions between adjacent hæms. The total effective interaction energies for the equilibria between (I) and SH', N₃', F', and OH' ions are 3360, 3120, 0, and 0 g.-cal. per g.-mol., respectively. In the first two cases complexes with covalent Fe atoms are formed, whilst in the other cases complexes with predominantly ionic Fe atoms are formed. Potentiometric measurements on the (I)-(II) electrode indicate that the val. of n in the Nernst equation is identical with that of the sigmoid coeff. The val., ~ 1.6 , confirms that interactions occur between ionically bound Fe compounds, with an interaction energy of ~2600 g.-cal. per g.-mol. J. W. S.

Effect of temperature on composition of complexes formed by interaction of chlorides in solution. A. V. TITOV (Trans. Ivanovo Chem. Tech. Inst., 1939, 12—14).—The vol. changes when aq. solutions of NaCl and ZnCl₂ are mixed indicate that a complex Na₂ZnCl₄ is formed and, below 0°, NaZnCl₃. R. C.

Solubility of mercuric halides in solutions of potassium halides. Character of the mercuric halide complex ions. Evidence for polymerisation of mercuric chloride. A. B. GARRETT (J. Amer. Chem. Soc., 1939, 61, 2744-2748).—The solubilities of HgBr₂ and HgI₂ in KBr and KI solutions and the solubility of HgBr₂ in H₂O have been determined. Calculations of the equilibrium consts. for the formation of complex ions of Hg halides indicate the formation of HgBr₃', HgI₃', and HgI₄'' [earlier work indicated the formation of HgCl₂)_xCI']. The anomalous solubility of HgCl₂ in dil. Cl' solutions is attributed to the polymerisation of HgCl₃ and this is supported by other evidence. The HgCl₃' ion is formed chiefly in Cl' solutions. The free energies of formation (ΔG_{208}) of the various ions from Hg halide and halide ions are : HgCl₃', -1700; HgBr₃', -365; HgI₃', 430; HgI₄'', -2100 g.-cal. per mol.

W. R. A.

Thermodynamic dissociation constants of α alkylsulphonylpropionic acids. A. MELLANDER (Arkiv Kemi, Min., Geol., 1939, **13**, **A**, No. 4, 9 pp.). —The following K_0 vals. are derived from conductivity data: α -methyl- 2.930, -ethyl- 2.734, -n-propyl-2.626, -isopropyl-sulphonylpropionic acid 2.515 × 10⁻³. Λ_0 vals. for the K, Na, Na, and K salts, respectively, are 107.42, 81.68, 80.12, and 103.22.

A. J. E. W. **Expression of** $p_{\rm H}$ as an arithmetic quantity. L. B. MILLER (Paper Trade J., 1939, 109, 21 Sept., 22—23; cf. A., 1939, I, 262).—The use of the symbols $A_{\rm H}$ and $A_{\rm OH}$, representing "active acidity" and "active alkalinity" respectively in an arithmetic method of expressing [H'] has advantages over the $p_{\rm H}$ (logarithmic) method. H. A. H.

Solution theory applied to zinc sulphate solutions. I. Activity coefficients in isodielectric media. Y. KOBAYASHI (J. Sci. Hirosima Univ., 1939, 9, 269–298).—The activity coeff. of $ZnSO_4$ in 15.65% aq. glycerol (I) and in 10% aq. MeOH has been found by measuring the e.m.f. of the cells $Zn-Hg|ZnSO_4(M.)$, (I) (15.65%)-H₂O, PbSO₄ (solid)] Pb-Hg, and $Zn-Hg|ZnSO_4(M.)$, MeOH (10%)-H₂O, PbSO₄ (solid)]Pb-Hg at 25° and various [ZnSO₄]. The activity coeff. and solvation energy are calc. from the Debye-Hückel theory. The solubility of PbSO₄ in aq. (I) in presence of $ZnSO_4$ is discussed.

W. R. A.

Equilibria between liquid and vapour in the system ethyl alcohol-cellosolve-water. E. M. BAKER, R. E. CHADDOCK, R. A. LINDSAY, and R. C. WERNER (Ind. Eng. Chem., 1939, **31**, 1263—1266; cf. following abstract).—The n and d of various mixtures of EtOH, H₂O, and OH·[CH₂]₂·OEt have been determined and utilised to study the compositions of the distillates formed by boiling liquids of various compositions. J. W. S.

Equilibria in the systems ethyl alcohol-water, ethyl alcohol-cellosolve, and cellosolve-water. E. M. BAKER, R. O. H. HUBBARD, J. H. HUGUET, and S. S. MICHALOWSKI (Ind. Eng. Chem., 1939, 31, 1260—1262).—A distillation apparatus which enables equilibrium to be reached between a boiling liquid mixture and its vapour, and allows the subsequent removal of samples of the liquid and distillate, is described. The b.p. and composition of the saturated vapours are recorded for various $EtOH-H_2O$, $EtOH-OH\cdot[CH_2]_2\cdotOEt$ (I), and (I)-H₂O mixtures. (I) and H_2O form a const.-b.p. mixture containing 92.1 mol.-% of H_2O . J. W. S.

Binary liquid systems. I. Vapour-liquid equilibria in the system carbon tetrachlorideethyl acetate. P. W. SCHUTZ (J. Amer. Chem. Soc., 1939, 61, 2691—2693).—The binary system CCl_4 -EtOAc has a min. b.p. of 71.65°/685 mm. for 58.2 mol.-% CCl_4 . From data at other pressures it appears that, in distinction to other similar systems, the rate of change of composition of the CCl_4 -EtOAc azeotrope decreases as the pressure decreases.

W. R. A.

Binary systems containing hydrazine. III. Thermal analysis of the system hydrazinephenol. V. I. SEMISCHIN (J. Gen. Chem. Russ., 1939, 9, 788—791).—The fusion curve suggests formation of a 1 : 2 compound, m.p. 63.6° (decomp.). 1 : 1 and 1 : 4 compounds previously reported are not confirmed. R. T.

Phase equilibrium relations in the system Na₂SiO₃-Li₂SiO₃-SiO₂. F. C. KRACEK (J. Amer. Chem. Soc., 1939, 61, 2863-2877).—The phase equilibrium of the system Na₂SiO₃-Li₂SiO₃-SiO₂ has been investigated by the methods of quenching and thermal analysis. The only ternary compound is $NaLiSiO_3$, melting incongruently at 847°. At the liquidus the primary phases are (Na2, NaLi)SiO3 solid solutions, Li₂SiO₃, Na₂Si₂O₅, Li₂Si₂O₅, and the three cryst. modifications of SiO₂. The liquidus fields meet at two ternary eutectics (a) at 697°, with (Na2, NaLi)SiO3, Li2SiO3, and Na2Si2O5, and (b) at 637°, with Li₂Si₂O₅, Na₂Si₂O₅, and quartz as constituents. Li2Si2O5 melts incongruently throughout its region of existence, the reaction temp. decreasing from 1033°, in the system Li₂SiO₃-SiO₂, to 641°, the peritectic end-point in the ternary system with Li₂Si₂O₅, Li₂SiO₃, and Na₂Si₂O₅ coexisting. The temp. for the inversion quartz \implies tridymite is $867^{\circ}\pm 3^{\circ}$. Revised data are given for the systems Na2SiO3- SiO_2 and Li_2SiO_3 - SiO_2 , showing that $Na_2Si_2O_5$ is trimorphous and that $Li_2Si_2O_5$ is polymorphic. Vals. of n for a no. of the glasses are given and the cocrystallisation of Na and Li compounds in solid solutions is discussed. W. R. A.

Equilibrium in the system NO-NO₂-HNO₃-H₂O at 0°. D. A. EPSCHTEIN (J. Gen. Chem. Russ., 1939, 9, 792—793).—Equilibrium coeffs. for NO-NO₂ mixtures over 35—62% HNO₃ at 0° are recorded.

R. T.

Solubility in the system $(NH_4)_2SO_4 + 2HCl = H_2SO_4 + 2NH_4Cl$ at 25°. J. B. BLÜMBERG and A. B. ZDANOVSKI (J. Gen. Chem. Russ., 1939, 9, 814—818).—The phase diagram (partial HCl pressure 1 atm.) of the quaternary system is given. The solid phases are : NH_4Cl , NH_4HSO_4 , $(NH_4)_3H(SO_4)_2$, and $(NH_4)_2SO_4$. R. T.

Equilibria in the system NH_4F - BeF_2 - H_2O at 0°. A. V. NOVOSELOVA and M. J. AVERKOVA (J. Gen. Chem. Russ., 1939, 9, 1063—1066).—The phase diagram suggests the existence of the salts $2NH_4F$, BeF_2 and NH_4F , BeF_2 . R. T.

System Li₂SO₄-Al₂(SO₄)₃-H₂O at 0°. H. A. HORAN and J. A. SKARULIS (J. Amer. Chem. Soc., 1939, 61, 2689—2691).—Details are given for the prep. of hydrated $Al_2(SO_4)_3$ of definite composition, corresponding with $Al_2(SO_4)_3$, $17H_2O$. The aq. solubilities of $Al_2(SO_4)_3$ and Li_2SO_4 at 0° are 27.50% and 26.50% respectively. In the ternary system only two solid phases exist, viz., Li_2SO_4, H_2O and $Al_2(SO_4)_3, nH_2O$ ($n \simeq 15$ —18). The invariant point for the system is 16.83% $Al_2(SO_4)_3$, 14.45% Li_2SO_4 . W. R. A.

Equilibria in systems involving salting-out. R. V. MERTZLIN (J. Gen. Chem. Russ., 1939, 9, 1303— 1309).—A discussion of salting-out from the point of view of the theory of heterogeneous equilibria. Salting-out may not be confined to ions only.

J. J. B.

Hydrothermal reactions. II. Magnesium hydrosilicates. II. W. JANDER and R. FETT (Z. anorg. Chem., 1939, 242, 145-160; cf. A., 1938, I, 262).-The system MgO-SiO₂-H₂O has been studied at 300-600° and at high pressures. The thermal diagram shows that in this region the only compounds that occur are serpentine (I) and talc. Anthophyllite and meerschaum are not formed. At low pressures Mg₂SiO₄ is formed. The following equilibrium between $\begin{array}{ll} \mathrm{Mg_2SiO_4} & \mathrm{and} & \mathrm{(I)} & \mathrm{occurs:} & 2\{3\mathrm{MgO}, 2\mathrm{SiO_2}, 2\mathrm{H_2O}\} \Longrightarrow \\ 3\mathrm{Mg_2SiO_4} + \mathrm{SiO_2} + 4\mathrm{H_2O}. & \mathrm{The \ heat \ of \ the \ reaction} \end{array}$ is calc. to be 18 kg.-cal. per mol. H₂O. The formation of humites by the addition of HF or MgF₂ to the system has also been studied. X-Ray measurements suggest that these substances contain the basic salt O. J. W. Mg(OH)F.

Equilibrium phases in the system CaO, Cr_2O_3 -CaO, Al₂O₃. F. I. VASENIN (J. Appl. Chem. Russ., 1939, 12, 651—654).—The system forms many solid solutions. The m.p. diagram shows neither max. nor min. Solutions of CaO, Al₂O₃ in CaO, Cr_2O_3 are easily prepared if air is admitted, but solutions of CaO, Cr_2O_3 in CaO, Al₂O₃ are obtained with difficulty since chromites are oxidised to chromates in presence of large amounts of CaO and Al₂O₃. The colour of the solid solutions gradually changes from white to dark green; it is stable to moist CO₂. D. G.

Approximate thermodynamic calculations. P. DROSSBACH (Metall u. Erz, 1936, 33, 515–518; Chem. Zentr., 1937, i, 3119; cf. A., 1938, I, 458).—Tables are given for calculating the heat of reaction, heat content, and change of thermodynamic potential for equilibria in which the mol. heats are given by $C_p = C'_p + \alpha T - \beta/T^2$. An approx. graphical method for the determination of α and β is described.

A. J. E. W.

Hydrazine. Heat of formation of hydrazine and hydrazine hydrate. A. M. HUGHES, R. J. CORRUCCINI, and E. C. GILBERT (J. Amer. Chem. Soc., 1939, **61**, 2639—2642).—Details of an adiabatic calorimeter are given. Heats of combustion of N_2H_4, H_2O and N_2H_4 are respectively 146,936 and 148,635 \pm 30 g.-cal. per mol. These data are used to calculate the following vals. : heats of formation, N_2H_4 (g) 22,250; (l) 12,000; N_2H_4, H_2O (l) 10,300; dil. solution 8160; heat of hydration of N_2H_4 , -1700 g.-cal. per mol. W. R. A.

Determination of the standard free energies of formation of metallic sulphides by the method of electromotive forces of galvanic cells. A. F. KAPUSTINSKI and J. A. MAKOLKIN (Acta Physicochim. U.R.S.S., 1939, **10**, 245—258).—Using Pt-H₂ and sulphide electrodes, the free energies and heats of formation of sulphides have been determined, and as a result of comparison with other data the following vals. are respectively proposed : Ag₂S -9500, -7550; α -Cu₂S -19,220, -18,500; PbS -20,990, -22,490; SnS -19,680, -18,180 g.-cal. The calc. solubility product for SnS is $1\cdot15 \times 10^{-27}$. C. R. H.

Heat of combusion of cis- and trans-azobenzene. R. J. CORRUCCINI and E. C. GILBERT (J. Amer. Chem. Soc., 1939, 61, 2925—2927).—The isothermal heats of combustion of cis- and trans-NPh:NPh are $1555\cdot6\pm0.2$ and $1545\cdot7\pm0.3$ kg.-cal. per mol. respectively; the calc. vals. of the heats of formation are $-75\cdot65$ and $-85\cdot55$ kg.-cal. per mol. respectively; the calc. heat of transition cis \rightarrow trans is 9.9 kg.-cal. per mol. W. R. A.

Partial vapour pressure of aqueous ethylamine solutions. B. P. DAILEY and W. A. FELSING (J. Amer. Chem. Soc., 1939, 61, 2808—2809).—From measurements of the partial v.p. of aq. NH₂Et, NHEt₂, and NEt₃ (0.05—2.2M.) at 25°, the free energy decreases attending the change amine (liquid) \rightarrow amine (1M.) have been evaluated as 2905, 1583, and -103 g.-cal. per mol. respectively. W. R. A.

Heat of dissolution of sucrose.—See B., 1939, 1166.

