

# BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

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

JANUARY, 1939.

**Fine structures of  $H_\alpha$  and  $D_\alpha$  under varying discharge conditions.** R. C. WILLIAMS (Physical Rev., 1938, [ii], 54, 558—567).—The fine structures were observed under varying conditions of excitation in a discharge tube with pure  $H_2$  and pure  $D_2$  at liquid air temp. The positions of fine structure components were invariant with changing discharge conditions. Analyses of intensities were made. The average separation of the two main components was  $0.319 \text{ cm.}^{-1}$  for  $H_\alpha$  and  $0.321 \text{ cm.}^{-1}$  for  $D_\alpha$ . The second and third most intense components were resolved in  $D_\alpha$  but not in  $H_\alpha$ ; the average interval was  $0.130 \text{ cm.}^{-1}$ . The respective theoretical intervals are  $0.328$  and  $0.108 \text{ cm.}^{-1}$ . N. M. B.

**Effect of positive-ray collisions on the polarisation of spectral lines in the magnetic field.** J. STARK and H. VERLEGER (Physikal. Z., 1938, 39, 763—767).—The intensity of spectral lines of H, He, and  $C^+$  when collisions occur between the radiating gas and positive rays in a magnetic field has been determined when the direction of the positive rays is perpendicular or parallel to the magnetic field. The intensity in directions parallel ( $I_p$ ) and perpendicular ( $I_s$ ) to the magnetic field was determined. For collisions perpendicular to the magnetic field,  $I_p/I_s < 1$ , whilst for collisions parallel to the field,  $I_p/I_s > 1$ .  $I_p/I_s$  was also determined for  $H_\alpha$ ,  $H\beta$ , and  $H\gamma$  for fields of 0—20,000 gauss. The deviation of  $I_p/I_s$  from unity decreases with decreasing pressure. A. J. M.

**Series spectrum of helium. I.** W. VON MEYEREN (Z. Physik, 1938, 111, 46—54).—Light from He at  $1.5 \times 10^{-4} \text{ mm.}$ , excited by the impact of fast electrons (up to 1800 e.v.), is photographed in the short-wave visible and the ultra-violet ranges, and the intensity distribution within the series is discussed. Seven new members of the secondary singlet series  $2^1P-n^1D$  are found. L. G. G.

**Connexion between strengthening and weakening of series by the electric field.** R. RITSCHL and R. SIKSNA (Physikal. Z., 1938, 39, 767—772).—The variation of intensity of two strong pairs of lines of ortho-He ( $2s-4p$ ,  $2p-4p$ ,  $2s-5p$ ,  $2p-5p$ ) and the line  $2S-4P$  of para-He in an electric field has been investigated. In addition to the increase of intensity of new transitions caused by the application of the field, there is simultaneous weakening of the lines present without a field, as the field strength is increased. For the  $2p-4p$  and  $2p-5p$  lines there are max. intensities for fields of 170 and 150 kv. per cm., respectively. A. J. M.

**Negative bands of  $^{14}\text{N}-^{15}\text{N}$ .** R. W. WOOD and G. H. DIEKE (J. Chem. Physics, 1938, 6, 734—739).—

The negative bands of  $N_2$  containing about 15% of  $^{15}\text{N}$  have been photographed, and the  $0 \rightarrow 0$ ,  $1 \rightarrow 0$ , and  $0 \rightarrow 1$  bands of the  $^{14}\text{N}-^{15}\text{N}$  mol. analysed. These bands are situated in agreement with the predictions of the elementary theory of isotopic shifts. They show no intensity alternations and perturbations at the positions in which these occur in the corresponding bands of the  $^{14}\text{N}-^{14}\text{N}$  mol. W. R. A.

**Zeeman effect in the spectrum of neon.** J. B. GREEN and J. A. PEOPLES, jun. (Physical Rev., 1938, [ii], 54, 602—605).—Data for  $\lambda\lambda$ , classifications,  $J$  vals., patterns, and  $g$  vals. for about 250 lines of Ne in fields of 27,000—32,000 gauss are tabulated. A high-frequency electrodeless discharge was employed, and the  $\lambda\lambda$  range was 3100—9000 Å. A no. of "forbidden" lines appear. Calc. and experimental  $g$  vals. show close agreement. N. M. B.

**Structure of the configurations of high azimuthal quantum number in Cu II and the rare gases.** G. H. SHORTLEY and B. FRIED (Physical Rev., 1938, [ii], 54, 749—753; cf. A., 1933, 1226).—Mathematical. An analysis of data due to Shenstone (cf. A., 1936, 537). N. M. B.

