

BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

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

AUGUST, 1940.

X-Rays emitted by rarefied gases excited by an electric discharge. L. GROVEN (Bull. Acad. roy. Belg., 1939, [v], 25, 329—333).—Vapours of Hg, I, and S excited by a discharge with exterior electrodes emitted X-rays of λ 5.7, 2.9, and 5.2 Å. in the *M*, *L*, and *K* spectra, respectively. The hardness is independent of the pressure but the intensity is a max. at a characteristic pressure; λ is independent of the diameter of the tube and of the exciting λ (7—35 m.). N. M. B.

K Absorption edges of Br (35) and Kr (36). C. H. SHAW (Physical Rev., 1940, [ii], 57, 877—881).—The absorption of monochromatic X-rays as a function of λ was measured for gaseous Kr, Br₂, and HBr in the region of the absorption edges. The structure for Kr is considerably different from that previously obtained for A (cf. Parratt, A., 1939, I, 543). The data for Br₂ and HBr are used to check the Kronig-Petersen theory (cf. following abstract). N. M. B.

Fine structure of the X-ray absorption limits of bromine and chlorine. T. M. SNYDER and C. H. SHAW (Physical Rev., 1940, [ii], 57, 881—886; cf. preceding abstract).—The ratio of the absorption coeff. of the Br atom in Br₂ to that in HBr for monochromatic X-rays is calc. by Petersen's theory as a function of the X-ray λ in the region of the *K* absorption edge. A predicted min. at \sim 5.9 v. on the high-frequency side of the edge agrees with experiment in position but not in intensity; a predicted broad max. at \sim 15 v. from the edge is not found. The structure for Cl is re-calc. from the Hartree self-consistent field and compared with photographic measurements. N. M. B.

Structure of the L absorption of sodium and its halides. H. M. O'BRYAN (Physical Rev., 1940, [ii], 57, 995—997).—The structure of soft X-ray absorption of thin films of Na, NaF, NaCl, NaBr, and NaI, photographed in the region 250—430 Å. with a plane-grating vac. spectrograph of 0.1 e.v. resolving power, is much narrower and more complicated than in the corresponding *K* absorption spectra. The halides have narrow intense absorption "lines" near 380 Å. towards shorter λ , with widths at half-max. intensity as small as 0.3 e.v. and almost the same λ as the emission of Na II in the vac. spark. Na has a sharp edge at 405 Å. and relatively faint structure at shorter λ . Continuous absorption in the halides starts near 45 e.v. and is probably due to transitions to the conduction states of the crystal lattice. The similarity to the ionisation potential of the free ion at 47 e.v. indicates a highly ionic character of the halides and little broadening and displacement by neighbouring ions in the crystals. N. M. B.

Fine structure of the Stark effect in the H β line. W. STEUBING and A. KEIL (Z. Physik, 1940, 115, 150—178).—A calculation of the effect by Schlapp's method (A., 1928, 806) shows that dissymmetry should be observed in the profile of the H β line with field strengths of 10⁴—10⁵ kv. per cm. This is verified by measurements on new high-dispersion spectrograms. A small displacement of the whole profile, which varies with the field strength, is also noted. A. J. E. W.

Forbidden atomic transitions in the spectra of the aurora and of the night sky. M. NICOLET (Bull. Acad. roy. Belg., 1939, [v], 25, 81—86; cf. Vegard, A., 1939, I, 347).—A discussion of available data indicates that the apparent relations between the auroral or night-sky radiations and the forbidden transitions of O II, O III, and N II do not establish the existence of these ionised atoms in the upper atm. Confirmation is found of λ 5577, 6300, and 6364 of O I, and of the identification of λ 3466.5 Å. in the auroral spectra with the ⁴S—²P transition of N I. N. M. B.

Arc spectrum of silver. A. G. SHENSTONE (Physical Rev., 1940, [ii], 57, 894—898).—In view of unsatisfactory available analyses, measurements were made with special types of arc, using a three-prism glass spectrograph for λ 10,000—5000, a quartz spectrograph for λ 5000—2100, and a 30,000-line 2-m. vac. spectrograph for λ 2100—1250. Full data and classifications for 243 lines (including 148 new lines), and vals. and identifications of levels, are tabulated. Term vals. and peculiarities of the spectrum are discussed in detail. N. M. B.

Effect of pressure on the wave-lengths of the international secondary standards in the first spectrum of iron. C. J. HUMPHREYS (J. Res. Nat. Bur. Stand., 1940, 24, 389—393).—The λ of the lines of the Fe I spectrum from an Fe arc in air, adopted as secondary λ standards, are compared with the vals. observed by Burns and Walters for a vac. arc source (A., 1930, 2). The term depressions accord with the vals. observed by Babcock (Astrophys. J., 1928, 67, 240). J. W. S.

Interaction of atomic energy levels. III. T. S. SUBBARAYA, K. SESHADRI, and N. A. N. RAO (Current Sci., 1940, 9, 173—175).—In continuation of previous work (A., 1940, I, 88, 241) mixtures of Cd and Zn have been investigated. Alterations in intensity of Cd and Zn lines due to admixture are recorded and discussed. W. R. A.

Zeeman effect in the xenon spark spectrum, Xe II. II. H. ANGENETTER (Z. Physik, 1940, 115, 309—320; cf. *ibid.*, 1939, 114, 636).—Measurements on

50 more lines (6990-88—4037-59 Å.) are recorded. Humphreys' analysis (A., 1939, I, 166) is completely confirmed, and g -factors are calc. for 59 terms. The g -sum law is not obeyed in some cases, probably owing to interaction of adjacent states.

A. J. E. W.

Mutual interaction of plasma electrons. W. R. HASELTINE (J. Math. Phys. Mass. Inst. Tech., 1939, 18, 174—201).—Mathematical. Some processes occurring in a simplified model of the plasma or positive-column region of an electrical discharge through a gas at low pressure are considered, with special reference to the mutual interaction of the electrons and its effect on velocity distribution.

A. J. M.

Metastable atoms and decrease in breakdown potential in rare gases. W. ROGOWSKI (Z. Physik, 1940, 115, 257—295).—A detailed account of work reported previously (A., 1939, I, 302; 1940, I, 97). The application and extension of theories due to Townsend and others are discussed.

A. J. E. W.

Positive-point to plane discharge in air at atmospheric pressure. A. F. KIP (Physical Rev., 1938, [ii], 53, 210).—Current-voltage characteristics are described.

L. S. T.

Collisions between gaseous molecules and slow electrons. L. A. M. HENRY (Bull. Acad. roy. Belg., 1939, [v], 25, 256—268).—An improved technique and apparatus are described. The gas in the form of a mol. jet enters the metal reaction chamber evacuated to $\sim 10^{-6}$ mm. and undergoes collisions with a jet of electrons from an indirectly heated oxide cathode. The radiation due to the transition of the excited mols. to the normal state is recorded by a photo-electric counter, and the ions formed are captured by a grid connected with an electrometer.

N. M. B.

Measurements of discharge characteristics of Geiger-Müller counters. W. E. RAMSEY (Physical Rev., 1940, [ii], 57, 1022—1029; cf. A., 1939, I, 594).—An experimental method is presented for determining directly the voltage-time relationship (for $t = 2 \times 10^{-7}$ — 1×10^{-4} sec. and $v. = 20$ — 350) of a counter wire from the initiation of the discharge to the attainment of the max. negative potential of the wire. Observations are satisfactorily represented by $E = -(Q/c) \log_{10} (t/t_0 + 1)$, where E = the potential of the wire, Q = a function of cylinder voltage, and t_0 = a const. for a given counter. Modifications for the case where the counter "overshoots" (the voltage pulse E_{max} from the counter $>$ the difference between starting potential and cylinder potential) are examined. Discharge characteristics were measured for a series of pressures of an A-O₂ mixture and results satisfy the logarithmic relation. An A-EtOH-filled self-quenching counter has characteristics of the same form.

N. M. B.

Discharge mechanism of Geiger-Müller counters. C. G. MONTGOMERY and D. D. MONTGOMERY (Physical Rev., 1940, [ii], 57, 1030—1040; cf. A., 1939, I, 594).—Ramsey's measurements (see preceding abstract) are interpreted on the basis of the inductive action of the positive-ion space charge

moving across the counter, and this action, with the hypothesis that the positive ions may eject electrons when they reach the cathode, explains both the fast and slow types of breakdown of counters. This mechanism simply explains the quenching of a counter discharge and the necessary conditions for the maintenance of a steady discharge. It is predicted and verified that a counter can be operated even when the potential is \gg that required for a continuous discharge, if the capacity of the counter wire is sufficiently reduced. A simple indirect method for measuring the breakdown characteristic of a counter is described, and results accord with the direct determinations.

N. M. B.

Mechanism of nuclear isomeride separation process. G. T. SEABORG, G. FRIEDLAENDER, and J. W. KENNEDY (J. Amer. Chem. Soc., 1940, 62, 1309—1310).—Isomeric transition of ¹²⁷Te and of ¹²⁹Te from their upper to lower states brings about complete reduction of telluric to tellurous acid. Since small recoil energies are associated with these isomeric transitions, it appears unlikely that the recoil energies cause bond rupture and activation. It is suggested that the reduction is caused by the high state of electronic excitation which results from the vacancy in the K or L shell created by the emission of the internal conversion electron. This view is supported by the fact that isomeric transitions are obtained with ¹²⁷TeEt₂ and ¹²⁹TeEt₂ but not with ⁶⁹ZnEt₂ at 110°, although the recoil energy of Zn is ~ 5 times that of Te.

W. R. A.

Neutrons from boron plus deuterons. H. STAUB and W. E. STEPHENS (Physical Rev., 1938, [ii], 53, 212).—Measurement of the energy distribution of neutrons from the disintegration of B with 1-Me.v. deuterons by the method of α -recoils in a He-filled high-pressure cloud chamber gives a curve similar to that of Bonner and Brubaker (A., 1936, 1174). Preliminary vals. of disintegration energies are recorded. The relative intensities are $\sim 1 : 2 : 1 : 3$.

L. S. T.

Disintegration of nitrogen by neutrons. Further experiments in a low-pressure cloud chamber. F. N. D. KURIE and M. KAMEN (Physical Rev., 1938, [ii], 53, 212).—Owing to various limitations, the method described can examine this disintegration in no greater detail than is already available.

L. S. T.

Maximum geological age and some consequences of the hypothesis of Wilkins. II. β -Activity of ¹⁷⁶Lu and its spectrochemical sensitivity. J. M. LÓPEZ DE AZCONA (Anal. Fis. Quím., 1939, 35, 7—11).—From Wilkins' supposition that originally U-I and Ac-U were in radioactive equilibrium, it is concluded that the greatest geological age is 3.75×10^9 years. Assuming a radiogenic origin for common Pb, it is calc. from its isotope ratio that the differentiation occurred at 0.182×10^9 years. Calculations are made for the equilibrium between Th and U. It is suggested that the radioactivity of Lu is due to ¹⁷⁶Lu \rightarrow ¹⁷⁶Hf + β .

F. R. G.

Probability of pair production in nitrogen by γ -rays. L. V. GROSCHEV (Compt. rend. Acad. Sci.

U.R.S.S., 1940, 26, 419—423; cf. A., 1939, I, 115).—From extensions of the work previously recorded it is deduced that the effective cross-section for the process of pair production in N_2 is 0.9×10^{-26} sq. cm. Comparison of this val. with that for pair production in Kr supports the view that the effective cross-section $\propto Z^2$. The excess of the mean energy of positrons over that of electrons is $>$ that predicted from the val. for Pb (A., 1936, 400). J. W. S.

Angular distribution and nuclear impulse for pairs in nitrogen. L. V. GROSCHEV (Compt. rend. Acad. Sci. U.R.S.S., 1940, 26, 424—428).—The mean angles made by the direction of the photon with the directions of emission of the positron and electron are equal (23°), whilst the mean angle between the directions of emission of the positron and electron is 40° . These vals. and the angular distribution are in accord with theory. J. W. S.

Presence of element 85 among disintegration products of radon. H. HULUBEI and (MLLE.) Y. CAUCHOIS (Compt. rend., 1940, 210, 696—697).—Priority is claimed for the observation of lines ascribed to element 85 in the X-ray spectrum of disintegration products of Rn (cf. A., 1939, I, 440; Minder, Helv. Phys. Acta, 1940, 13, 144). A. J. E. W.

Resonance scattering of neutrons in helium. H. STAUB and H. TATEL (Physical Rev., 1940, [ii], 57, 936; cf. A., 1939, I, 171).—Using a continuous 0.6—2.0-Me.v. neutron spectrum, the resonance arising from the existence of a virtual P level of ^5He was investigated. Measurements of the shape of the resonance curve indicate that the level of ^5He has a width at half-max. of 0.4 Me.v. The shape of the resonance peak of the scattering cross-section curve indicates a doublet structure of the two levels $J = \frac{3}{2}$ and $J = \frac{1}{2}$ with a splitting of 0.24 ± 0.1 Me.v.; the doublet is inverted. The $\frac{3}{2}$ level is unstable against decay into a neutron and an α -particle by 0.76 Me.v. and the $\frac{1}{2}$ level by 1.0 Me.v. N. M. B.

Missing heavy nuclei. L. A. TURNER (Physical Rev., 1940, [ii], 57, 950—957; cf. A., 1940, I, 142).—Considerations of the regularities in the distribution of isotopes indicate that Rn, Ac-A, Th-A, and Ra-A should be somewhat β -active but the branching ratios would be too small for detection of the activity except for Rn and Ra-A; $^{239}_{93}\text{ekaRe}$ should be β -active with half-life ~ 1 month, $^{237}_{93}\text{ekaRe}$ should be an α -emitting nucleus, and $^{237}_{92}\text{U}$ should be β -active; the heaviest β -stable isotopes of transuranic elements should be $^{237}_{93}\text{ekaRe}$, $^{244}_{94}\text{ekaOs}$, $^{243}_{95}\text{ekaIr}$, and $^{250}_{96}\text{ekaPt}$. Isotopes of transuranic elements should undergo fission on exposure to slow neutrons; this and their presumably greater probability may account for their absence in nature. The relative abundance of ^{235}U and ^{238}U is in fair agreement with the hypothesis that the amount of ^{235}U was determined by a balance between production from ^{239}U and loss by fission. The probable chain of disintegration of $4n + 1$ nuclei is discussed; the estimated short half-lives and absence of a possible long-lived transuranic ancestor explain their non-survival. Hypothetical irradiation by neutrons or spontaneous fission of a transuranic

ancestor will account for the low abundance of ^{209}Bi . N. M. B.

Products of uranium fission. Radioactive isotopes of iodine and xenon. R. W. DODSON and R. D. FOWLER (Physical Rev., 1940, [ii], 57, 966—971; cf. A., 1939, I, 350).—Decay curves of U-fission activities confirm available data (cf. Abelson, *ibid.*, 504) and establish the following active fission products: ^{131}I (6.6 hr.) \rightarrow ^{131}Xe (9.5 hr.) \rightarrow Cs (?); ^{131}Xe (4.3 days) \rightarrow Cs (?). The 4.3-day Xe is produced by decay of 22-hr. I. The 6.6-hr. I is either a direct fission product or the product of an active Te of half-life < 1 min. N. M. B.

Anomalous scattering of neutrons by helium and the d - d neutron spectrum. E. HUDSPETH and H. DUNLAP (Physical Rev., 1940, [ii], 57, 971—975).—A study of the variation ratio of the cross-section for scattering by He and H of neutrons from a d - d source partly surrounded by 3 cm. of paraffin shows the anomalously high cross-section in He at 1.0 Me.v. (cf. Staub, A., 1939, I, 171), and a He-H cross-section ratio diminishing to \sim half this max. at 1.4 Me.v., with no other max. The d - d neutron spectrum, investigated by He recoils, appears to be homogeneous, with no evidence for a low-energy neutron group of intensity as great as 1% of that of the main group. This indicates that ^3He is not formed in an excited state. N. M. B.

Interference phenomena in the scattering of slow neutrons. H. G. BEYER and M. D. WHITAKER (Physical Rev., 1940, [ii], 57, 976—981; cf. A., 1939, I, 396).—Transmission measurements of C neutrons (neutrons absorbed by Cd) show that the total cross-sections for various elements depend markedly on the physical and chemical states of these elements; this is indicated by the transparency of single crystals as compared with the polycryst. form, and by the non-additivity of cross-sections for compounds and alloys. The de Broglie λ of the C neutrons accords with an interference interpretation of these effects. Data for SiO_2 , permalloy, and compounds of Fe, Ni, Mn, Cu, Zn, and the free elements are reported. N. M. B.

Radioactive isotopes of indium. J. L. LAWSON and J. M. CORK (Physical Rev., 1940, [ii], 57, 982—994; cf. A., 1939, I, 546).—Identifications, half-lives, radiations, and formation reactions for 10 radioactive In isotopes are tabulated and discussed in detail. Mass nos. and half-lives are: 116 (13 sec. and 54 min.), 114 (50 days and 72 sec.), 112 (65 hr.), 117 (117 min.), 113 (105 min.), 115 (4.5 hr.), 111 (23 min.), and 110 (66 min.). Assignments were effected by production with different excitation methods and measurement of energies of emitted β - and γ -radiations. Elements in which internally converted γ -rays are emitted are identified by observation of the differences in the K -, L -, and M -conversion electron energies and comparison with known binding energies from X-ray analysis. The β -spectrum of ^{114}In (50 days) is observed (an allowed transition) and on comparison with β -decay theory, previously tested by measurements on forbidden spectra, agrees with the predictions of the Fermi theory. N. M. B.

Neutron-proton interaction. H. B. HANSTEIN (Physical Rev., 1940, [ii], 57, 1045).—Investigations of the neutron-proton cross-section for In-resonance neutrons (energy ~ 1 e.v.) and for neutrons absorbed in Cd, under improved geometrical conditions, were made by means of transmission measurements in $C_{16}H_{34}$ by the resonance filter method. The val. obtained for In-resonance neutrons is $21 \pm 1 \times 10^{-24}$ sq. cm., in good agreement with Cohen (cf. A., 1939, I, 172), and for thermal neutrons 49.0×10^{-24} sq. cm., in good agreement with available data (cf. Carroll, A., 1938, I, 593). N. M. B.

Cloud-chamber studies in the cyclotron magnetic field. L. W. ALVAREZ and W. M. BROBECK (Physical Rev., 1938, [ii], 53, 213). L. S. T.

Energy release from ${}^9\text{Be}$ (d, α) ${}^7\text{Li}$ and the production of ${}^7\text{Li}$. (MISS) E. R. GRAVES (Physical Rev., 1940, [ii], 57, 855—862; cf. Williams, A., 1938, I, 7).—Investigations with a variable air pressure absorption cell, ionisation chamber, and linear amplifier show that the α -particles from ${}^9\text{Be}$ (d, α) ${}^7\text{Li}$ consist of two groups differing at 760 mm. and 15° by 3.08 ± 0.10 mm. range, reduced to zero bombarding voltage. They are associated with the production of ${}^7\text{Li}$ in the ground state and in an excited state, the latter formed, at 239 kv. bombarding voltage, 1.7 times as often as the former. The energy balance associated with the production of the ground state is 7.093 ± 0.022 Me.v. The energy of the excited level is 494 ± 16 ke.v., and this is discussed in connexion with vals. from other reactions in which ${}^7\text{Li}$ is an end-product and with γ -ray measurements of the level. The total yield curve for α -particles was investigated for 235—390 kv. bombarding voltage. N. M. B.

Ends of the mesotron tracks observed in an expansion chamber. A. MIGDAL and J. POMERANCHUK (Physical Rev., 1940, [ii], 57, 934).—Mathematical. A mesotron, after ceasing to produce appreciable ionisation, has sufficient energy to traverse by diffusion a certain distance from the end-point of the track (cf. Nishina, A., 1939, I, 292) before undergoing disintegration. The distribution probability and diffusion range are examined. N. M. B.

New type of nuclear reaction. R. SHERR (Physical Rev., 1940, [ii], 57, 937).—Experiments described show that the 33-min. period observed when S is bombarded with 0.1 $\mu\text{a.}$ of 22-Me.v. He^{++} ions from a cyclotron is ${}^{34}\text{Cl}$ formed by the reactions ${}^{32}\text{S}(\alpha, d){}^{34}\text{Cl}$ or ${}^{32}\text{S}(\alpha, pn){}^{34}\text{Cl}$. It can also be formed by ${}^{31}\text{P}(\alpha, p){}^{34}\text{Cl}$ or ${}^{33}\text{S}(d, n){}^{34}\text{Cl}$. Two very weak unidentified activities of 3.3 hr. and >8 days were observed, but there was no evidence of a 1.1 hr. period. N. M. B.

Production and half-life of ${}^{33}\text{Cl}$. J. B. HOAG (Physical Rev., 1940, [ii], 57, 937).—The decay curve of high-purity S bombarded with 8-Me.v. deuterons in an atm. of He was analysed into a 2.5-min. component due to ${}^{32}\text{S}(d, \alpha){}^{30}\text{P}$ and a 2.8-sec. component identified as arising from ${}^{32}\text{S}(d, n){}^{33}\text{Cl}$. The 2.8-sec. period is therefore due to the decay of ${}^{33}\text{Cl}$ in the reaction ${}^{33}\text{Cl} \rightarrow {}^{33}\text{S} + e^+$. N. M. B.

Penetrating [cosmic] radiation under more than 300 metres water-equivalent. J. BARNÓTHY

(Z. Physik, 1940, 115, 140—149).—Certain anomalies in coincidence counter measurements by the author (A., 1939, I, 351) and others are explained if the radiation at considerable depths consists of neutrons or neutrinos produced by decomp. of mesotrons, together with ionising secondaries which penetrate 20 cm. of Pb. A. J. E. W.

Hard component of cosmic radiation in the stratosphere. A. EHMERT (Z. Physik, 1940, 115, 326—332; cf. Schein, Jesse, and Wollan, A., 1939, I, 594).—The altitude variation of rays penetrating 9 cm. of Pb has been studied with triple coincidence counters attached to a balloon. At atm. pressures (p) >300 mm. the results conform to the absorption curve for normal p ; the no. of coincidences increases in the range 300—100 mm., and is const. within the experimental error (10%) at $p = 100$ —16 mm. The const. val. is 12.2 times the val. at sea level. A. J. E. W.

Decomposition probability of the mesotron. A. EHMERT (Z. Physik, 1940, 115, 333—338).—Measurements of the altitude effect for penetrating particles and of absorption in H_2O (cf. preceding abstract and A., 1937, I, 545) and Blackett's energy spectrum (*ibid.*, 390) are used to obtain decomp. data for the mesotron. No assumptions are made as to the height of origin, initial energy, or energy loss. If μ is the mass and τ the mean life period of the mesotron, $\mu c^2/\tau = (2.1 \pm 0.6) \times 10^{13}$ ev. per sec.; if $\mu = 160m$, $\tau = (3.7 \pm 1) \times 10^{-6}$ sec. Previous determinations of τ from the barometer effect give concordant results if the particle energies are corr. A. J. E. W.

Asymptotic orbits in the theory of primary cosmic radiation. A. BAÑOS, jun. (J. Math. Phys. Mass. Inst. Tech., 1939, 18, 211—238; cf. A., 1939, I, 296).—Mathematical. The calculation of the motion of charged particles in the field of a magnetic dipole, which occurs in the Lemaitre-Vallarta theory of the charged component of cosmic rays, is considered. In particular the calculation for a given parameter of a family of trajectories, asymptotic to a given symmetric, unstable, periodic orbit, is dealt with. A. J. M.

Intensity and rate of production of mesotrons in the stratosphere. M. SCHEIN, W. P. JESSE, and E. O. WOLLAN (Physical Rev., 1940, [ii], 57, 847—854; cf. A., 1940, I, 190).—Data are reported from balloon flights with a coincidence counter recording vertical mesotron intensity and also the no. of mesotrons produced in a 2-cm. Pb block by a non-ionising radiation. The absorption coeff. for mesotrons in the pressure range 8—50 cm. is 1.2×10^{-3} per g. per sq. cm. The production of mesotrons in the Pb block becomes noticeable at ~ 35 cm. pressure and increases with altitude at about the same rate as does the soft component, indicating that the photons are mainly responsible for the observed creation in the Pb. On this assumption the calc. cross-section for the process is 0.7×10^{-27} per sq. cm. per nuclear particle in Pb. N. M. B.

Magnetic storm effect on cosmic rays at high latitudes. D. H. LOUGHRIDGE and P. F. GAST (Physical Rev., 1940, [ii], 57, 938).—The beginning of a magnetic storm was accompanied by a sudden decrease in cosmic-ray intensity of $\sim 2\%$ at 58° N.

magnetic latitude. The normal and abnormal intensity-latitude curves are given. N. M. B.

Anomalous absorption of the hard component of cosmic rays in air. M. AGENO, G. BERNARDINI, N. B. CACCIAPUOTI, B. FERRETTI, and G. C. WICK (Physical Rev., 1940, [ii], 57, 945—950; cf. Rossi, A., 1940, I, 5, 190).—The anomalously large absorption in air of mesotrons was confirmed, independently of the assumption of isotropic distribution of primary rays, by comparison of the vertical intensity of mesotrons at 500 and 3460 m., and of that at 3460 m. with the intensity under a zenith angle of 45°. Results interpreted on the hypothesis of mesotron instability are consistent with a mesotron proper lifetime of 4 or 5 μ -sec. N. M. B.