Electrode potentials of metals subjected to mechanical deformation. I. L. V. NIKITIN (J. Gen. Chem. Russ., 1939, 9, 794—803).—The potential of Cu electrodes falls, and of Ag electrodes rises, during deformation. The effects are ascribed to rise in temp. R. T.

Platinum electrode. VII. VIII. Effect of poisoning on the capacity of the platinum electrode. A. SCHLIGIN and B. ERSCHLER (Acta Physicochim. U.R.S.S., 1939, 11, 45–58; cf. A., 1937, I, 200).—The poisoning of smooth and platinised Pt electrodes by As_2O_3 , KCN, and $HgCl_2$ has been studied. The activity of the poisons increases in the order $As_2O_3 < \text{KCN} < HgCl_2$. The agreement between the results for smooth and platinised electrodes indicates that their surface structures are similar. O. D. S.

Difference effect in passivity phenomena. V. ČUPR (Korros. u. Metallschutz, 1939, 15, 256—261). —The behaviour of systems consisting of a compound electrode (Zn in $ZnSO_4$ and Cu in $CuSO_4$) with a reference electrode has been studied, and results in agreement with theory have been obtained. These considerations are then applied to the so-called "difference effect," the views of Müller (A., 1936, 1474) being supported. F. J. G.

Silver and mercurous iodide electrodes. W. C. VOSBURGH, P. F. DERR, G. R. COOPER, and R. G. BATES (J. Amer. Chem. Soc., 1939, 61, 2592–2594). —The cell Ag|AgI, I'|I', Hg₂I₂|Hg has an e.m.f. of 0.1112 v. at 25° (temp. coeff. = 0.00030 v. per degree), which is not as const. or reproducible as was expected. Calculation from this val. gives ~0.1517 v.

at 25° for the normal potential of the AgI electrode. Although each of the electrode systems in the above cell is highly reproducible under favourable conditions, no single electrolyte has been found which does not affect unfavourably one or other of the electrodes. W. R. A.

Relation between glass electrode theories of Nikolsky and Dole. M. DOLE (Acta Physicochim. U.R.S.S., 1939, 10, 707—710).—The assumptions made by Nikolsky in the derivation of his theory of the glass electrode (A., 1938, I, 143) are identical with those made by Dole (A., 1935, 170), and the resulting mathematical expressions are shown to be equiv.

A. J. M. **Rôle of electrons in the functioning of cells. Daniell cell.** V. KARPEN (Compt. rend., 1939, 209, 509—511).—An expression for the e.m.f. of a Daniell cell is derived, using previous results (A., 1939, I, 567), and generalised to include cells of other types. A. J. E. W.

Saturated standard cells with small temperature coefficients. IV. Addition of various sulphates to the electrolyte of the Weston cell. W. C. VOSBURGH, P. F. DERR, G. R. COOPER, and B. PETTENGILL (J. Amer. Chem. Soc., 1939, 61, 2687-2689).-Modified Weston cells have been prepared in which the electrolyte is saturated with two sulphates, of which one is hydrated CdSO₄ or a double salt of $CdSO_4$, and the temp. coeffs. have been measured. The cell made with Cd-Bi amalgam and containing Li_2SO_4 as the second sulphate has a temp. coeff. < that of the Na₂SO₄ cell (cf. A., 1939, I, 267). These cells, however, are unsuitable as standards in comparison with the Na₂SO₄ cells because they are more variable and have an e.m.f. different from saturated and unsaturated Weston cells. Extended observations indicate that the e.m.f. of the Na₂SO₄ cell is more nearly const. at const. temp. than the unsaturated Weston cell for periods of <2 years. Cells containing a second sulphate other than Li_2SO_4 and $Na_{2}SO_{4}$ have been investigated. W. R. A.

Kinetics of redox potentials. I—III. A. L. ROTINJAN (J. Gen. Chem. Russ., 1939, 9, 1182—1187, 1188—1197, 1198—1206).—I. Stabilisation of the redox potentials of mixtures of H_3AsO_4 and H_3AsO_3 (in presence of KI) can be attained in acid, but not alkaline, solutions.

II. With a cathode-polarised Pt electrode, the time required for stabilisation of the potential of the system falls with rising [H^{*}] and [I'], and with increasing $[As^{V}]/[As^{III}]$; it is expressed by $\tau = a([H_3AsO_4]/[H_3AsO_3])^{-b}$, where a and b are consts. τ is least for platinised glass electrodes.

III. For oxidised Pt electrodes $\tau = a - b \log [H_3AsO_4]/[H_3AsO_3]$, irrespective of the oxidation method applied. The E_h is \propto [H[•]] of the layer of electrolyte at the surface of the electrode. R. T.

Electrical double layer at the interface of two liquids. E. J. W. VERWEY and K. F. NIESSEN (Phil. Mag., 1939, [vii], 28, 435—446).—The potential function at the surface of two liquid phases about which a small amount of electrolyte is distributed is considered. The total potential drop D due to one phase containing excess of positive and the other excess of negative ions consists of two parts given by $\alpha = (n_2 K_2/n_1 K_1)^{\frac{1}{2}}$, where $n = \text{ionic concn. and } K = \text{dielectric const., and } \Delta = \epsilon D/kT$. Various special cases are considered. T. H. G.

Electrochemical polarisation of metal electrodes. I. Mechanism of polarisation of the iron electrode. V. A. ROITER, V. A. JUSA, and E. S. POLUJAN (Acta Physicochim. U.R.S.S., 1939, 10, 389-414).--An expression for the oscillogram of the anodic and cathodic polarisation of metal electrodes is derived, based on the mechanisms of discharge and ionisation lag, and has been investigated for Fe electrodes prepared by various methods. The deviation of the experimental oscillogram from that calc. is explained by reference to the velocity of discharge and ionisation. The surface of the electrode is polarised to an extent depending on c.d. The reason for " overpolarisation" and for the usual non-agreement of the current strength-potential curve with the equation of the discharge theory is explained. The calculation from oscillogram data of the abs. velocities of the ionisation and discharge processes is indicated. The peculiarity of the electrochemical behaviour of Fe electrodes in having a small final velocity of the ionisation and discharge processes is shown to agree with calc. vals. for metals of the Zn type. W. R. A.

Electrochemical polarisation of metal electrodes. II. Polarisation of zinc electrode. V.A. ROITER, E. S. POLUJAN, and V. A. JUSA (Acta Physicochim. U.R.S.S., 1939, 10, 845-858; cf. preceding abstract) .- The cathodic and anodic polarisation of single crystals of Zn have been studied by an oscillographic method. The relation between polarisation overvoltage and current intensity is the same as that which holds for gas electrodes, apparent differences being due to changes in the electrode surface during polarisation. With single crystals of Zn two kinds of change may occur, viz., increase of the surface area and of the activity of the surface. The velocity of the ionisation and discharge processes at an electrode surface in equilibrium with the solution is calc. to be $\sim 10^{-10}$ g.-ion per sq. cm. per sec. The polarisation of Fe and Zn electrodes is compared. O. J. W.

Polarisation in deposition of tin from acid solutions of its simple salts. M. LOSOHKAREV, O. ESSIN, and V. SOTNIKOVA (J. Gen. Chem. Russ., 1939, 9, 1412—1422).—The polarisation potential π developing during electrodeposition of Sn (Sn anode, SnCl₂ or SnSO₄ electrolyte) is due initially to slowness of diffusion of Sn ^{*} from the anode to the solution (concn. polarisation). After attainment of limiting c.d. π is determined by the rate of discharge of Sn ions at the cathode, and its val. varies with the nature of the surface of the latter. Addition of cresolsulphonic acid to the electrolyte causes chemical polarisation. R. T.

Overvoltage on a mercury cathode in concentrated solutions of acids. I. Hydrochloric and hydrobromic acids. S. A. JOFA (Acta Physicochim. U.R.S.S., 1939, 10, 903—912).—Measurements have been made of the overvoltage, η , at a Hg cathode in 0·1—12·5N-HCl and in 0·2—8·5N-HBr. η decreases with increasing concn. of acid. At low concns. of acid η varies linearly with log c.d., but with increasing concn. departures from linearity are observed and the general slope of the curve changes. These anomalies are related to changes in the structure of the surface double layer due to adsorption of anions and also to the increase in the activity coeff. of the acid. O. J. W.

Overvoltage on mercury in the presence of surface-active electrolytes. S. JOFA, B. KABANOV, E. KUTSCHINSKI, and F. CHISTIAKOV (Acta Physicochim. U.R.S.S., 1939, 10, 317-332).—Two methods of measuring the overvoltage on a Hg cathode are described, (a) the method of the Hg drop, (b) the method of the large Hg cathode. Using acidified solutions of Na₂SO₄, KCl, KBr, KI, and (NBu₄)₂SO₄, the H overvoltage on Hg and the electro-capillary curves have been investigated. The H overvoltages are decreased by surface-active amions and increased by surface-active cations, in qual. agreement with the theory advanced by Frumkin (A., 1938, I, 201).

W. R. A.

Hydrogen overvoltage on nickel. P. LUKOV-ZEV, S. LEVINA, and A. FRUMKIN (Acta Physicochim. U.R.S.S., 1939, 11, 21–44; cf. A., 1938, I, 201).— The H overvoltage on Ni has been investigated in solutions of HCl from 0·15 to 0·0003N., and of NaOH from 8·8 to 0·001N., at c.d. from 1×10^{-8} to 5×10^{-4} amp. per sq. cm. and the effect of neutral salts studied. The anodic polarisation of Ni in a H₂ atm. has been investigated in the same NaOH solutions. The results for overvoltage agree with Tafel's equation. Results are interpreted on the theory of the slow discharge of ions at the electrode. O. D. S.

Chemical activation by gaseous ionisation. S. C. LIND (J. Chem. Physics, 1939, 7, 790—792).— The comparative uses of the gas ion clustering hypothesis and of a free atom or free radical mechanism in reactions taking place under ionising conditions are considered. W. R. A.

Experimental basis for the theory of quasiunimolecular reactions. R. N. PEASE (J. Chem. Physics, 1939, 7, 749—752).—A crit. review of reactions which have been represented as of the quasiunimol. type indicates that the isomerisation of cyclopropane to propylene (Chambers et al., A., 1934, 369) is the only example which satisfies the requisite conditions. This suggests the necessity of reviewing the apparent restriction placed on the rate of activation by collision. W. R. A.

Calculation of thermal explosion limits. D. A. FRANK-KAMENETZKI (Acta Physicochim. U.R.S.S., 1939, 10, 365—370).—A theory of thermal explosions has been developed mathematically by which the ignition conditions may be calc. from the kinetics and heat of reaction, the dimensions of the explosion chamber, and the thermal conductivity of the reacting mixture. For the decomp. of MeNO₃, N₂O, and CH_2N_2 and for the oxidation of H_2S experimental and calc. vals. agree, but for the decomp. of EtN₃ the calculations fail. W. R. A.

Polymerisation of gaseous butadiene. G. B. KISTIAKOWSKY and W. W. RANSOM (J. Chem. Physics, 1939, 7, 725—734).—The velocity coeff. k of the dimerisation of butadiene (I) from 446° to 660° κ .

 $\simeq 9.20 \times 10^9 \exp{(-23,690/RT)}$ c.c. mol.⁻¹ sec.⁻¹ and deviations encountered suggest an increase in activation energy with temp. The 3-vinylcyclohexene formed is converted into $\Delta^{3:3'}$ -octahydrodiphenyl by addition with further (I), $k = 1.3 \times 10^{14} \exp{(-38,000/RT)}$ c.c. mol.⁻¹ sec.⁻¹. The data are in best agreement with those calc. statistically for an activated complex with the resonating structure

 $(H_2C=CH=CH=CH_2)_2$. The rôle of resonating free radicals in other reactions of dienes is briefly discussed. W. R. A.

Kinetics of the vapour-phase reaction of cyclopropane with iodine. R. A. OGG, jun., and W. J. PRIEST (J. Chem. Physics, 1939, 7, 736-747).-The thermal (245–280°) and photochemical (180–230°) reactions between gaseous I and cyclopropane (I), studied by observation of the pressure changes in a system of const. vol., are essentially homogeneous and lead to the reversible formation of I.[CH2]3.I. The only important side reaction is a slow I-catalysed isomerisation of (I) to propylene. Empirical rate expressions are given, and vals. of velocity and equilibrium consts. are recorded. The formation of the free radical I·[CH₂]₃· from I and (I) is considered to be the rate-determining step with the velocity coeff. $7.36 \times 10^{12} \exp{(-17,280/RT)}$ (mol./c.c.)⁻¹sec.⁻¹ For the reaction $(I) + I_2 \rightarrow C_3 H_6 I_2$, $\Delta E = -17,200$ g.-cal. per mol. Taking the energy of the C-I bond as 43,000, that of the C-C bond in the (I) ring is 32,900 g.-cal. per mol. W. R. A.

Decomposition of ethyl bromide and the collision theory of first-order reactions. F. DANIELS and P. L. VELTMAN (J. Chem. Physics, 1939, 7, 756-764).—The first-order thermal decomp. at $\sim 400^{\circ}$ of EtBr to CH₄ and HBr has been studied with special reference to wall effects. Present and previous (A., 1938, I, 315) results agree with the production of Et and Br as the primary stage of decomp., followed by a series of reactions which do not involve long chains. Low-pressure effects are explained as wall effects. The decrease in the first-order rate coeff. of EtBr decomp. (and for N₂O₅ decomp.) at low pressures is not caused by the decreased no. of collisions as predicted by the collision hypothesis, but by surface effects or competing chemical reactions which become important at low pressures. A quant. re-examination of the collision hypothesis is suggested. W. R. A.

Decomposition of acetaldehyde and deuteroacetaldehyde. R. E. SMITH (Trans. Faraday Soc., 1939, 35, 1328—1336).—Comparison of the thermal decomp. (followed manometrically) of MeCHO with that of CD_3 ·CHO suggests that more than one mechanism is involved, and that the important process is probably activation of the C-H bond. The sp. effects of C_2H_4 , C_2H_6 , and CO_2 on the reaction rate for MeCHO are studied. F. L. U.

Inflammation of hydrocarbon-air mixtures.— See B., 1939, 1090.

Exchange of hydrogen ions between hydrogen sulphide and methyl alcohol. K. H. GEIB (Z. Elektrochem., 1939, 45, 648-650).—The exchange of H^{*} between H₂S and the OH in MeOH has been studied by rate measurements on MeOD-H₂S and MeOH-D₂S mixtures at -79° to -115° . The times of half-change at these temp. are 0.2—0.5 and 30— 100 min., respectively, the change being slower from the MeOD-H₂S side; HCl accelerates the exchange at -115° . At equilibrium the MeOH contains $\sim 66^{\circ}_{0}$ of the D (distribution coeff. 4—4.5). The activation energy is 7.5—8 kg.-cal. The mechanism involves transfer of H^{*} or D^{*} from complexes such as D₃S^{*} and MeOHD^{*} to neutral mols. A. J. E. W.