**Interferometric wave-length comparison of the red cadmium radiation emitted by different sources.** W. E. WILLIAMS and D. V. GOGATE (Proc. Roy. Soc., 1938, A, 167, 509—516).—A comparison is made of the line  $\lambda$  6438 Å. emitted by a G.E.C. Osira Cd lamp and a Schuler hollow-cathode discharge. The greatest difference recorded was  $< 1$  part in  $10^8$ . G. D. P.

**Nuclear spin of iodine. III. Further measurements on the fine structures in the first spark spectrum.** S. TOLANSKY and G. O. FORESTER (Proc. Roy. Soc., 1938, A, 168, 78—103; cf. A., 1936, 262).—Earlier measurements are extended into the ultra-violet. The fine structure of 58 lines is known and 39 are allocated to terms which go to the ( $^4S$ ) or ( $^2D$ ) series limit. G. D. P.

**Radiation from the high-pressure discharge in mercury vapour in different spectral regions.** J. KERN (Z. tech. Physik, 1938, 19, 249—254).—The light efficiency and radiation efficiency in the medium and long-wave ultra-violet regions of the radiation from a high-pressure Hg discharge were determined under various conditions. The ultra-violet efficiency depends only slightly on pressure. A. J. M.

**Absorption spectrum of thorium.** T. L. DE BRUIN and J. N. LIER (Proc. K. Akad. Wetensch. Amsterdam, 1938, 41, 956—964).—Intensities and  $\lambda\lambda$  for about 450 lines in the range 5049—2187 Å., obtained

by the methods of the under-water spark and the exploding wire, are tabulated. N. M. B.

**Excitation of absorption lines in outer atmospheric shells of stars.** O. STRUVE and K. WURM (*Astrophys. J.*, 1938, **88**, 84—109).—The anomalous intensities of He I in the outer shells of certain *B* stars have been investigated. Physical conditions in the outer shells are discussed. L. S. T.

**Multiplet calibration of the Arcturus spectrum.** S. G. HACKER (*Astrophys. J.*, 1938, **88**, 65—83).—The effective photospheric temp. is found to be  $3925^{\circ} \pm 75^{\circ} \text{K}$ ., using  $5740^{\circ} \text{K}$ . for that of the sun, the mean electron pressure in the star's atm.,  $3.9 \times 10^{-8} \text{ atm.}$ , and the level of ionisation, 7.7 v. The relative abundances of the elements present in the star are tabulated. L. S. T.

**Spark potential curves of inert gases at low pressures.** H. KLEMPERER (*Z. tech. Physik*, 1938, **19**, 270).—Spark potential curves for technically pure inert gases are given, and other data relative to the discharge in these gases are collected. A. J. M.

**Quantum-mechanical calculation of the effect of pressure on spectral lines.** I. C. REINSBERG (*Z. Physik*, 1938, **111**, 95—108).—The general theory of broadening and displacement due to pressure is developed as an expansion of the Lorentz theory of impact damping and Margenau's theory of energy distribution at impact. L. G. G.

**Position numbers of electron terms in a partly ionised gas.** K. H. RIEWE and R. ROMPE (*Z. Physik*, 1938, **111**, 79—94).—Term position nos. of Hg and H are calc. and it is shown that neglect of the degree of ionisation can lead to errors in many problems connected with discharge in gases. H. C. G.

**Theory of complex spectra.** G. H. SHORTLEY and B. FRIED (*Physical Rev.*, 1938, [ii], **54**, 739—748).—Mathematical. An extension and simplification of existing theory. N. M. B.

**Scattering and photo-electric absorption of high-voltage X-rays in nitrogen.** H. C. TRUEBLOOD and D. H. LONGBRIDGE (*Physical Rev.*, 1938, [ii], **54**, 545—554).—An expansion-chamber investigation of 100—800 ke.v. X-radiation passing through  $\text{N}_2$ , and a determination of the energy of recoil electrons as a function of the angle of emission, and the angular distribution of photo-electrons as a function of energy, is described. Results are in agreement with the Klein-Nishina formula when allowance is made for the presence of photo-electrons distinguished from recoils by the criterion of max. Compton energy. A preliminary val. of the ratio of recoil electrons to photo-electrons is obtained. N. M. B.

**Secondary emission from clean tungsten.** E. COOMES (*Physical Rev.*, 1937, [ii], **51**, 1008).—This emission has been investigated over an energy range for primary electrons of 50—2000 v. Secondary emission is increased when Th is evaporated on to the clean W. L. S. T.