Direct evidence of a proton component of cosmic radiation. T. H. JOHNSON, J. G. BARRY, and R. P. SHUTT (Physical Rev., 1940, [ii], 57, 1047—1048; cf. A., 1939, I, 506; 1940, I, 189).—Analysis under various assumptions of certain Wilson cloud-chamber tracks indicates that ~15% of the penetrating rays reaching the "slow" state are protons and that 1.5% of the fast cosmic rays can be protons. N. M. B.

Air mass effect on cosmic-ray intensity. Y. NISHINA, Y. SEKIDO, H. SIMAMURA, and H. ARAKAWA (Physical Rev., 1940, [ii], 57, 1050—1051).—Analyses, similar to those reported by Loughridge (cf. A., 1940, I, 54), are given for cosmic-ray data obtained in Japan. A warm front produced a gradual decrease in cosmic rays; the cold front caused only statistical fluctuations. N. M. B.

Existence of mesotron showers. W. F. G. SWANN and W. E. RAMSEY (Physical Rev., 1940, [ii], 57, 1051).—Further direct evidence of the existence of mesotron pairs is obtained from recent observations with an apparatus previously described (cf. A., 1940, I, 189). There is evidence of ~16 mesotron pairs per 10,000 events recorded. N. M. B.

Ionisation, negative ion formation, and recombination in the ionosphere. N. E. BRADBURY (Physical Rev., 1938, [ii], 53, 210).—Ionisation in the ionosphere is discussed in the light of present theories of recombination and negative ion formation. L. S. T.

Relativistic spin-orbit coupling in nuclei. S. M. DANCOFF and P. MORRISON (Physical Rev., 1938, [ii], 53, 211). L. S. T.

Production of pairs by fast electrons. W. E. LAMB, jun., and A. J. F. SIEGERT (Physical Rev., 1938, [ii], 53, 211).—Theoretical. L. S. T.

Formation of matter. T. THAYER-OJEDA (Separate, Santiago de Chile, 1939, 3—56; cf. A., 1938, I, 55).—Empirical relations between *d* and at. wt. are deduced. F. R. G.

Sources of stellar energy. Criticism of the Bethe-Gamow theory. R. N. RAI (Indian J. Physics, 1940, 14, 55—60).—Existing theories concerning the energy production in white dwarfs are reviewed. The low energy of production may arise from the existence of neutrons and high pressure due to the degenerate electron gas inside the white dwarfs. W. R. A.

Classical theory of spinning particles. H. J. BHABHA (Proc. Indian Acad. Sci., 1940, 11, A, 247—267, 467).—Mathematical. Exact relativistic classical equations taking radiation reaction into account for the rotation and translation of a point dipole are given for the case where the dipole is always a pure magnetic dipole in the rest system. W. R. A.

Elementary heavy particles with any integral charge. H. J. BHABHA (Proc. Indian Acad. Sci., 1940, 11, A, 347—368, 468).—Theoretical. Divergences in the quantum theory of the electron are attributed to the neglect of effects of radiation reaction. The interaction of the meson field (neutral and charged) with heavy particles is discussed. W. R. A.

Structure of the negative ion. Determination of the nuclear magnetic moment. T. V. IONESCU (Compt. rend., 1940, 210, 699—701).—Theoretical. The vibrational ν of gaseous negative ions (particularly that of H), which fall in the region of short and ultra-short electro-magnetic waves, are considered; the results are in agreement with experimental data [V. MAJERU]. A new method for the determination of nuclear moments follows from the theory. A. J. E. W.

Flint's five-dimensional theory of the electron. W. BAND (Phil. Mag., 1940, [vii], 29, 548—552).—By a change of unit for the fifth co-ordinate, the fifth component of momentum is made equal to the spin momentum, and the spin is brought into relation with the de Broglie λ . L. J. J.

Internal scattering of γ -rays. E. P. COOPER and P. MORRISON (Physical Rev., 1940, [ii], 57, 862—866).—Mathematical. The internal scattering of an electric dipole γ -ray by the *s* electrons of a radioactive atom, where the radiation field of the near-by nucleus can fulfil momentum conditions impossible for a plane wave, is considered. In agreement with experiment, the no. of internally scattered electrons is found to be inappreciable. N. M. B.

Oppenheimer-Phillips process. G. M. VOLKOFF (Physical Rev., 1940, [ii], 57, 866—876).—Mathematical. An examination of the energy distribution of the outgoing protons in the process of neutron capture by heavy nuclei bombarded with deuterons (cf. Bethe, A., 1938, I, 112). N. M. B.

Field theories for charged particles of arbitrary spin. L. I. SCHIFF (Physical Rev., 1940, [ii], 57, 903—905).—Mathematical. A class of field theories that are invariant under the complete Lorentz and gauge groups is discussed. N. M. B.

Effect of the Coulomb force on binding energies of light nuclei. W. E. STEPHENS (Physical Rev., 1940, [ii], 57, 938—939).—Data are tabulated and discussed for experimental vals. and for vals. calc. on four different nuclear models of differences in binding energy between 12 pairs of isobaric light nuclei for which $Z = \frac{1}{2}A \pm \frac{1}{2}$. A "nuclear radius" defined from the formula of the Coulomb repulsion *C* of the extra proton and calc. from observed vals. of *C* is plotted as a function of *A*. The vals. for ${}^9\text{B}$ and ${}^5\text{Li}$ are anomalous. N. M. B.

Resonance scattering of α -particles. M. E. ROSE (Physical Rev., 1940, [ii], 57, 958—965).—The elastic scattering of α -particles by nuclei of zero spin is considered on the many-body theory. Procedures for determining resonance energies and the assignments of angular momenta are discussed and criticised. An alternative method is suggested for obtaining the angular momenta directly from measurements of the angular distribution of the scattering at fixed energies. A procedure, eliminating straggling of α -particles, for a more accurate determination of the energies and widths of resonance levels is given, the resonance energy and width depending only on readily measurable quantities.

N. M. B.

Theory of meson decay. H. A. BETHE and L. W. NORDHEIM (Physical Rev., 1940, [ii], 57, 998—1006; cf. A., 1940, I, 190).—Mathematical. A new derivation of the meson lifetime and of the β -decay formula according to Yukawa's theory is given. Quant. agreement for both meson decay and β -decay is not obtained, as adjustment of consts. to give observed lifetime for β -decay results in a meson lifetime of $\sim 10^{-8}$ sec. compared with $\sim 10^{-6}$ sec. from cosmic-ray observations.

N. M. B.

"Surplus" terms in [spectra of] hydrides. B. GRUNDSTRÖM (Z. Physik, 1940, 115, 120—139).—"Surplus" terms of diat. hydride mols. such as InH, TlH, HgH, CaH, and SrH can be incorporated in a dissociation scheme by application of the mode of coupling designated by Mulliken "far nuclei case c," and the Wigner-Witmer rules; the ground state is obtained by a combination of the ground states of the free atoms. Certain other peculiarities of the above spectra and that of AlH can also be explained.

A. J. E. W.

Structure of the 2916 A. band of OD and the mass ratio of the hydrogen isotopes. K. R. RAO and M. G. SASTRY (Current Sci., 1940, 9, 172—173).—Consts. for the 2916 A. (2,1) band of OD and vibrational energy levels for the upper $2\Sigma^+$ state are given. The deduced ratio of H isotopes is 0.7282 (cf. 0.7281 calc. from isotopic masses of H and D).

W. R. A.

Equilibrium between H_2O and D_2O . I. R. RAO and Y. P. RAO (Current Sci., 1940, 9, 171—172).—The Raman spectra of pure H_2O , 99.4 at.-% D_2O , and their mixtures have been investigated. Pure H_2O gives a band extending from 2977 to 3817 cm^{-1} (max. 3443), whilst mixtures give a narrower band from 3080 to 3808 cm^{-1} (max. 3461). Pure D_2O gives a band 2194—2844 cm^{-1} (max. 2538 and 2400); mixture 2244—2810 cm^{-1} (max. 2523). Intensity distributions are markedly altered on admixture.

W. R. A.

Origin of radio fade-outs and the absorption coefficient of gases for light of wave-length 1215.7 A. W. M. PRESTON (Physical Rev., 1940, [ii], 57, 887—894).—In view of the suggestion that the ionisation in the D region of the ionosphere causing radio fade-outs is due to radiation of the first Lyman line of H at 1215.7 A. from solar eruptions, the accurate absorption coeffs. for this line were measured. The vals. obtained, O_2 0.28, N_2 \ll 0.005, CO_2 2.01, and H_2O vapour 390 (all reduced to n.t.p.), indicate that although the line may penetrate to sufficiently low

altitudes it is unlikely that it can produce ionisation and hence cause fade-outs. The possibility of these being due to higher Lyman series members or to X-rays of ~ 2 A. is considered.

N. M. B.

Pressure effect on infra-red absorption. J. STRONG and K. WATANABE (Physical Rev., 1940, [ii], 57, 1049).—A new method of determining the height of atm. O_3 depends on simultaneous measurement of the absorption of O_3 in the ultra-violet where the absorption is independent of pressure and in the infra-red at 9.6 μ . where it is pressure-dependent. Laboratory measurements of infra-red absorption for 6—104 mm. pressure (P) can be represented by $A = kP^2$, where $A = \%$ absorption and $k = 0.174$. This equation satisfies data for CO_2 at 14.7 μ .

N. M. B.

Extreme ultra-violet absorption spectra of simple hydrocarbons. E. P. CARR and H. STÜCKLEN (Proc. VII Conf. Spectros., 1939, 128—133).—A summary of results of measurements down to 1600 A. of the absorption spectra of straight-chain and cyclic olefines (A., 1938, I, 173) and of $\Delta^{6\gamma}$ -pentadiene, ethylallene, and diallyl.

O. D. S.

Detection and estimation of molecules in the stars. H. G. HOWELL (Proc. VII Conf. Spectros., 1939, 142—146).—A review.

O. D. S.

Ultra-violet absorption spectra and formation of indole and indolenine derivatives.—See A., 1940, II, 288.

Ultra-violet absorption and chemical constitution of substituted carbamides and thiocarbamides. A. CLOW and N. L. HELMRICH (Trans. Faraday Soc., 1940, 36, 685—696; cf. A., 1938, I, 233).—Absorption curves between λ 4000 and 2200 of 35 derivatives of $CO(NH_2)_2$ and $CS(NH_2)_2$ have been determined and are correlated with their chemical constitutions as given by the diamagnetic susceptibilities.

F. L. U.

Spectroscopic evidence for hydrogen bonds. Hexyl alcohols. I. S. C. STANFORD and W. GORDY (J. Amer. Chem. Soc., 1940, 62, 1247—1251).—The infra-red absorption spectra of hexan- α -, β -, and γ -ol, β -methylpentan- α -, β - and δ -ol, γ -methylpentan- α -ol, and β -ethylbutan- α -ol have been measured in the 3 μ . region for the pure liquids and for 0.291, 0.1, and 0.05M. solutions in CCl_4 . From the location of the O—H bond and its behaviour on dilution, conclusions are drawn regarding the degree of association of the isomerides.

W. R. A.

Photochemical studies. XXX. Fluorescence of diacetyl. General considerations governing the study of fluorescence. F. C. HENRIQUES, jun., and W. A. NOYES, jun. (J. Amer. Chem. Soc. 1940, 62, 1038—1043).—The effects of pressure, temp., λ , intensity, and added CO_2 on the fluorescence of Ac_2 have been investigated. Ac_2 emits no measurable fluorescence when irradiated by 3130 or 2537 A. The quantum efficiency of the fluorescence emitted on excitation with 3650 A. increases with rising pressure from 4 to 50 mm., at first rapidly, then more slowly, and finally attains an almost const. max. val. The fluorescence decreases slightly with increased temp. from 15° to 60°; the fluorescence efficiency is inde-

pendent of the incident intensity. Addition of COMe_2 enhances the fluorescence except at very high pressures of COMe_2 when some apparent quenching sets in. A mechanism is advanced in which the state formed by absorption cannot fluoresce but changes into other (fluorescing) states by collision. At least three upper states appear to be involved. W. R. A.

Effect of low temperature on the intensity of fluorescence. J. E. DINGER and W. KUNERTH (Iowa State Coll. J. Sci., 1940, 14, 195—198).—Using 2537 Å. as exciting radiation, the intensities of fluorescence (*I*) of three commercial phosphors, CdB_2O_5 , ZnSiO_3 , and CaWO_4 , at temp. between 20° and -183° have been measured. For ZnSiO_3 *I* remains approx. const. down to -90° , increases rapidly to a max. at -130° , and then falls. CaWO_4 behaves similarly, with a max. at -150° , whilst CdB_2O_5 remains const. down to -80° and then falls steadily. The three phosphors show a sharpening of the fluorescence band as temp. is lowered. W. R. A.

Splitting of spectral lines at scattering by liquids. S. M. MITRA (Indian J. Physics, 1940, 14, 1—11).—The fine structure of the Rayleigh line due to the mol. scattering of C_6H_6 , PhMe , CCl_4 , CS_2 , MeOH , PhCl , *cyclo*-hexane and -hexanol has been investigated by a Fabry-Perot etalon. Splitting was observed for each compound, first components alone being present; no higher components (cf. Gross, *e.g.*, A., 1932, 676, 722) nor red shifts (cf. Cabannes, A., 1930, 15) were observed. Vals. of $\Delta\nu$ were $>$ those calc. from the Brillouin expression, $\Delta\nu = 2v_0(v/c)\sin\theta/2$, where *v* is the velocity of sound in the medium and θ the angle of scattering. $\Delta\nu$ increases (*a*) as v_0 the frequency of the incident radiation increases, (*b*) as θ increases, (*c*) as the temp. is lowered. With decrease of temp. the Doppler components on each side of the central line become sharper and more intense, whilst the intensity of the central component decreases. All three components are completely polarised. W. R. A.

Dark current of a willemite crystal. R. C. HERMAN and R. HOFSTADTER (Physical Rev., 1940, [ii], 57, 936).—In an investigation of photo-conductivity at low temp., the dark current showed a sudden large increase at $\sim -60^\circ$, while the crystal was warming up with the field on, and then fell to its low initial val. The effect is obtained on ultraviolet illumination of the crystal (but not if this is depolarised) at low temp. with the field on and subsequent warming up in the dark. The effect is probably connected with the emission of trapped light (cf. Johnson, A., 1939, I, 355). N. M. B.

Deviations from Ohm's law at high current densities. E. GUTH and J. MAYERHÖFER (Physical Rev., 1940, [ii], 57, 908—915).—Mathematical. The deviations are calc. on the basis of the wave-mechanical theory of conductivity. A c.d. of 10^9 amp. per sq. cm. causes a deviation of only 1%. N. M. B.

Dipole moments and structures of certain compounds of sulphur, selenium, and phosphorus. C. P. SMYTH, G. L. LEWIS, A. J. GROSSMAN, and F. B. JENNINGS (J. Amer. Chem. Soc., 1940, 62,

1219—1223).—Vals. of μ in C_6H_6 at 25° are given: H_2S_2 , 1.17; S_2Cl_2 , 1.60; Se_2Cl_2 , 2.1; SeOCl_2 , 2.62; POCl_3 , 2.40; PSCl_3 , 1.41 D. H_2S_2 appears to have an extended structure, H-S-S-H , with a small proportion of branched mols., $\text{H}_2\text{S-S}$. S_2Cl_2 and Se_2Cl_2 appear to be a mixture of Cl-X-X-Cl and (predominantly) X-XCl_2 in the form of an irregular tetrahedron. SeOCl_2 is an irregular tetrahedron. Moments of the following linkings have been calc.: Se-O , 3.0; P^+-O^- , 3.5; P^+-S^- , 2.5 D. W. R. A.

Optical rotatory power of bromo- and iodo-aryl derivatives of stereoisomeric methylenecamphors.—See A., 1940, II, 255.

Periodic table. J. GUZMÁN (Anal. Fis. Quím., 1939, 35, 104—106).—A graphical arrangement of the elements, with *Z* and their chemical properties (rare gases being zero) as co-ordinates. F. R. G.

Degeneracy in non-relativistic Bose-Einstein statistics. D. V. GOGATE and D. S. KOTHARI (Indian J. Physics, 1940, 14, 21—36).—Mathematical. Direct proofs of the Maxwell-Boltzmann, Fermi-Dirac, and Bose-Einstein distribution laws are given. W. R. A.

[Interrelation of molecular constants for diatomic molecules. II.] R. A. NEWING (Phil. Mag., 1940, [vii], 29, 603; cf. A., 1940, I, 198).—A correction. L. J. J.

Hindered rotation in methyl alcohol. J. S. KOEHLER and D. M. DENNISON (Physical Rev., 1940, [ii], 57, 1006—1021).—The problem is examined mathematically in relation to a model in which a rigid OH bar may rotate, under the action of a hindering potential, about the axis of a rigid pyramid representing the Me group. A qual. treatment of the behaviour of the energy levels as the potential barrier height is raised from zero to ∞ is given, and an exact method of calculating the energy levels, wave functions, and transition probabilities is devised. It is shown that the levels lying well below the barrier (vibrational levels) are each split into three components, the spread of which depends on the penetrability of the barrier. Levels lying above the barrier rapidly acquire the character of states found in free rotation. Calculations with a barrier height of 770 cm.^{-1} give levels and a spectrum in qual. agreement with observational data, but the barrier height is probably $\sim 470 \pm 40 \text{ cm.}^{-1}$. N. M. B.

Ferromagnetism, antiferromagnetism, and particle size. W. KLEMM (Z. Elektrochem., 1940, 46, 296—297).—Discussion of the data of Haul and Schoon (cf. A., 1940, I, 13) leads to the view that although antiferromagnetism is possible with large well-formed crystallites ($\alpha\text{-Fe}_2\text{O}_3$) as well as with small ill-formed crystallites ($\gamma\text{-Fe}_2\text{O}_3$), ferromagnetism can occur only when the crystallites are well formed and $>$ a limiting size. C. R. H.

New X-ray effect. (SIR) C. V. RAMAN and P. NILAKANTAN (Current Sci., 1940, 9, 165—167). W. R. A.

Crystallography of diamonds of the Brazilian type. I. I. SCHAFFRANOVSKI (Compt. rend. Acad. Sci. U.R.S.S., 1940, 26, 662—665).—Crystallographical data are given. F. J. G.

Secondary *K*-absorption edges of cobalt salts in solid and liquid solutions. B. B. RAY, S. R. DAS, and N. BAGCHI (Indian J. Physics, 1940, **14**, 37—54).—The primary and secondary *K*-absorption edges of solid Co, CoO, Co₃O₃, CoSO₄·7H₂O, Co(NO₃)₂·6H₂O, CoCl₂·6H₂O, CoCl₂, and Co(NO₂)₂; aq. solutions of CoSO₄·7H₂O (1·7, 1·0, 0·1, 0·05N.), CoCl₂·6H₂O (1·5, 1·0, 0·1, 0·05N.), and Co(NO₃)₂·6H₂O (1·9, 0·64, 0·32N.); and a saturated solution of Co(NO₃)₂·6H₂O in conc. HNO₃ have been measured. The primary *K*-edge is at longer λ for Co than for compounds, but the secondary is similar in all solid compounds. The influences of crystal structure and dissolution are discussed. W. R. A.

Width of the *K*-absorption edge of cobalt. N. BAGCHI (Indian J. Physics, 1940, **14**, 61—65; cf. preceding abstract).—The width of the *K*-absorption edge of Co is > that of solid compounds of Co examined (*loc. cit.*), whilst in solid compounds it is > for their aq. solutions. The width for Co(NO₃)₂·6H₂O in conc. HNO₃ is > in H₂O > solid. The *K'* structure edge has been found for Co and Co₂O₃. W. R. A.

Crystal structure of sodium formate, HCO₂Na. W. H. ZACHARIASEN (J. Amer. Chem. Soc., 1940, **62**, 1011—1013).—HCO₂Na recrystallised from H₂O as twinned crystals with (001) as twinning plane. It is slightly hygroscopic. The crystals are monoclinic, a_1 6·19±0·01, a_2 6·72±0·01, a_3 6·49±0·01 Å, α_2 121° 42'±10', 4 mols. per unit cell, space-group *C*₂/*c* (*C*_{2h}). Na, H, and C atoms are on twofold rotation axes, O atoms in general positions; parameter vals. are given. The two C—O bonds of the HCO₂ group are in complete resonance; C—O = 1·27 Å and the bond angle is 124°. Na has six O neighbours at an average distance of 2·44 Å. W. R. A.

Crystal structure of dicyanodiamide. E. W. HUGHES (J. Amer. Chem. Soc., 1940, **62**, 1258—1267).—The monoclinic unit cell of dicyanodiamide (I) has a 15·00, b 4·44, c 13·12 Å, β 115° 20', space-group *C*2/*c*, 8 mols. of C₂N₄H₄ per unit cell. The positions of atoms have been determined and correspond with a mol. structure consisting of (A) and its resonance forms (B) and (C). Mol. packing is

$$\begin{array}{ccc} \text{N}:\text{C}:\text{N} > \text{C}:\text{NH}_2 & \text{N}:\text{C}:\text{N} > \text{C}:\text{NH}_2 & \text{N}:\text{C}:\text{N} > \text{C}:\text{NH}_2 \\ \text{NH}_2 & \text{NH}_2 & \text{NH}_2 \\ \text{(A)} & \text{(B)} & \text{(C)} \end{array}$$

dominated by H bonds, one of which is of the rare bifurcated type. The properties of (I) are discussed in relation to the proposed structure. W. R. A.

Electron diffraction investigation of the molecular structure of tellurium tetrachloride. D. P. STEVENSON and V. SCHOMAKER (J. Amer. Chem. Soc., 1940, **62**, 1267—1270).—An electron diffraction investigation of gaseous TeCl₄ gives Te—Cl = 2·33±0·02 Å, Cl—Cl = 5·37±0·06 Å, and a bond angle of 93±3°. The mol. has a configuration derived from the trigonal bipyramid, one of the equatorial positions being occupied by the unshared electron pair. This configuration is compatible with the high dipole moment of TeCl₄. The "irregular tetrahedral" *C*_{3v} structure proposed by Kimball (A., 1940, I. 198) is incompatible with these data. W. R. A.

Molecular structure of sulphur dioxide. V. SCHOMAKER and D. P. STEVENSON (J. Amer. Chem. Soc., 1940, **62**, 1270—1272).—Redetermination of the electron diffraction of SO₂ (A., 1936, 144) yields S—O = 1·43₃±0·01 Å and O—S—O angle = 120±5°, in good agreement with 121±5° calc. from bond distance and entropy. W. R. A.

Study of structures of bismuth chloride and bromide molecules in the vapour phase by electron diffraction. H. A. SKINNER and L. E. SUTTON (Trans. Faraday Soc., 1940, **36**, 681—685).—BiCl₃ and BiBr₃ have a pyramidal structure, with the following dimensions: Bi—Cl 2·48±0·02, Bi—Br 2·63±0·02 Å; Cl—Bi—Cl 100±6°, Br—Bi—Br 100±4°. F. L. U.

Study of structures of inorganic pentahale molecules in the vapour phase by electron diffraction. H. A. SKINNER and L. E. SUTTON (Trans. Faraday Soc., 1940, **36**, 668—680).—The following bond lengths are deduced from the diffraction patterns of NbCl₅, TaCl₅, NbBr₅, and TaBr₅: Nb—Cl 2·29±0·03, Nb—Br 2·46±0·03, Ta—Cl 2·30±0·02, Ta—Br 2·45±0·03 Å. The contraction of the links in these compounds is of the same order as those observed in MoCl₅ and IF₅. The structure is trigonal bipyramidal. F. L. U.

Paramagnetic relaxation times for titanium and chrome alum. J. H. VAN VLECK (Physical Rev., 1940, [ii], **57**, 1052; cf. A., 1940, I, 200).—Detailed amendments and corrections. N. M. B.

Method for determining the charging potential of dielectrics and the lower limit of secondary electron emission from a monocrystal of NaCl. I. D. KIRVALDZE (Compt. rend. Acad. Sci. U.R.S.S., 1940, **26**, 635—637).—A method for determining the sign of the charge produced by electron bombardment of a crystal, and hence the lower limit of secondary electron emission, is described. For NaCl the limit is ~11 v. F. J. G.

Crystallographic properties of anhydrous and trihydrated sodium carbamates. B. YOSHIKI (J. Soc. Chem. Ind. Japan, 1940, **43**, 83 B).—NH₂·CO₂Na forms orthorhombic, acicular or prismatic crystals whilst NH₂·CO₂Na·3H₂O crystals belong to the triclinic system and are granular or short prismatic. Optical consts. have been measured. W. R. A.