Cracking of decalin under pressure. M. D. TILITSCHEEV and V. K. SCHTSCHITIKOV (J. Gen. Chem. Russ., 1939, 9, 1086–1093).—The thermostability of decahydronaphthalene (I) is \ll that of $C_{10}H_8$, but > of *n*-decane. The activation energy of cracking of (I) at 425–500° is 65,500 g.-cal. per g.-mol. The velocity coeff. is given by $\log K = 15 \cdot 11 - 14,330/T$. R. T.

Reactions of organic oxygen compounds with ammonia. I. Relative rates of reaction between ketones and liquid ammonia. S. S. DRAGUNOV (J. Gen. Chem. Russ., 1939, 9, 693—697).—The relative rates of reaction between $COMe_2$, COMePr, COPhMe, 1-methylcyclohexan-3-one, 1-methylcyclohexan-4-one, PhCHO, and liquid NH₃ at 0° and atm. pressure have been determined. The rates of reaction are dependent primarily on the electrochemical character of the radicals, steric hindrance being a secondary factor. $CPh_3 OH$ and CPh_3 did not react with NH₃ in the absence of catalysts.

V. A. P Hydrolysis of benzoic and related esters in varying media. R. A. HARMAN (Trans. Faraday Soc., 1939, 35, 1336—1343).—Measurement of the effect of substituents on the consts. in the Arrhenius equation has been extended to phenylacetic and

cinnamic esters (cf. A., 1938, I, 405). The transmission of such effects to the carbonyl C atom is less marked in the former than in any hitherto examined; in the cinnamic it is approx. the same as in the benzoic esters. The effect on the consts. of changing the solvent has been studied for alkaline hydrolysis of EtOBz and m-NO₂·C₆H₄·CO₂Et in EtOH-H₂O and COMe₂-H₂O mixtures; the usual relation between the temp.-independent const. and the activation energy is found. F. L. U.

Oxidation of aldoses by hypoiodite. IV. K. MYRBÄCK (Svensk Kem. Tidskr., 1939, 51, 179-192; cf. A., 1939, II, 490)-Comparative data are given on the rates of oxidation of various sugars by I in presence of varying concns. of NaOH. In general, the rates relative to that for glucose (I) are independent of [OH']. The rates for lactose, maltose, melibiose, and cellobiose are equal, and > that for (I); that for d-galactose (II) is somewhat > that for (I), whilst those for d- and l-arabinose are equal, and >that for (II). The rates for d- and l-xylose are \simeq that for (I); that for d-ribose is < that for (I). The rate of oxidation of *d*-mannose is especially low, and this accounts for the difficulties sometimes occurring in its determination. F. J. G.

Effect of periodic acid on lactic acid and its degradation products (acetaldehyde, methyl alcohol, formaldehyde, formic acid) .- See A., 1939. II, 532.

Kinetic study of the formation of d-glucosephenylhydrazone. A. ORNING and G. H. STEMPEL, jun. (J. Org. Chem., 1939, 4, 410-417).-The reaction between equilibrium d-glucose (I) and a mixture of NHPh·NH₂ and its hydrochloride has been followed polarimetrically in aq. solution at 30°. If all oxidising agents, including dissolved O₂, are eliminated there is no evidence of osazone formation. The forward reaction is between NHPh·NH₃⁺ and an intermediate substance symmetrically related to the isomeric forms of (I). The reverse reaction is accelerated by H. W. acid.

Oxidation of simple sugars.-See A., 1939, II, 493.

Mutarotation of tetramethyl-a-d-glucopyranose and -mannopyranose.—See A., 1939, II, 494.

Exchange of chlorine substituted in aromatic compounds for amino-groups. V. Kinetics of reaction of o-chloronitrobenzene with aqueous ammonia. N. N. VOROSHCOV, jun., and V. A. KOBELEV (J. Gen. Chem. Russ., 1939, 9, 1043-1046). —The velocity of the reaction $o - C_6 H_4 Cl \cdot NO_2 + NH_3$ $\rightarrow o$ -NH₂·C₆H₄·NO₂ + HCl \propto concn. of substrates and \propto temp. (log $K = 7.20 - 4482/T \pm 0.01$). The activation energy is 20,500 g.-cal. In presence of CuCl, the catalytic and non-catalytic reactions proceed simultaneously. R. T.

Mechanism of oxidation of organic compounds by selenium dioxide. V. Kinetics of oxidation of aldehydes. N. N. MELNIKOV and M. S. ROKITZ-KAJA (J. Gen. Chem. Russ., 1939, 9, 1158-1161).-The rates of the (bimol.) oxidation by 5N-SeO, in AcOH of MeCHO, EtCHO, Pr^aCHO, Pr^βCHO, heptaldehyde, and Bu^βCHO have been examined at 20°. The rates fall with increasing mol. wt. and from the normal to the iso-compound, as would be expected if the rate of reaction is dependent on the degree of enolisation of the aldehyde. G. A. R. K.

Detonation of nitrogen iodide under the action of nuclear fragments from uranium bombarded by neutrons. Experiments on other explosives. P. FABRE, C. MAGNAN, and H. MURAOUR (Compt. rend., 1939, 209, 436-438; cf. A., 1939, I, 482).-The detonation of N iodide by neutron bombardment of adjacent U oxide has been confirmed by experiments with a high-intensity neutron generator; the time required for detonation corresponded with detonation "yields" $(0.09-0.2) \gg$ those of Feenberg (A., 1939, I, 426), probably owing to the use of driver specimens. No detonation was obtained under similar conditions with Pb(N₃)₂, diazo-m-nitroaniline perchlorate, (CH2)6N4 peroxide, trinitrotriazidobenzene, or Hg fulminate. Attempts to detonate Au fulminate by fission of Au also failed.

A. J. E. W.

Emission of ultra-violet radiation and pyrolysis of ferric azide. C. RACZ (Compt. rend., 1939, 209, 534-536; cf. A., 1939, I, 481).-Photogenic decomp. processes with activation energies (E) of \sim 47 and 33.5 kg.-cal. and an oxidation process (64 kg.-cal.) occur in $Fe(N_3)_3$ heated in the atm. at

 $>270^\circ$, $303+4^\circ$, or $334+6^\circ$, respectively. The first and third of these vals. occur with other azides; the second corresponds with decomp. of a relatively stable intermediate, as after preliminary heating at 310° decomp. occurs at $<305^{\circ}$ (E = 34 and 75 kg.-cal.). Detonation occurs at 200° in a closed space and at 230° in a current of N₂, in which max. emission occurs $\sim 20^{\circ}$ below the detonation temp. owing to the inhibiting effect of Fe. A. J. E. W.

Kinetics of crystal growth. S. ROGINSKI (Acta Physicochim. U.R.S.S., 1939, 10, 825-844).-Theoretical. The kinetic equations of free growth of a single crystal are derived. The conditions favouring different types of growth and the growth of a plane cryst. film are discussed and compared with existing experimental data. O. J. W.

Co-operative activation. W. E. GARNER (Nature, 1939, 144, 287) .- Reactions in organised condensed systems occurring with activation energies > those normally associated with the temp. range at which the reactions occur, e.g., the denaturation of proteins, the decomp. of CaCO₂,6H₂O, and the production of detonation nuclei in solid explosives, are discussed. The rapid rates of these abnormal processes are attributed to co-operative activation of a no. of points, n, on the surface within a short time interval, the activation energy required at each point being E/n, where E is the measured activation energy. L. S. T.

Garner principle of co-operative activation. F. G. DONNAN (Nature, 1939, 144, 446).-The Garner principle (preceding abstract) should be of val. in interpreting many catalytic phenomena, including reactions that occur in the operation of enzymes and co-enzymes. L. S. T.

Reaction kinetics in processes of nucleation and growth. W. A. JOHNSON and R. F. MEHL (Amer. Inst. Min. Met. Eng. Tech. Publ. No. 1089, 1939, 27 pp.; Met. Tech., 1939, 6, No. 5).-An analytical expression is derived for the rate of reaction of a reaction proceeding by nucleation and growth when nucleation (a) occurs without regard for matrix structure and the nuclei tend to grow into spherical nodules, and (b) when nucleation is restricted to the grain boundaries and the nuclei tend to grow to hemispherical nodules. R. B. C.

Influence of organic peroxides on the cool flame of butane. E. J. BLAT, M. J. GERBER, and M. B. NEUMANN (Acta Physicochim. U.R.S.S., 1939, 10, 273–296).—The decomp. of $(EtO)_2$ and MeO_2H is accelerated by increase in pressure up to a crit. pressure, p_k , which decreases with decrease in temp. At pressures $> p_k$ decomp. is explosive. Decomp. cannot be ascribed to a thermal process but proceeds by chain mechanism. (EtO)₂ and MeO₂H reduce the induction period of the cool flame in C5H12-O₂ mixtures. The data afford further proof of the theories of Neumann and his co-workers (cf. A., 1936, 1344, 1468, and subsequently) on the formation of cool hydrocarbon flames, combustion, which is brought about by peroxide decomp., proceeding in two stages. remainers and - (Don-set job .etc.t . . C. R. H.

Mechanism of the oxygen effect on hydrogen bromide reacting with ethenoid compounds.— See A., 1939, II, 530.

Decomposition of hydrogen peroxide by catalase. F. H. JOHNSON and K. L. VAN SCHOUWENBURG (Nature, 1939, 144, 634—635).—Experiments showing that this decomp. can occur under anaërobic conditions are described. L. S. T.

Reaction of a-thiocyanopropionic acid with water. A. FREDGA (Arkiv Kemi, Min., Geol., 1939, **13**, **A**, No. 5, 18 pp.).—The pseudo-unimol. reaction : SCN·CHMe·CO₂H (I) + $H_2O \rightarrow NH_2$ ·CO·S·CHMe·CO₂H has been studied polarimetrically at 25° in aq. solution containing <0.5N-strong acid. Under these conditions (I) is practically non-ionised, and the formation of SH-CHMe CO, H and 2:4-diketo-5-methylthiazolidine is negligible. In 0.53N-HCl the effect of KCl is given by : $k \times 10^4 = 7.03 - 0.92$ [KCl]. The salt effect of NaCl is smaller, in contradiction of the Brönsted theory. In 0.28N-KHal, k increases very rapidly with concn. of the corresponding HHal.: HI \gg HBr > HCl. Although log $(k - k_0) \propto$ [HCl], no simple relation can be found for HBr and HI. The effects are ascribed to catalysis by the undissociated acids. In 0.28N-KF addition of HF gives a min. val. of k at [HF] = 7–9. At low [HF] vals. of k lie above those for corresponding [HCl] etc., and tend towards a much larger k_0 . This is due to catalysis by HF₂' ions, KHF_2 being very active at low concess. For [HCl] = 0.53 and [KCl] = 0.28 the temp. coeff. is given by : $\log k = 11.446 - 4356/T$. The mechanism of the reaction is discussed. M. H. M. A.

Effect of nuclear and side-chain substitution on the oxonium ion catalysed iodination of acetophenone derivatives. L. ZUCKER and L. P. HAMMETT (J. Amer. Chem. Soc., 1939, 61, 2779-2784).-The rates of iodination of COPhMe, p- $C_6H_4Br \cdot COMe$, $p - C_6H_4Me \cdot COMe$, 2:4:6- $C_6H_2Me_3$ ·COMe (I), COPhEt, COPhPr^{α}, and COPhPr^{β} in 1.388M. aq. HClO₄, and COPhMe in 0.210M. aq. HClO₄, have been measured by a colorimetric method. The data agree with those reported for the bromination of some of these ketones in 75% AcOH-H₂O solutions 0.5M. to HCl (cf. A., 1935, 1209), the effect on the rate of iodination of substitution of a Me group for H in the side chain being \gg the effect of substitution in the ring. No steric hindrance was found in the iodination of (I). W. R. A.

Mechanism of the acid-catalysed enolisation of acetophenone derivatives. L. ZUCKER and L. P. HAMMETT (J. Amer. Chem. Soc., 1939, 61, 2785— 2791; cf. preceding and following abstracts).—The basic ionisation consts. of COPhEt, COPhPr^a, and COPhPr^{β} have been measured. The iodination of COPhMe shows a general acid catalysis. The ratedetermining step in the acid-catalysed enolisation of ketones is proton removal. W. R. A.

Kinetics of the iodination of acetophenone in sulphuric and perchloric acid solutions. L. ZUCKER and L. P. HAMMETT (J. Amer. Chem. Soc., 1939, 61, 2791–2798; cf. preceding abstract).—The rate of iodination of COPhMe in 2 to 30% aq. HClO₄ and in 0.5 to 66% aq. H₂SO₄ is determined by the

rate of enolisation in the more dil. solutions and by the rate of reaction of the enol with I in acid solutions containing >51% H₂SO₄. At intermediate concns. the two rates are approx. equal. The rate of enolisation, however, even in aq. HClO₄, is $\propto c_{\text{off},+}$ over a wide range. W. R. A.

Steric nature of the ortho effect in the hydrogen exchange reactions of aromatic tertiary amines. W. G. BROWN, A. H. WIDIGER, and N. J. LETANG (J. Amer. Chem. Soc., 1939, 61, 2597-2601).-The theory of the ortho effect states that the inhibition of the H₂-exchange reactions of NPhMe₂ and its derivatives is a steric effect concerned with the tendency of an o-substituent to block the formation of quinonoid structures. This has been tested experimentally by two independent methods: (i) by varying the size of the o-substituent, and (ii) by an argument that if the amino-N atom is linked with the o-C so as to form a 5-membered ring which would be necessarily coplanar with the Ph ring, there should be no ortho effect. The results are consistent with predictions. Thus the inhibition by an o-F of H lability is \ll by an o-Cl. Further, N-methylindoline and N-methyltetrahydroquinoline (dicyclic coplanar structures) exchange H readily, whilst N-methylhomotetrahydroquinoline, the heterocyclic ring of which must be highly puckered (7-membered), exhibits the inhibition of reactivity which is characteristic of o-substituted tert. amines. W. R. A.