**Optical properties and photo-electric emission in thin films of alkali metals.** H. E. IVES and H. B. BRIGGS (*J. Opt. Soc. Amer.*, 1938, **28**, 330—

338).—The photo-electric emission from thin films ( $< 10^{-8} \text{ cm.}$ ) of K, Rb, and Cs on a Pt-Ir base has been determined. The experimental cell included a device for local cooling to prevent conducting films on the glass. The results support the authors' theory (cf. A., 1937, I, 285) that the emission  $\propto$  the rate of absorption of energy in the topmost layer of the alkali-metal film. The theory is further developed and gives close agreement with experiment. J. A. K.

**Products of dissociation of benzene vapour by electron impact.** P. KUSCH, J. T. TATE, and A. HUSTRLID (*Physical Rev.*, 1937, [ii], **51**, 1007).—At an electron energy of 75 v. the ions that have been identified in the mass-spectrograph, and their intensities relative to  $\text{C}_6\text{H}_6^+$ , are  $\text{C}_6\text{H}_6^+$ , 100;  $\text{C}_6\text{H}_5^+$ , 17;  $\text{C}_6\text{H}_4^+$ , 5;  $\text{C}_6\text{H}_3^+$ , 2;  $\text{C}_6\text{H}_2^+$ , 4;  $\text{C}_6\text{H}^+$ , 1.3;  $\text{C}_6^+$ , 0.25;  $\text{C}_5\text{H}_3^+$ , 2.5;  $\text{C}_5\text{H}_2^+$ , 0.6;  $\text{C}_5\text{H}^+$ , 0.5;  $\text{C}_5^+$ , 0.02;  $\text{C}_4\text{H}_4^+$ , 1.3;  $\text{C}_4\text{H}_3^+$ , 1.5;  $\text{C}_4\text{H}_2^+$ , 1.2;  $\text{C}_4\text{H}^+$ , 2;  $\text{C}_4^+$ , 0.3;  $\text{C}_3\text{H}_3^+$ , 6.7;  $\text{C}_3\text{H}_2^+$ , 3;  $\text{C}_3\text{H}^+$ , 2.5;  $\text{C}_3^+$ , 0.3;  $\text{C}_2\text{H}_3^+$ , 1.4;  $\text{C}_2\text{H}_2^+$ , 1.2;  $\text{C}_2\text{H}^+$ , 0.15;  $\text{C}_2^+$ , 0.03;  $\text{CH}_3^+$ , 0.2;  $\text{CH}_2^+$ , 0.02;  $\text{CH}^+$ , 0.03;  $\text{C}^+$ , 0.05;  $\text{H}_2^+$ ;  $\text{H}^+$ ;  $\text{C}_6\text{H}_6^{++}$ , 3.3;  $\text{C}_6\text{H}_5^{++}$ , 0.4;  $\text{C}_6\text{H}_4^{++}$ ;  $\text{C}_6\text{H}_3^{++}$ , 0.9;  $\text{C}_6\text{H}_2^{++}$ ;  $\text{C}_6\text{H}^{++}$ , 0.01. Appearance potentials of some of the ions have been obtained. L. S. T.

**Scattering of fast electrons.** W. A. FOWLER (*Physical Rev.*, 1938, [ii], **54**, 773).—A comparison of electron scattering data (cf. A., 1938, I, 546) with unpublished computations of Williams on plural and multiple scattering. N. M. B.

**Internal tension and dynamics of the radiating electron.** T. DE DONDER and J. GÉHÉNIAU (*Compt. rend.*, 1938, **207**, 719—722).—A mathematical derivation of Dirac's equations (A., 1938, I, 551) is given. A. J. E. W.

**Helium-deuteron and deuteron-deuteron nuclear reactions.** M. L. OLIPHANT (*Physical Rev.*, 1938, [ii], **54**, 772).—A correction of Rublig (cf. A., 1938, I, 547) and of Myers (cf. *ibid.*, 551). N. M. B.

**Application of Clay's new value of the Jaffé-Zanstra coefficient for air to high-pressure ion current measurements.** J. W. BROXON and G. T. MERIDETH (*Physical Rev.*, 1938, [ii], **54**, 605—608).—Data previously reported (cf. A., 1938, I, 426) are analysed with the help of Clay's new coeff. val.  $1.24 \times 10^{-5}$  for air. Revised curves are given and discussed. N. M. B.

**Initial recombination of ions.** L. ONSAGER (*Physical Rev.*, 1938, [ii], **54**, 554—557).—Mathematical. The probability of recombination of a pair of ions of given initial separation is computed from the laws of Brownian motion. N. M. B.