Increasing the chemical activity of cadmium iodide by irradiation. J. A. HEDVALL, P. WALLGREN, and S. MÅNSSON (Trans. Faraday Soc., 1940, **36**, 697—706).—Recent work on the properties of crystals having faulty lattices is reviewed. The possibility of crystals having layer lattices exhibiting different photosensitivity on different surfaces has been examined by irradiating CdI₂ with absorbable λ on the basal and prism faces. In presence of a little H₂O vapour blackening is produced in the latter but not in the former. Vapours which are more strongly adsorbed than H₂O (C₅H₅N is the most effective) prevent the blackening. Further, the solubility in an EtOH—light petroleum mixture is increased by ~14% by irradiation. F. L. U.

Temperature-dependence of tensile strength of a polystyrene glass. E. JENCKEL and P. LAGALLY

(Z. Elektrochem., 1940, 46, 186—188).—The tensile strength (s) of polystyrene glass fibres (degree of polymerisation 1180, M 122,500) has a sharp max. at $\sim 50^\circ$, above which s falls rapidly. An approx. 2.5-fold fall in s occurs with increasing cross-section between 0.015 and 0.077 sq. cm. In contrast with similar glasses of low mol. wt., the max. s val. does not correspond with the temp. range of solidification ($\sim 85^\circ$), or with the "brittle point," which is much lower; it may relate to a second "solidification" region made possible by the multiple modes of linking suggested by Kuhn. A. J. E. W.

Polymorphic forms of organic compounds. J. TIMMERMANS (Bull. Acad. roy. Belg., 1939, [v], 25, 417—430).—A discussion of a system of classification of the polymorphic forms of groups of org. compounds, with variations of form under various conditions and hypotheses as to origin, based on all available data. N. M. B.

Allotropy in phosphorus and sulphur. K. SCHAUM (Z. Elektrochem., 1940, 46, 228—231).—A review and discussion from the viewpoint of the general study of allotropy. A. J. E. W.

Galvano- and thermo-magnetic phenomena in iron and nickel. E. H. BUTLER, jun., and E. M. PUGH (Physical Rev., 1940, [ii], 57, 916—921).—The Hall, Ettingshausen, Nernst, and Righi-Leduc effects, the Thomson coeff., and the thermal and electrical conductivities for bars of Ni and electrolytic Fe were measured. The three independent Sommerfeld-Fermi relations between the effects are verified within a factor of 3. The Fermi statistical conduction theory does not account for the size of an effect unless the average field for the conduction electrons in the Fe is twice, and in Ni ~ 15 times, the measured val. of the magnetic induction. Explanations are suggested. N. M. B.

Active iron. XIII. [Magnetic] measurements on complex iron cyanides in solution. A. SIMON and H. KNAUER (Z. Elektrochem., 1940, 46, 13—25; cf. A., 1940, I, 59).—The construction and standardisation (with specially purified H_2O) of an accurate form of Quinke's apparatus for the measurement of χ in solutions are described. Data are recorded for $\sim 0.5M$. aq. and dil. $HClO_4$ solutions of $K_3Fe(CN)_6$ and $K_4Fe(CN)_6$, and compared with data for the solutions and solid salts obtained by the Gouy method; χ for aq. $K_4Fe(CN)_6$ falls rapidly on keeping. The effects of dilution and keeping on the χ vals. for aq. $Na_4[Fe(CN)_5AsO_2]$ and $Na_4[Fe(CN)_5NO_2]$, respectively, are also examined. Dissolution reduces χ for paramagnetic salts, whilst diamagnetism is increased. The changes, which are discussed in detail, are attributed to differences in dissociation, hydrolysis, hydration, and polymerisation, the effect of light, and changes in the association of H_2O . Owing to these effects the secondary dissociation of the complexes cannot be studied by χ measurements on their solutions. A. J. E. W.

Magnetic study of polymerisation of styrene. S. S. BHATNAGAR, P. L. KAPUR, and (MISS) G. KAUR (J. Indian Chem. Soc., 1940, 17, 177—182).—The diamagnetic susceptibility (χ) of styrene increases steadily during polymerisation in vac., whereas in

presence of O_2 it first decreases and afterwards rises until the final product has a higher val. of χ than a sample polymerised in vac. The initial low val. is attributed to the formation of peroxides, and the high final val. to the combined effects of anisotropy and the disappearance of double bonds. F. L. U.

Molecular structure of some selenium and tellurium compounds. M. PRASAD and S. S. DHARMATTI (Current Sci., 1940, 9, 175—176).—The diamagnetic susceptibilities ($-\chi \times 10^6$) of Se_2Br_2 , H_2SeO_3 , H_2TeO_3 , and $TeMe_2I_2$ are 112.6, 45.41, 34.89, and 145.40, respectively, in good agreement with theoretical vals. obtained by the methods of Slater and of Angus. Vals. of χ for the various Se and Te valency states and for S in S_2Cl_2 and SO_2Cl_2 are derived. W. R. A.

Configuration of some cupric, nickelous, and cobaltous complexes by means of magnetic measurements. G. N. TYSON, jun., and S. C. ADAMS (J. Amer. Chem. Soc., 1940, 62, 1228—1229).—The following compounds have been synthesised: salicylaldehyde complexes of Cu^{II} (I), Ni^{II} (II), Co^{II} (III), and salicylaldehyde complexes of Cu^{II} (IV) and Ni^{II} (V). From magnetic measurements (II) and (III) are tetrahedral, and (I), (IV), and (V) are planar. (V) is diamagnetic. W. R. A.

Fresnel formulæ applied to the phenomena of non-reflecting films. K. B. BLODGETT (Physical Rev., 1940, [ii], 57, 921—924).—The amplitudes of rays reflected and transmitted by non-reflecting films of transparent isotropic substances are calc. for (1) a film of refractive index n_1 bounded on both sides by a medium of refractive index n_0 , and (2) a film bounded by media of refractive indices n_0 and n_2 . For zero reflexion the thickness t of the film must be $n_1 t \cos r = (2n + 2)\lambda/4$ in (1), and $n_1 t \cos r = (2n + 1)\lambda/4$ in (2), where r is the angle of refraction of light in the film. N. M. B.

Rotatory dispersion and circular dichroism of *l*-menthyl *d*- β -chloro- β -nitrosobutyrate. S. MITCHELL and G. K. SIMPSON (J.C.S., 1940, 784—787).—The extinction coeff., ϵ , sp. rotation, $[\alpha]$, and circular dichroism, $\epsilon_l - \epsilon_r$, of EtOH solutions of *l*-menthyl *d*- β -chloro- β -nitrosobutyrate have been measured in the region 4800—6800 Å., covering the double absorption band due to the NO-group. The curves of ϵ and $\epsilon_l - \epsilon_r$, plotted against λ , are similar in form and each can be represented as the sum of two probability curves. The anisotropy factors $(\epsilon_l - \epsilon_r)/\epsilon$ deduced from the component curves have equal max. By using Lowry and Hudson's equation (A., 1933, 889) the contributions to the $[\alpha]-\lambda$ curve associated with each of the component circular dichroism curves are evaluated, and by subtracting these from the observed vals. of $[\alpha]$ a curve is obtained which represents the rotatory dispersion after the partial rotation due to the NO-group has been removed. J. W. S.

Thermodynamics of *n*-heptane and $\beta\beta$ -trimethylpentane, including heat capacities, heats of fusion and vaporisation, and entropies. K. S. PITZER (J. Amer. Chem. Soc., 1940, 62, 1224—1227).—Molal heat capacities in the solid, liquid, and gaseous

states have been determined for $n\text{-C}_7\text{H}_{16}$ (I) and $\text{CH}_3\text{Pr}^{\beta}\text{Bu}^{\nu}$ (II) from 14° to 423°K . The following data are given: heats of fusion and vaporisation, 3355.8 ± 4 and 7660 ± 20 (I), 2201.6 ± 2 and 7410 ± 20 (II) g.-cal. per mol.; $S_{298.15} = 78.60 \pm 0.2$ (I) and 78.40 ± 0.2 (II) g.-cal. per degree per mol.; $S_{(gas)371.51^{\circ}} = 111.77 \pm 0.3$ (I); $S_{(gas)372.33^{\circ}} = 112.05 \pm 0.3$ g.-cal. per degree per mol. W. R. A.

Nucleus formation in molten metals. L. HORN and G. MASING (Z. Elektrochem., 1940, 46, 109—119).—The formation of solidification nuclei is studied statistically by measuring the degree of supercooling of the melt with different rates of cooling. In the fully automatic apparatus described, which is designed for repeated measurements on the same mass of metal, the specimen is heated to a specified limit above the m.p. and then cooled at a fixed rate; the point of solidification is determined from a photographically-recorded temp.-time curve. Curves are given showing the variation of the no. of nuclei with temp. for Sb and Al. With Sb the supercooling increases rapidly with the temp. of preheating, probably owing to the effect of traces of impurity on nucleus formation, but with Al the effect is smaller. The "radioactive" law of nucleus formation is obeyed by Al, but not by Sb. Photomicrograms illustrating the structure of the solidified reguli are discussed. A. J. E. W.

Rate of evaporation of liquids. W. PRÜGER (Z. Physik, 1940, 115, 202—244).—The temp. (θ_s) in the surface of a liquid evaporating at normal pressures (p) is slightly $>$ the b.p. (θ_0) determined by the v.p. above the surface; if Δp is the difference of v.p. which corresponds with $\theta_s - \theta_0$, the rate of evaporation is $\mu = K\Delta p$, so long as Δp is small and the rate of supply of heat is not excessive. The evaporation const. K is characteristic of each liquid, and depends on p , θ , and to a marked degree on the condition of the surface. K has approx. the order of magnitude of the evaporation const. in a vac., so that the condensation coeff., $f = (\text{mols. condensing})/(\text{mols. striking surface})$, can be calc. from μ data. $K = 270 \times 10^{-6}$ cm. per sec. per mm. for H_2O at 100° , and $f = 0.02$; with CCl_4 $f = \sim 1$, and very few mols. are reflected from the surface. $\theta_s - \theta_0 \approx 0.01^{\circ}$ in H_2O and $\sim 0.001^{\circ}$ in CCl_4 . K for H_2O is much reduced in a glass vessel, owing to the presence of dissolved material in the surface. It is confirmed that there is a linear fall of temp. towards the surface in a surface layer of the liquid a few tenths of a mm. thick; this fall may reach several degrees. The true surface temp. must therefore be obtained by extrapolation, using measurements with very small thermocouples. A. J. E. W.

Variation of physical constants in homologous series. II. Density. V. GÓMEZ ARANDA (Anal. Fis. Quím., 1939, 35, 45—63).—A reprint of a paper previously abstracted (A., 1938, I, 240). F. R. G.

Sodium chloride at very high pressures. R. B. JACOBS (Physical Rev., 1940, [ii], 57, 1046; cf. Bridgman, A., 1940, I, 236).—The absence of polymorphic transitions in the range 10^5 — 2×10^5 atm. is discussed with reference to the free energy-pressure and mol. vol.-pressure curves for body-centred and

face-centred NaCl. A theoretical pressure-vol. curve is compared with Bridgman's measurements.

N. M. B.
Retrograde condensation. D. L. KATZ and F. KURATA (Ind. Eng. Chem., 1940, 32, 817—827).—The phase behaviour of simple and complex materials is discussed, with particular reference to a mixture of natural gas and gasoline, for which P - V and P - T relations are illustrated in graphs. Simple rules for nomenclature are recommended and it is suggested that phase behaviour is more accurately described without using the term "retrograde condensation."

J. W. S.
Pressure-volume-temperature relations of ethylene in the critical region. I. J. DACEY, R. McINTOSH, and O. MAASS (Canad. J. Res., 1939, 17, B, 206—213).—Regions of const. pressure with changing vol. were observed in isothermals at 8.92° , 9.22° , 9.42° , 9.50° , and 9.60° . The pressure of the heterogeneous system at 9.50° corresponds with that of the flat portion of the homogeneous isothermal at the same temp. and is also identical with that of the system which had been heated at const. vol. to destroy the density difference and then cooled again to 9.50° . A hysteresis which was observed on reversing the direction of measurement of the 9.60° isothermal, *i.e.*, from "vapour" to compressed "liquid," was caused by time lags in passing from the "vapour" region of an isothermal to regions of high density. It is concluded that the gas system, although macroscopically homogeneous at these temp., is still a two-phase system, the effect of the temp. being to disperse, or mix mechanically, the two phases. Mechanical stirring did not influence any of these phenomena.

D. F. R.
Pressure-volume-temperature relations for propane. W. W. DESCHNER and G. G. BROWN (Ind. Eng. Chem., 1940, 32, 836—840).—The P - V - T relations for C_3H_8 have been studied at 100 — 350° and 1 — 140 atm. It has $T_{crit.}$ 96.85° , $P_{crit.}$ 42.1 atm., and $d_{crit.}$ 0.224 . The saturated-liquid and vapour densities are recorded for 30 — 96.85° , and the fugacity at various pressures is calc. J. W. S.

Vapour pressure of liquid bismuth between 603° and 638° . A. H. WEBER and S. C. KIRSCH (Physical Rev., 1940, [ii], 57, 1042—1044; cf. A., 1938, I, 378).—Measurements were made by the method of mol. effusion, the metallic deposits being weighed directly with a micro-balance. The 7 vals. reported are fairly well represented by the empirical equation $\log_{10} p$ (in mm.) $= -52.23(205)/T + 9.03$ in good agreement with that given in the International Critical Tables. N. M. B.

Vapour pressures for six aliphatic nitro-compounds. E. B. HODGE (Ind. Eng. Chem., 1940, 32, 748).—The v.p. of MeNO_2 , EtNO_2 , $\text{Pr}^{\alpha}\text{NO}_2$, $\text{Pr}^{\beta}\text{NO}_2$, CHMeEtNO_2 , and BuNO_2 have been determined and the consts. in the equation $\log P = A/T + B \log T + C$ tabulated. A nomograph is included. D. F. R.

Correlating vapour pressure and latent heat data; a new plot. D. F. OTHMER (Ind. Eng. Chem., 1940, 32, 841—856).—The v.p. of pure substances and solutions, and the dissociation pressures of salt hydrates and other compounds, yield straight lines when plotted

logarithmically against the v.p. of a reference substance at corresponding temp. This confirms the validity of the relation $\log p = (L/L') \log p' + C$, where p and p' are the v.p. and L and L' are the mol. latent heats, respectively, of the compounds at the same temp., and C is a const. This method of plotting is illustrated for the v.p. of various compounds and solutions in comparison with Cl_2 , C_6H_{14} , H_2O , NH_3 , or C_6H_6 . The method can be used to determine heats of fusion, dissolution, hydration, dilution, or dissociation. The f.p. of salt solutions, enthalpy charts, steam-distillation relations, the composition of vapours from binary solutions, const.-b.p. mixtures, etc. can also be studied by this method. Other equations, useful for similar calculations, are suggested.

J. W. S.

Thermodynamic properties of fluorochloromethanes and -ethanes. A. F. BENNING and R. C. McHARNES (Ind. Eng. Chem., 1940, 32, 698—701; cf. A., 1940, I, 248).—The P - V - T relations of CHClF_2 , CHCl_2F , CCl_3F , and $\text{CCl}_2\text{F}\cdot\text{CClF}_2$ have been determined by the measurement of isometrics at 3.5—21 atm. and the results expressed in an equation of state of the Beattie-Bridgeman type (A., 1929, 252). V.d. measurements have also been made at 0.25—2.5 atm. by the Dumas method and above 20 atm. by the dew-point method.

D. F. R.

Thermodynamic properties of fluorochloromethanes and -ethanes. IV. Orthobaric densities and critical constants of three fluorochloromethanes and trifluorotrchloroethane. A. F. BENNING and R. C. McHARNES (Ind. Eng. Chem., 1940, 32, 814—816).— d vals. for CHClF_2 , CHCl_2F , CCl_3F , and $\text{CCl}_2\text{F}\cdot\text{CClF}_2$ have been determined between -70° and their crit. temp. (96.0° , 178.5° , 198.0° , and 214.1° , respectively). From these data and the v.p. and v.d. data (cf. A., 1940, I, 248, and preceding abstract) the respective rectilinear diameters are calc.

J. W. S.

Thermodynamic properties of the hexyl alcohols. IV. γ -Methylpentan- α -ol and - δ -ol. F. HOVORKA, H. P. LANKELMA, and I. SCHNEIDER (J. Amer. Chem. Soc., 1940, 62, 1096—1098).—Vals. of γ , η , ρ , v.p., n , parachor, Eötvös const., degree of association, b.p., heat of vaporisation, and crit. temp. are recorded and discussed.

W. R. A.

Direct comparison on a crystal of calcite of the X-ray and optical interferometer methods of determining linear thermal expansion. Evidence of differences among calcite crystals. J. B. AUSTIN, H. SAÏNI, J. WEIGLE, and R. H. H. PIERCE, jun. (Physical Rev., 1940, [ii], 57, 931—933).—Measurements by the two methods on the same specimen of calcite gave vals. for the coeff. of linear expansion agreeing within the limit of measurement. Comparison of these results with data for other crystals of calcite shows a significant difference in the expansion of different crystals. The spacing between the (211) planes is also measurably different.

N. M. B.

Viscosity of gases and vapours at high pressures. E. W. COMINGS and R. S. EGLY (Ind. Eng. Chem., 1940, 32, 714—718).—A graphical method based on the concept of corresponding states is described for predicting the η of pure gases and vapours

at high pressures when the η at atm. pressure, and the crit. temp. and pressure, are known. Comparison with published data for seven gases and vapours indicates that above the crit. temp. and pressure the predicted η differs from the experimental val. by <20%. The method may be applied similarly to thermal conductivity and diffusivity of gases.

D. F. R.

Viscosities of linear polyesters. Exact relationship between viscosity and chain length. P. J. FLORY (J. Amer. Chem. Soc., 1940, 62, 1057—1070).— η for molten linear polyesters (average mol. wt. 200—10,000) is represented satisfactorily by $\log \eta = A + CZ_w^t$, where Z_w is the wt. average chain length and A and C are consts. The relation also holds for mixtures of two polyesters when one has a low and the other a high average mol. wt. η - T relationships, determined at 80—202°, show that $d \log \eta / dT$ is independent of the average mol. wt., indicating that the elementary process causing viscous flow consists of a displacement of a small portion of the entire mol. and is independent of mol. size. ρ and thermal expansion coeffs. of polyesters have been measured from 80° to 167°. The calculation of average mol. wts. from measurements of η is discussed.

W. R. A.

Figures in thin layers of grease and viscous liquids. W. D. KUMLER (J. Physical Chem., 1940, 44, 612—618).—Figures such as those observed on the rims of vac. desiccators are formed in greases or liquids of suitable η and stickiness when the substance is placed between smooth plates and pressure is applied and subsequently released. The figures consist of holes in the material and their forms vary with η and composition. No relationship exists between tendency to form the figures and polarity or tendency to form liquid crystals.

J. W. S.

Molar zero fluidity volumes of organic compounds. A. S. CHAKRAVARTI (J. Indian Chem. Soc., 1940, 17, 205—209).—The relationship deduced by Friend (cf. A., 1938, I, 446) between fluidity and sp. vol. has been used to calculate mol. zero fluidity vols. (V_0) for a no. of org. compounds containing N or a halogen. The calc. vals. agree, for the most part closely, with those derived from d and η data, and lead to the following at. vals. of V_0 : N 6.0, Cl 18.0, Br 23.0, I 29.0. Some OH-compounds are also considered.

F. L. U.

Generalised thermodynamic potentials for perfect gas mixtures. P. VAN RYSELBERGHE (Bull. Acad. roy. Belg., 1939, [v], 25, 314—318).—Mathematical.

N. M. B.

Thermal demixing of gas mixtures. II. Thermodiffusion. N. G. SCHMAHL and J. SCHEWE (Z. Elektrochem., 1940, 46, 203—212; cf. A., 1936, 1338).—A review of the literature and principles of thermodiffusion is given, and experiments with H_2 - HCl , $-\text{H}_2\text{S}$, $-\text{CH}_4$, $-\text{CO}_2$, $\text{CO}-\text{CO}_2$, and O_2-CO_2 mixtures (generally at pressure $p = 300$ mm.) are described. The mixtures were allowed to reach equilibrium in two bulbs in direct connexion, one at room temp. (T_1) and the other at 200—1000° (T_2). The dependence of the degree of demixing on the vols. of the bulbs, time,

% composition of the gas mixture, and T_2 is examined. The expression $\Delta\lambda = K_i \log_e T_2/T_1$, in which $\Delta\lambda$ is the change in mol. fraction due to demixing, is verified; K_i , which is const. over the above temp. range, shows an approx. parallelism with the ratio of the mol. wts. of the two gases, but other factors such as the size and "hardness" of the mol. are of greater importance. With H_2-H_2S and $-CO_2$ $\Delta\lambda$ falls rapidly with increasing p (>3.5 atm.), although the p coeff. is small at 1 atm.; extrapolation of the curves suggests that no demixing would occur at ~ 4.3 atm. A. J. E. W.

Variation of the differential diffusion constant of sulphuric acid with temperature. E. A. HOLLINGSHEAD and A. R. GORDON (J. Chem. Physics, 1940, 8, 423—424).—By a method previously described (A., 1939, I, 192) the diffusion const. of H_2SO_4 has been determined for concns. of 0.025—1.0M. at 10—35°. The variation of the const. with concn. is similar to that at 25°; the mean activation energies of transport for the ranges 10—15°, 15—25°, and 25—35° are 4.9, 4.5, and 3.8 kg.-cal., respectively.

W. R. A.

(A) Faraday effect and conductivity of electrolytic solutions. (B) Faraday effect of strong electrolytes in aqueous solutions. VII. NH_4Cl , $BaCl_2$, $NaNO_3$, KNO_3 , Na_2SO_4 , $ZnSO_4$, and $NaClO_4$. A. OKAZAKI (Mem. Ryojun Coll. Eng., 1939, 12, 33—43, 45—60).—(A) The equiv. % increments of Verdet's const. ω and the rotation const. $D = n\omega\lambda^2/(n^2 + 2)^2$ of alkali halide solutions are \propto degree of dissociation up to concn. of 6 g.-equiv. per l. The mol. rotations of the salts in dissociated and undissociated states have been calc.

(B) Measurements with D -lines at 25° show that the corr. mol. rotation of the chlorides decreases with increasing concn. and that of $NaClO_4$ increases slightly, while those of the nitrates and sulphates are nearly independent of concn. The val. of e/m for the dispersion electron, its no. per mol., and the λ of the absorption band of these electrolytes (except $NaClO_4$) in dissociated states have been calc. For uni- and bi-valent electrolytes e/m is respectively $<$ and $>$ the accepted val. D. F. R.

Molar volumes of solutes. IV. O. REDLICH (J. Physical Chem., 1940, 44, 619—629; cf. A., 1931, 905, 1122).—Available data for aq. and non-aq. solutions confirm the relationship between apparent mol. vol. (ϕ) and concn. (c) of electrolytes derived from the Debye-Hückel theory, viz., $\phi = \phi^0 + kw^{1.5}c^{0.5}$. ($w = 0.5\sum v_i z_i^2$, where v_i is the no. of ions of species i formed by 1 mol. of electrolyte and z_i is the valency). This equation differs from Masson's empirical rule (A., 1930, 31) in that the factor k should be independent of the electrolyte and should vary only with the solvent and temp., whilst being a limiting law it will apply only at low c . In dil. solutions of non-electrolytes ϕ varies linearly with c . A formula is given for interpolating and extrapolating mol. vols. J. W. S.

Conception of osmotic pressure. A. THIEL (Z. Elektrochem., 1940, 46, 129—131).—The concept of osmotic pressure (Π) is discussed with reference to diffusion in solutions and phenomena at phase boundaries (solubility of salts and solution tension of metals), in order to reconcile these factors with the

modern view that Π is associated with the solution as a whole and is largely a solvent effect, rather than a result of thermal motion of the solute mols. Π must be distinguished from "diffusion pressure," and the idea of a solution pressure acting in opposition to Π must be abandoned in the light of modern theories of electrolytes and ionic activity. A. J. E. W.

Partial pressure of hydrogen chloride from its solutions in *o*-nitrotoluene, *m*-nitrotoluene, and *n*-hexane at 25°. S. J. O'BRIEN and C. L. KENNY (J. Amer. Chem. Soc., 1940, 62, 1189—1192).—Partial pressures at 25° of HCl from its solutions in *o*- and *m*- $C_6H_4MeNO_2$ and in *n*- C_6H_{14} over the concn. ranges 0.023—0.259, 0.012—0.139, and 0.004—0.02M., respectively, have been measured. The basicities of the solvents are deduced and compared with those deduced from infra-red absorption of HCl in various solvents. In $C_6H_4MeNO_2$, HCl obeys Henry's law and shows negative deviation from Raoult's law, whilst in *n*- C_6H_{14} Henry's law is obeyed and there is positive deviation from Raoult's law. W. R. A.