Kinetics of the exchange of oxygen between benzoic acid and water. I. ROBERTS and H. C. UREY (J. Amer. Chem. Soc., 1939, 61, 2580—2584).— The rate of exchange of ¹⁸O between BzOH and H₂O has been studied at 80° in dil. aq. solution using HCl as catalyst. The reaction has been followed by decomp. samples of BzOH, crystallised out from the reaction mixture, into C_6H_6 and CO_2 and analysing the CO_2 in a mass spectrometer. The rate is of the first order with respect to the difference in [¹⁸O] of the reactants, first order with respect to H^{*} ion, independent of BzOH, and free from salt effects (KCl). The similarity between this reaction and the acid-catalysed esterification and ester hydrolysis reactions is indicated (cf. following abstract).

W. R. A. Mechanism of acid-catalysed ester hydrolysis, esterification and oxygen exchange of carboxylic acids. I. ROBERTS and H. C. UREY (J. Amer. Chem. Soc., 1939, 61, 2584-2587; cf. preceding abstract).-A combination of recent ¹⁸O investigations with recorded kinetic data for acid-catalysed ester hydrolysis, esterification and O exchange of carboxylic acids suggests that all three reactions have the same mechanism. Taking as a basis the fact that these reactions are acid-catalysed and of first order in H₂O or EtOH, the compositions of the reactive complexes the disappearances of which control the reaction rates have been determined. Only three of the proposed mechanisms yield the crit. complex required by the kinetics. The criterion of pre-equilibrium in H₂O and D₂O proposed by Bonhoeffer and Reitz (A., 1937, I, 469) is not applicable since the simple two-step mechanism assumed is incorrect for the present reactions. W. R. A.

Racemisation of optically active a-alkylsulphonylpropionic acids. A. MELLANDER (Arkiv Kemi, Min. Geol., 1939, 13, A, No. 3, 30 pp.).-k data are given for the racemisation of 0.05-0.2N- α methyl-, -ethyl-, -n-propyl-, and -isopropyl-sulphonylpropionic acids (I) in various aq. media at 25° ; E vals. are derived from supplementary measurements at 35°. In acids (HCl, HBr, HClO₄, concn. c) k is max. for $c = \sim 0.04$ N. and falls with increasing c, the variation being linear over certain ranges; an anion effect thus operates, the effect of the ions decreasing in the order ClO_4' , Br', Cl'. The effect of adding salts with a common anion corresponds with the increased anion concn., and H' has no unique effect on the racemisation. Data for aq. and partly neutralised solutions show that k decreases with c at [H] < ~ 0.04 N., and is min. at $p_{\rm H} \sim 6$. The data for strongly acid solutions indicate the predominance of base catalysis by H_2O , acting on (I) mols., and k is determined by the relation between the f vals. for (I) and the transition complex. At lower acidity changes in the dissociation of (I) introduce other mechanisms, involving base catalysis by the (I) anion itself acting on the undissociated mol., and a less important base effect of H₂O on the anion. Racemisation is rapid in alkaline solution and a marked positive salt effect, which is ∞ concn., occurs; $k \propto$ [OH'], indicating catalysis by OH', but base catalysis of the general type also occurs to a small extent.

A. J. E. W. Racemisation of optically active a-phenylsulphonylpropionic acid. L. RAMBERG and I. HED-LUND (Arkiv Kemi, Min. Geol., 1939, 13, A, No. 1, 36 pp.).-Measurements of the rate of racemisation are described, and k data for 0.1N-PhSO, CHMe CO, H (I) in various aq. media at 25° are recorded and discussed; E vals. are deduced from measurements at 35°. A strong anion effect is observed in acid solutions, k showing a linear decrease with increasing acid concn. over limited ranges (HCl 0.1-1.0, HBr 0.1-1.2, HClO₄ 0.05-0.5N.); in presence of salts with a common anion the k vals. are only slightly <those for acids of equiv. anion concn., the nature of the cation having little effect. The effectiveness of the anions studied decreases in the order ClO_4' , I', (Br', NO₃'), Cl'. The kinetic results do not differentiate between base catalysis of racemisation of undissociated (I) and acid catalysis acting on the anion, but the former mechanism is preferred owing to the potentially acidic character of (I); activity effects are considered in detail. A base catalytic effect of H₂O, acting on both the undissociated mol. and its anion, accounts for the k changes on addition of nonelectrolytes, change of the [(I)], and partial neutralisation of the (I). In neutral solution the effect of OH' predominates. Vals. of the rate consts. for the four processes are compared. A. J. E. W.

Acid catalysis in liquid ammonia. III. Catalysis of the reaction of ammonolysis of santonin by acid amides, phenols, and other weak acids. G. S. MARKOVA and A. I. SCHATTENSTEIN. IV. Kinetics of the ammonolysis of pilocarpine in liquid ammonia in the presence of ammonium salts. A. I. SCHATTENSTEIN and G. S. MARKOVA (Acta Physicochim. U.R.S.S., 1939, **11**, 117—130, 131—151; cf. A., 1937, I, 251).—III. The catalytic activity of $\rm NH_4$ salts of weak mineral and carboxylic acids, phenols, carboxyl-amides and -imides, derivatives of aquo- and ammono-carbonic acids, nitro-aniline, MeNO₂, and carbazole have been investigated and correlated with the acidic character of solutions of these compounds in liquid $\rm NH_3$.

IV. The reaction of pilocarpine with liquid NH_3 is accompanied by a lowering of sp. rotation. The rate of reaction has been studied polarimetrically at 0°, 10°, 20°, and 30° in the presence of a no. of NH_4 salts. The reaction is pseudo-unimol. The influence of 2N-NaBr, -NaNO₃, -NaI, and -NaClO₄ on the reaction in presence of NH_4 Cl and NH_4 Br has been studied. The catalytic activity of the NH_4 salts depends on the nature of the anions present. The anion activities are in the order $Cl' > Br' > NO_3' > l' > ClO_4'$. O. D. S.

Kinetics of the reaction between ammonia and nitric oxide on the surface of a platinum catalyst. E. A. MICHAILOVA (Acta Physicochim. U.R.S.S., 1939, 10, 653-676).-The kinetics of the reaction $2NH_3 + 3NO = 2.5N_2 + 3H_2O$ were investigated at $500-530^{\circ}$ K. and at ~ 2 cm. pressure. With equiv. quantities of the gases, or with excess of NO, the reaction proceeds according to the stoicheiometric equation, but complications occur with excess of NH₃. The reaction velocity is independent of the pressures of each individual gas, but depends on the ratio of the pressures. The velocity reaches a max. at a certain proportion of both gases, and with equiv. amounts of the gases remains const. for the first 40-50 min. The reaction mechanism is discussed and the equation $dp_{N_z}/dt = (p_{NH_z}p_{NO})/(\alpha p_{NH_z} + \beta p_{NO})^2$ is deduced for the rate of reaction. From data obtained over the above temp. range, the apparent energy of activation is 24.8 kg.-cal. The time for quarter change when the reaction occurs under industrial conditions (1000°, 10% NH₃, pressure ~7 cm.) was calc. to be 10⁻⁹ sec. In practice, however, the reaction is hindered by the powerful adsorption of O_2 on the Pt. A. J. M.

Hydrogenation of iron nitrides. B. N. JERO-FEEV (Acta Physicochim. U.R.S.S., 1939, 10, 313— 315).—The conclusions reached by Morozov and Kagan (cf. A., 1939, I, 33) as a result of their experiments on the poisoning of Fe catalysts in the synthesis of NH₃ are adversely criticised. C. R. H.

[Hydrogenation of iron nitrides.] M. KAGAN (Acta Physicochim. U.R.S.S., 1939, 10, 935—936).— A reply and criticism (cf. preceding abstract). O. J. W.

Kinetics of cyclisation of disobutyl at platinised charcoal catalyst. B. A. KAZANSKI and A. L. LIBERMAN (J. Gen. Chem. Russ., 1939, 9, 1431—1434). —The apparent activation energy of the reaction $Bu_2^{\beta} \rightarrow 1$: 4-dimethylcyclohexane (I) (Pt-C catalyst, at 300°) is practically identical with that of the further reaction (I) $\rightarrow p$ -xylene. The velocity of evolution of H₂ during the initial 30—40 min. of both reactions is > during the succeeding periods.

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Relationship between energy of activation and activity of catalysts. A. D. CHVATOV (J. Gen. Chem. Russ., 1939, 9, 819–824).—The activity of a 1:1 Ni-Al₂O₃ catalyst for the reaction MeCHO \rightarrow CH₄ + CO was halved by passing small amounts of CO at 100°, but the activation energy was unaffected. It is concluded that the active centres occupy only a very small part of the catalyst surface. R. T.

Oxidation of stearic acid by oxygen. L. H. BRIGGS and B. W. THOMAS (New Zealand J. Sci. Tech., 1939, 21, 47—52B).—The rate of absorption of O_2 by stearic acid at 100° is increased by Co stearate, V_2O_5 , and Ni, Pb, Cu, and Mn stearates in that order of descending activity. All the oxidised acids give a positive Fellenberg test, but none a positive Kreis test. The peroxide val. of the oxidised acids decreases with increasing O_2 absorption. Theoretical implications of the results are discussed. C. S. W.

Catalysed polymerisation of butadiene at a liquid-gas interface. G. GEE, C. B. DAVIES, and H. W. MELVILLE (Trans. Faraday Soc., 1939, 35, 1298—1312).—The polymerisation has been studied at the surface of aq. H_2O_2 by following the change in surface tension (γ) , the relation between γ and the surface concn. of polymeride having been previously determined. The rate of polymerisation $\propto [H_2O_2]$ and the partial pressure of butadiene. Analysis of the data shows that the life of the active polymeride is shorter than the reaction time. The complex so formed starts a polymerisation chain which is broken by some deactivating collision different from that which initiates the propagation. F. L. U.

Vapour-phase catalytic oxidation of organic compounds. Production of tolualdehyde and phthalic anhydride from xylene.—See B., 1939, 1098.

Fischer-Tropsch [catalytic] synthesis of hydrocarbons.—See B., 1939, 1097.

Catalytic hydration of olefines.—See B., 1939, 1097.

Catalysts for coal hydrogenation.—See B., 1939, 1088.

Conversion of carbon monoxide by water vapour on iron catalysts.—See B., 1939, 1089.

Cathodic production of hydrogen peroxide.— See B., 1939, 1140.

Electrodeposition of lead from solutions of lead sulphamate.—See B., 1939, 1132.

Electrodeposition of metals from solutions containing sulphamic acid and its salts.—See B., 1939, 1132.

Formation of formaldehyde by electrolysis of acetate.—See A., 1939, II, 533.

Electrolysis of mixtures of pivalates with nitrates.—See A., 1939, II, 532.

Mechanism of the recombination of the hydroxyl radical in the electric discharge through water vapour. V. KONDRATEEV (Acta Physicochim. U.R.S.S., 1939, 10, 791-804).—In the electrical discharge through H₂O vapour OH radicals disappear to about an equal extent by the two processes:

Volume and surface processes during the oxidation of nitrogen in a glow discharge. I. B. A. KONOVALOVA and N. I. KOBOSEV (Acta Physicochim. U.R.S.S., 1939, **10**, 631—652; cf. A., 1939, I, 480).— The process is a combination of a vol. and a wall process, the latter being poisoned by polar mols. The investigation of the effect of polar mols, thus provides a method of separating the two processes. At low pressures 60% of the NO is produced by the wall process. Toxic mols. do not affect the spectrum of N₂. Activating mols., such as CO and CO₂, affect the spectrum and therefore influence the vol. process. The dissociation of NO in the discharge is not poisoned by H₂O, and hence is not a wall reaction. The results differ from those of Westhaven *et al.* (A., 1930, 553), the differences being explained. A. J. M.

Volume and surface processes during the oxidation of nitrogen in a glow discharge. II. B.A. KONOVALOVA and N. I. KOBOSEV (Acta Physicochim. U.R.S.S., 1939, 10, 813-824; cf. A., 1939, I, 480).-The wall catalytic process occurring during the oxidation of N₂ in a glow discharge is probably a reaction of N_2^+ ions with adsorbed O_2^- ions, and at very low pressures the electrical oxidation of N₂ is wholly due to this reaction. H₂O vapour poisons the wall process. but also has a positive catalytic effect on the vol. reaction in the gas space, especially in the O₂ region. Addition of CO and CO2 to the gas produces an activating effect on the vol. reaction which is clearly reflected in the emission spectrum of the dis-O. J. W. charge.

Oxidation of a graphite electrode in very dilute water vapour in the glow discharge. V. SIHVONEN and R. NÄSÄNEN (Suomen Kem., 1939, 12, B, 25-26).—The primary product is CO, part of which is further oxidised to CO. F. J. G.

Inversion of sucrose in an ultra-high-frequency field. S. P. VOSKRESENSKI and E. N. MALASCHENKO (J. Gen. Chem. Russ., 1939, 9, 1118—1120).—Hydrolysis of sucrose, in presence or absence of HCl, is unaffected by maintaining the solutions in a highfrequency field ($\lambda = 3$ —12 m.). R. T.

Carbon monoxide-oxygen flame. VI. Photochemical oxidation of CO near the region of self-inflammation. H. KONDRATEEVA and V. KON-DRATEEV (Acta Physicochim. U.R.S.S., 1939, 10, 805-812; cf. A., 1939, I, 569).—Using a streaming method a mixture of CO + $3O_2$ at 90 mm. was exposed to the light of an Al spark at $224-490^\circ$. Up to 400° the rate of photo-oxidation of CO is practically independent of temp., but increases rapidly as the temp. approaches that of self-inflammation, viz., between 442° and 490° . The rates of the photochemical and of the dark reactions are compared and the no. of initial centres for the latter is calc.

O. J. W.

Decomposition of hydrogen peroxide by potassium ferrocyanide. I. B. B. LAL (J. Indian Chem. Soc., 1939, 16, 321–332).—Aq. K_4 Fe(CN)₆ (I)

is photodecomposed by bright sunlight, producing K aquopentacyanoferrite up to a max. concn. in the photochemical equilibrium $(I) + H_2 O \Longrightarrow KCN +$ $K_3Fe(CN)_5, H_2O(II)$. (II) is very effective in decomp. H_2O_2 . Thus when a mixture of (I) + H_2O_2 is illuminated by bright sunlight, (II) is removed immediately it is formed, and more (II) is produced by the photochemical reaction until all the H2O2 is used up. The after-effect observed in the decomp. of H_2O_2 by (I) after exposure is thus due to the reversible formation of (II), which decomposes H₂O₂ in the dark with a uniformly high velocity in presence of excess of (I), and not to the formation of colloidal $Fe(OH)_3$ or Fe^{•••} ion. The presence of (I) greatly increases the decomp. activity of (II) owing to the oxidation of ferrite to ferrate by H_2O_2 , and to the reduction of ferrate to ferrite by H_2O_2 , and to the tradition of reflate to ferrite by the excess of (I). The greater is the time of exposure of the mixture (I) + H_2O_2 , the greater is the val. of the velocity coeff., whereas aq. (I), illuminated prior to its mixing with H₂O₂ in the dark, decomposes H_2O_2 with a velocity coeff. independent of the time of exposure. A mechanism of the decomp. of H₂O₂ by aq. (I), based on these observations, has been outlined. W. R. A.

Optical sensitisation of silver halides. VII. Spectral sensitivity and absorption spectrum of sensitised layers of silver bromide. S. NATANSON (Acta Physicochim. U.R.S.S., 1939, 11, 67-74; cf. B., 1937, 1137).—The absorption curves of erythrosin, phloxine, rhodamine B, and iodoeosin adsorbed on transparent sublimed layers of AgBr have been measured and shown to correspond exactly with the sensitivity curves for the same systems. O. D. S.

Cadmium-photosensitised reactions of ethane. E. W. R. STEACIE and R. POTVIN (J. Chem. Physics, 1939, 7, 782—789; cf. A., 1938, I, 632).—The Cdphotosensitised decomp. of C_2H_6 and the Cd-photosensitised reactions of C_2H_6 —H₂ mixtures have been investigated. The data indicate that the primary stage involves the rupture of a C-H bond (as for the Hg-photosensitised reactions), probably by Cd $({}^{3}P_{1})$ + $C_{2}H_6 = CdH + Et$. The products are H₂, CH₄, $C_{3}H_8$, C_4H_{10} , and higher hydrocarbons. The CH₄ probably results from the Me radicals formed by H + $Et \rightarrow 2Me$, and the higher hydrocarbons from recombination of radicals. The Cd-photosensitised decomp. of $C_{3}H_8$ and $C_{4}H_{10}$ is considered.

W. R. A. Photochemical decomposition of benzene vapour. I. G. I. KRASSINA. II. N. A. PRILE-SHAEVA (Acta Physicochim. U.R.S.S., 1939, 10, 189—192, 193—198).—I. The photodissociation of C_6H_6 vapour according to $C_6H_6 + h_V \rightarrow Ph + H$ has been established by detecting at. H. Of $\lambda\lambda$ 1850— 2300 A. the range 1850—2000 A. is the most effective.

II. The increase in H₂ pressure with time due to the recombination of at. H has been investigated. For the ranges 1850—2000 A. and 2000—2150 A. the no. of C₆H₆ mols. dissociating per sec. is 1.55×10^{13} and 0.29×10^{13} respectively. Assuming that $\lambda\lambda$ 1990—2150 A. cause predissociation whilst $\lambda\lambda < 1990$ A. produce direct decomp., the probability of direct decomp. is five times that of the predissociation process.

128 31 0001 C. R. H.

Effect of temperature on the predissociation of photoactivated acetaldehyde molecules. G.K. ROLLEFSON and D. C. GRAHAME (J. Chem. Physics, 1939, 7, 775-779).-By measuring the quantum yields of the photochemical reaction it is found that at room temp. the no. of free radicals produced in MeCHO by the absorption of 2652 A. is > the no. produced by 3132 A. Increase in temp. causes a relative increase in radical yield at 3132 A. until at 100° the yields are equal. At still higher temp. the yield with 3132 A. is > with 2652 A. This temp. effect is explained by assuming that at 3132 A. the dissociation is aided by thermally-excited vibrational energy, and this is supported by the observation that rise of temp. causes the fluorescence to fade in a way analogous to the increase in dissociation. Evidence for thermally-induced predissociation with 2652 A. is lacking, and the lower efficiency of production of free radicals with this λ is attributed to a difference in the electronic states attained by MeCHO excited by the two $\lambda\lambda$.

W. R. A.

Photochemical production of reducing sugars from glycosides by ultra-violet light. L. J. HEIDT (J. Amer. Chem. Soc., 1939, 61, 2981—2982).— Ultra-violet light is absorbed by fructosides and glucosides with liberation of reducing sugars. A special arrangement of apparatus for this purpose has been devised, and some preliminary details of the photochemical production are given. W. R. A.

Explanation of mitogenetic radiation as "sensitised fluorescence." A. GURVITSCH and L. GUR-VITSCH (Acta Physicochim. U.R.S.S., 1939, 10, 719— 724).—Frankenburger's theory, that energy made available in org., and particularly fermentation, reactions taking place by intermediate formation of atoms and radicals, can be used to excite mols. of other substances present giving rise to mitogenetic radiation, has been confirmed experimentally. When glycine, previously irradiated, was mixed with glucose undergoing fermentation, the characteristic glucose bands at 1900—1905 and 1915—1920 A. were excited. No fermentation product could act as the receptor in this case. Na' and Cl' can act as receptors. The bearing of these results on mitogenetic spectral analysis is discussed. A. J. M.

Polymerisation processes induced by mitogenetic radiation. A. GURVITSOH and L. GUR-VITSCH (Acta Physicochim. U.R.S.S., 1939, 10, 711-718).-When a freshly prepared 10% peptone (I) solution is irradiated with mitogenetic radiation a substance is produced which reacts with gastric juice, whilst the original (I) does not. If the peptone solution is shaken with kaolin, the latter separated, and the solution is then irradiated, the same effect is obtained, but if the shaking with kaolin is carried out after the irradiation, there is no effect. The absorption of irradiated (I) in the range 2800-2450 A. is considerably > that of the original substance. These phenomena point to the formation of a polymeride under the influence of the radiation. The concn. of the polymeride, within certain limits, ∞ that of the original peptone solution. The polymerisation of a dipeptide (glycylglycine) by mitogenetic radiation was also investigated. After irradiation the product had

no effect on gastric juice, but a positive effect was obtained after the addition of a small amount of serum-albumin. A. J. M.

Mitogenetic radiation during the formation of sparingly soluble precipitates. A. I. RABI-NERSON and M. A. VLADIMIRSKAIA (Acta Physicochim. U.R.S.S., 1939, 10, 859—866; cf. A., 1939, I, 118).—During the pptn. of many sparingly sol. salts $[e.g., BaSO_4, BaCrO_4, CaCrO_4, Cu_2Fe(CN)_6,$ $Zn_2Fe(CN)_6]$ ultra-violet mitogenetic radiation is emitted. The spectral distribution of the radiation is characteristic of the particular salt and probably of the anion. The mechanism of the process is discussed. O. J. W.

Hydrolysis of starch films by polarised infrared radiation. E. S. SEMMENS (Nature, 1939, 144, 379—380; cf. A., 1935, 132).—Photographs showing the hydrolysis of starch grains by exposure to polarised radiation from a heated Pt gauze are reproduced. L. S. T.

Rupture of macro-molecules by ultrasonic waves. G. SCHMID and O. ROMMEL (Z. Elektrochem., 1939, 45, 659—661).—Exposure of PhMe solutions of polystyrenes (mol. wt. 195,000—850,000) to a powerful source of ultrasonic waves causes a decrease of the mean mol. wt. (determined viscosimetrically) towards a const. limiting val. (~30,000), illustrating the breakage of chemical linkings by the waves. The decrease of mol. wt. is rapid in the first 30 min., but becomes slower on further exposure. Similar effects are observed with other solvents, and in solutions of guncotton and polyacrylic esters. A. J. E. W.

When is a substance oxidised, reduced, electro-oxidised, or electro-reduced? H. G. Bos (Chem. Weekblad, 1939, 36, 671-675).—The various ideas covered by the terms oxidation and reduction are discussed and it is shown how in many cases contradictory results may be obtained according to the definition accepted. S. C.

Chemistry of the "inert" gases. II. Hydrates of argon and neon. III. Chemical methods of separation of "inert" gases from their mixtures. B. A. NIKITIN (J. Gen. Chem. Russ., 1939, 9, 1167—1175, 1176—1181).—II. Mixed crystals of $SO_2,6H_2O$ (I) and $A,6H_2O$ are obtained by leaving A in contact with (I) and ice, at -10.5° , for several days. The partition coeff. for A in these conditions is 78×10^{-4} , as compared with 0.57×10^{-4} for Ne. Under analogous conditions He was not found in the crystals.

III. Mixtures of inert gases are separated by a method depending on fractional co-deposition with (I), in the above conditions. R. T.

Copper azide and its complexes. A. CIRULIS (Naturwiss., 1939, 27, 583).—The prolonged action (2 months) of 2% HN₃ on fine Cu powder gave pure anhyd. Cu azide as small, blackish-violet, rhombic crystals. The substance explodes when struck or rubbed; explosion point 202°. From CuO or Cu(OH)₂ in contact with 2% HN₃, CuN₆ was obtained in the form of smaller, moss-green crystals. This salt, when dry, is much more explosive than the first. Two basic Cu azides were prepared which were less explosive. 87 complex Cu azides with NH_3 , amines, and various org. bases have been prepared. The coordination no. is usually 4 or 3, more rarely 6 and 2 Most of the complexes are explosive. A. J. M.

Copper periodates. R. K. BAHL and S. SINGH (J. Indian Chem. Soc., 1939, 16, 269—272).—Dropwise addition of aq. paraperiodic acid, $HIO_{4,2}H_2O$, to an aq. suspension of $CuCO_3$ (*a*), and boiling a suspension of disodium paraperiodate, $Na_2H_3IO_6$, with excess of aq. $CuSO_4$ (*b*), both yielded cryst. yellow-green cupric paraperiodate, Cu_2HIO_6 or $Cu_4I_2O_{11}, H_2O$, which does not lose wt. when heated at 120° in an air oven or at 110° in vac. Method (*a*) does not yield $Cu_5(IO_6)_{2,5}H_2O$. Dropwise addition of $HIO_4, 2H_2O$ to dil. aq. $Cu(OAc)_2$ gave deep green Cu^{II} paraperiodate heptahydrate, $Cu_5(IO_6)_2, 7H_2O$ (I) but not Cu^{II} metaperiodate, $Cu(IO_4)_2$. (I) does not lose wt. in an air oven at <70° but at 74° is slowly dehydrated to $Cu_5(IO_6)_2, 5H_2O$ (II). Between 74° and 120° there is no further loss in wt. The v.p. of (I) and (II) at 74° are 5 and 3 mm. respectively. W. R. A.

Reaction of some xanthic acids with metallic salts.—See A., 1939, II, 532.

Co-ordination compounds with 8-aminoquinoline as a chelate group.—See A., 1939, II, 521.

Action of gaseous ammonia on anhydrous or hydrated magnesium chloride. L. J. OLMER and (MLLE.) M. L. QUINET (Compt. rend., 1939, 209, 513—516).—MeOH, EtOH, or Pr^{*}OH solutions of anhyd. MgCl₂ yield cryst. [Mg(NH₃)₆]Cl₂ (I) on treatment with NH₃; (I) is slowly converted into [Mg(H₂O)₆]Cl₂ (II) by H₂O vapour, and forms MgCl₂,4NH₃ or MgCl₂,2NH₃ in a vac. at 15° or 111°, respectively. Pure anhyd. MgCl₂ is conveniently prepared by heating (I) at 800° in absence of air. At 15—111° NH₃ converts (II) into NH₄Cl and Mg(OH)₂; alcoholic solutions afford the same products at 70°, but at -20° to 20° [Mg(NH₃)₅(H₂O)]Cl₂ or [Mg(NH₃)₃(H₂O)₃]Cl₂ is formed, according as the concn. of (II) is < or >6%. A. J. E. W.

Thermal behaviour of compounds important in analytical practice. I. Calcium oxalate monohydrate. J. KRUSTINSONS (Z. anal. Chem., 1939, 117, 330—332; cf. A., 1938, I, 370; 1939, I, 90).—Data showing the effect of temp. and time of heating on the loss of H_2O from CaC_2O_4, H_2O (I) over the range $120-150^\circ$ are recorded. After heating for 4 hr. at 130°, the loss in wt. on 0.5463 g. of (I) is 0.24 mg. or 0.04%. A temp. of 130° can be safely used for drying (I), and fluctuations in temp. to 150° of short duration can be disregarded. The temp. of 200° for complete expulsion of H_2O is confirmed. The decomp. of CaC_2O_4 begins at 430°. L. S. T.

Calcium silicides. V. LOUIS and H. H. FRANCK (Z. anorg. Chem., 1939, 242, 117—127).—By the action of Ca on Si (2Ca : 1Si) at ~1050° in a stream of CO_2 , rapid cooling, and treatment of the product with an EtOH solution of NH₄Cl, Ca₂Si₂ (98%) was obtained. X-Ray measurements show that Ca₂Si₂ can be prepared in two forms, which by appropriate heat-treatment are mutually interconvertible. Ca₂Si₂ is not converted into CaSi, by heating. By the action of Ca on Si (4Ca: 1Si) the compound Ca_oSi, which has a cubic structure, a 4.7 A., was obtained. O. J. W.

Calcium silicides and nitrogen. H. H. FRANCK and V. Louis (Z. anorg. Chem., 1939, 242, 128-137; cf. preceding abstract).—CaSi₂ reacts with N_2 at high temp. to form Ca(SiN)₂, the stability of which is governed by the temp.-dependent equilibrium $Ca(SiN)_2 \rightleftharpoons CaSiN_2 + Si$. Ca_2Si_2 reacts with N_2 at $\sim 1200^{\circ}$ according to : $Ca_2Si_2 + 2N_2 = 2CaSiN_2$. Pure CaSiN, can be prepared in this way.

O. J. W.

Basic phosphates of bivalent metals. IV. Strontium hydroxyapatite. R. KLEMENT (Z. anorg. Chem., 1939, 242, 215-221; cf. A., 1938, I, 320).—Sr hydroxyapatite, $Sr_{10}(PO_4)_6(OH)_2$ (I), can be prepared in an impure state by hydrolysis of $SrHPO_4$ with 0.1N-NaOH or with a phosphate buffer solution $(p_{\rm H}$ 11.0), and by pptn. of Sr salts with alkaline phosphate solutions. It is obtained pure by heating $Sr_3(PO_4)_2$ with $SrCO_3$ in a stream of H_2O vapour at 1150°. X-Ray measurements show that (I) crystallises in the hexagonal form, a 9.74, c 7.20 A., and is isomorphous with the corresponding Ca, Ba, and Pb compounds. O. J. W.