Apparent and partial molal volumes of sodium chloride and hydrochloric acid in mixed solutions. H. E. WIRTH (J. Amer. Chem. Soc., 1940, 62, 1128—1134).—The apparent and partial (\bar{V}) mol. vols. at 25° of (a) aq. NaCl, (b) HCl, (c) NaCl in HCl solution, (d) HCl in NaCl solution have been determined. \bar{V} of NaCl is decreased at const. total vol. ionic strength by adding HCl and the decrease is $\propto [HCl]$, whilst \bar{V}_{HCl} increases at const. total concn. when NaCl is added and the increase is $\propto [NaCl]$. \bar{V}_{H_2O} for the mixed solutions is greatest in solutions of pure HCl and least in solutions of pure NaCl. These changes are due to changes in the structure of H_2O , caused by ions in solution. W. R. A.

Solubility of nitrogen in liquid iron-chromium and -vanadium alloys. R. M. BRICK and J. A. CREEVY (Amer. Inst. Min. Met. Eng., 1940, Tech. Paper, 1165, 9 pp.; Metals Tech., 7, No. 3).—The alloys were melted in a vac. and, after pretreatment with H_2 , were held in contact with N_2 for 2 hr. at 50° above their liquidus temp. With Fe-Cr alloys, the m.p. is lowered by dissolution of N_2 . No gas evolution occurred on solidification of alloys with >40 at.-% of Cr, and solid ingots of the other alloys were obtained by the use of a H_2O -cooled Cu quenching rod. Determinations of N_2 in the ingots were made by vac. fusion. In agreement with Krivobok (B., 1935, 594) it was found that the solubility of N_2 rises slowly from 0.139 at.-% in Fe to 2.12 at.-% in the alloy with 30 at.-% of Cr, and then more rapidly and linearly to 13.6 at.-% in Cr. The solubility of N_2 in powdered solid Cr at 900° is considerably greater, viz., 37.6 at.-%, and it thus seems probable that in the liquid alloy an unstable nitride phase is formed. Quenched samples of alloys with >20 at.-% of Cr and saturated with N_2 show traces of a eutectoid structure, containing about 8 wt.-% of N_2 . Preliminary tests indicate that dissolution of N_2 raises the m.p. of Fe-V alloys considerably.

J. C. C.

Solubility of nitrogen in steel.—See B., 1940, 530.

Concentration-dependence of diffusion in solid metals. W. SEITH and J. HERRMANN (Z. Elektrochem., 1940, 46, 213—218).—Experiments on the diffusion of Mg and Tl in Pb are described; blocks of Pb welded to Pb-Mg or -Tl alloy were heated in a vac. at 220—270° or 260—305°, respectively, and layers of the Pb at known distances from the interface were analysed spectrophotometrically. The diffusion const. of Tl in Pb, which is independent of concn., is given by $D = (9.0 \times 10^4)e^{-24,600/RT}$ (units, cm. and days); as the val. of D is $>$ that for Pb in Pb the heat of relaxation is smaller for Tl. D for Mg in Pb depends on concn., and when extrapolated to zero concn. is still $>$ the self-diffusion const. of Pb. A. J. E. W.

(A) Calculation of the diffusion coefficient of mixtures of powdered metals. S. D. HERTZRIKEN and M. A. FAINGOLD. **(B) Diffusion of zinc into α -brass.** S. D. HERTZRIKEN, I. SACHAROV, and L. STOLPER (Mém. Physique, Kiev, 1940, 8, 127—134, 135—142).—(A) Mathematical. The coeff. of diffusion of Ni into Cu is $D = 3 \times 10^{-5}$ sq. cm. per 24 hr. at 850°.

(B) D , determined by the method of vac. evaporation, rises from 0.18 to 2.0×10^{-3} sq. cm. per 24 hr. from 600° to 750°. R. T.

Solid solubility of chromium in aluminium containing up to 2% of magnesium. W. HOFMANN and R. W. HERZER (Metallwirts., 1940, 19, 141—143).—From resistance measurements and microscopical examination it has been shown that the solubility of Cr in very pure Al is 0.56% and 0.3% at 600° and 500°, respectively, but that it is reduced by addition of Mg until with 2% of Mg present the solubilities of Cr are 0.38% and 0.2% at these temp., respectively. J. W. S.

Nature of certain intermetallic lattices. A. L. NORBURY (J. Inst. Metals, 1939, 65, Advance copy, 611—634).—The structure of complex lattices based on the "basic" body-centred cubic, close-packed hexagonal, and NiAs lattices are shown to be capable of derivation from the basic lattice by the replacement of atoms by electrons, or vice versa; e.g., γ -brass is formed from 27 body-centred cube-units by 2 electrons replacing 2 atoms, thus $27(3e : 2a) + 2e - 2a = 83 : 52$ for the electron (e) : atom (a) ratio, instead of 21 : 13, and $\text{Cu}_{21}\text{Zn}_{31}$ instead of Cu_5Zn_8 for the formula. Other $e : a$ ratios are $84e : 51a$ for γ -brass, $85e : 50a$ for γ_2 -brass, $39e : 21a$ for ζ_2 -Cu-Al, $40e : 20a$ for η_2 -Cu-Al, and $28e : 12a$ for CuAl_3 . Similarly the basic $7e : 4a$ hexagonal lattice forms subsidiary lattices at $14e : 9a$ (ζ -Ag-Zn) and $15e : 7a$ (Co_2Al_5), and the basic $10e : 4a$ NiAs lattice forms subsidiary lattices at $35e : 21a$ (γ' -CoSn), $37e : 19a$ (PtPb), $39e : 17a$ (η -Cu-Sn), and $42e : 14a$ (FeS). The ordered electron-atom replacement which occurs in the formation of the above types of subsidiary lattices is ascribed to energy exchange between the at. electron shells and the free electrons. A disordered replacement may also occur with the formation of a solid solution having the same lattice; this is ascribed to energy exchange between the electron shells of solvent and solute atoms.

A. R. P.

Thermodynamic analysis of liquidus curves of intermetallic compounds. K. HAUFFE and C.

WAGNER (Z. Elektrochem., 1940, 46, 160—170).—Formulæ are derived by which the concn.-dependence of the chemical potential (μ) of the components of alloy phases in binary systems can be deduced from measurements on the liquidus curves. μ -mol. fraction curves are obtained from the liquidus curves for Bi_2Mg_3 , AuIn_2 , Bi_2Ca_3 , SnMg_2 , LaAl_2 , PrAl_2 , and SnLa_2 , which include cases in which the liquidus is approx. parabolic, and in which it is composed of approx. linear segments. The μ curve for each component generally has a flattened S-shape, a rapid increase of μ occurring in the neighbourhood of the m.p. max.; with Bi_2Mg_3 , Bi_2Ca_3 , and SnMg_2 this can be explained if a salt-like structure (e.g., $\text{Mg}_3^{2+}\text{Bi}_3^{3-}$) is assumed for the cryst. and liquid phases, but in the other cases cited such a structure is not possible.

A. J. E. W.

X-Ray study of alloys of silver with lead, bismuth, and thallium. H. H. CHISWIK and R. HULTGREN (Amer. Inst. Min. Met. Eng., Tech. Paper 1169, 1940, 5 pp.; Metals Tech., 1940, 7, No. 3).—X-Ray diffraction measurements confirm that the Ag-Pb and Ag-Bi systems are of the simple eutectic type. The solubility of Pb in Ag varies from 1.3% at 300° to 0.6% at 250°, and of Bi from 1.5% at 260° to 0.6% at 200°. Preliminary measurements suggest that the solubility of Tl in Ag is $\sim 9\%$ at 287°.

J. C. C.

Structure of alloys in the system silver-antimony. F. WEIBKE and I. EFINGER (Z. Elektrochem., 1940, 46, 53—60).—Detailed thermal, micrographic, and X-ray data for the concn. range 17—31 wt.-% of Sb are used to construct the phase diagram for the system. Two intermediate phases, ϵ and ϵ' , occur at room temp.; the boundary on the Sb side for ϵ mixed crystals is at Sb 16.7—17.0% at 400—500°, and their structure is hexagonal close-packed with a 2.956—2.961, c 4.787—4.789 Å, c/a 1.620—1.618 at this boundary. The ϵ' phase (Ag_3Sb mixed crystals) has a high-temp. modification, ϵ'' , which gives an almost identical X-ray diagram, showing that the two forms differ only in their state of order; the ϵ' and ϵ'' field extends from Sb 23.5—22.6—20.0% at 400—500—562° to Sb 28.6%, and the transition points are 440° and 449°, respectively, at these limits. Above 28.6% the ϵ' and ϵ'' phases occur in equilibrium with Sb, and ϵ'' gives a eutectic melting at 484°. The ϵ'' phase is formed peritectically from ϵ and the melt at 562°. The ϵ' and ϵ'' phases are rhombic, with a 2.980, b 5.171—5.164, c 4.736—4.725 Å. (400—500°) on the Ag side, and a 2.988, b 5.235, c 4.846 Å. (400°) on the Sb side. The variation of the lattice const. with concn. is not linear. A. J. E. W.

Electrochemical studies on the system silver-antimony. F. WEIBKE and I. EFINGER (Z. Elektrochem., 1940, 46, 61—69).—Accurate e.m.f. (E) measurements on the cell $\text{Sb-Ag}|\text{LiCl-KCl}$ eutectic, $\text{SbCl}_3|\text{Sb}$ have been made at 430° and 470°, using Sb-Ag alloys containing 2—31.6 at.-% of Sb. The vals. of E and dE/dT are discussed with reference to the phase diagram (cf. preceding abstract). With Sb > 26.1 at.-% $E = 40$ —50 mv., although this alloy contains eutectically-deposited Sb, and the vals. of dE/dT are unusually high, suggesting that the

measured E vals. do not relate only to the process of alloy formation. dE/dT varies steadily with $[Sb]$ in the α , ϵ , and ϵ' phase regions, indicating a statistical distribution of atoms in the lattices; an abrupt change occurs at the $\epsilon'-\epsilon''$ transition point, probably owing to an order-disorder effect. The results are used to calculate vals. of the apparent change of partial mol. free energy (ΔF) and entropy, and of the heat of formation, which is negative and relatively high. ΔF has a max. val. of ~ 1 kg.-cal. per g.-atom with 26.1 at.-% of Sb. The heat of transformation of ϵ'' into ϵ' is -1.26 kg.-cal. per g.-atom, and this transition is an example of a change which is endothermic on cooling. A. J. E. W.

Process of precipitation from solid solution.
I. Crystallographic mechanism for the Al-Cu alloys. C. H. SAMANS (Amer. Inst. Min. Met. Eng., 1940, Tech. Paper 1186, 10 pp.; Metals Tech., 7, No. 3).—It is suggested that pptn. of θ -CuAl₂ from the supersaturated solid solution takes place in 7 stages. Groups containing the required no. of Cu atoms first segregate by chance, and these re-align themselves into an ordered arrangement to form nuclei of θ' -CuAl₂ which then grow and are pptd. as particles by formation of interfaces. The Cu atoms then re-align themselves more symmetrically, after which the Al atoms on the (011) planes "buckle" or shear on alternate planes by 0.544 Å. in the [100] direction, and finally the Al atoms on the (101) planes "buckle" by the same amount in what was originally the [010] direction. J. C. C.

Aluminium-silicon alloys.—See B., 1940, 535.

X-Ray study of the constitution of aluminium-zinc alloys of high purity above 275°: new high-temperature X-ray camera. E. C. ELLWOOD (J. Inst. Metals, 1940, 66, 87-96).—The camera is described in detail and figured; it permits the direct X-ray examination of alloys sealed, in the form of fine powder, into a thin (0.5-mm.) glass tube, and heated at temp. up to 450°. No evidence was found of a peritectic reaction at $\sim 380^\circ$ in Al-Zn alloys with 40-55 at.-% Zn; the diagram of Gayler and Sutherland (A., 1938, I, 69) is, therefore, confirmed. A. R. P.

Solubility of lead in tin. A. STOCKBURN (J. Inst. Metals, 1940, 66, 33-38).—Micrographic examination and resistivity measurements indicate that Sn dissolves 2.0-2.1% of Pb at the eutectic temp. (183°); the solidus at the Sn end is almost a straight line joining the m.p. of Sn and the eutectic horizontal at $\sim 2\%$ Pb. A. R. P.

X-Ray investigation of aluminium-rich iron-nickel-aluminium alloys after slow cooling. A. S. BRADLEY and A. TAYLOR (J. Inst. Metals, 1940, 66, 53-65).—The following phases have been identified by X-ray powder photographs of slowly cooled alloys: α -face-centred and β -body-centred cubic phases of the Ni-Fe system; α_1 (Ni₃Al or Ni₃Fe), β_1 (Fe₃Al) and β_2 (NiAl or FeAl) corresponding with the α and β phases, respectively, but with superlattices; trigonal δ (Ni₂Al₃), orthorhombic ϵ (NiAl₃), face-centred cubic κ (Al), λ_1 (Fe₂Al₇), monoclinic μ (Fe₂Al₅), rhombohedral ν (FeAl₂), hexagonal π (Fe₃NiAl₁₀), and

monoclinic (?) ρ (FeNiAl₉ or possibly FeNi₂Al₁₃). Ternary δ contains a max. of 1-2% of Fe, but the Al may vary within 6%; ϵ dissolves up to 4% of Fe by replacement of Ni, whereas κ is almost pure Al and may be in equilibrium with λ_1 , ϵ , or ρ , according to the composition. The narrow limits of the λ_1 phase field of the Fe-Al system are considerably widened by addition of Ni, which produces wide variations in the axial ratios and hence marked changes in the high-order reflexions; this gives rise to several superstructure phases of the λ type corresponding with those found in the Fe-Cu-Al system. The π phase dissolves appreciable amounts of Ni and Al without losing its homogeneity, but the ρ phase has only a narrow range of composition. Analogies are pointed out between the Co-Al and the Fe-Ni-Al systems, from which it is inferred that Co is intermediate in metallic properties between Fe and Ni. A. R. P.

Nickel-beryllium constitutional diagram. S. OKAMOTO (Japan Nickel Rev., 1940, 8, 125-131).—The diagram has been redetermined by means of thermal analysis, microscopical examination, magnetic and X-ray analysis, and hardness measurements. The results are in general agreement with those of Masing and Dahl (B., 1929, 724). The compound Ni₅Be₂ was not found within any temp. range. The solid solubility of Be in Ni (the α solution) is $<1\%$ at room temp., 2% at 900°, 2.6% at 1000°, and 2.8% at 1100°. The eutectic composition and temp. are Be 5.7% and 1153°. Within the range Be 1-13% there are two phases, α and β (solution of NiBe in Ni). The Curie point for annealed saturated α is 255°, and for the quenched supersaturated solution may be as low as 90°. S. J. K.

Niobium-nickel alloys.—See B., 1940, 533.

Anomaly in nickel-rich solid solution of nickel-chromium binary system. Z. YANO (Bull. Inst. Phys. Chem. Res. Japan, 1940, 19, 110-117).—Electrical and dilatometric measurements and X-ray analysis show that the anomaly in the Ni-rich Ni-Cr solid solution resembles that in the Ni-Cu-Zn system, indicating an order-disorder transformation. L. J. J.

Magnetic study of the two-phase iron-nickel alloys. A. T. PICKLES and W. SUCKSMITH (Proc. Roy. Soc., 1940, A, 175, 331-344).—Measurement of magnetic saturation intensity of annealed Fe-Ni alloys shows that there is a two-phase field in the Fe-rich part of the system. Phase boundaries were determined above 450° and the relation of the equilibrium diagram to the thermal hysteresis observed with normal rates of cooling is studied. G. D. P.

Replaceability of mercury by gallium in dental stoppings. F. WEIBKE and E. HESSE (Z. Elektrochem., 1940, 46, 219-222).—A ternary diagram for the system Ag-Ga-Sn (excluding the extreme Ag corner) is discussed with reference to the suitability of the alloys for dental stoppings. Alloys prepared by rubbing Ag-Sn into liquid Ga are unsuitable, as they are too soft in the available concn. range (15-40% Ga); the m.p. of harder alloys with $<15\%$ Ga are too high. A. J. E. W.

Solubility of methane in benzene. E. P. SCHOCH, A. E. HOFFMANN, A. S. KASPERIK, J. H. LIGHTFOOT, and F. D. MAYFIELD (Ind. Eng. Chem., 1940, 32, 788—791).—An apparatus for measuring the P - V - T relations of mixtures of hydrocarbons at pressures >400 atm. is described. Sp. vol. and bubble point pressure data for 11 mixtures of CH_4 and C_6H_6 (19—76 mol.-% CH_4) at 100–27° F. are recorded. J. W. S.

Solubility of cadmium and zinc oxalates in salt solutions. W. C. VOSBURGH and J. F. BECKMAN (J. Amer. Chem. Soc., 1940, 62, 1028—1031).—Vals. are given for the solubilities of CdC_2O_4 in KClO_4 , $\text{Cd}(\text{ClO}_4)_2$, and K_2SO_4 solutions. The solubility increases with the concn. of K_2SO_4 , CdSO_4 , and $\text{Cd}(\text{ClO}_4)_2$ but is independent of the concn. of KClO_4 solutions, indicating the presence of CdC_2O_4 , Cd^{2+} and $\text{CdC}_2\text{O}_4 \cdot \text{SO}_4^{2-}$, in which CdSO_4 is regarded as incompletely dissociated. The presence of ZnC_2O_4 , Zn^{2+} explains the solubility of ZnC_2O_4 in ZnSO_4 . Recalc. vals. of the instability consts. of the ions $\text{Cd}(\text{C}_2\text{O}_4)_2^{2-}$ and $\text{Zn}(\text{C}_2\text{O}_4)_2^{2-}$ are given. W. R. A.

Influence of electrolytes on solubility of organic substances in water. A. J. A. VAN DER WYK (Arch. Sci. phys. nat., 1940, [v], 22, Suppl., 23—26).—Theoretical. The difference between the heats of dissolution of a sparingly sol. org. substance in H_2O and in an aq. salt solution is compounded of three terms referring to the effect of the salt on the H_2O , and to complex formation with the anion and the cation. Consideration of the dependence of these on concn. leads to the equation

$$-(RT/x) \log_3(l_x/l_0) = C_0 + C_1/(K_1 + x) + C_2/(K_2 - x)$$
 where l_0 and l_x are the solubilities of the org. substance in H_2O and in salt solution of concn. x , and C_0 , C_1 , C_2 , K_1 , and K_2 are consts. The form of this equation provides for the great complexity of observed relationships. F. J. G.

Sorption of chlorine by active charcoal. III. Sorption isotherms at low pressure. K. ARII (Bull. Inst. Phys. Chem. Res. Japan, 1940, 19, 148—159; cf. A., 1939, I, 21).—Sorption isotherms for Cl_2 on sugar C activated by heating at 900°, determined at 20—40° and 0.05—50 mm. Hg, give for the amount sorbed (a) in mg. per g. the general equation $a = 165.58p^{0.0578} - (2.0968 - 0.742 \log p)\theta$. L. J. J.

Adsorption of electrolytes by active carbon. (Application of polarographic method.) Y. TERUI (Bull. Inst. Phys. Chem. Res. Japan, 1940, 19, 160—166).—The wts. adsorbed at 25° by 1 g. of active C from Ti_2SO_4 and CdCl_2 solutions at initial concns. 0.004—0.0001 and 0.005—0.0005 g.-ion per l. are 0.000733 $C^{0.519}$ and 0.000239 $C^{0.240}$, respectively, in g.-ion $\times 10^{-6}$ per l., where C is the equilibrium concn. of the ion in g.-ion per l. L. J. J.

Polarisation and colour changes due to adsorption on surface-active substances. III. E. WEITZ, F. SCHMIDT, and J. SINGER (Z. Elektrochem., 1940, 46, 222—227; cf. A., 1940, I, 109, 158).—Further cases are cited in which colourless or weakly coloured org. compounds give strongly coloured adsorbates on Al_2O_3 , SiO_2 gel, and other surface-

active substances, owing to formation of heteropolar structures on adsorption. The compounds studied include derivatives of CPh_3OH , fuchsin, and diphenylphthalide, unsaturated ketones, 1:8-diphenyloctatetraene, and $\text{CHPh}\cdot\text{CH}\cdot\text{NO}_2$. Tetramethyldiaminodiphenylphthalide ("malachite-green lactone") gives greenish-blue adsorbates on numerous compounds, even when rubbed with the dry adsorbent; the adsorbates probably contain the heteropolar betane form. The closely related rhodamine-*B* base behaves in a similar way. In general the compounds are adsorbed from C_6H_6 solution, and the adsorbates are readily eluted with EtOH or COMe_2 .

A. J. E. W.

Specific action of ultra-short waves. M. THIS (Strahlenther., 1939, 66, 494—514).—No changes in surface tension were observed when a no. of org. and inorg. compounds in aq. or colloidal solution or in suspension and a no. of foams were subjected to a high-frequency field. E. M. J.

Surface covering and energy of adhesion of organic compounds. P. A. THIESSEN and E. SMOON (Z. Elektrochem., 1940, 46, 170—180).—An expression is derived by which the energy of adhesion (W_A) of a liquid drop on an insol. solid surface can be calc. from the contact angle (θ). A photographic method for the determination of θ from drop profiles, and its application in typical cases, are described. Data are given for H_2O on $\text{C}_{30}\text{H}_{62}$, $\text{C}_{31}\text{H}_{64}$, cetyl palmitate, stearic acid, and $(\text{CH}_2)_n(\text{CO}_2\text{H})_2$ ($n = 14, 16$). θ vals. on dry and wet surfaces may differ by 30—35° if polar groups lie in the surface. W_A is a measure of the polarity of the surface, and therefore of the exposed groups; this is confirmed qualitatively by adsorption of radioactive material. At surfaces composed of Me and CO_2H groups, $W_A = \sim 52$ and 123 ergs per sq. cm., respectively. The approx. surface energies are deduced to be 3.7 and 39.25 in air, and 24.5 and -10.95 ergs per sq. cm. at interfaces with H_2O . A. J. E. W.

Oxidation of drying oils in unimolecular layers.—See B., 1940, 544.

Cybotaxis at interfaces. T. H. HAZLEHURST and H. A. NEVILLE (J. Physical Chem., 1940, 44, 592—600).—The existence of primary rolling drops is attributed to cybotaxis, a relative measure of which can be obtained from the "crit. heights" of different liquids (cf. A., 1938, I, 135). The stability of a gas bubble at a liquid-liquid interface depends on cybotaxis in the lower liquid, so that at H_2O -oil interfaces a bubble will break through from the H_2O to the oil, but not in the reverse direction, whilst oil drops will break through from the H_2O side, but H_2O drops cannot break through from the oil side. If other factors are absent, a H_2O -in-oil emulsion is more stable than an oil-in- H_2O emulsion. In accord with the theory, an emulsifying agent stabilises systems in which it is preferentially in the external phase. In thixotropic systems cybotactic groups are supposed to extend as spines from active spots on the particles and form bridges which offer resistance to shear. If equilibrium conditions of interfacial energies are satisfied, drops of an immiscible liquid

or solid particles, but not gas bubbles, can rest in a liquid-liquid interface in contact with both phases.

J. W. S.

Agaric acid and the Donnan theory of membrane equilibrium. R. J. HARTMAN, E. W. KANNING, and J. E. WEBER (J. Amer. Chem. Soc., 1940, **62**, 1302—1303).—The membrane (*a*) and H electrode (*b*) potentials for the system agaric acid (I)—HCl have been measured using a cell consisting of two saturated calomel electrodes and a "parlodin" membrane with dil. HCl outside and (I) (1.25%) in $\text{Ca}(\text{OH})_2$ or HCl inside the membrane. After ~ 2 hr. equilibrium was established and (*a*) and (*b*) were approx. equal. The membrane potential arises from the unequal distribution of H^+ and Cl^- ions since no agarate or Ca ions could be detected in the HCl (outside) solution. When (*b*) is plotted against p_{H} of the inside solution two max. at p_{H} 3.0 and 1.0 are revealed. The latter is attributed to the hydrolytic decomp. of (I) into simpler units.

W. R. A.

Measurement of thermal motion in aerosols and its use in the determination of particle size. A. WINKEL and H. WITZMANN (Z. Elektrochem., 1940, **46**, 181—185).—A method of following the motion of individual aerosol particles (radius $r < 500$ μ) in a closed cell is described. The particles are photographed at short intervals (0.05 sec.) on a regularly displaced film, and their thermal motion and rate of sedimentation are determined from measurements on the negative; r may be calc. from either of these determinations, but the second often gives high results owing to convection effects. The method is rapid and particularly suitable for determination of the r distribution in fine aerosols. Photophoresis effects can be measured. r data are given for tobacco smoke and paraffin and Sudan-red aerosols.

A. J. E. W.

Composition of mixed vapours in the cloud chamber. T. N. GAUTIER and A. E. RUAIK (Physical Rev., 1940, [ii], **57**, 1040—1041).—The difference in composition of alcohol- H_2O vapours in cloud chambers from the liquid mixtures producing them must be considered when ranges or cross-sections are calc. Curves are given for EtOH and H_2O , showing, for various temp., the v.p. of each constituent as a function of vol.-% of EtOH in the liquid.

N. M. 3.

Diffusion, Brownian movement, Loschmidt-Avogadro number, and light. F. EHRENIACHT (Physical Rev., 1940, [ii], **57**, 1050; cf. A., 190, I, 277).—The importance of the influence of magnetophoresis in the geomagnetic field on observations and theory of Brownian movement is emphasized.

N. M. B.

Molecular interactions at oil-water interfaces.

I. Molecular complex formation and stability of oil-in-water emulsions. II. Phase inversion and stability of water-in-oil-emulsions. J. H. SCHULMAN and E. G. COCKBAIN (Trans. Faraday Soc., 1940, **36**, 651—661, 661—668).—I. Optimum stability of Nujol-in- H_2O emulsions is secured by the presence of an interfacial film which is electrically charged and in a condensed state. Such films are afforded by pairs of substances, one H_2O -sol., the other oil-sol., that are

shown by experiments with an air- H_2O interface to form complexes; stability of the latter is increased by an excess of the H_2O -sol. component, whilst only a monolayer of the oil-sol. component is necessary. The stability of the films, and consequently of the emulsions also, depends mainly on the extent of interaction between the non-polar parts of the two mols., and this in turn is affected by their configuration; thus Na cetyl sulphate gives good emulsions with elaidyl alcohol but poor ones with oleyl alcohol.

II. Stability of H_2O -in-Nujol emulsions requires an interfacial film which is rigid or very viscous and electrically uncharged. Phase inversion occurs when a stable Nujol-in- H_2O emulsion is treated with multivalent ions so as to neutralise the existing charge on the film and interlink adjacent mols., or when a substance forming a non-ionised or isoelectric complex with the film is added (e.g., tannic acid at a suitable p_{H} to an emulsion stabilised with $\text{C}_{17}\text{H}_{35}\text{NH}_2\text{HCl}$). A H_2O -in-Nujol emulsion can be prepared directly by using a suitable pair of neutral substances, e.g., cholesterol and digitonin. A mechanism of phase inversion is given. The H_2O droplets in emulsions of the inverted type are contained in more or less rigid sacks and are usually not spherical.

F. L. U.

Determination of emulsifying efficiencies. L. H. COHAN and N. HACKERMAN (Ind. Eng. Chem. [Anal.], 1940, **12**, 210—213).—Apparatus and procedure for measuring the turbidity of a standard emulsion after different times of treatment are described. The method is compared with microscopical examination and with measurement of the time of creaming of the emulsions. Examination of the effect of temp. during emulsification on the turbidity of the resultant emulsion shows that temp. should be kept at $35 \pm 3^\circ$ for making accurate comparisons of emulsifying efficiency.

L. S. T.

Particle size determination of colloidal systems by the supercentrifuge. E. A. HAUSER and H. K. SCHACHMAN (J. Physical Chem., 1940, **44**, 584—591).—A method is derived for determining the particle size distribution in colloidal systems from the distribution of the material deposited on passage through a Sharples ultracentrifuge.

J. W. S.

Coefficient of thixotropy of suspensions of carbon black in mineral oil. J. E. ARNOLD and C. F. GOODEVE (J. Physical Chem., 1940, **44**, 652—670).—Details are given for the calibration and method of operation of an instrument similar to that previously described (A., 1939, I, 160) for measuring anomalous viscosity. Suspensions of C black in liquid paraffin can be milled to give const. and reproducible thixotropy. For the concn. range 4—7%, the coeff. of thixotropy (θ) of these suspensions \propto (concn.)². Temp. has little effect on θ , but has the normal large effect on the residual viscosity. The results are interpreted in terms of the impulse theory of thixotropy.

J. W. S.

Determination of the lifetime of active polymeric molecules. T. T. JONES and H. W. MELVILLE (Proc. Roy. Soc., 1940, A, **175**, 392—409).—A method of determining the distance of diffusion of a

polymerisation reaction is described and applied to the photo-polymerisation of $\text{CH}_2=\text{CH}\cdot\text{CO}_2\text{Me}$. G. D. P.

Reaction of pectins with acids. T. K. GAPONENKOV (J. Appl. Chem. Russ., 1940, 13, 281—284).—Sugar-beet Ca Mg pectate acts as a buffer substance; it gives up H^+ to alkaline, and takes up H^+ from acid solutions. R. T.

Viscosity of stannic phosphate gels during setting. M. PRASAD and K. V. MODAK (Proc. Indian Acad. Sci., 1940, 11, A, 282—287).—The η of gel-forming mixtures of various amounts of SnCl_4 and H_3PO_4 have been measured during gelation at const. temp. η increases with time, but, for a const. amount of SnCl_4 , increasing amounts of H_3PO_4 increase the rate of change of η , whilst addition of increasing amounts of SnCl_4 to a fixed amount of H_3PO_4 decreases the rate of change of η . Tentative explanations are given. Increased temp. causes a small decrease in η in the early stages of gelation, but, beyond a certain stage, the rate of change of η is increased. On the other hand, addition of EtOH diminishes the rate of change of η . W. R. A.

Kinetics of sol-gel transformation. III. Influence of temperature on the setting of some inorganic jellies. H. L. DUBE and S. PRAKASH. **IV. Influence of purity of the sol on the setting of ferric arsenate and ferric phosphate jellies.** H. L. DUBE (Proc. Indian Acad. Sci., 1940, 11, A, 318—330, 331—346).—III. The expression $\log S = \log R + p \log C$ (A., 1934, 606) has been tested for FePO_4 (I), FeAsO_4 (II), $\text{Al}(\text{OH})_3$ (III), and $\text{Zr}(\text{OH})_4$ (IV) sols of various concns., and found to be universally applicable. For (I), (II), and (IV), $\log R$ increases and p decreases slightly with temp., and for (III), $\log R$ increases and p remains const.

IV. With increasing purity of sol, vals. of p and $\log R$ increase when setting is carried out in the presence of KCl, but decrease with K_2SO_4 . It is suggested that jellies from the same sol set with different electrolytes are characteristically different in texture. W. R. A.

Elasticity of rubber.—See B., 1940, 552.

Solubility of cellulose derivatives.—See B., 1940, 519.

Morphological character of gelatinisation of nitrated cellulose membranes. G. MANGENOT and (MLLE.) M. RAISON (Compt. rend., 1940, 210, 674—676).—In general, di- and tri-nitrated cotton and ramie fibres immersed in glyceryl trinitrate, MeNO_3 , diethylene glycol nitrate (I), and cyclopentanone (II) swell to a gel and then dissolve. Di- or tri-nitrated cotton is attacked by (II) diluted with C_6H_{14} without appreciable swelling; if a dye which colours the gelatinised fibre (e.g., Sudan-red) is added, microscopical examination shows a pattern of rings and spirals on the fibre surface. The action of (I) is similar, but swelling is more pronounced. Dinitrated ramie in (I) splits off acicular fragments parallel to the axis of the fibre, and no patterns are observed. Cotton and ramie fibres thus appear to possess different structures, which are probably related to the "ring" and "fibre" structures of Frey-Wyssling (cf. A., 1937, III, 157). A. J. E. W.

Imbibition of methæmoglobin solutions by cellulose.—See A., 1940, III, 607.

Hydrogenation-dehydrogenation equilibria in gases. H. ZEISE (Z. Elektrochem., 1940, 46, 293—296).—Equilibrium consts. and degrees of dissociation for various reactions paraffin \rightleftharpoons olefine + H_2 between 300° and 1500° K. have been deduced from vals. of $\Delta G/T$ (G = free enthalpy) calc. according to Pitzer's theory (cf. A., 1937, I, 398, 557). C. R. H.

Equilibrium constants for the systems alkyl formates and alkyl acetates with stearic acid. C. BARKENBUS, C. A. ROSWELL, and A. E. MITTS (J. Amer. Chem. Soc., 1940, 62, 1251—1253).—Ester interchange with acids (acidolysis) has been studied by determining the equilibrium const. K for the reaction of Me, Et, Pr ^{α} , Pr ^{β} , Bu ^{α} , Bu ^{β} , and $n\text{-C}_5\text{H}_{11}$ formates and Me, Et, Pr ^{α} , Bu ^{α} , and $n\text{-C}_5\text{H}_{11}$ acetates with stearic acid. K decreases as the length of the alkyl group of the ester increases; higher vals. are obtained when the ester has 5 C. Lower K vals. are given by branched-chain alkyl esters than by n -alkyl esters. Activity is much less influenced by the acid than by the alkyl chain. Formates are more active than acetates and, except for Pr ^{α} CO_2Me , K vals. then decrease slightly with increasing length of the acid chain. W. R. A.

Equilibrium in an esterification reaction with perchloric acid as catalyst. H. M. TRIMBLE and E. L. RICHARDSON (J. Amer. Chem. Soc., 1940, 62, 1018—1019).—The reaction $\text{AcOH} + \text{EtOH} \rightleftharpoons \text{EtOAc} + \text{H}_2\text{O}$ in the presence of HClO_4 has been studied, using up to 25.79 mol.-% of catalyst. The apparent equilibrium const. K and the mol.-% m of HClO_4 are related by $K = 3.45 + 0.68m$ up to $m = 11$. This equation cannot be explained as due to a combination of H_2O with HClO_4 to form a definite hydrate as proposed by Jones and Lapworth (J.C.S., 1911, 99, 1427). W. R. A.

Ionisation of calcium phytate.—See A., 1940, III, 618.

Dissociation constants of arsenious acid and hydroxylamine. F. ISHIKAWA and I. AOKI (Bull. Inst. Phys. Chem. Res. Japan, 1940, 19, 136—141).—Glass electrode measurements of p_{H} at 25° in HAsO_2 - NaAsO_2 and $\text{NH}_3(\text{OH})\cdot\text{Cl}$ solutions give vals. 8.4×10^{-10} and 4×10^{-8} for the dissociation consts. of HAsO_2 and NH_2OH , respectively. L. J. J.

Strength of carbonic acid. Rate of reaction of carbon dioxide with water and hydroxyl ion. A. R. OLSON and P. V. YOULE (J. Amer. Chem. Soc., 1940, 62, 1027—1028).—The catalytic efficiency of HCO_3' indicates that the first ionisation const. of H_2CO_3 is $\sim 2 \times 10^{-4}$. The heats of activation of (i) $\text{CO}_2 + \text{H}_2\text{O} = \text{H}_2\text{CO}_3$ and (ii) $\text{CO}_2 + \text{OH}' = \text{HCO}_3'$ are 19 and 10—13 kg.-cal. per mol., respectively. W. R. A.

Phase segregation and its relation to the properties of the system palladium-hydrogen. D. P. SMITH (Trans. Electrochem. Soc., 1940, 78, Preprint 5, 53—66).—Theoretical. A survey of literature on the system Pd-H suggests that the α and β phases do not form an aggregate but are wholly segregated. Segregation offers an explanation of

anomalies, hitherto unexplained, observed in the electrical conductivity and dissociation tension of the system. C. R. H.

F.p. and solubility data for the system chlorine monoxide-water. C. H. SECOY and G. H. CADY (J. Amer. Chem. Soc., 1940, 62, 1036—1038).—The f.p.—composition curve of the system $\text{Cl}_2\text{O}-\text{H}_2\text{O}$ has been investigated over the range 0—100%. H_2O and Cl_2O are partly miscible and the point represented by Cl_2O 20.7 mol.-%, 236.8° K., is invariant. Solid HOCl is not obtained, but $\text{HOCl}\cdot 2\text{H}_2\text{O}$ separates from solutions of concn. >11.7 mol.-% of Cl_2O . The f.p. of Cl_2O is -120.6°. The solubilities at various temp. of Cl_2O in H_2O and H_2O in Cl_2O are given. W. R. A.

Phase equilibria in hydrocarbon systems. B. H. SAGE, H. M. LAVENDER, and W. N. LACEY (Ind. Eng. Chem., 1940, 32, 743—747; cf. A., 1940, I, 65).—The sp. vols. of six $\text{CH}_4-\text{C}_{10}\text{H}_{22}$ mixtures have been determined at 70—250° F. and at pressures >4500 lb. per sq. in. The partial sp. vols. in the liquid phase are given in tabular and graphical form. D. F. R.

Liquid-vapour equilibrium of the system aniline-water. J. GRISWOLD, D. ANDRES, E. F. ARNETT, and F. M. GARLAND (Ind. Eng. Chem., 1940, 32, 878—880).—The compositions of the liquid and vapour phases of the system $\text{NH}_2\text{Ph}-\text{H}_2\text{O}$ have been studied at 745 mm. over the complete composition range. The variation of the composition of the NH_2Ph and vapour phases with change of pressure at 100° is also recorded. J. W. S.

X-Ray investigation of the system $\text{Cr}_2\text{O}_3-\text{NiO}$. L. THOMASSEN (J. Amer. Chem. Soc., 1940, 62, 1134—1136).—Equilibrium diagrams indicate the spinel $\text{NiO}\cdot\text{Cr}_2\text{O}_3$ as the only compound present. The solubility of Cr_2O_3 and of NiO in the spinel is small. Lattice consts. for NiO and various mixtures are given. NiO does not dissolve Cr_2O_3 . W. R. A.

Dehydration of zinc sulphate heptahydrate by the aqueous method. Solubility curve of different hydrates. R. ROHMER (Compt. rend., 1940, 210, 669—671; cf. A., 1939, I, 523).— $\text{ZnSO}_4\cdot 7\text{H}_2\text{O}$ is slowly dehydrated when shaken with its saturated aq. solution at 70°, and lower hydrates with 6, 4, 2, and 1 H_2O are formed successively; solubility data are given for these hydrates at 30—85°. Invariant points at which pairs of the hydrates coexist in contact with the solution occur at 37.9° (7, 6), 48.8° (6, 1), 54.6° (6, 2), and 63.4° (6, 4 H_2O); the corresponding solubilities are 40.8, 43.0, 44.2, and 46.5 wt.-% of ZnSO_4 , and the densities of the congruent solutions are 1.561, 1.606, 1.627, and 1.662, respectively. A. J. E. W.

Existence of carbamate ion in the reaction of the ammonia-soda process. I. Sodium carbamate-sodium carbonate equilibrium. T. KUKI, S. NIWA, and R. HARA (J. Soc. Chem. Ind. Japan, 1940, 43, 76—79B).—The systems $\text{NH}_2\cdot\text{CO}_2\text{Na}-\text{H}_2\text{O}$ and $\text{NH}_2\cdot\text{CO}_2\text{Na}-\text{NH}_3-\text{H}_2\text{O}$ have been investigated at 0°, 25°, 50°, and 75°. When different amounts of H_2O are added to a liquid NH_3 solution of NaCl into which CO_2 is passed, stable $\text{NH}_2\cdot\text{CO}_2\text{Na}$ is the chief carbonation product over a wide range of H_2O concn. The equilibrium $\text{NH}_2\cdot\text{CO}_2\text{Na} + 2\text{H}_2\text{O} \rightleftharpoons \text{NaHCO}_3 +$

NH_4OH has been investigated between 0° and 75° from both directions and over a wide range of $[\text{NH}_3]$. The equilibria of both systems are represented for all temp. by a single curve of (mol.-% carbamate/total CO_2) plotted against (wt.-% total NH_3 /total $\text{NH}_3 + \text{H}_2\text{O}$). NH_3 stabilises $\text{NH}_2\cdot\text{CO}_2\text{Na}$. W. R. A.

Solid polyiodides of rubidium. H. W. FOOTE and M. FLEISCHER (J. Physical Chem., 1940, 44, 633—640).—In the system $\text{RbI}-\text{I}-\text{PhMe}$, RbI_3 is the only binary compound stable at either 6° or 25°. In the system $\text{RbI}-\text{I}-\text{C}_6\text{H}_6$ the ternary compounds $\text{RbI}_7\cdot 4\text{C}_6\text{H}_6$ and $\text{RbI}_8\cdot 4\text{C}_6\text{H}_6$ are also stable phases at both temp. The dissociation pressure of RbI_3 at both temp. has been calc. from the solubilities. J. W. S.

Additive compounds of iodine with alkali bromides and thiocyanates. H. W. FOOTE and M. FLEISCHER (J. Physical Chem., 1940, 44, 640—646).—Study at 6° of systems comprising an alkali bromide or thiocyanate, I, and C_6H_6 or PhMe indicates that NaBr , KBr , NH_4Br , TlBr , NaCNS , and NH_4CNS form no additive compounds with I. CsBr and KCNS form the compounds CsBrI_2 and $\text{KCNS}\cdot 6\text{I}\cdot 4\text{C}_6\text{H}_6$, respectively. The dissociation pressure of CsBrI_2 at 6° is 0.00486 mm. J. W. S.

Iodides of some multivalent metals. H. W. FOOTE and M. FLEISCHER (J. Physical Chem., 1940, 44, 647—652).—Studies at 6° of systems comprising FeI_2 , CuI , or AgI with I and C_6H_6 or PhMe indicate that FeI_3 , CuI_2 , and AgI_3 do not exist at this temp. In the systems $\text{TlI}-\text{I}-\text{C}_6\text{H}_6$ and $\text{TlI}-\text{I}-\text{PhMe}$, however, the compounds Tl_6I_8 and TlI_3 are formed, and their dissociation pressures are calc. J. W. S.

Ternary systems ethylene glycol-potassium carbonate-water and dioxan-potassium carbonate-water. K. A. KOBE and J. P. STONG, jun. (J. Physical Chem., 1940, 44, 629—633).—The solubility of K_2CO_3 in various $(\text{CH}_2\text{OH})_2-\text{H}_2\text{O}$ mixtures has been determined at 25° and 40°. The liquid phase remains homogeneous at all concns. at these temp. The solubilities in the system K_2CO_3 -dioxan- H_2O have been determined at 0°, 25°, and 40°. Two liquid phases are formed. Of 31 electrolytes tested, 16 salted out dioxan, but none salted out $(\text{CH}_2\text{OH})_2$. J. W. S.

Equilibria in the reaction $\text{ZnO} + \text{CO} \rightleftharpoons \text{Zn}_{\text{vapour}} + \text{CO}_2$. I. M. BODENSTEIN [with W. FALKENBERG] (Z. Elektrochem., 1940, 46, 132—134; cf. Maier and Ralston, A., 1926, 358).—The equilibrium has been studied by the following method: CO is passed over ZnO at temp. T , and the equilibrium mixture of Zn vapour, CO , and CO_2 is analysed, after cooling, by determination of Zn , ZnO , CO , and CO_2 in the mixture produced by partial reversal of the equilibrium. $\log K_p = -5.572$ to -1.332 at $T = 884-1326^\circ \text{K.}$, where $K_p = p_{\text{Zn}} \cdot p_{\text{CO}}/p_{\text{CO}_2}$. A. J. E. W.

Equilibrium in the reduction of molybdenum dioxide by hydrogen. K. TONOSAKI (Bull. Inst. Phys. Chem. Res. Japan, 1940, 19, 126—132).—Vals. of K_p ($p_{\text{H}_2\text{O}}/p_{\text{H}_2}$), determined by a static method at 645—823° for $0.5\text{MoO}_2 + \text{H}_2$ (1 atm.) $\rightleftharpoons 0.5\text{Mo} + \text{H}_2\text{O}$ (1 atm.) give: $\log K_p = -1444.6/T + 0.9413$; $\Delta H = 8877 - 3.755T + 1.47 \times 10^{-3}T^2 + 25150/T$;

$\Delta F^\circ = 8877 + 3.755T \log_e T - 1.47 \times 10^{-3}T^2 + 12575/T - 31.06T$. For $\text{Mo} + \text{O}_2$ (1 atm.) $\rightarrow \text{MoO}_2(\text{s.})$, $\Delta F_{298}^\circ = -120.816$ kg.-cal., $\Delta H_{298} = -131.692$ kg.-cal., $\Delta S_{298} = -36.5$ g.-cal. per degree, $S_{298}^\circ = 19.3$ g.-cal. per degree. Combination with Chipmann's data for the water-gas reaction gives for $0.5\text{MoO}_2 + \text{CO}$ (1 atm.) $\rightleftharpoons 0.5\text{Mo} + \text{CO}_2$ (1 atm.); $\Delta F^\circ = -1143 + 3.355T \log_e T - 0.00327T^2 + 0.25 \times 10^{-6}T^3 + 12575/T - 17.43T$; $\Delta H_{298} = -1.781$ kg.-cal. L. J. J.

Equilibrium in the reduction of molybdenum dioxide by deuterium. K. TONOSAKI (Bull. Inst. Phys. Chem. Res. Japan, 1940, 19, 133—135; cf. preceding abstract).—Corresponding vals. for reduction by D_2 at 685 — 845° are given by $\log K_p = 0.884 - 1211.5/T$. Combination with vals. for H_2 gives for $\text{H}_2\text{O}(\text{g.}) + \text{D}_2(\text{g.}) \rightleftharpoons \text{H}_2(\text{g.}) + \text{D}_2\text{O}(\text{g.})$: $\log K_p = -0.0573 + 233.1/T$. L. J. J.

Systems copper-nickel-sulphur and copper-nickel-arsenic. W. KÖSTER and W. MULFINGER (Z. Elektrochem., 1940, 46, 135—141).—Results of a thermal, micrographic, and magnetic study of the systems are used to construct ternary diagrams for the regions $\text{Cu-Ni-Cu}_2\text{S-Ni}_3\text{S}_2$ and $\text{Cu-Ni-Cu}_3\text{As-Ni}_5\text{As}_2$. The miscibility gap on the $\text{Cu-Cu}_2\text{S}$ side is closed with 27% of Ni. Cu_2S and Ni_3S_2 give a quasi-binary system with a eutectic at 705° (Cu 13.3, Ni 60.9, S 25.8%), at which the solid phases are Cu_2S and a $\beta\text{-Ni}_3\text{S}_2$ solid solution containing ~3% of Cu_2S ; a eutectoid change, due to the $\beta \rightarrow \alpha$ transition in Ni_3S_2 , occurs at 535° . A ternary eutectic occurs close to the Ni_3S_2 corner (Cu 14, Ni 63, S 23%), at 580° ; the solid phases are Cu_2S and Cu-Ni and $\text{Cu-Ni}_3\text{S}_2$ mixed crystals (α and θ , Cu 20.5, 5; Ni, 79, 70; S 0.5, 25%, respectively). A ternary eutectoid point occurs at Cu 2, Ni 72, S 26%, at which the α phase has Cu 5.5, Ni 94, S 0.5%, and the θ phase becomes nearly pure Ni_3S_2 . Sectional diagrams at 5, 10, 15, and 20% of S are given. In the second system, Cu_3As and Ni_5As_2 give a quasi-binary system which has a eutectic (Cu 61, Ni, 9.5, As 29.5%) at 638° ; the solid phases are Cu_3As and an extensive series of solid solutions (Cu 56.2, Ni 14.0, As 29.8% at eutectic). The ternary eutectic is at 635° , at which the solid phases are α , θ , and η mixed crystals (Cu 94, 70.5, 57; Ni 1, 2, 14.5; As 5, 27.5, 28.5%). No eutectoid change takes place above room temp. A. J. E. W.

Ternary systems. XXV. Solid solutions of some picromerites at 25° . A. E. HILL, G. S. DURHAM, and J. E. RICCI (J. Amer. Chem. Soc., 1940, 62, 1031—1036).—Continuous series of solid solutions were found at 25° for the ternary systems $\text{Mg}(\text{NH}_4)_2(\text{SO}_4)_2\text{-Cu}(\text{NH}_4)_2(\text{SO}_4)_2\text{-H}_2\text{O}$; $\text{CuK}_2(\text{SO}_4)_2\text{-NiK}_2(\text{SO}_4)_2\text{-H}_2\text{O}$; $\text{CoK}_2(\text{SO}_4)_2\text{-CuK}_2(\text{SO}_4)_2\text{-H}_2\text{O}$; $\text{ZnK}_2(\text{SO}_4)_2\text{-CuK}_2(\text{SO}_4)_2\text{-H}_2\text{O}$; $\text{ZnK}_2(\text{SO}_4)_2\text{-NiK}_2(\text{SO}_4)_2\text{-H}_2\text{O}$; and $\text{Cu}(\text{NH}_4)_2(\text{SO}_4)_2\text{-CuK}_2(\text{SO}_4)_2\text{-H}_2\text{O}$. All belong to type 1 of Roozeboom's classification. W. R. A.

Heat and free energy of formation of deuterium oxide. F. D. ROSSINI, J. W. KNOWLTON, and H. L. JOHNSTON (J. Res. Nat. Bur. Stand., 1940, 24, 369—388).—Calorimetric measurements indicate that the ratio of the heats of formation of liquid D_2O and H_2O

at 25° and 1 atm. is 1.03068 ± 0.00029 and that the ratio of the heats of vaporisation of these liquids at 25° and zero pressure is 1.03145 ± 0.00075 . By combining these results with other data various thermodynamic vals. are calc. Assuming the bond energies in H_2 and D_2 and in H_2O and D_2O to be equal, the difference between the zero point energies of H_2O and D_2O is 3548 ± 22 g.-cal. per g.-mol., in accord with previous observations (A., 1940, I, 146). J. W. S.