Corrosion of zinc.—See B., 1939, 1128.

Formula and analysis of the cadmium cyanide complex. N. HALL (Metal Ind., N.Y., 1939, 37, 404-406).-The equilibrium ratio CdO: NaCN is 1:3.8, indicating that the factor 1.74 is sufficiently accurate for calculating the combined NaCN from the Cd content. Owing to the presence of NH₂ from the decomp. of NaCN, the determination of free CN' by titration with AgNO₃ in presence of KI gives high results. A method for determining total cyanide by titration with AgNO₃ after the addition of aq. NH₃ is described. L. S. T.

Chemistry of boron hydrides. I. Structure of boron hydrides. II. Reactions of diborane and derivatives. A. J. E. WELCH (Chem. and Ind., 1939, 869-872, 937-940).-A review.

Indium. C. REID (Chem. and Ind., 1939, 837-A. J. E. W. 838).—A review.

Iodine and fluorine derivatives of monosilane. A. G. MADDOCK, C. REID, and H. J. EMELÉUS (Nature, 1939, 144, 328).—In presence of All₃ at 80°, SiH₄ and HI yield SiI₄, SiHI₃, SiH_3I , b.p. 45.8°, m.p. -56.5° , and SiH_2I_2 , a heavy liquid (v.p. 2–3 mm. at 0°). With Hg, SiH₃I gives SiH₄, and Si₂H₆, H₂, and HgI; both burn readily in air, forming SiO, and I. SiH₂I vapour absorbs light of $\lambda < \sim 2800$ A., and is rapidly decomposed by light in presence of O_2 with liberation of I. In presence of anhyd. Et₂O, SiH₃I reacts with Mg, some of which is dissolved. The residue is blackened, and a white, Et₂O-sol. compound separates in small amounts, whilst H. and SiH, are evolved. At room temp. in presence of $SbCl_5$, SiH_2Cl_2 and SbF_3 yield SiF_4 and SiH_2F_2 , b.p. -77.5° , m.p. -119.1° , an inflammable gas which has no action on Hg or glass. SiH₃Cl reacts with SbF₃ in a similar manner. L. S. T.

Compounds of titanium sulphate. I, II. B.E. BOGUSLAVSKAJA (J. Gen. Chem. Russ., 1939, 9, 1077-1083, 1084-1085).-I. Dissolution of TiO. in excess of 60—90% H_2SO_4 at 100—225° is followed by deposition of crystals of $TiOSO_4, 0$ —2 H_2O .

II. $K_2 TiF_6$ is heated with $H_2 SO_4$ to evolution of SO_3 , and the cooled residue is diluted, when Ti(SO₄)₂,4H₂O ppts. R. T.

New class of ammines. Complex thiostannates. G. SPACU and A. POP (Bul. Soc. Stiinte Cluj, 1939, 9, 307-317).-By the action of excess of Na2S solution on SnCl4 and pptn. with EtOH the compound Na₄SnS₄,10H₂O (I) is obtained. The greywhite crystals are stable in absence of acid vapours. Aq. solutions are stable in presence of excess of Na₂S, and the equilibrium $[SnS_4]''' \Longrightarrow [SnS_3]'' + S''$ is set up. By the action of ammines on solutions of (I) the following compounds have been prepared :

[Decomposition of] hydrazine. C. H. BAMFORD (Trans. Faraday Soc., 1939, 35, 1239-1246).-N2H4 vapour explodes when sparked, giving NH₃, N₂, and H₂, the H₂ probably arising from thermal decomp. of some NH3. The explosion has been studied with and without addition of NO and pressure limits have been determined. Study of the heterogeneous decomp. of N₂H₄ vapour at a uniformly heated quartz surface in presence of NO (cf. A., 1939, I, 326) indicates that the primary reaction is probably dissociation into 2NH.,. F. L. U.

Fluorination of phosphorus trichloride. H. S. BOOTH and A. R. BOZARTH (J. Amer. Chem. Soc., 1939, 61, 2927-2934).-Details of the fluorination of PCl₃ to PFCl₂, of PFCl₂ to PF₂Cl, and of PF₂Cl to PF_3 by SbF_3 in presence of $SbCl_5$ as catalyst are discussed. PCl_3 can also be fluorinated stepwise in the vapour phase by solid heated CaF_2 . The reaction between PCl_3 and PF_3 at high temp. has been in-vestigated; $PFCl_2$ and PF_2Cl are formed but in an impure state owing to side reactions occurring with the glass tube and resulting formation of P, POF₃, and SiF₄, the last two being extremely difficult to remove from PF,Cl by fractionation. Monofluorodichlorophosphine, PFCl₂, is a colourless gas, condensible to a colourless liquid and a white solid (twig-like crystals); it hydrolyses in moist air, does not fume, and is absorbed by aq. NaOH; m.p. $-144.0^{\circ}\pm0.2^{\circ}$ b.p. $13.85 \pm 0.05^{\circ}$; v.p. log p (mm.) = 7.439 - 1308/T. Difluoromonochlorophosphine, PF2Cl, is a colourless gas, condensible to a clear liquid and a white solid; does not fume; hydrolyses in moist air $< PFCl_2$; is stable at -78° (as a liquid); is absorbed by aq. NaOH; m.p. $-164\cdot8\pm0\cdot2^{\circ}$; b.p. $-47\cdot3\pm0\cdot05^{\circ}$; v.p. log p (mm.) = 7.043 - 939.7/T. PF₃ has m.p. $-151.5\pm0.2^{\circ}$, b.p. $-101.15\pm0.05^{\circ}$, v.p., log p (mm.) = 7.310 - 761.4/T. PF₃ hydrolyses very slowly in air, is odourless and toxic, causing, even in small concn., sharp chest pains. The crit. temp. and pressures of the fluorides are given. The reactions between the fluorides and Cl₂ have been studied. PF2 and Cl2 react rapidly under the influence of the

C arc to give PF_3Cl_2 (b.p. ~0.10°). PFCl₂ and PF_2Cl on chlorination yield unstable liquids, probably $PFCl_4$ and PF_2Cl_3 . PFCl₄ decomposes in ~30 hr. at 25° to give a white solid ($?PCl_5$) and a colourless gas ($?PF_5$). PF_2Cl_3 decomposes much more slowly.

W. R. A. **Fluorination of phosphoryl trichloride.** H. S. BOOTH and F. B. DUTTON (J. Amer. Chem. Soc., 1939, 61, 2937—2940).—Fluorination of POCl₃ by SbF₃ and by CaF₂ yields POF₃ (b.p. $-39\cdot8\pm0\cdot1^{\circ}$), phosphoryl difluoromonochloride, POF₂Cl (b.p. $3\cdot1\pm0\cdot1^{\circ}$; m.p. $-96\cdot4^{\circ}$), and phosphoryl monofluorodichloride, POFCl₂ (b.p. $52\cdot9\pm0\cdot1^{\circ}$; m.p. $-80\cdot1^{\circ}$). V.p. and crit. consts. of the products are given. The properties of the new compounds are intermediate between those of POCl₃ and POF₃; the compounds hydrolyse readily in air. W. R. A.

Fluorination of phosphorus tribromide. H. S. BOOTH and S. G. FRARY (J. Amer. Chem. Soc., 1939, **61**, 2934—2937).—Controlled fluorination of PBr₃ has been carried out by SbF₃ at 70° and 170° (Br as catalyst) and in the vapour state by heated CaF₂. The products are PF₃, monofluorodibromophosphine, PFBr₂, m.p. -115°, b.p. $78\cdot4\pm0\cdot1°$, v.p. log p (mm.) = $7\cdot866 - 1646\cdot2/T$, and difluoromonobromophosphine, PF₂Br, m.p. -133\cdot8°, b.p. $-16\cdot1\pm0\cdot1°$, v.p. log p(mm.) = $7\cdot620 - 1217\cdot9/T$. Both give clear liquids and white cryst. solids, fume in air, have a pungent odour, react with Br to yield PFBr₄ and PF₂Br₃, and decompose to PF₃ and PBr₃. Both react with Hg to give Hg halides and P. W. R. A.

Polymerisation and depolymerisation of phosphonitrile chlorides. O. SCHMITZ-DUMONT (Z. Elektrochem., 1939, 45, 651).—(PNCl₂)₃ undergoes a homogeneous exothermic polymerisation reaction in a sealed tube (vol. 100 c.c. per g.) at 600°, with formation of (PNCl₂)₄ and liquid and cryst. higher polymerides, but no PNCl₂-rubber (I). Similar products are obtained from (PNCl₂)₄ or (I) under these conditions, showing that a true equilibrium exists between the various polymerides. The proportion of higher polymerides in the equilibrium mixture increases with the concn., and above a crit. val. (I) appears in the products. Depolymerisation of (I) is effected by heating at $>380^\circ$ in a vac. A. J. E. W.

Mechanism of hydrolysis of inorganic esters. J. B. M. HERBERT and E. BLUMENTHAL (Nature, 1939, 144, 248).—Hydrolysis at 80—90° of Me₃PO₄ (I) with NaOH prepared from Na and H₂O enriched in ¹⁸O, and ρ determinations of the H₂O formed after combustion of the MeOH produced by the hydrolysis, show that rupture occurs at the P–O linking of (I). ρ measurements of the residual H₂O show that, apart from the hydrolytic replacement of O, there is only a slight exchange of O between the H₂O and (I). L. S. T.

Reactions of oxygen atoms. P. W. SCHENK and H. JABLONOWSKI (Z. Elektrochem., 1939, 45, 650).—The following reactions occur at liquid air temp. in O₂ containing O atoms: $H_2S + O + O_2 =$ H_2SO_3 (subsequently oxidised to H_2SO_4 ; no S separates if $H_2S: 0$ is >1); $2NO_2 + O = N_2O_3$. Cl₂ gives Cl oxides, including Cl₂O and ClO₂; Br gives BrO₂, but no higher oxide. A. J. E. W.

Non-interchange of elementary radiosulphur with carbon disulphide. R. A. COOLEY, D. M. YOST, and E. MCMILLAN (J. Amer. Chem. Soc., 1939, 61, 2970-2971).-Since CS₂ is used extensively as a solvent for Ra-S in chemical and biological investigations it has been necessary to establish that no interchange occurs. Ra-S was prepared by ²D bombard-ment of a metal sulphide (I), followed by dissolving (I) in HCl and passing the H₂S into N-KI saturated with I. The KI solution was warmed and I volatilised while Ra-S coagulated to globules, principally of amorphous (µ-)S, insol. in CS. These globules could be converted into sol. S by heating in an autoclave. The exchange experiments were carried out by heating at 100° 3 mg. of Ra-S in 300 mg. of CS₂ in one leg of a sealed U-tube for from 42 to 68 hr., after which half of the CS₂ was distilled into the other leg of the U-tube. The contents of both legs were subjected to a Carius combustion and the H2SO4 formed was converted into dry Li₂SO₄, the activity of which was determined. The amount of interchange is $\langle 2\%, i.e., \langle$ the experimental error of activity determination. W. R. A.

Preparation of alkali uranates, niobates, and vanadates in the dry way. H. GUITER (Compt. rend., 1939, 209, 561—562).—The following coloured salts are prepared by heating the alkali carbonate with U_3O_8 , Nb_2O_5 , or V_2O_5 : M_2UO_4 (M = Na, K, Li, Rb, Cs; insol. in H_2O), $5M_2O,Nb_2O_5$ (Li, Na, K), $4M_2O,Nb_2O_5$ (Rb, Cs), $3M_2O,V_2O_5$ (Li, Na), $2M_2O,V_2O_5$ (K, Rb, Cs). The sulphates and V_2O_5 yield the following : $4Li_2O,5V_2O_5$, $2M_2O,3V_2O_5$ (Na, K), $M_2O,2V_2O_5$ (Rb, Cs). A. J. E. W.

Preparation of sources of Po-Be neutrons. C. HAENNY and M. HAÏSSINSKY (J. Chim. phys., 1939, 36, 218—220).—A method involving reduction of a Po solution in a Be tube is described. The source of neutrons thus obtained has double the intensity of one made by deposition on Ag. F. L. U.

Action of hydrogen sulphide on paraperiodic acid. R. K. BAHL and S. SINGH (J. Indian Chem. Soc., 1939, **16**, 339—342).—When saturated aq. H_2S solution is added to 1% aq. paraperiodic acid (H_5IO_6) free I and colloidal S are immediately formed. The colour becomes progressively deeper but after a time fades. This is due to the reduction of H_5IO_6 occurring in two stages: (a) $6H_5IO_6 + 15H_2S = 3I_2 +$ $2H_2SO_4 + 13S + 28H_2O$; (b) $3I_2 + 3H_2S = 6HI +$ 3S. Reaction (b) does not commence until (a) is completed. W. R. A.

Action of strong solutions of alkalis on potassium ferricyanide. E. BARNES (J. Indian Chem. Soc., 1939, 16, 308–309).—With sufficiently conc. KOH free O_2 is obtained from $K_3Fe(CN)_6$ thus: $4K_3Fe(CN)_6 + 4KOH = 4K_4Fe(CN)_6 + 2H_2O + O_2$. The vol. of O_2 is < the theoretical amount and some N_2 is present, suggesting that some (CN) groups have been oxidised. However, since no $Fe(OH)_3$ is formed it would seem that no $[Fe(CN)_6]^{\prime\prime\prime}$ radicals are completely broken up. W. R. A.

New complex ammines belonging to the group of iron and cobalt dinitrosothiosulphates. G. SPACU and C. G. MACAROVICI (Bul. Soc. Stiințe Cluj, 1939, 9, 197—206).—By addition of various ammines to an aq. solution of $Na[(NO_2)_2FeS_2O_3],2H_2O$ at 0° the following *compounds* have been prepared: *trans*-[Co en_2Cl_2]A (yellowish-green), [Cu en_3]A_2,2H_2O (bronze), [Co(NH_3)_6]A_3,4H_2O (brown),

[Co en₃] $A_{3,4}$ H₂O (brown), and [Cr en₃] $A_{3,4}$ H₂O (yellowish-brown), where $A = [(NO_2)_2$ FeS₂O₃]⁷. The anion A is fairly stable in solution at 0°. By mixing aq. solutions of K₃[Co(NO₂)₂(S₂O₃)₂] and of various ammines and pptg. with EtOH the following compounds were obtained : cis-[Co en₂Cl₂]₃B,2H₂O (violetbrown), [Co en₃]B,H₂O (brown), [Co(NH₃)₆]B,3H₂O (bronze), [Cr en₃]B,3H₂O (bronze),

Co-ordination power of phenylethylenediamines. I. Para- and dia-magnetic tetram-minonickel salts. I. LIFSCHITZ, J. G. Bos, and K. M. DIJKEMA (Z. anorg. Chem., 1939, 242, 97-116). -By the action of $(CH_2 \cdot NHPh)_2$ ("stien") and of NH2 (CH2)2 NHPh (" phenen ") on salts of bivalent metals (Cu, Co, Ni, Pt, Zn, Hg) brightly coloured complex salts of the types [M stien₂]X₂ and [M phenen₂]X₂ are obtained (X = one equiv. of an anion). The prep. of 31 such compounds is described. The Ni compounds occur in blue and vellow forms which are without exception paramagnetic and diamagnetic, respectively. The magnetic and other evidence shows that the blue and yellow compounds are isomerides, in which Ni has a co-ordination no. 4. In the yellow compounds the complex contains two non-polar Ni-N linkages. O. J. W.