Heats of formation of the vanadium oxides V_2O_3 , V_2O_4 , and V_2O_5 . H. SIEMONSEN and H. ULICH (Z. Elektrochem., 1940, 46, 141—145).—The following heats of formation are obtained by calorimetric measurements (for details of method cf. also A., 1939, I, 524): V_2O_3 296, V_2O_4 342, V_2O_5 373, all ± 2 kg.-cal. per g.-mol. at 20° . The following heats of reaction are also obtained: $\text{V}_2\text{O}_3 + 0.5\text{O}_2 = \text{V}_2\text{O}_4 + 46.5 \pm 0.8$, $\text{V}_2\text{O}_3 + \text{O}_2 = \text{V}_2\text{O}_5 + 77.1 \pm 0.5$, $\text{V}_2\text{O}_4 + 0.5\text{O}_2 = \text{V}_2\text{O}_5 + 30.6 \pm 0.6$ kg.-cal., all at 20° . A. J. E. W.

Heats of formation of calcium aluminates. W. A. ROTH and U. WOLF (Z. Elektrochem., 1940, 46, 232—233).—The heat of formation of $5\text{CaO} \cdot 3\text{Al}_2\text{O}_3$ from corundum and CaO , determined by dissolution in aq. HCl , is -11.1 kg.-cal. per g.-mol. at 20° ; the heat of crystallisation is 34.7 kg.-cal. The heat of formation of $3\text{CaO} \cdot \text{Al}_2\text{O}_3$ (cf. Thorvaldson *et al.*, A., 1930, 1524) is corr. to -3.9 kg.-cal., using modern data. (All vals. ± 1.5 kg.-cal.) A. J. E. W.

Thermal data. XII. Heats of combustion of carbamide and guanidine carbonate and their standard free energies of formation. H. M. HUFFMAN (J. Amer. Chem. Soc., 1940, 62, 1009—1011).—Isothermal heats of combustion at 25° of $\text{CO}(\text{NH}_2)_2$ and guanidine carbonate have been measured calorimetrically and the vals. of ΔG° are -47.21 and -144.34 kg.-cal., respectively. The val. of ΔG° from the third law data is 80 g.-cal. < that from equilibrium data. W. R. A.

Active substances. XLIV. Heat content and lattice condition of active nickel. R. FRICKE and W. SCHWECKENDIEK (Z. Elektrochem., 1940, 46, 90—95; cf. A., 1940, I, 295).—Ni obtained by reduction of $\text{Ni}(\text{OH})_2$, " Ni_2O_3 ," or basic Ni carbonate with H_2 at $>235^\circ$ is pyrophoric, but if reduced at $>460^\circ$ the product is stable in air. The pyrophoric properties are not due to adsorbed H_2 , as they are retained after heating in N_2 at 235° for several hr.; they are lost if the container is opened under EtOH and the Ni allowed to dry in air, owing to superficial oxidation, but the Ni is readily ignited by a flame. The heats of dissolution of pyrophoric specimens in aq. HCl-ICl_3 are 0.35 — 1.75 kg.-cal. per g.-atom $>$ those of stable specimens. X-Ray powder photographs show that the difference is due not only to differences in particle size (103—149 and 266 Å., respectively), but also to irregular lattice defects and the presence of Ni in the X-ray-amorphous form. A. J. E. W.

Heat capacity data for isopropyl alcohol vapour. G. S. PARKS and C. H. SHOMATE (J. Chem. Physics, 1940, 8, 429).—Using a const.-flow method C_p vals. of Pr^iOH at 1 atm. pressure have been deter-

mined at 427.9°, 457.7°, and 480.3° K. The data are represented by $C_p = -4.54 + 0.0767T$, in much better agreement with observed data than vals. calc. from the equation of Fugassi and Rudy (A., 1938, I, 565). W. R. A.

Thermodynamic properties of paraffins and olefines. R. H. EWELL (Ind. Eng. Chem., 1940, 32, 778—783).—By extrapolation of the entropies and heats of formation of the lower hydrocarbons, rules are derived for calculating these vals. for any paraffin or olefine at 25°. The results are used to calculate the proportions of the various isomeric olefines present at equilibrium at various temp. At 150—175° all isomerides in any group have approx. equal free energy; the more highly branched isomerides are more stable below this temp., whilst the others are more stable above this temp. J. W. S.

Thermodynamic properties of sulphuric acid solutions and their relation to the electromotive force and heat of reaction of the lead storage battery. D. N. CRAIG and G. W. VINAL (J. Res. Nat. Bur. Stand., 1940, 24, 475—490).—From the partial mol. heat contents of H₂SO₄ solutions of various concns., the heat of the reaction in the Pb accumulator is redetermined and gives good agreement with the vals. derived from electrochemical data. The partial mol. heat capacities and vols. of H₂SO₄ solutions are also recalcd. and are used to compute the change in e.m.f. with change of pressure. The results confirm the double sulphate theory of the reaction (B., 1935, 773). J. W. S.

Variation of transference numbers of potassium chloride in aqueous solution with temperature. R. W. ALLGOOD, D. J. LE ROY, and A. R. GORDON (J. Chem. Physics, 1940, 8, 418—422).—Transference nos. of aq. KCl (0.01—0.10N.) at 15—45° have been measured by the moving-boundary method, using anion and cation boundaries. The Longworth function t_+^0 is linear in the concn. for the whole temp. range, but t_+ decreases with rising temp. in contradiction to the Kohlrausch generalisation. W. R. A.

Decomposition potential of sodium pyrophosphate and niobium pentoxide dissolved in molten phosphate. S. I. SKLJARENKO and O. S. DRUSHININA (J. Appl. Chem. Russ., 1940, 13, 163—169).—The decp. potential of Na₄P₂O₇ at 1010° is 0.71 v. (temp. coeff. -0.00107 v. per degree); substantially identical results are obtained with 1:2 Na₄P₂O₇-NaCl and 1:2:0.2—1.5 Na₄P₂O₇-NaCl-Nb₂O₅ mixtures. The anode process is: P₂O₇⁴⁻ → P₂O₅ + O₂; P₂O₅ + Na₄P₂O₇ → 4NaPO₃, and the cathode process is Na⁺ → Na; 10Na + Nb₂O₅ → 5Na₂O + 2Nb; Na₂O + 2Na₄P₂O₇ → 2Na₃PO₄. R. T.

Oxidation-reduction potential of co-enzyme. I. H. BORSOOK (J. Biol. Chem., 1940, 133, 629—630).—The oxidation-reduction potential at 30° (E_0') of cozymase (diphosphopyridine nucleotide) calc. from thermal data and equilibrium measurements is -0.072 ± 0.0008 v., the temp. coeff. being -0.00043. ΔF for the reaction MeCHO + 2H + 2e → EtOH calc. from this val. of E is in agreement with that calc. from thermal data. A. L.

Action of magnetism on electrolyte solutions. G. DESTRIAU (Compt. rend., 1940, 210, 697—699).—A p.d. is slowly developed between suitably disposed electrodes in a paramagnetic electrolyte solution exposed to a strong inhomogeneous magnetic field, owing to attraction of paramagnetic ions to regions of higher field strength. With saturated aq. NiSO₄ and Ni-plated Cu electrodes in a field of 6500—9500 gauss, the p.d. reaches a max. (60 mv.) in ~1 hr., and falls to 0 2—3 hr. after the field is removed. A. J. E. W.

Hydrogen electrode processes on mercury. A. MITUYA (Bull. Inst. Phys. Chem. Res. Japan, 1940, 19, 142—147).—Measurements of cathodic current (I) of 10⁻¹¹—10⁻⁸ amp. and electrode potential (ψ) on the Hg-H₂ electrode at overvoltages 0.02—0.2 v. give vals. of $\tau = -RT/F\partial \log_e I/\partial \psi = 0.3$ and 1.5 for high and low overvoltages, respectively, in agreement with Horiuti and Okamoto's electrochemical mechanism. L. J. J.

Hydrogen and oxygen overvoltages of chromium-nickel alloys in 1-molar potassium hydroxide. M. DE K. THOMPSON and G. H. SISTARE, jun. (Trans. Electrochem. Soc., 1940, 78, Preprint 4, 47—51).—With increasing [Cr] and for c.d. 0.001—1.0 amp. per sq. cm. the H₂ overvoltage of Cr-Ni alloys decreases to a min. val. between 20 and 30% of Cr and then increases. Only for c.d. 0.0001 amp. per sq. cm. is a continuous increase observed. The plot of log c.d. against overvoltage is approx. linear. There is no connexion between the overvoltage curve and the m.p. diagram. O₂ overvoltages for pure Ni and for alloy containing 10.68% of Cr are recorded. Alloys richer in Cr corrode. C. R. H.

Polarisation in cuprous oxide at low temperatures. II. V. I. LJASCHENKO (Mém. Physique, Kiev, 1940, 8, 193—195).—The potential jump in a Cu₂O-Cu anode rises linearly with external potential from 0 to 650 v., and then falls. The val. falls with rising temp. from -183° to -90°. R. T.

Peculiarities in the [polarographic] current-voltage curve for europium salt solutions and structure of the solutions. L. HOLLECK (Z. Elektrochem., 1940, 46, 69—71; cf. A., 1939, I, 338).—Polarographic curves for the reduction of aq. EuCl₃ are closely similar in form over a wide concn. range (0.0009—0.18N.), and the diffusion current is approx. const. between the steps in the curve due to the process Eu³⁺ → Eu²⁺ and the discharge of Eu²⁺. In aq. Eu(NO₃)₃, however, the curves for concns. > ~0.03N. develop irregularities in this region, showing that other discharge processes are possible; with low concns. (0.0006N.) the curves resemble those for EuCl₃. Parallel differences, ascribed to changes in ion field symmetry in the Eu(NO₃)₃ solutions, are observed in the absorption spectra (cf. Freed and Jacobson, A., 1938, I, 620). It is deduced that the additional discharge processes are due to reduction of NO₃⁻, which can reach the cathode in a reducible form only at higher concns., owing to some change in the structure of the solutions. A. J. E. W.

Polarographic studies on complexes in aqueous solution. M. VON STACKELBERG and H. VON FREYHOLD (Z. Elektrochem., 1940, 46, 120—129).—The

effect of complex formation on reversible oxidation or reduction processes at a dropping Hg electrode is discussed. In certain cases the difference in the nos. of co-ordinated addenda in the oxidised and reduced states and vals. (generally relative) of the dissociation const. of the complex ions can be approx. determined. The essential conditions are complete reversibility of the electrode process (indicated by identical half-wave potentials for oxidation and reduction) and rapid establishment of equilibrium (in \gt a fraction of a sec.) at the Hg surface; the co-ordinating group should be present in excess. These limitations are illustrated by data for Zn-C₂O₄ and -OH, Fe-C₂O₄ and -F, and Cu-NH₃ complexes. An approx. quant. agreement with theory is shown by a gradual transition from the simple Cu²⁺/Cu wave to a double Cu²⁺/Cu⁺-Cu⁺/Cu wave in aq. Cu(NO₃)₂ containing increasing amounts of Cl⁻; the change is due to the existence of CuCl₂' in presence of 0.01-0.1N-Cl⁻, and the non-existence of a similar Cu⁺ complex in this concn. range.

A. J. E. W.

Electrolytic reduction of aqueous chromic acid solutions. E. MÜLLER (Z. Elektrochem., 1940, 46, 82-90).—C.d.-*E* curves (*E* = cathode potential referred to normal calomel electrode) for the reduction process are discussed. With pure aq. CrO₃ and a C (graphite) cathode the c.d. rises rapidly to ~13 amp. per sq. dm. (*E* = 0.80-0.50 v.), owing to reduction of CrO₃; *E* then falls abruptly to ~-1.2 v., evolution of H₂ commences, and reduction ceases because an "R-film" of oxide pptd. on the surface by concn.-polarisation effects prevents CrO₃ from reaching the electrode. With a Au cathode *E* falls quickly to ~-0.6 v., and H₂ evolution (without reduction) sets in; in this case the protective "F-film" must be formed by a different mechanism, as no concn.-polarisation can occur. If SO₄²⁻ is present reduction and concn.-polarisation occur at the Au cathode with *E* = 0.4-0 v.; the SO₄²⁻ causes electrochemical dissolution of the F-film, and formation of an R-film becomes possible. The R-film on a C cathode is somewhat sol. in presence of SO₄²⁻, and some reduction takes place simultaneously with the H₂ evolution; with Au this does not occur, as the R-film is replaced by an F-film as soon as H₂ evolution commences, and SO₄²⁻ is then without effect. With C in presence of SO₄²⁻ the abrupt fall of *E* occurs at a higher c.d. (16 amp. per sq. dm.), and the process oscillates between reduction and H₂ evolution; this can be explained if F-films can be formed on parts of the non-uniform C surface. The R-film probably consists of Cr₂O₃.CrO₃, and the F-film of oriented mols. of Cr(OH)₂.CrO₄ (cf. A., 1939, I, 256).

A. J. E. W.

Electrolysis of aqueous sulphurous acid. I. F. IVANEI (J. Appl. Chem. Russ., 1940, 13, 181-184).—The cathode process is represented: H₂SO₃ + 4H → 3H₂O + S; H₂SO₃ + 6H → 3H₂O + H₂S; 2H₂S + SO₂ → 2H₂O + 3S. The yield of H₂SO₄ (anode process) is theoretical, and of S 75-80% (Pt anode, graphite cathode; [SO₂] = 0.5-1%).

R. T.

Graphical methods of kinetic chemistry. J. M. GONZÁLEZ BARREDO (Anal. Fís. Quím., 1939, 35, 12-14).—The errors observed by Caamaño (A., 1936,

1074) in the author's work (*loc. cit.*) arose from misprints and do not invalidate the formula for *n* in the differential equation $dx/dt = k(a-x)^{n-1}$.

F. R. G.

Bivalent nitrogen. I. Rate of dissociation of tetraphenylhydrazine. C. K. CAIN and F. Y. WISELOGLE (J. Amer. Chem. Soc., 1940, 62, 1163-1169).—The kinetics of the reaction between N₂Ph₄ and NO at 75° and 100° has been studied and a mechanism involving production of free NPh₂ radicals at NO pressures >0.2 atm. is advanced. Solid N₂Ph₄ rapidly decomposes at 100°. In *o*-C₆H₄Cl₂, N₂Ph₄ absorbs NO quantitatively and irreversibly to give NPh₂.NO and at 100° the half-life of N₂Ph₄ is 3.1 min. From this the calc. activation energy for the dissociation is 30±1.5 kg.-cal., *i.e.*, 10 kg.-cal. > the energy of dissociation of N₂H₄, calc. from thermochemical data.

W. R. A.

Kinetics of cracking of hydrocarbons under pressure.—See B., 1940, 510.

Calculation of weight average mol. wts. during the course of decomposition of homogeneous linear polymerides. W. H. DURFEE and Z. I. KERTESZ (J. Amer. Chem. Soc., 1940, 62, 1196-1198).—Mathematical. A formula giving the wt. average mol. wt. of a linear polymeride during chain fission has been deduced. This has been employed to calculate the average no. and wt. mol. wt. of a 100-unit polymeride undergoing fission.

W. R. A.

Kinetics of isotopic exchange between carbon dioxide, hydrogen carbonate ion, carbonate ion, and water. G. A. MILLS and H. C. UREY (J. Amer. Chem. Soc., 1940, 62, 1019-1026).—The rates of exchange of C between CO₂ and HCO₃' and of O between CO₂, HCO₃', CO₃'', and H₂O, and the rate of hydration of CO₂, have been investigated using "heavy" isotopes. Exchange between CO₂ and H₂O is due to reversible hydration alone and the energy of activation, between 0° and 25°, is ~16,800±40 g.-cal. O exchange of HCO₃' occurs through formation of CO₂ as a result of hydration at *p*_H >8 and the rate is unaffected by addition of NaCl or KCl but is accelerated by phosphate buffer. The O exchange of CO₃' with H₂O is slow but is > for simple hydration of CO₂, possibly because CO₂ reacts with OH' ions. When the concn. of OH' ions is high, the exchange is retarded because only small amounts of CO₂ are present.

W. R. A.

Kinetics of reaction between potassium persulphate and alkyl iodides. II. M. S. TELANG and V. V. NADKARNY (J. Indian Chem. Soc., 1940, 17, 219-222; cf. A., 1940, I, 121).—The rate of oxidation of EtI by aq. K₂S₂O₈ increases with dilution (*v*) according to the formula $k_v = k_1 + \omega \log v$. In passing from MeI to BuⁿI there is a simultaneous decrease of activation energy and of the probability factor, which latter is always <1. *sec.*, *tert.*, and *iso*-iodides are more reactive than the corresponding primary and *n*-compounds.

F. L. U.

Binding of sulphurous acid by glucose. F. P. SCHALAIKIN (J. Appl. Chem. Russ., 1940, 13, 263-266).—The velocity of binding of H₂SO₃ by glucose \propto concn. of substrates. At room temp. the reaction is

slow, equilibrium being attained after 13—25 days, according to the concn. R. T.

Kinetics of the formation of the Grignard reagent. II. Rate of reaction with ethyl bromide. F. C. GZEMSKI and M. KILPATRICK (J. Org. Chem., 1940, 5, 264—275; cf. A., 1938, II, 224).—Improvement in the methods of studying the rate of dissolution of Mg in EtBr—Et₂O gives uniform and reproducible results; the reaction occurs only at a contact which initiates the change, the rate of which \propto [EtBr]. The nature of the contact does not appreciably alter the velocity coeff. for the substances studied but it alters the yield of MgEtBr in some cases. H. W.

Theory of prototropic and protolytic changes. A. SKRABAL (Z. Elektrochem., 1940, 46, 146—160).—An attempt to deduce rate expressions for acid- and base-catalysed equilibrium reactions, assuming catalysis to be due to a succession of reactions between the catalyst and the substrate, leads to complex results which agree with the law of additive catalytic activity only in extreme limiting cases. Satisfactory results are obtained if simultaneous reactions are supposed to occur in the substrate and between catalyst and substrate, or if the catalyst merely changes the state of the reacting mols. without influencing the course of the reaction, as in the case of proton exchange (cf. Wegscheider, A., 1900, ii, 532). Both these cases are in accord with Brönsted's relations between catalytic activity and strength of acids and bases. A. J. E. W.

Kinetics of neutralisation. M. KILPATRICK (J. Amer. Chem. Soc., 1940, 62, 1094—1096).—The neutralisation of the trinitrophenylmethide ion (A., 1939, I, 472) is interpreted as an acid-catalysed reaction. The proposed mechanism explains the observed kinetic data. W. R. A.

Acid-catalysed esterification of aliphatic acids. H. A. SMITH (J. Amer. Chem. Soc., 1940, 62, 1136—1140).—The rate coeffs., k , for the H-catalysed esterification of β -methylvaleric acid (I), Bu ^{γ} CO₂H (II), and CHX₂·CO₂H (X = Et, Pr ^{α} , Bu ^{α} , Bu ^{β}) have been determined as previously described (A., 1939, I, 206) at 20°, 30°, 40°, and 50°. The rate for (I) \simeq that for Bu ^{β} CO₂H. (II) esterifies slowly, and the remainder very slowly; the activation energies of CHX₂·CO₂H are $>$ those of (I) and (II). The results of a simultaneous lengthening of two chains on the esterification velocity of branched-chain acids are parallel with these found when the length of a single chain is increased for n -acids (A., 1939, I, 206). A small decrease in k occurs on the first Me substitution ($<$ for Et), and little change occurs on further increase in chain length. The results are explained by means of a ring theory. W. R. A.

Inversion of sucrose. L. J. HEIDT and C. B. PURVES (J. Amer. Chem. Soc., 1940, 62, 1006—1009).—Using a method previously described (A., 1938, I, 362), the rates of inversion of sucrose are slightly $>$ those obtained by the dilatometric method under the same conditions (*loc. cit.*). The activation energy is 25.9 kg.-cal. over the range 0—35°. Log k at 0° \propto [HCl] from 0.1 to 4.4N. W. R. A.

Rates of formation of sulphoaliphatic acids. T. F. MURRAY, jun., and W. O. KENYON (J. Amer. Chem. Soc., 1940, 62, 1230—1233).—The reaction between H₂SO₄ and Ac₂O, (EtCO)₂O, and (Pr ^{α} CO)₂O in presence of the corresponding acids at 40° yields sulphoaliphatic acids (I). The rate of formation of (I) has been investigated and it is shown that H₂SO₄ disappears according to a first-order equation and its rate of disappearance is related to anhydride concn. Mechanisms for the reaction and for acylation in presence of H₂SO₄ catalyst are proposed. W. R. A.

Organic catalysts. XXI. Activation of organic catalysts. W. LANGENBECK (Z. Elektrochem., 1940, 46, 106—108; cf. A., 1939, II, 283).—The following general rules for the activation of "covalency catalysts" are enunciated: (a) the catalysed change has \leq two component reactions, of which only the slowest need be accelerated by activation. (b) Activation is a multiplicative effect, *i.e.*, the effects of activating groups are superposed on one another, and the best combination of such groups can be selected with regard to their successive introduction in the prep. of the catalyst. (c) Activating groups must be separated from the catalytically active group only by aromatic nuclei, a double bond, or a conjugated system. (d) The most favourable orientation of the activating groups (in "activating positions") cannot be decided empirically, and may vary with external factors. (e) A substituent in an activating position may cause inactivation if its effect is $<$ that of H; inactivation may therefore be a criterion of an activating position. (f) Substituents fall into two classes, first order (halogen, Me, NH₂, etc.) and second order (CO₂H, NO₂, etc.), apparently corresponding with their orienting effect in the C₆H₆ nucleus; if a first-order group has an inactivating effect, a second-order group will probably activate, and vice versa. Rules (d)—(f) are illustrated by the action of isatin and its derivatives as dehydrogenases; with basic solvents (C₅H₅N etc.) the catalytic effect of isatin-6-carboxylic acid increases with the proton affinity of the base. A. J. E. W.

Activation of aluminium chloride in the Friedel-Crafts reaction by the catalytic influence of chlorides of elements in the fourth group of the periodic system. E. OTT and W. BRUGGER (Z. Elektrochem., 1940, 46, 105—106).—The yield of 2-acetyl-1-methyl- Δ^1 -cyclopentene obtained from cyclohexane and AcCl in presence of COMe₂ by the Friedel-Crafts method (cf. Neninetzcu and Cantuniari, A., 1932, 1132) is increased from <20 to $\sim 50\%$ if the AlCl₃ used contains SnCl₄, SiCl₄, or TiCl₄; the optimum effect is obtained with $\sim 1\%$ of SnCl₄. The activating action of fourth-group chlorides on AlCl₃ has been observed in other similar cases. A. J. E. W.

Influence of the state of order on the heats of reaction of alloy catalysts. A. SCHNEIDER (Z. Elektrochem., 1940, 46, 321—325).—The heats of activation (g) of mixed crystals of AuCu₃, PdCu₃, and PdCu decrease abruptly as the crystals pass from a disorderly to an orderly state with rise in temp. Further rise in temp. brings about a more gradual

increase in q . In each case the decrease in q , which occurs over a temp. range of approx. 25° , is ~ 10 kg.-cal. These changes differ from those encountered in the case of AuCu, where an increase in q occurs under similar conditions. This difference in behaviour is also indicated by magnetic susceptibility and elasticity data. C. R. H.

Significance of magnetic condition in the activity of a catalyst. Catalytic decomposition of formic acid on cobalt-palladium alloy in relation to magnetic changes. G. COHN (Svensk Kem. Tidskr., 1940, 52, 49-64).—The decomp. of HCO_2H over Pd-Co (90 : 10) foil has been studied at 130 – 180° and 18 – 28 mm. Hg. The val. of $d \log k / d(1/T)$ changes sharply at the Curie interval (152 – 160°); $Q_{\text{paramagnetic}} - Q_{\text{ferromagnetic}} = < 5$ kg.-cal. but $A_{\text{paramagnetic}}/A_{\text{ferromagnetic}} = \sim 5$. The results are discussed in relation to structural changes over the Curie interval. M. H. M. A.

Mixed copper-chromium oxide hydrogenation catalysts. V. N. IPATIEV, B. B. CORSON, and J. D. KURBATOV (J. Physical Chem., 1940, 44, 670-679).—The activity of Cu in catalysing the hydrogenation of C_6H_6 and of isopentene at 225° and 1 atm. is considerably increased by the addition of small amounts of Cr_2O_3 . Max. activity is attained with 5% of Cr_2O_3 , and further additions lead to a decrease in activity. The activity of either pure Cu or Cu- Cr_2O_3 catalysts is considerably increased by the presence of traces of Ni. All the Cu-containing catalysts caused rapid hydrogenation of isopentene at 100° and 124 atm. Cu prepared by reduction with H_2 under pressure is less active for the hydrogenation of C_2H_4 than is Cu prepared by reduction at atm. pressure of CuO formed by decomp. of the basic carbonate. Reduced Cu is deactivated by heating at 400 – 500° . J. W. S.

[Non-]effect of ultrasonic vibrations on fused ammonia-synthesis catalyst.—See B., 1940, 524.

Oxidative catalysis in aniline-black dyeing.—See B., 1940, 521.

Cathode processes in electrolysis of solutions of copper salts in presence of selenium dioxide.—See B., 1940, 542.

Polymerisation process in electrical discharges. A. SCHECHTER and K. SIRKINA (Compt. rend. Acad. Sci. U.R.S.S., 1940, 26, 446-449).— $(\text{CN})_2$ is decomposed rapidly in a condensed spark or silent discharge, yielding N_2 and C, whilst a solid deposit of the composition C_{2n}N_n is formed on the walls of the tube. Formation of this deposit is favoured by a low c.d., and subsequent passage of a discharge through O_2 contained in the vessel coated with the deposit causes its decomp. with production of CO and N_2 . The velocity of decomp. of $(\text{CN})_2$ is independent of pressure over the range investigated (0.01 – 0.6 mm.). J. W. S.

New type of structure-sensitive photochemical phenomenon in crystals. J. A. HEDVALL, P. WALLGREN, and S. MÄNSSON (Svensk Kim. Tidskr., 1940, 52, 98-101).— CdI_2 crystals in presence of traces of H_2O , illuminated with a Hg arc, show darkening on the faces parallel to the prism axis only. The

effect is absent in the absence of H_2O . CdBr_2 in the same cryst. form shows a similar effect. CdCl_2 and CdF_2 are not affected. The effect is absent in presence of poisons for H_2O adsorption, e.g., $\text{C}_5\text{H}_5\text{N}$ and $o\text{-C}_6\text{H}_4\text{Me}\cdot\text{NH}_2$. The irradiated CdI_2 crystals showed an increased solubility in moist C_6H_6 . L. J. J.

Photochemical oxidation of oxalic acid sensitised by ferric ions. R. LIVINGSTON (J. Physical Chem., 1940, 44, 601-611).—It is confirmed that in the presence of Fe^{+++} ions and in absence of O_2 the photochemical decomp. of $\text{H}_2\text{C}_2\text{O}_4$ occurs with a quantum yield of ~ 0.5 , whilst in presence of O_2 it has a quantum yield of ~ 1 , and no detectable amount of Fe^{++} ions is formed (cf. A., 1929, 1023; 1932, 28). Red light, which is absorbed strongly by the solution, does not induce reaction. The thermal oxidation of Fe^{++} by O_2 does not induce the oxidation of $\text{C}_2\text{O}_4^{--}$. Possible mechanisms of the reaction are discussed. J. W. S.

Reactions of ethyl radicals. W. J. MOORE, jun., and H. S. TAYLOR (J. Chem. Physics, 1940, 8, 396-403).—The photolysis of ZnEt_2 , and HgEt_2 under a variety of conditions has been investigated and the mols.-% of H_2 , C_2H_4 , C_2H_6 , C_4H_{10} , and C_4H_8 in the products have been determined. For ZnEt_2 (45 – 250°) very little thermal decomp. occurred even at high temp.; Zn was deposited and thus reproducible rate measurements could not be made. In presence of H_2 , ZnEt_2 yields, at 250° , a trace ($< 1\%$) of CH_4 , but no CH_4 when H_2 is absent. At lower temp. the amount of $\text{C}_2\text{H}_4 \approx$ that of C_2H_6 and $\text{H}_2 \approx \text{C}_4\text{H}_8$; there is a considerable amount ($\sim 20\%$ at 45°) of C_4H_{10} and some higher hydrocarbons. At higher temp. the amount of C_4H_{10} increases whilst the amounts of C_2H_4 and C_2H_6 decrease. At $> 160^\circ$ H_2 begins to disappear from the reaction products; C_4H_8 remains const. throughout the temp. range. Above 200° the C_2H_6 increases whilst C_2H_4 decreases but the H : C ratio is maintained const. at 2.5. With HgEt_2 thermal decomp. is unimportant even at 250° ; much smaller quantities of H_2 are formed than with ZnEt_2 . C_4H_{10} appears to diminish as temp. increases, and the over-all rate of reaction increases three-fold in the temp. range, suggesting an increased quantum yield with temp. Addition of H_2 gives an increased rate of decomp. with more C_2H_6 and C_4H_{10} formed at lower temp. The effect of H_2 on the products formed under various conditions is discussed. Addition of N_2 or packing the reaction vessel leads to formation of more C_4H_{10} . The primary process involves formation of Et radicals. Combination of two Et radicals, bimolecularly or as a three-body process in the gas phase or at the wall, yields C_4H_{10} . C_2H_6 and C_2H_4 are formed thus: $\text{Et} + \text{Et}_2\text{Hg}(\text{Zn}) = \text{C}_2\text{H}_6 + \text{C}_2\text{H}_4 + \text{EtHg}(\text{Zn})$. Formation of C_4H_8 and H_2 appears to result from surface reactions having different mechanisms for the two metal alkyls. The activation energy of the reaction between Et radicals and H_2 is 9 ± 2 kg.-cal. W. R. A.

Effect of organic reducing agents on corrosion of metals by inorganic reagents.—See B., 1940, 533.

Potentiometric study of complex thiosulphates. Alkaline-earth silver thiosulphates. R.

PORTILLO and J. G. TÁNAGO (Anal. Fís. Quím., 1939, 35, 15—23).—The compound $\text{Ca}[\text{Ag}_2(\text{S}_2\text{O}_3)_2] \cdot 2\text{H}_2\text{O}$ was obtained similarly to the corresponding Sr salt (A., 1936, 809). F. R. G.

Displacement of chemical equilibrium as an aid to investigating the copper rust reaction. R. SCHENCK and H. KEUTH (Z. Elektrochem., 1940, 46, 298—308).—The influence of added substances on the v.p. of SO_2 in the reaction $2\text{Cu}_2\text{O} + \text{Cu}_2\text{S} \rightleftharpoons 6\text{Cu} + \text{SO}_2$ has been investigated. Au, Pd, Pt, and Ag, which form alloys or mixed crystals with Cu, increase the v.p. Fe_2O_3 , Mn_2O_3 , and Cr_2O_3 , which react with Cu_2O , reduce the v.p. In this connexion the existence of a phase $4\text{Cu}_2\text{O} \cdot \text{Cu}_2\text{Mn}_2\text{O}_4$ is reported. The addition of MnS , CoS , and BaS , which form compounds with Cu_2S , should cause a decrease in v.p., but the interpretation of the data is complicated by the reaction between added sulphide and Cu_2O . C. R. H.

Active intermediate states in the combination of oxides and their thermodynamic detection. R. SCHENCK and H. KEUTH (Z. Elektrochem., 1940, 46, 309—312).—The intermediate formation of $\text{Cu}_2\text{Cr}_2\text{O}_4$ when Cr_2O_3 is introduced into the reaction $2\text{Cu}_2\text{O} + \text{Cu}_2\text{S} \rightleftharpoons 6\text{Cu} + \text{SO}_2$ has been investigated at 700° . A stable phase consisting of a solution of $\text{Cu}_2\text{Cr}_2\text{O}_4$ in Cu_2O , the composition of which lies between $5\text{Cu}_2\text{O} \cdot \text{Cr}_2\text{O}_3$ and $4\text{Cu}_2\text{O} \cdot \text{Cr}_2\text{O}_3$, has been detected. There is also a more transient $\text{Cu}_2\text{O} \cdot \text{Cr}_2\text{O}_3$ phase which exists at the Cu_2O surface. C. R. H.

Action of water on copper pipes.—See B., 1940, 531.

Effect of the addition of salt vapour on the synthesis and the crystal growth of spinel. T. NODA and M. HASEGAWA (J. Soc. Chem. Ind. Japan, 1940, 43, 72—73B).—Larger amounts of spinel, $\text{MgO} \cdot \text{Al}_2\text{O}_3$, are obtained when alkali or alkaline-earth halides are added. The crystal habit is generally octahedral. The efficiencies of different salt series are $\text{LiX} > \text{NaX} > \text{KX}$; $\text{MgX}_2 > \text{CaX}_2 > \text{SrX}_2 > \text{BaX}_2$ ($\text{X} = \text{F}$ or Cl); $\text{M}^+\text{F} > \text{M}^+\text{Cl}$; $\text{M}^+\text{F}_2 > \text{M}^+\text{Cl}_2$ ($\text{M} = \text{metal}$). W. R. A.

Formation of cristobalite and quartz by reheating vitreous silica under high pressure, developed with the aid of explosives. A. MICHEL-LÉVY and J. WYART (Compt. rend., 1940, 210, 733—734; cf. A., 1939, I, 427).—Quartz (I) is produced by heating vitreous SiO_2 with aq. KOH under a pressure of 3000—4000 kg. per sq. cm. in Ag tubes, at 440 — 720° , for 4—13 days. With H_2O alone, cristobalite (II) is formed at 545 — 610° . In a Cu tube (I) is obtained with H_2O at 450 — 605° , showing that Cu has a mineralising effect; (II) is formed at 720 — 730° . In a Cu tube with moderate amounts of KOH (I) is produced at 540 — 585° . A. J. E. W.

Inhibiting action of minute amounts of sodium hexametaphosphate on the precipitation of calcium carbonate from ammoniacal solutions. I. Quantitative studies of the inhibition process. R. F. REITEMEIER and T. F. BUEHRER. II. Mechanism of the process with special reference to the formation of calcium carbonate crystals. T. F. BUEHRER and R. F. REITEMEIER (J. Physical Chem., 1940, 44, 535—551, 552—574).—I. Addition of

~ 1 p.p.m. of glassy $\text{Na}_6\text{P}_6\text{O}_{18}$ (I) prevents the pptn. of CaCO_3 from solutions containing $\text{Ca}(\text{HCO}_3)_2$ (200 p.p.m.) and NH_3 (550 p.p.m.), whilst cryst. NaPO_3 is relatively ineffective. At low $[\text{Ca}^{++}]$, P_2O_5 also inhibits the pptn., but the effect of PO_4^{---} is limited by the pptn. of $\text{Ca}_3(\text{PO}_4)_2$. No other inorg. salts have this property. The concn. of (I) required to prevent pptn. increases slightly with increasing $[\text{NH}_3]$ and considerably with increasing $[\text{Ca}(\text{HCO}_3)_2]$. NH_4 salts and neutral Na salts increase the efficiency of (I), suggesting an indirect effect on the activities of the Ca^{++} and HCO_3^- ions and of NH_4OH .

II. Ultramicroscopic studies of the pptn. of CaCO_3 in presence of (I) indicate that the CaCO_3 does not pass into a colloidal state and that such a state is not stabilised by (I), but it promotes the formation of larger and more distorted calcite crystals. At concns. of (I) > 0.6 p.p.m. the (I) is adsorbed by the CaCO_3 in such a way that the Ca:P ratio is ~ 300 . The inhibition is considered to involve a restricted or deranged crystallisation due to the adsorption of (I) on the crystal faces. Cryst. NaPO_3 acquires the property of inhibiting pptn. of CaCO_3 in presence of KOH. J. W. S.

Reaction of boron fluoride with aluminium chloride or bromide. E. L. GAMBLE, P. GILMONT, and J. F. STIFF (J. Amer. Chem. Soc., 1940, 62, 1257—1258).—By the action of BF_3 on AlCl_3 or AlBr_3 , under described conditions, BCl_3 or BBr_3 can be prepared. They are also prepared when fluoborate reacts with AlCl_3 or AlBr_3 . BF_3 reacts with AlI_3 to give BI_3 in small yield. No fluochlorides or fluobromides of B have been isolated. W. R. A.

Effect of the addition of salts on the crystal growth of alumina. T. NODA and Y. ISHARA (J. Soc. Chem. Ind. Japan, 1940, 43, 71—72B).— $\text{Al}(\text{OH})_3$ calcined at 1000° gave $\gamma\text{-Al}_2\text{O}_3$ which was converted into $\alpha\text{-Al}_2\text{O}_3$ by heating at 1300° . The crystal growth is accelerated by addition of vapours of various halides. The efficiency is in the order $\text{NaF} > \text{KF} > \text{LiF}$. Hexagonal plates were obtained when NaF and KF were used, whereas LiF gave a mixture of needles or columns and granular polyhedra. Alkali chlorides are less efficient than the corresponding fluorides, and $\text{NaCl} > \text{KCl} > \text{LiCl}$; NaCl and KCl gave hexagonal plates. For other series the efficiencies are $\text{CaF}_2 > \text{MgF}_2 \gg \text{SrF}_2$ and BaF_2 ; $\text{MgCl}_2 > \text{CaCl}_2$ and $\text{SrCl}_2 \gg \text{BaCl}_2$. W. R. A.

Rapid means of obtaining manganese-free iron. T. W. RAY (J. Lab. clin. Med., 1940, 25, 745—747).—A procedure for removing sol. Mn salts from Fe by a special means of pptn. and by removing the washings by centrifuging rather than by filtration, is described. C. J. C. B.

Preparation of cobalt carbonyl, cobalt nitrosyl carbonyl, and cobalt carbonyl hydride by the cyanide method. A. A. BLANCHARD and P. GILMONT (J. Amer. Chem. Soc., 1940, 62, 1192—1193).—If a small amount of a carrier, a cyanide or cysteine, is present CO is absorbed quantitatively by an alkaline suspension of a Co salt to form $\text{KCo}(\text{CO})_4$ thus: $2\text{CoCl}_2 + 11\text{CO} + 12\text{KOH} = 3\text{K}_2\text{CO}_3 + 2\text{KCo}(\text{CO})_4$ (I) + $4\text{KCl} + 6\text{H}_2\text{O}$. When the carrier is absent no absorption of CO occurs. The carrier causes

intermediate formation of volatile $\text{HCo}(\text{CO})_4$ (II), which is liberated from (I) by acids. With NO (I) gives $\text{Co}(\text{CO})_3\text{NO}$ according to: $\text{KCo}(\text{CO})_4 + \text{NO} + \text{H}_2\text{O} \rightarrow \text{Co}(\text{CO})_3\text{NO} + \text{CO} + \text{KOH} + 0.5\text{H}_2$. Spontaneous decomp. of (II) at room temp. yields $[\text{Co}(\text{CO})_4]_2$. W. R. A.

Spectrophotometry in analytical chemical research. M. G. MELLON (Proc. VII Conf. Spectros., 1939, 101—106; cf. A., 1937, I, 201).—Qual. and quant. applications are described. O. D. S.

p_{H} values of salts as an aid to their identification. N. A. TANANAIEV and J. V. KARJAKIN (J. Appl. Chem. Russ., 1940, 13, 304—308).—The p_{H} of solutions of Na salts of weak acids are in certain cases characteristic of the given salts, and may serve for their identification. R. T.

Determination by photo-electric methods. II. A. DEL CAMPO, F. BURRIEL, and L. G. ESCOLAR (Anal. Fis. Quím., 1939, 35, 41—44).—The method previously described (A., 1937, I, 199) is used for the determination of I' and Br', separately or together. In presence of each other, I' can be determined; owing to the difference in solubility of AgI and AgBr, pptn. of AgI is completed first and the end-point is indicated by a movement of the ammeter needle. F. R. G.

Determination of nitrogen in iron and steel.—See B., 1940, 530.

Determination of silicon in fluorspar or cryolite.—See B., 1940, 524.

[Analysis of] cyanide plating solutions.—See B., 1940, 536.

Gravimetric determination of sodium in natural waters with zinc uranyl acetate. O. OPARINA (Hydrochem. Mat. 1939, 11, 96—103).—The accuracy attainable in the determination of Na in aq. NaCl by the Zn uranyl acetate method has been determined. The error involved in the determination of Na in natural waters without previous removal of Ca and Mg is \times that in the determination in aq. NaCl. R. C.

Modification of the iodate method for determining barium. F. C. GUTHRIE (J.S.C.I., 1940, 59, 98).—The volumetric determination of Ba after pptn. as $\text{Ba}(\text{IO}_3)_2$ (A., 1939, I, 98) has been modified to avoid error due to loss of the ppt. during washing. The Ba is pptd. by adding a measured vol. of aq. KIO_3 , the mixture is made up to known vol., and excess of KIO_3 is determined in an aliquot of the filtered solution by means of $\text{Na}_2\text{S}_2\text{O}_3$.

Coprecipitation of barium ion with hydrous aluminium, chromic, and ferric oxides in the presence of ammonium ion. L. LEHRMAN, J. BEEN, and M. MANES (J. Amer. Chem. Soc., 1940, 62, 1014—1018).—The loss of Ba^{++} when hydrous Al_2O_3 , Cr_2O_3 , and Fe_2O_3 are pptd. by aq. NH_3 in presence of NH_4 salts is attributed partly to surface adsorption and not to the formation of BaCO_3 ; NH_4^+ partly replaces Ba^{++} in the adsorption. Occlusion of Ba^{++} occurs with Al_2O_3 , Cr_2O_3 , and Fe_2O_3 but when large amounts of oxides are pptd. the surfaces

are not saturated with Ba^{++} . Al_2O_3 and Cr_2O_3 cause post-pptn. of Ba^{++} . W. R. A.

Determination of zinc in transparent rubber articles.—See B., 1940, 552.

Determination of lead in ethyl petrol.—See B., 1940, 511.

Determination of lead in metal coatings.—See B., 1940, 532.

Flotational reaction for aluminium. I. M. KORENMAN (J. Appl. Chem. Russ., 1940, 13, 309—310).—5 ml. of solution are made alkaline with aq. NH_3 , acid with AcOH, and 2—3 ml. of buffer solution (p_{H} 4.5—5.5) are added, followed by 3—4 drops of conc. aluminon solution. The mixture is shaken with 1 ml. of CHCl_3 , when a red film forms at the phase interface in presence of 0.05—0.1 mg. of Al; Fe^{II} , Co^{II} , Zn, Ni^{II} , and Mn^{II} do not interfere, except in very large excess. R. T.

Determination of manganese and magnesium in aluminium alloys.—See B., 1940, 535.

Volumetric determination of ferric iron. F. R. BRADBURY and E. G. EDWARDS (J.S.C.I., 1940, 59, 96—98).— Fe^{+++} may be determined directly by titration with HgNO_3 in presence of excess of NH_4CNS . Fe^{++} or total Fe can be determined by titrating the solution resulting from KMnO_4 titration. The $[\text{NH}_4\text{CNS}]$ must be ≥ 10 equivs. per equiv. of Fe^{+++} . In presence of HCl more conc. than 0.1N, results are 1—2% high.

Conductometric analysis of chrome-tanning liquors.—See B., 1940, 554.

Influence of extraneous elements on the intensity ratio of line pairs used in quantitative analysis. II. W. R. BRODE and J. L. APPLETON (Proc. VII Conf. Spectros., 1939, 36—41).—The variation with concn. of Pb and Mg and of extraneous elements, Sn, Bi, Sb, Cu, Cd, Ni, and Zn, of the intensity ratio of Pb and Mg line pairs has been investigated. Intensity ratios of the Pb line 2833.07 are the least influenced by concn. and by extraneous elements. The effect of concn. on intensity ratios is small in the presence of Cu. O. D. S.

Mercury recording thermometer for use over long periods of time. L. O. COOK (J. Sci. Instr., 1940, 17, 161—162).—The shadow of a flat-section Hg column of a thermometer is cast on to a drum of bromide paper, which is rotated at intervals by a relay, worked through an intermediate Hg switch from contacts on a mains-driven clock. D. F. R.

Temperature gradient control in crystallisation from the melt. D. C. STOCKBARGER (Rev. Sci. Instr., 1939, 10, 205—211; cf. A., 1938, I, 409).—A thermo-couple in the furnace windings operates a galvanometer the mirror of which deflects a beam of 2-phase 60-cycle modulated light through a phase selector on a photo-electric cell. The output from the cell, after amplification, energises the field of a motor of which the armature is connected to 60-cycle a.c., so that the direction of deflexion of the galvano-

meter determines the direction of rotation of the motor. The motor drives heavy rheostats controlling the heating power of the furnace. A safety release in the gear train from the motor to the rheostats guards against the motor accidentally running continuously in one direction.
D. F. R.

Determination of the heat evolution of reactions at high temperature and pressure. A. LÉOPOLD (Compt. rend., 1940, 210, 672—674).—A method of following the heat effect of degrading hydrogenation and similar composite reactions is outlined. A curve obtained by plotting the heat evolved or absorbed against time can be resolved into "reaction zones," each consisting of a consecutive max. and min., which correspond with the successive stages of the reaction; the heat effect of each stage can be deduced, and the process can be suitably interrupted to determine the character of each reaction involved. Typical curves for the hydrogenation of tetrahydronaphthalene are given.
A. J. E. W.

Spectrographic analysis. I. Equipment, technique, and applications of spectrographic analysis in the [New Zealand] Dominion laboratory. S. H. WILSON (New Zealand J. Sci. Tech., 1940, 21, B, 225—240).—In an account of the lay-out and equipment of the laboratory the advantages and disadvantages of spectrographic analysis are discussed, particularly with reference to general and routine work. The spectrographic method may not result in any time-saving unless qual. results are sufficient, but its principal advantages are its ability to detect many elements in one sample at the same time and the permanent nature of the spectrogram.
C. R. H.

Spectrographic analysis at the U.S. naval torpedo station. A. MANKOWICH (Proc. VII Conf. Spectros., 1939, 19—23).—Laboratory practice is described.
O. D. S.

Prism versus grating for spectrochemical analysis. M. SLAVIN (Proc. VII Conf. Spectros., 1939, 51—58).—The grating spectrograph is superior to the prism spectrograph for qual. analysis owing to its high resolving power in the visible and near infrared. For quant. analysis a grating spectrograph corr. for astigmatism by Sirks' method is superior for elements of which the principal lines lie at $\lambda > 3600$, and can be used for all analyses.
O. D. S.

Spectroscopic suggestions. W. F. MEGGERS (Proc. VII Conf. Spectros., 1939, 73—75).—The importance, for line identification, of a narrow slit and of exact λ determination by the use of the Hartmann dispersion formula in prism spectrography is emphasised.
O. D. S.

Testing and use of concave diffraction gratings. G. R. HARRISON (Proc. VII Conf. Spectros., 1939, 59—64).—Methods of selecting, mounting, and testing gratings are described.
O. D. S.

Recording microphotometer. R. C. MACHLER (Proc. VII Conf. Spectros., 1939, 65—67).—A development of the instrument of Knorr and Albers (A., 1937, I, 427).
O. D. S.

Rapid spectrum line photometer. W. A. KERR (Proc. VII Conf. Spectros., 1939, 68—72).—Apparatus is described.
O. D. S.

Ultra-violet photo-electric spectrophotometer. D. L. DRABKIN (Proc. VII Conf. Spectros., 1939, 85—90).—The light source and amplifier system are described in detail.
O. D. S.

Use of the spectrograph and densitometer for spectrophotometry and colorimetry. A. E. RUEHLE and E. K. JAYCOX (Proc. VII Conf. Spectros., 1939, 98—100).—Absorption is measured directly by comparison of the photographic densities of the spectra of the solution and pure solvent. By this method the absorption curve of K_2CrO_4 (Int. Crit. Tables) has been reproduced to $\pm 3\%$ and Bi determined as $BiI_3 \cdot xKI$ to $\pm 6\%$.
O. D. S.

Fundamental features of the photographic process and their special manifestation in quantitative spectrochemical methods. L. W. STROCK (Proc. VII Conf. Spectros., 1939, 134—141).—Theoretical. The influence of reciprocity failure, intensity retardation of development, the Eberhard effect, and the fog effect on the log concn.-log exposure time curve is discussed.
O. D. S.

Luminous universal X-ray spectrograph of high resolving power. E. INGELSTAM (Rev. Sci. Instr., 1940, 11, 160—164).—Internal and external reflexions from the (4130) and (1340) planes respectively of a curved quartz crystal have been employed in a spectrograph covering the range 0—2.300 Å. The aperture of the instrument is 65° and by calibrating the film (sensitised on one side only) direct λ reading is possible. Rapid adjustment is facilitated by aligning indexes on two screens of fluorescent material. Technical improvements in the crystal holder have been made.
T. H. G.

New form of Sauter X-ray goniometer. D. E. THOMAS (J. Sci. Instr., 1940, 17, 141—149).—The necessary synchronism between the rotations of the crystal and film is obtained with two synchronous a.c. motors. The film can be used normal to the incident X-rays or inclined at an angle to intercept the more deviated reflected rays. In both these film positions equatorial and layer line reflexions can be obtained.
D. F. R.

Polarising comparison-microscope for use in petrographic measurements. G. T. FAUST (U.S. Bur. Mines, Rept. Invest. 3503, 1940, 7 pp.).—The use of such a microscope for investigating separated fractions of minerals, coal, and ceramic materials is described and illustrated.
L. S. T.

Mechanism of the combustion of methane. L. COPPENS (Bull. Acad. roy. Belg., 1939, [v], 25, 530—535).—In view of the supposed formation of CH_2O as an intermediate product, an apparatus for investigating the ultra-violet absorption spectrum during the process of slow partial combustion of CH_4 is described. Results show conclusively the presence of CH_2O . Causes of the presence of H_2 in the products of partial combustion are discussed.
N. M. B.

New method for investigating the refractive index and thickness of thin interference films on

glass. A. VAŠIČEK (Physical Rev., 1940, [ii], 57, 925—931; cf. A., 1939, I, 256; Blodgett, *ibid.*, 238).—The method described depends on the special condition under which light reflected by the film is plane polarised. Results of measurements are tabulated.