Complex nickel salts with quadri- and sexavalent central atom.—See A., 1939, II, 471.

Recent developments of spectrographic analysis. E. VAN SOMEREN (Metallurgist, 1939-40, 12, 29-31, 44-46).—A review. C. E. H.

Hydroxy- and amino-azonitro-compounds. II. α -Naphtholazo-*p*-nitrobenzene as an indicator for hydrogen ions in non-aqueous solutions. L. KULBERG (J. Gen. Chem. Russ., 1939, 9, 684—692; cf. A., 1939, II, 257).—The micro-titration of acids and alkalis in aq. solutions of MeOH, EtOH, and COMe₂ may be carried out by using α -naphtholazo-*p*nitrobenzene as an indicator under standard conditions. The neutral salt error is very small. The theory of the method is discussed. V. A. P.

Polarographic method in organic chemistry. I. Electroreduction of peroxides. A. A. DOBRIN-SKAJA and M. B. NEUMANN (Acta Physicochim. U.R.S.S., 1939, 10, 297—306).—The polarographic method has been applied to the determination of H_2O_2 , MeO_2H , and $(EtO)_2$. The method is capable of detecting 2.5×10^{-7} g. of H_2O_2 , 10^{-7} — 10^{-8} g. of MeO_2H , and 10^{-7} g. of $(EtO)_2$ per ml. and is particularly applicable to the determination of peroxides in composite condensates obtained during the cool-flame oxidation of hydrocarbons. C. R. H.

Bromoiodometric investigations. XI. Is the Hahn fluorescein reaction specific for bromine? J. H. VAN DER MEULEN (Chem. Weekblad, 1939, 36, 702—705).—The formation of a red coloration when fluorescein solution is treated with chloramine-T is not sp. for Br; it is also produced even more rapidly in daylight by I. Br can be detected in presence of I by buffering the solutions with either H₃BO₃ (31 g,) and N-NaOH (8 c.c. per l.) or 0.1N-NaH₂PO₄, in which only I is liberated. S. C.

Determination of iodine in Fucus vesiculosus. —See B., 1939, 1175.

Determination of sulphate in waters by the volumetric chromate method. J. COURTOIS and P. BONJEAN (Ann. Chim. Analyt., 1939, [iii], 21, 229-235).—The method given in "Einheitsverfahren der physikalischen und chemischen Wasseruntersuchung" (Berlin, 1936) leads to low results, mainly owing to adsorption of CrO_4 " on the pptd. BaSO₄ and BaCrO₄. A crit. investigation of each stage of the method shows that (i) the error due to adsorption is much reduced by pptn. at 100°, (ii) the use of higher [KI] and dil. H₂SO₄ gives a more accurate iodometric determination of CrO_4 " in the filtrate, and (iii) other stages of the process are less crit. H₃PO₄ and HClO₄ cannot be used instead of HCl or H₂SO₄ to liberate I from the CrO_4 " and I'. With 37-150 mg. of SO₄", the modified method detailed reduces the error in the determination from 11 to $3\cdot5^{\circ}_{0}$. L. S. T.

Argentometric titration of selenious acid. R. RIPAN-TILICI (Z. anal. Chem., 1939, **117**, 326–330). —The solution containing SeO₃" (~0.01M.) is neutralised with NaOH to $p_{\rm H}$ 9.6 (thymolphthalein) and titrated with 0.05-0.1N-AgNO3 in presence of 2-3 drops of 0.2% alcoholic fluorescein (I). The Ag₂SeO₃ first pptd. weakly adsorbs (I) and is coloured yellowishred, but at the equivalence point the colour changes to bright red owing to marked adsorption of (I) by (Ag₂SeO₃)Ag^{*}. 0.5 c.c. of 0.2% diphenylcarbazone can replace (I). The ppt. is then first coloured violet, and near the equivalence point the colour changes to blue. This colour fades on shaking. More indicator (0.3 c.c.) is added, and at the equivalence point the ppt. is coloured blue suddenly and the solution is colourless. Both methods give results in agreement with those obtained potentiometrically (A., 1939, I, 486). L. S. T.

Beer's law and Lambert's law in the photometric examination of coloured solutions. C. TOFFOLI (R. Ist. San. Pubbl., 1939, 2, 575–586).— Deviations from the Beer–Lambert law occurring in the examination of dil. aq. NH₃, treated with Nessler's reagent, by the step-photometer are discussed. F. O. H.

Determining residual ammonia in presence of chloroamine [in water].—See B., 1939, 1185.

Determination of nitrogen in leather.—See B., 1939, 1155.

Colorimetric micro-determination of nitrates. M. PESEZ (J. Pharm. Chim., 1939, [viii], 30, 112— 117).—The reaction described previously (A., 1939, I, 384) is used for the determination of NO₃'. The colour intensity \propto concn. for 0·1—1 mg. of NO₃'. Cl', but not NO₂', interferes with the reaction, and must be removed by addition of the equiv. amount of Ag₂SO₄. Details of procedure for the determination of NO_3' in pure solutions and in potable waters are given, L. S. T.

Indirect volumetric determination of arsenates. G. SPACU and M. VANCEA (Bul. Soc. Stiinte Cluj, 1939, 9, 318—320).—The $AsO_4^{\prime\prime\prime}$ is pptd. with AgNO₃ solution in presence of NH_4NO_3 and NH_4OAc , and after filtration the excess of Ag is determined by Volhard's method. The method is rapid and accurate. O. J. W.

Detection and determination of arsenical war gases in drinking water.—See B., 1939, 1184.

Determination and occurrence of boron in natural phosphates, superphosphates, and defluorinated phosphate rocks.—See B., 1939, 1113.

Determination of small amounts of boron [in soils and plants].—See B., 1939, 1159.

Volumetric determination of alkali sulphate. A. KRÜGER (Z. anal. Chem., 1939, 117, 333).—Aq. Na₂SO₄ containing BaCO₃ in suspension is completely transformed into Na₂CO₃ by the passage of CO₂. The filtrate from the BaCO₃ and BaSO₄ is titrated with N-HCl (Me-orange). L. S. T.

Electrometric determination of the tarnish products on silver and copper alloys.—See B., 1939, 1132.

Determination of magnesium and manganese in fertilisers.—See B., 1939, 1160.

Derivatives of 8-hydroxyquinoline in analytical chemistry. J. MOLLAND (Tids. Kjemi, 1939, 19, 119—122).—Salts of 7-nitro-8-hydroxyquinoline-5sulphonic acid have been studied. The insol. Pb salt is suitable for gravimetric determinations. The characteristic microcryst. Na, K, Mg, Ca, Sr, Ba, Zn, Cd, Hg, Al, Tl, Co, Ni, Cu, and brucine salts may be used for microscopic identification. M. H. M. A.

Drop analysis. O. S. FEDOROVA (Trans. Ivanovo Chem. Tech. Inst., 1939, 40–42).—The drop reaction for Pb using a mixture of $KSnI_3$ and $Cd(NO_3)_2$ is improved by substituting $H_2C_2O_4$ for $Cd(NO_3)_2$. A modification of the Mo-blue test for detecting Sb in presence of Sn is described. R. C.

Iodometric determination of copper in nitric acid solution. W. ORLIK (Z. anal. Chem., 1939, 117, 332—333).—Attention is directed to the author's prior communication (A., 1930, 444), which has been overlooked by Hagen (A., 1939, I, 430). L. S. T.

Separation of copper from cadmium. E. CRESPOLANI (Boll. Chim. farm., 1939, 78, 459).—The use of warm dil. H_2SO_4 , which dissolves CdS but not CuS, is advocated for the separation of Cu from Cd in qual. and toxicological analysis. O. J. W.

2:2'-Diquinolyl; a reagent for copper. J. G. BRECKENRIDGE, R. W. J. LEWIS, and L. A. QUICK (Canad. J. Res., 1939, 17, B, 258-265).--2:2'-Diquinolyl (I), prepared by catalytic dehydrogenation of quinoline, gives a purple colour with Cu' which is sp. and has sensitivity 1 in 10⁸. The intensity of the colour produced follows Beer's law and a calibration curve obtained using a photo-electric colorimeter is given. Ni and Fe interfere in determinations of Cu' by the reagent and are first removed with dimethylglyoxime and aq. $\rm NH_3$ respectively. To the Cu sample containing 4×10^{-5} g. per ml., 5 ml. of 10% NaHSO₃ solution, 1 ml. of solution of (I) in glacial AcOH (0.5 g. per 1.), and sufficient glacial AcOH to produce 50 ml. are added, the intensity of colour being measured in a photo-electric colorimeter. Stable complexes of (I) with CuCl₂ and CoCl₂ are described. F. H.

Determination of small amounts of copper in [agricultural] spray residues.—See B., 1939, 1163.

Analysis of German-silver alloys.—See B., 1939, 1128.

Reactions of rare earths and allied elements with polyhydric phenols and alkaloids. VII. Colorimetric determination of cerium with brucine, and the reaction between persulphate and brucine. F. M. SCHEMJAKIN and V. A. VOL-KOVA (J. Gen. Chem. Russ., 1939, 9, 698—700).— Optimum conditions for the colorimetric determination of Ce with brucine (A., 1938, I, 535) have been determined. A new colour reaction between $(NH_4)_2S_2O_8$ and brucine, which may be used for the detection of either reactant, is described. V. A. P.

Separation of iron, aluminium, and chromium from cobalt, nickel, and manganese by means of pyridine. C. G: MACAROVICI (Bul. Soc. Ştiințe Cluj, 1939, 9, 207—214).—The separation of Al and Cr from mixtures with Co, Ni, and Mn by Ostroumov's method (cf. A., 1936, 1222) is unsatisfactory.

Ö. J. W.

α-Nitro-β-naphthol as precipitant for cobalt and palladium. C. MAYR and W. PRODINGER (Z. anal. Chem., 1939, 117, 334; cf. A., 1934, 1324).— $1:2-NO_2 \cdot C_{10}H_6 \cdot OH$ (I) prepared by the method of Stenhouse and Groves (Annalen, 1877, 189, 151) contains considerable amounts of nitrosonaphthol. Pure (I), obtained by the method of Liebermann and Jacobson (A., 1882, 521), gives no ppt. with Co or Pd. L. S. T.

Colorimetric determination of chromium as trioxalatochromic acid.—See B., 1939, 1154.

Determination of tungsten. N. N. KOROBOV (Trans. Ivanovo Chem. Tech. Inst., 1939, 33—36).— The WO₄" solution, containing 5 drops of a 0·1% solution of diamine-fast-scarlet 6BS, is titrated at the b.p. with 0·1N-Pb(NO₃)₂. At the end-point the dye is withdrawn from the solution by the ppt. NH_4NO_3 , HCl, AcOH, and HNO₃ interfere. R. C.

Oxidation-reduction indicators. II. Fuchsin and new-fuchsin as indicators in titration of tin and antimony with bromate. Z. G. REICHINSTEIN (Trans. Ivanovo Chem. Tech. Inst., 1939, 36—40).— SnCl₂ and SbCl₃ can be titrated at room temp. with NaBrO₃ using the above as (reversible) indicators. At the end-point the yellow or violet solution becomes orange. Too small a [HCI] causes error. R. C.

Volumetric determination of titanium in its ores and in ferrotitanium.—See B., 1939, 1113.

Spectrophotometry of reflecting materials. R. DONALDSON (J. Sci. Instr., 1939, 16, 114—117).— The specimen is illuminated normally and all light diffused from it between the angles 35° and 55° is focussed onto a photo-cell by means of two spherical concave mirrors. The conditions of the Commission Internationale de l'Eclairage (C.I.E.) are thus adhered to. The sensitivity of the instrument does not fall below 0.3 of its val. when measuring transparent materials. F. J. L.

Vacuum grating spectrograph mounting. W. R. S. GARTON (J. Sci. Instr., 1939, 16, 117—121).— The grating is mounted on the Eagle plan inside a chamber which can be evacuated. A lock between the chamber and the main tube minimises the time necessary for pumping and adjustments, which can all be made from without the evacuated chamber. The apparatus is sensitive in the extreme ultra-violet.

F. J. L.

Permanent nephelometer from Pyrex glass.— See A., 1939, III, 1113.

Method of designating colours. D. B. JUDD and K. L. KELLY (J. Res. Nat. Bur. Stand., 1939, 23, 355—385).—A system of describing the colours of powders is developed. Suggestions are made for its extension to opaque non-metallic surfaces generally and to transparent and translucent materials.

J. W. S.

[Analytical] applications of the Rayleigh interferometer.—See B., 1939, 1080.

Application of the filter method in objective heterochromatic photometry. H. KÖNIG (Helv. Phys. Acta, 1939, 12, 313—329).—The photometric comparison of monochromatic with incandescent electric light in the middle region of the visible spectrum by means of filtered and unfiltered Se cells, and by means of the thermopile with combination filters, has been studied. By the former method, the accuracy attainable is 2%, as compared with 1% by the latter. L. J. J.

Effect of tube-length on the visibility of dust particles with an oil-immersion objective. (A) D. G. BEADLE and H. S. PATTERSON. (B) F. E. J. OCKENDEN (Nature, 1939, 144, 327, 516).—(A) In certain circumstances a considerable fraction of the finest dust particles examined are not visible until the tube-length is reduced by ~ 2 —3 cm.

(B) The effect is well known. The change in tubelength given above has no scientific significance.

L. S. T.

Focussing device for micrography. R. L. DOWDELL and C. H. GREEN (Met. Progr., 1939, 36, 40-41).—A ground glass hangs freely in the plane of focus and carries a magnifier for focussing sharp images. R. B. C.