N. M. B.

Problems of light excitation in spark sources. H. KAISER (Proc. VII Conf. Spectros., 1939, 77—81).—Subjects discussed are: the electrical nature of the spark, the production of uniform sparks, irregular types of discharge, distribution of spark strokes over the electrode surface, action of the spark on the electrodes, light excitation in vapour clouds, cooling of vapour clouds, and the influence of surface structure on vapour projection. O. D. S.

Pulsating direct current arc discharges. J. SCHUCH (Proc. VII Conf. Spectros., 1939, 82—84).—The variation at different phases of a pulsating d.c. Fe arc of the intensity ratio with respect to Fe of the spectra of impurities (Si, Ni, Cr, Mn, and V) present in small traces has been investigated by means of a synchronised rotating aperture run off the same a.c. source as that supplying the full-wave vac. rectifier. In some cases enhancement by a factor of 23 was observed. The degree of enhancement varies greatly with phase angle, the best all-round enhancement being obtained at an angle $\sim 60^\circ$. O. D. S.

Electrodeless measurement of electrical resistance of metals and alloys at high temperature.

I. Electrical resistance of manganese. G. GRUBE and H. SPEIDEL (Z. Elektrochem., 1940, 46, 233—242).—Two methods for the determination of sp. resistance, ρ , are described; one is an a.c. bridge method depending on eddy currents, and the other a torsion method in which ρ is measured by the couple exerted on a cylindrical specimen by a rotating magnetic field. Vals. of ρ for Mn at 20—1300° ($2.6 \times 10^{-4} \Omega$. at 20°) are recorded; $d\rho/dT$ is positive up to 660°, but negative from 660° to the α - β transition point, 740°, at which ρ falls from 3.1 to $1.6 \times 10^{-4} \Omega$.; β -Mn can be supercooled to 610°. β -, γ -, and δ -Mn all have negative vals. of $d\rho/dT$, and each transformation, including melting, is accompanied by a fall in ρ (1.05—0.8, 0.75—0.70, 0.70—0.40 $\times 10^{-4} \Omega$).

A. J. E. W.

Electron counter with an aluminium cathode. P. G. BORZJAK and J. I. KOVALENKO (Mém. Physique, Kiev, 1940, 8, 197—204).—An electron counter, with a borate-Li-Be glass window and an Al cathode, described, is used to measure the work function of the thermo-electron, at 20—145°; this is $\phi = 0.57$ v. at 80—145°, and 0.12 v. at 23—63°. The results are not in conformity with any known theory of the nature of emission centres. R. T.

Technique of high-intensity bombardment with fast particles. F. N. D. KURIE (Rev. Sci. Instr., 1939, 10, 199—205).—In order to protect the cyclotron chamber from the spattering of non-refractory targets under high-intensity bombardment, the target is placed on a H₂O-cooled Cu holder in a small rectangular bombardment chamber, filled with H₂ or He at a low pressure, and separated from the cyclotron chamber by a metal window 0.0001—0.001 in. thick. The window is supported on a grid of

elongated holes, having a geometrical aperture of 93%. D. F. R.

Engineering and atomic transmutation. J. D. COCKCROFT (J. Inst. Metals, 1940, 66, 141—148).—A lecture. The construction of the cyclotron at the Cavendish Laboratory and its use in producing intense sources of the radioactive forms of the elements are described and some applications of these radioactive elements in biology and metallurgy are discussed. A. R. P.

Completely portable radioactivity meter requiring no high-voltage battery. H. F. KAISER (Rev. Sci. Instr., 1939, 10, 218—219).—A simple valve oscillator and rectifier, employing a small 135-v. wireless battery, gives a source of 1400 v. d.c. and is used in conjunction with a multi-vibrator, Ne tube coupled circuit recently proposed by Johnson (A., 1938, I, 478). D. F. R.

Opening a tube in vacuum. J. J. BRADY (Rev. Sci. Instr., 1940, 11, 181).—The seal of the tube to be opened is connected by vac. wax to a subsidiary evacuable system. The latter contains a heated hairpin of fine W wire welded between thicker W leads and flexible Cu spirals. The bend of the hairpin is connected to an electromagnetically controlled plunger by means of which it can, when white hot, be caused to touch and soften the seal to be opened. By highly evacuating the subsidiary system oxidation of the contents of the experimental tube after opening is prevented. T. H. G.

Admission of pure gases to vacuum systems. E. L. JOSSEM (Rev. Sci. Instr., 1940, 11, 164—166).—The diffusion of H₂, D₂, N₂, O₂, and CO through metals and of He and Ne through SiO₂ is reviewed. An apparatus which permits a const. flow of gas into an experimental vac. system is described. A closed tube of a suitable metal or of SiO₂ serves as a semipermeable membrane and is sealed to the experimental system either directly or via a Pt thimble sealed to the glass. Admission of gas is controlled by a coil of wire surrounding the metal tube. T. H. G.

Elementary processes in dust and fog filtration. H. WITZMANN (Z. Elektrochem., 1940, 46, 313—321).—The laws of aerosol filtration have been studied with the aid of experiments with Sudan-red G fogs and filters of known characteristics. Data for multilayer filters of cellulose and artificial silk show that the amount of aerosol removed at any one layer \propto the concn. at the layer. The absorptive powers of several paper, stone, and sintered glass filters of varying porosities have similarly been examined. The mathematical theory of dust removal by sedimentation, centrifuging, etc. is applied to aerosol filtration. The laws governing the dry filtration of aerosols and those governing filtration of liquid suspensions are fundamentally the same. C. R. H.

Separation of alloys and isotopes by the centrifuge. H. C. POLLOCK (Physical Rev., 1940, [ii], 57, 935—936).—The partial separation of the constituents of liquid Wood's metal, involving a density change of 13%, is described. The separation of isotopes in a liquid seems to be negated by the slowness of

mol. sedimentation. The separation of Cl isotopes by the evaporative centrifuging (cf. Humphreys, A., 1940, I, 36) of HCl just above its m.p., or of CCl_4 is discussed. N. M. B.

Thermal separation of isotopes. W. W. WATSON (Physical Rev., 1940, [ii], 57, 899—902; cf. A., 1940, I, 35).—The performance and separation efficiency of a simple multi-stage apparatus for various arrangement of coupling are discussed with reference to data obtained for $\text{CH}_4\text{-N}_2$ mixture separation, concn. of ^{13}C , and $^{22}\text{Ne}\text{-}^{20}\text{Ne}$ separation. Results are in agreement with the Furry-Jones-Onsager theory (cf. A., 1939, I, 395). N. M. B.

Attainment of high hydrostatic pressures. R. W. GORANSON and E. A. JOHNSON (Physical Rev., 1940, [ii], 57, 845; cf. A., 1940, I, 247).—Pressures $>200,000$ atm. were obtained in the second-stage cylinder of a two-stage cascaded pressure apparatus.

Piston displacement measurements indicated that NaCl was compressed $>20\%$ (probably $\sim 30\%$). The initial vol. compressibility to 10,000 atm. was 4.2×10^{-6} , according with the accepted val. N. M. B.

Sensitive static vapour pressure apparatus. R. C. CHANDLER (J. Physical Chem., 1940, 44, 574—583).—The apparatus comprises a differential tensiometer, the solution bulbs being immersed in a thermostat whilst the lower portion of the manometer contains a liquid piston which actuates a mirror arranged so as to measure changes in the level of the liquid with a sensitivity corresponding with a change in v.p. of $<10^{-4}$ mm. The methods of temp. control and the calibration and operation of the apparatus are described in detail. J. W. S.

Efficiency of fractionating columns.—See B., 1940, 504.

Geochemistry.

Measurement of the rate of exchange of oxygen between a water basin and the atmosphere. G. VINBERG (Compt. rend. Acad. Sci. U.R.S.S., 1940, 26, 666—669).—A method for analysing diurnal fluctuations of $[\text{O}_2]$ in the H_2O of lakes, ponds, etc. is described. F. J. G.

Hydrochemical regime of the ice-covered Volga river in connexion with the death of fish observed during winter 1939. B. A. SKOPINTZEV (Compt. rend. Acad. Sci. U.R.S.S., 1940, 26, 670—673).—Examination of recorded analytical data suggests that O_2 -deficiency in the H_2O of the Volga during winter is not due to oxidation of org. matter but to feeding by underground instead of by surface H_2O . F. J. G.

Diurnal variation in dissolved oxygen and p_{H} of natural water basins. B. A. SKOPINTZEV (Hydrochem. Mat., 1939, 11, 112—119).—In two cases studied the intensity of biochemical processes, *i.e.*, the sum of photosynthetic and oxidative processes, in samples of the H_2O contained in submerged bottles differed from that in the free H_2O . The discrepancy is ascribed to the vertical migration of zooplankton, to the vertical movement of surface layers of H_2O cooled during the night, to diffusion of O_2 from the H_2O into the air, and to fixed water-plants. R. C.

Geochemical characteristics of mineral waters of Northern Urals. V. M. LEVTSCHENKO (Hydrochem. Mat., 1939, 11, 190—204).—The genesis of the various waters is discussed in relation to the solubility of gypsum (I) and CaCO_3 in aq. NaCl, and to the activity of SO_4^{--} -reducing bacteria. The solubility of (I) in 0—4M-NaCl at 25° is recorded. R. C.

Chemical composition of Abastuman hot springs. V. M. LEVTSCHENKO (Hydrochem. Mat., 1939, 11, 205—210).—Analyses have been made and the activities of the various dissolved ions calc. R. C.

Metamorphosis of salt lakes. V. V. EPSTEIN (Hydrochem. Mat., 1939, 11, 211—231).—Owing to the solonetz soil of the West Siberian Plain the ground

H_2O contains Na_2CO_3 and most salt-lakes are very alkaline. Thus the accumulation of alkaline earths, which are pptd. as carbonates, is prevented; deposition of gypsum (I) is impossible. Only in lakes fed by hard ground H_2O do alkaline-earth cations accumulate and is (I) pptd. A classification of salt-lakes is based on these observations. R. C.

Soljony Liman. E. S. BURKSER, E. J. KITAER, and M. M. FUCHS (Hydrochem. Mat., 1939, 11, 244—254).—A hydrochemical study of the lake. R. C.

Manganese content of ore-mine waters. I. P. NOVOCHATSKI and S. K. KALININ (Compt. rend. Acad. Sci. U.R.S.S., 1940, 26, 652—654).—Ore-mine waters contain 0.2—16.0 mg. per l. of Mn, representing 0.018—3.16% of the solid residue. F. J. G.

Chemistry of ore-mine waters according to spectroscopic analysis. I. P. NOVOCHATSKI and S. K. KALININ (Compt. rend. Acad. Sci. U.R.S.S., 1940, 26, 655—658).—Results of chemical and spectroscopic analyses are given. F. J. G.

Effect of bottom deposits on the chemistry of fresh-water basins. S. V. BRUEVITSCH, R. M. PEVSNJAK, V. L. PONIZOVSKAJA, and M. A. SIBIRJAKOV (Hydrochem. Mat., 1939, 11, 131—168).—Analyses of the H_2O and the solution expressed from the ooze in Lake Bisserovo at various depths have shown a considerable accumulation of biogenic elements, other than O and nitrates, in the ooze solution as compared with the H_2O on the bottom of the lake. The distribution of the elements varies considerably with the season, and especially during the mixing of the H_2O in spring considerable amounts pass from the ooze into the H_2O . R. C.

Physicochemical investigation of Achtal muds. E. S. BURKSER and V. V. BURKSER (Hydrochem. Mat., 1939, 11, 232—243).—The high content of MgCO_3 and CaCO_3 and absence of sulphates suggest that the carbonates were formed by biochemical reduction of sulphates, the S being removed by petroleum. The dried mud recovers its original properties on moistening with H_2O . R. C.

Achtal volcanic mud. V. M. LEVTSCHENKO (Hydrochem. Mat., 1939, 11, 177—189).—Mud used for therapeutic purposes has been analysed. It has marked colloidal properties, due to a high clay content. It has probably been formed by the leaching action of salt H_2O . R. C.

Structure of meteoric iron. E. A. OWEN (Phil. Mag., 1940, [vii], 29, 553—567).—The distribution of plessite, kamacite, and taenite shown by the Widmanstätten figures of meteoric Fe-Ni is in agreement with the view that the γ phase existing at high temp. is transformed directly on rapid cooling into a metastable (α_2) form, which gives an equilibrium mixture of α and γ phases on annealing at relatively low temp. L. J. J.

Recrystallisation of magnesia. H. G. SCHUR- ECHT and V. D. FRÉCHETTE (J. Amer. Ceram. Soc., 1940, 23, 134—136).—X-Ray studies of several magnesites calcined at 800—1400° showed that the lightly calcined mineral was crypto-cryst. with a periclase structure and that "dead burning" merely increased the crystal size. J. A. S.

White tantalite. A. E. WILLIAMS (Chem. Eng. Min. Rev., 1940, 32, 239).—Partly rounded, resinous, prismatic crystals of manganotantalite of greyish-white colour occur sparingly in the alluvial deposits of the Finnis River, Northern Territory, Australia. They have d 6.37, contain Ta_2O_5 48.44, Nb_2O_5 33.10, FeO 1.26, MnO 16.12, and $(Ce,Zr)O_2$ 0.82, and show loss on ignition 0.24%. A. R. P.

Kasolite. H. BRASSEUR (Bull. Acad. roy. Belg., 1939, [v], 25, 654—659).—Kasolite (I) has (X -rays) a_0 13.22, b_0 7.04, c_0 6.81 Å, β 76° 21' giving $a_0 : b_0 : c_0$ 1.878 : 1 : 0.967 in agreement with new goniometric measurements. The formula of (I) is $UO_3 \cdot PbO \cdot SiO_2 \cdot H_2O$, with 4 mols. per unit cell and ρ_{calc} . 6.256. L. S. T.

Distribution of heavy accessory minerals in a laccolith. E. C. DAPPLES (Amer. J. Sci., 1940, 238, 439—450).—Mineral analyses for the Mt. Wheatstone, Colorado, laccolith are recorded and discussed. The zircon (I) content is characteristically low. (I), sphene, and apatite are not uniformly distributed throughout the igneous body. L. S. T.

Maucherite (nickel-speiss, placodine, temiskamite). M. A. PEACOCK (Min. Mag., 1940, 25, 557—572).—Maucherite and temiskamite are shown to be identical with Ni-speiss, a by-product in the manufacture of smalt. Analysis of material from Sudbury, Ontario, gave Ni 49.96, Co 0.20, Fe 0.84, Cu 0.69, As 45.88, S 0.97, H_2O 0.36, gangue 0.32, total 99.22; d 8.00; and from Eisleben in Thuringia Ni 50.03, Co 0.84, Fe trace, Cu 0.13, As 45.90, S 0.18, gangue 1.66, total 98.74; d 7.83. It forms radially fibrous or granular aggregates, platinum-grey in colour with a reddish tinge. Crystals are tetragonal, and the unit cell of dimensions a 6.844, c 21.83 Å. contains $Ni_{44}As_{32} = 16Ni_3As_2 - 4Ni$, there being four vacant Ni positions in the structure. L. J. S.

Iron-rich kornerupine from Port Shepstone, Natal. J. E. DE VILLIERS (Min. Mag., 1940, 25, 550—556).—Rough orthorhombic ($a : c = 0.854 : 1$) crystals of greyish kornerupine, associated with

biotite, tourmaline, and grandidierite, have d 3.445, H 6½, α 1.682, β 1.698, γ 1.699, and gave on analysis SiO_2 29.53, B_2O_3 3.5, Al_2O_3 40.97, Fe_2O_3 11.66, FeO 1.72, MnO 0.08, MgO 10.90, Na_2O 0.70, TiO_2 0.44, P_2O_5 0.12, $H_2O + 0.67 = 100.29$. The unit cell (A., 1929, 1223, prismatine) contains $(R''''_2, R'''_3, R'_6)_3(Si_3, B_4)O_{15}$. L. J. S.

Composite dike at Brockhill, Worcestershire. J. H. TAYLOR (Min. Mag., 1940, 25, 538—549).—A small dike consists of teschenite (detailed chemical analysis given) with narrow margins of quartz-dolerite. The latter has evidently resulted from reaction of the teschenitic magma with the intruded sediments. The adjacent marls have been converted into hornfels. L. J. S.

Reversible photosensitivity in artificial materials containing rutile. W. O. WILLIAMSON (Min. Mag., 1940, 25, 513—528).— TiO_2 (as finely divided anatase), after heat-treatment with Fe or Mn salts (0.40—1.00% Fe_2O_3) with conversion into rutile, rapidly becomes brown on exposure to daylight, this colour fading again in the dark. The photosensitivity is held to depend on the entry of impurities into the rutile crystals. L. J. S.

Conglomerates and lavas in the Singhbhum-Orissa iron ore series. F. G. PERCIVAL and E. SPENCER (Trans. Min. Geol. Met. Inst. India, 1940, 35, 343—364).—Characteristics and occurrences of the conglomerates and of the lava and ash beds are described. Chemical analyses [P. B. GUPTA] of two dolerites and two lavas are recorded. L. S. T.

Geology of the Searchlight district, Clark County, Nevada. E. CALLAGHAN (U.S. Geol. Survey, 1939, Bull. 906-D, 135—188).—Rock types, mineral deposits, mines, and prospects are described. L. S. T.

Quantitative mineralogical analysis applicable to nepheline syenites and other nepheline-bearing rocks. M. DORFMAN (Compt. rend. Acad. Sci. U.R.S.S., 1940, 26, 453—455).—A smoothed surface of the specimen, preferably perpendicular to the direction of mineral flow, is immersed for 5—7 hr. in 5% HNO_3 , which dissolves only the nepheline (I). The specimen is washed and dried, when feldspar and dark-coloured minerals are readily detectable. To distinguish (I) from other minerals the specimen is dipped in 0.01% aq. aluminum slightly acidified with $AcOH$, when a red varnish is formed over the (I). The composition is determined by the point method at 1-mm. intervals. J. W. S.

Zeolites of the Crimea. M. N. SCHKABARA (Compt. rend. Acad. Sci. U.R.S.S., 1940, 26, 659—661).—Descriptive. F. J. G.

Granites from the Vosges. (MME.) E. JÉRÉMIÉ (Compt. rend., 1940, 210, 571—573).—The deposits are described, and detailed chemical analyses are given for 14 specimens. A. J. E. W.

Weathering of igneous rocks. VI. Weathering-complex. M. HARADA (J. Agric. Chem. Soc. Japan, 1940, 16, 311—320; cf. A., 1938, I, 334).—The weathering complex in soils consists of three fractions, A_1 which is sol. in the dark in a solution containing 18.4 g. of $K_2C_2O_4$ and 3.2 g. of $H_2C_2O_4$

per l., A_2 which is insol. in this solution but is decomposed by hot conc. HCl, and B which is decomposed only by hot conc. H_2SO_4 . The amounts of A_1 and A_2 , and SiO_2 , Al_2O_3 , and Fe_2O_3 in A_1 , A_2 , and B in various kinds of soil from igneous rocks have been determined. When the humus in soils is oxidised by 3% aq. H_2O_2 in presence of $Fe(OH)_3$ part of the Al in A_1 becomes sol. in the $H_2C_2O_4$ -oxalate solution. J. N. A.

Geochemistry of "vapps." A. M. KUZNETZOV and D. P. PROTSCHUCHAN (Compt. rend. Acad. Sci. U.R.S.S., 1940, 26, 226—229).—The "vapps" (clays) and sandstones of Levshino, Perm, are described. The vapp crumbles in air to fine rubble and thin bent laminae. Immersion in H_2O prevents this disintegration. The average chemical analysis recorded shows high CO_2 , MgO, and CaO ($CaCO_3 + MgCO_3 = 17.89\%$). The vapps consist of a highly dispersed mass of argillaceous particles cemented with $CaCO_3$. L. S. T.

Mineralogical composition of clays and their physical and chemical properties. I. D. SEDLETZKI and S. JUSUPOVA (Compt. rend. Acad. Sci. U.R.S.S., 1940, 26, 244—246).—Data recorded and discussed for certain Middle-Asiatic clays and loesses indicate that physical and chemical properties are related to composition of the constituent minerals. L. S. T.

Principles of classification of argillaceous minerals. I. D. SEDLETZKI (Compt. rend. Acad. Sci. U.R.S.S., 1940, 26, 240—243).—The outlines of a classification based on the changes $gel \rightleftharpoons metastable minerals \rightleftharpoons stable minerals$ are put forward and discussed. L. S. T.

Preparation of thin sections of clays. A. V. WEATHERHEAD (Min. Mag., 1940, 25, 529—533).—A smooth surface, prepared by grinding on dry glass plates without the use of abrasives, is treated with amyl acetate and then with pyroxylin; after drying, the film is peeled off and mounted.

Blue rock-salt. H. PETERSSON (Nature, 1940, 145, 743—744; cf. A., 1940, I, 238).—1 p.p.m. of Au in rock-salt corresponds with a Au content in the original sea- H_2O of ~ 25 mg. per ton, which is \gg the highest val. (0.04 mg. per ton) found experimentally. L. S. T.

Formula of jordanite. D. J. FISHER (Amer. Min., 1940, 25, 297—298; cf. A., 1939, I, 226).—A discussion. The formula $Pb_{14}As_7S_{23}$ is preferred. L. S. T.

Optical properties and chemical composition of magnesian orthopyroxenes. H. H. HESS and A. H. PHILLIPS (Amer. Min., 1940, 25, 271—285; cf. A., 1938, I, 588).—Twelve chemical analyses are recorded and discussed. Optical properties and chemical composition are correlated, and a revised nomenclature for members of the enstatite-orthoferrosilite series is suggested. L. S. T.

Gratonite—a new mineral from Cerro de Pasco, Peru. C. PALACHE and D. J. FISHER (Amer. Min., 1940, 25, 255—265; cf. A., 1939, I, 284).—Gratonite has a_0 17.69, c_0 7.83 Å., $a_0 : c_0 = 1 : 0.4426$, α 114° 05'; space-group C_{3v}^5 ($R3m$). A chemical

analysis [F. A. GONYER] and a spectrographic analysis for trace elements are given. The formula is $Pb_{27}As_{12}S_{45}$ or $Pb_{27}As_{12}S_{42}$. Relationships to guitermanite, jordanite, and geocronite are discussed. L. S. T.

Geologic occurrence of gratonite at Cerro de Pasco, Peru. G. W. RUST (Amer. Min., 1940, 25, 266—270). L. S. T.

Allanite from Barringer Hill, Llano Co., Texas. J. P. MARBLE (Amer. Min., 1940, 25, 168—173).—A chemical analysis and optical properties are recorded. The ratios $Pb/(U + 0.36Th)$ and $He/(U + 0.27Th)$ are 0.428 and 8.76, respectively. The former val. indicates either a large accumulation of common Pb or extensive alteration. L. S. T.

Gold deposits of British Gold Coast (West Africa). F. E. KLINGER (Berg- u. Huttenm. Monatsh., 1940, 88, 17—22).—The Au contents of various deposits are given. R. B. C.

Placer gold in Alaska. J. B. MERTIE, jun. (J. Washington Acad. Sci., 1940, 30, 93—124).—The composition, distribution, and genesis of the Au found in Alaska placer deposits are discussed with special reference to the variations in the Ag : Au ratio. The theory that enrichment of the surface layers of the metal particles is due to slow dissolution of the Ag therefrom by surface waters is rejected. A. R. P.

Mizpah coal field, Custer County, Montana. F. S. PARKER and D. A. ANDREWS (U.S. Geol. Survey, 1939, Bull. 906-C, 8—133). L. S. T.

Geology and coal resources of the Minot region, N. Dakota. D. A. ANDREWS (U.S. Geol. Survey, 1939, Bull. 906-B, 43—84). L. S. T.

Microscopical investigation of podzol from the town Kirovsk. P. N. TSCHIRVINSKI (Compt. rend. Acad. Sci. U.R.S.S., 1940, 26, 156—158).—The material examined consists mainly of quartz grains, with felspar in secondary quantities. A detailed examination of the constituents suggests that the podzol is made up chiefly of materials of gneisses, granites, amphibolites, and to a smaller extent kyanite shales and Khibin alkaline rocks. L. J. J.

Calcium montmorillonite in saline soils. I. SEDLETZKI (Compt. rend. Acad. Sci. U.R.S.S., 1940, 26, 154—155).—Thermal and X-ray examination of Na saline soils from the left bank of the Volga and the Chernigov province show the presence of montmorillonite (I) in the $<0.2\mu$. fraction in all cases. Mg is combined undisplaceably with (I) and beidellite, and Ca undisplaceably with (I). It is suggested that Ca can displace Mg isomorphically, giving eventually $(Al_2Ca_3)(OH)_3Si_3CaSi_4O_{10}$. With decreasing alkalinity during the leaching of soils, Ca-(I) is converted into Mg-(I), in accordance with the lower cryst. lattice energy for Ca. L. J. J.

Alteration of miocene basalts in the Cantal, and nature of derived soils. H. ERHART (Compt. rend., 1940, 210, 537—539).—The changes are discussed with reference to detailed chemical analyses [RAOULT] and soil p_H data. A. J. E. W.