Cells without transference for $p_{\rm H}$ determination. O. REDLICH and H. KLINGER (J. Amer. Chem. Soc., 1939, 61, 2983).—To eliminate the source of experimental and theoretical inconvenience in routine $p_{\rm H}$ determination using cells with liquid junctions, cells of the type $\rm H_2$, $\rm H^+X' + TlBr$ (sat.), AgBr, Ag have been examined (cf. Hamer, A., 1937, I, 581). The solubility of TlBr is high enough to secure a definite potential uninfluenced by common impurities, and is yet so low that the activity of the H' ion is not appreciably altered, and the liquid junction potential between a solution containing no TlBr and a solution saturated with TlBr may be safely neglected. This liquid junction can further be avoided by saturating with TlBr that part of the solution in contact with the H_2 electrode. This type of cell is applicable only to solutions which do not form any ppt. when saturated with TlBr, and do not contain Tl' or Br' ions in an amount comparable with the solubility of this salt. The use of similar electrodes as reference electrodes under these conditions is indicated. W. R. A.

The diode as a frequency-changer for measurements at ultra-high frequencies. G. F. GAINS-BOROUGH (Nature, 1939, 144, 548-549). L. S. T.

The new ultramicroscope. ANON. (Sprechsaal, 1939, 72, 389—391).—The electron microscope is described. G. H. C.

Electron ultramicroscope for research institutes. B. VON BORRIES and E. RUSKA (Naturwiss., 1939, 27, 577—582).—The construction of an electron ultramicroscope and the technique of using it are described. Some uses of the instrument are briefly indicated. A. J. M.

Production of very fine quartz fibres. A. H. S. HOLBOURN (J. Sci. Instr., 1939, 16, 331–334).— An elastic-catapult method of producing long lengths of quartz fibre between 0.1 and 5 μ . in diameter is described. The fibre is produced with both ends attached to given points and stretched tightly between them. D. F. R.

Simple valve for use in laboratory apparatus. G. P. GIBSON (J.S.C.I., 1939, 58, 317-319).-A laboratory valve which is superior to a tap for controlling the rate of flow of hot fluids is described. It has been adapted for use in (i) an all-glass steamvacuum still, (ii) a partial-reflux still-head, and (iii) the reservoir of a reaction vessel. The valve in (i) controls the amount of steam drawn by vac. through the liquid being distilled, in (ii) divides the stream of boiling liquid falling from a total condenser into two portions, one of which passes to the receiver and the other returns to the column as reflux, and in (iii) controls the rate of flow of a hot liquid from a reservoir to a reaction vessel. Rotation of the plug of the valve when in use in an apparatus under reduced pressure may be effected through a metal gland.

Methods and apparatus for micro-gas analysis. H. HARTRIDGE (J. Sci. Instr., 1939, 16, 317—324).— A review of existing methods. Improvements for obtaining greater accuracy are suggested. The diver and mica-plate methods, recently devised for estimating the O_2 -CO₂ exchange in living tissue, could be extended to gas analysis. An accuracy of ~0.01% on a vol. of only 20 cu. mm. should be obtained. D. F. R.

Saturation of gases by laboratory wet test meters. F. A. SMITH and J. H. EISEMAN (J. Res. Nat. Bur. Stand., 1939, 23, 345—353).—Tests on a laboratory wet test meter registering 0.1 cu. ft. per revolution indicate that the saturation of dry air is >98% complete at all practicable rates of flow. The error in vol. indicated owing to incomplete saturation is <0.2%, whilst the error due to failure to level the meter is <0.1% if the quantity of H₂O present is the same as at calibration. J. W. S.

Determination of solubilities of gases in liquids with use of the Van Slyke-Neill manometric apparatus for both saturation and analysis. D. D. VAN SLYKE (J. Biol. Chem., 1939, 130, 545-554).-The technique is described (cf. A., 1924, ii, 872; 1927, 800). Solubilities in aq. solutions and in oils can be determined at room temp. and saturation as well as analysis are carried out in the chamber of the apparatus. Saturation is obtained by first shaking the liquid in the chamber with the gas at slightly above atm. pressure and then at exactly atm. pressure. The unabsorbed gas is ejected and then the amount of gas in the liquid is determined. Results const. to 1 part in several hundred can be obtained. J. N. A.

High-speed oil-vapour condensation pumps. M. MATRICON (J. Phys. Radium, 1939, [vii], 10, 385—388).—A method for measuring the pumping speeds of oil-diffusion pumps is described. The effect of the nature of the gas is discussed.

H. J. E.

Separation of gases by diffusion. C. G. MAIER (J. Chem. Physics, 1939, 7, 854).—If the constituents of a binary mixture of gases (e.g., H_2 and N_2 or CO) are allowed to diffuse into a third condensible vapour (e.g., steam) the relative rates of diffusion generally approximate closely to the Graham's law ratio. The construction and performance of an apparatus are described. W. R. A.

Construction and operation of a thermal diffusion column for the separation of isotopes. T. I. TAYLOR and G. GLOCKLER (J. Chem. Physics, 1939, 7, 851–853).—The change in the abundance ratio of ${}^{13}\text{CH}_4$ by thermal diffusion has been studied in a column, the construction and operation of which are described. W. R. A.

Enrichment of mercury isotope by a separation tube method. W. GROTH and P. HARTECK (Naturwiss., 1939, 27, 584).—Apparatus for making use of the Clusius method to separate partly the isotopes of Hg is described. About 0.25 g, of "light" Hg was separated per hr., and the difference in *d* between it and ordinary Hg was detected by using it in a barometer tube. The method can be applied to vapours of other metals, e.g., Cd. A. J. M.

Thermal method for the separation of gases and isotopes. A. BRAMLEY and A. K. BREWER (Science, 1939, 90, 165—166).—In the concentrictube method of separation (cf. A., 1939, I, 483), efficiency of design has been investigated for the separation of 1 : 1 mixtures of CH_4 and NH_3 , and He and Br, and of the Cl isotopes in HCl. Optimum conditions depend on the nature of the gas, and separation depends primarily on the difference in mass of the two components divided by their sum. Conditions involving wall symmetry and corrugations enhance swirl definition and thereby increase separation. L. S. T.

Crystallo-chemical analysis. The Barker index at Oxford. M. W. PORTER and R. C. SPILLER (Nature, 1939, 144, 298—299).—The Barker method of identifying crystals from measurements of their angles is outlined, and examples of its use are described. L. S. T.

Apparatus for detecting carbon monoxide in air.—See B., 1939, 1182.

Separation and fractionation [of proteins, enzymes, etc.] by froth flotation.—See A., 1939, III, 1020.

Splitting of mica (muscovite) for optical purposes. F. E. WRIGHT (Amer. J. Sci., 1939, 237, 736—741).—A method for obtaining strips of mica suitable for use in optical instruments and of any phase angle, or thickness $>1.5 \mu$., is described. An arrangement of the petrographic microscope for measuring the phase angle of a mica plate or foil by the Friedel method is given. L. S. T.

Method of producing a long single-crystal wire of aluminium with any desired crystallographic axis. T. FUJIWARA (J. Sci. Hirosima Univ., 1939, 9, 227—231).—By the method described a long single-crystal wire of Al can be obtained with any desired crystallographic axis oriented in the direction of the wire axis by submitting it to annealing only. W. R. A.

Georg Lunge, 1839–1923. E. BERL (J. Chem. Educ., 1939, 16, 453–460). L. S. T.

Geochemistry

Temperature of the stratosphere in high latitudes. A. VASSY and E. VASSY (Nature, 1939, 144, 284).—Computations of the mean temp. of atm. O_2 , and radio-sounding measurements, indicate that in arctic regions the stratosphere is hot in summer and cold in winter, and that the higher is the altitude the greater is the difference between the extreme temp. L. S. T.

Atmospheric ozone. II. E. VASSY (J. Phys. Radium, 1939, [vii], 10, 366; cf. A., 1939, I, 391).— A reply to Barbier and Chalonge (*ibid.*, 495).

W. R. A.

Helium-neon content of sea-water and its relation to the oxygen content. N. W. RAKE-

STRAW, C. R. HERRICK, jun., and W. D. URBY (J. Amer. Chem. Soc., 1939, 61, 2806—2807).—A repetition of earlier work (A., 1935, 724) under more suitable and representative conditions shows that the sea is approx. saturated with Ne and He at all depths, and there is no indication of a depth of min. concn. Hence there is no relation with the depth of min. $[O_2]$. W. R. A.

Mineral springs of Boario (Brescia). G. BRA-GAGNOLO (Annali Chim. Appl., 1939, 29, 402–413).— Data for chemical, physico-chemical, radioactive, bacteriological, and pharmacological properties are tabulated. F. O. H. Physico-chemistry of thermal water of Monfalcone. B. DORO (Annali Chim. Appl., 1939, 29, 374-380).—Coeffs. of solvent and ionic activities are calc. from analytical data previously given (A., 1939, I, 392). F. O. H.

Fluoride in potable waters of Valsugana (Trentino). D. E. DALL'ECO (Annali Chim. Appl., 1939, 29, 340–344).—The method of micro-determination of F' used [distillation as H_2SiF_6 and titration with 0.01N-Th(NO₃)₄] is described. Samples from 122 places in the district have [F'] 0.05–1.70 mg. per l. F. O. H.

Analysis of mineral waters of the Sangiorz-Bai springs [Roumania]. V. ALEXA (Bul. Soc. Stiințe Cluj, 1939, 9, 260—269).—Chemical composition and physico-chemical data for five H_2O sources, which are rich in NaCl, Ca(HCO₃)₂, and Mg(HCO₃)₂, and contain appreciable amounts of Mn and Fe and traces of Li, Br, I, B, and Rn, are recorded.

O. J. W.

Chemical features of Yellowstone National Park. I. B. DOUGLASS (J. Chem. Educ., 1939, 16, 422-435).—Characteristics of the different types of springs and chemical phenomena associated with the phase of volcanism found in this locality are described and illustrated by photographs. Selected chemical analyses of the gases and springs are given.

L. S. T.

Hot-spring problem. A. L. DAY (Bull. Geol. Soc. Amer., 1939, 50, 317—336).—An address in which the origin, meteoric or magmatic, of hot-spring waters, particularly of Yellowstone Park, is discussed. Recent work on these springs is summarised. L. S. T.

Vanadium, chromium, and molybdenum contents of the hot springs of Japan. K. KURODA (Bull. Chem. Soc. Japan, 1939, 14, 307—310).—Data are recorded for nine springs, giving V 0—0.247, Cr 0—0.073, Mo 0.0004—0.016 p.p.m., respectively. A spectrographic method for determining Mo is described. L. J. J.

Analysis of the water and mud from the lake and environs of the "baths of the town of Turda" [Roumania]. C. G. MACAROVICI and E. POPPER (Bul. Soc. Științe Cluj, 1939, 9, 270—280).— Chemical composition and physico-chemical data are given. O. J. W.

Solubility of copper components in cuprocalcic muds. A. QUARTAROLI and A. RATTU (Annali Chim. Appl., 1939, 29, 419–424).—Cu compounds in effluvial muds are only slightly sol. in alkaline media; they are sol. initially in acid or neutral media but gradually become less sol. until they are merely in suspension. The results are discussed with reference to the winning of Cu from effluvial muds. F. O. H.

Exchangeable manganese in river and ocean muds. K. J. MURATA (Amer. J. Sci., 1939, 237, 725-735).—Chemical examination of muds from the Colorado, Mississippi, Ohio, Potomac, and Monocacy rivers, of red deep-sea clay, of terrigenous blue mud, and of the delta deposit of the Mississippi river, and of a Pacific red clay shows that Mn in an exchangeable form exists in river and ocean muds. This Mn coexists with dissolved Mn in the waters in direct contact with the muds. The amount of exchangeable Mn decreases as the total Mn in the muds increases. High total Mn in sediments is due to accumulation of insol. $MnO_{2,n}H_{2}O$ minerals of unknown composition. Reducing conditions arising from the decomp. of org. matter increase exchangeable Mn and decrease the insol. Mn oxides in the sediments. The oxidising conditions that usually prevail in absence of decomp. org. matter favour the reverse process. Mn contents of the muds etc. and the solubilities of rhodochrosite, wad, etc. in N-NH₄OAc are recorded. L. S. T.

Definition of the ooze of estuaries. J. BOUR-CART (Compt. rend., 1939, 209, 542—544).—The viscous grey or black ooze found in Atlantic estuaries consists of inorg. material (\geq 70%), including a sandy constituent, bound together by org. matter containing a trace of Fe, which results from the decomp. of algæ and vegetation. A. J. E. W.

Mean chemical composition of meteoritic accretion. F. G. WATSON, jun. (J. Geol., 1939, 47, 426-430).—The ratio of falling stony to metallic materials probably lies between 1:1 and 4:1. The average chemical composition of all meteorites computed for this range of ratios is tabulated.

L. S. T. **Properties of white sapphire.** S. FREED, H. L. MCMURRY, and E. J. ROSENBAUM (J. Chem. Physics, 1939, 7, 853).—Plane transparent windows of white sapphire, cut from synthetic crystals of corundum (pure Al_2O_3), show excellent transmission throughout the visible and in the ultra-violet to ~1435 A. The high chemical stability of cryst. Al_2O_3 suggests that it might withstand corrosive liquids and gases, and this has been confirmed by the observation that white sapphire windows have remained unattacked after contact with liquid and gaseous HF for 15 hr.

W. R. A. Fluorescence of Finnish minerals in ultraviolet light. L. H. BORGSTRÖM (Bull. Comm. géol. Finlande, 1936, 9, 349—355; Chem. Zentr., 1937, i, 3113).—The colour and approx. intensity of fluorescence in a no. of minerals are recorded.

A. J. E. W.

Petrography of the crystalline limestones and quartzites of the Grenville series [of Ontario]. E. C. BRUCE and G. A. RUSSELL (Bull. Geol. Soc. Amer., 1939, 50, 515-528).—The Grenville rocks are mainly of sedimentary origin. They were originally an interbedded series of sands, clays, and limestones which are now quartzites, gneisses, and cryst. limestones. Some of the latter are dolomitic, and most of them contain small amounts of non-carbonate the formation of non-aluminous silicates of Mg and Ca from the original CaCO3 and MgCO3. Minor silicates throughout the cryst. limestone were formed by reactions between gaseous emanations from the granite or pegmatite and the original carbonates. Quartzites (mineral analyses given) are interbedded with the limestones and, owing to the less reactive nature of quartz, are much less contaminated by foreign minerals than is the limestone. L. S. T.