**Formation of negative ions at metal surfaces.** R. A. SMITH (*Proc. Roy. Soc.*, 1938, **A**, 168, 19—42).—A theoretical discussion of the conditions under which ions are formed at a metal surface. Detailed calculations are given for the conversion of  $\text{Hg}^+$  into  $\text{Hg}^-$  at a Ni surface. W is stated to behave similarly. The process accounts for the observations of other workers. The formation of at. negative ions from mol. positive ions is considered. G. D. P.

**New process of negative-ion formation. IV.** F. L. ARNOT and C. BECKET (*Proc. Roy. Soc.*, 1938, **A**,

168, 103—122; cf. A., 1937, I, 274).—The process consists of the capture of one electron by a positive ion at a metal surface; the excited atom may then capture a second electron, so forming a negative ion of the same element as the incident positive ion, or the excited atom may transfer its energy to an adsorbed atom which then captures an electron from the metal surface forming a negative ion of an element different from the incident positive ion. The results of previous work are reviewed in the light of the second of the above processes. G. D. P.

**Effective cross-section of positive alkali ions with respect to gas molecules.** K. H. BRACEWELL (Physical Rev., 1938, [ii], 54, 639—643).—A mass-spectrographic investigation of the absorption of 40—400-v.  $\text{Na}^+$  ions in  $\text{H}_2$ ,  $\text{N}_2$ , and  $\text{O}_2$  is described, and curves showing the absorption with reference to neutralisation, retardation, or small angle scattering are given. Mean free paths and effective cross-sections are a function of gas pressure, ion velocity, and the nature of the gas-ion combination. Mean free paths decrease in the order  $\text{H}_2$ ,  $\text{N}_2$ ,  $\text{O}_2$ , and cross-sections in the reverse order, apparently approaching kinetic theory vals. at zero accelerating potential. N. M. B.

**Positive rays and their application in mass spectrography.** L. CARTAN (Ann. Physique, 1938, [xi], 10, 426—502).—The optics of positive rays have been systematically investigated with a view of perfecting the technique of the mass spectrograph. With a newly designed spectrograph, which is described, the isotope  $^{12}\text{C}$  has been obtained pure. W. R. A.

**Some chemical properties of element 43. II.** C. PERRIER and E. SEGRÈ (Atti R. Accad. Lincei, 1938, [vi], 27, 579—581; cf. A., 1937, I, 545).—Further methods of isolating the active element obtained by bombarding Mo with deuterons in a cyclotron are described, especially its separation from Re. The activity is due to isotopes of element 43. Some chemical properties of this element are described. O. J. W.

**Nuclear isomerism in element 43.** E. SEGRÈ and G. T. SEABORG (Physical Rev., 1938, [ii], 54, 772).—Radioactive Mo of half-life 65 hr. (cf. Sagane, A., 1938, I, 594) decays into a 6-hr. activity (ascribed to element 43) which emits a line spectrum of electrons and also X- and  $\gamma$ -radiation. Identifications and explanations are discussed. N. M. B.

**Isotopic constitution of mercury and lead.** A. O. NIER (Physical Rev., 1937, [ii], 51, 1007).—A new magnetic mass-spectrograph allows the search for rare isotopes to be extended beyond the limits attainable previously. Hg consists of the isotopes 204, 202, 201, 200, 199, 198, and 196 present in abundances  $\propto$  22.7, 100, 44.6, 78.7, 57.6, 34.2, and 0.50, respectively. Upper limits are set for other possible isotopes. A sample of ordinary Pb consisted of the isotopes 208, 207, 206, and 204 (cf. A., 1938, I, 426). L. S. T.

**Isotopes of uranium and lead.** A. C. LANE (Science, 1938, 88, 240).—Historical. L. S. T.

**Stopping of the recoil electrons produced by the fluorine + proton  $\gamma$ -rays.** J. J. TURIN and H. R. CRANE (Physical Rev., 1937, [ii], 51, 1012).—The recoil electrons produced by the 6-Me.v.  $\gamma$ -radiation from F bombarded with protons have been passed through absorbers of C and Pb and the losses measured. In C, the losses agree with the theoretical losses due to electron collisions, but in Pb, radiative losses play a large part, and increase with an increase in energy of the incident particle. L. S. T.

**Production of high-energy  $\alpha$ -particles by the Princeton cyclotron.** M. G. WHITE, M. C. HENDERSON, W. J. HENDERSON, and L. N. RIDENOUR (Physical Rev., 1937, [ii], 51, 1012—1013).—Doubly-charged He ions have been accelerated in a cyclotron to 9 Mv. at a current of 0.05  $\mu\text{a}$ . The He beam can be separated almost completely from possible deuteron contamination. L. S. T.

**Retardation of neutrons in hydrogen-containing substances.** S. FLUGGE (Z. Physik, 1938, 111, 109—124).—An extension of the diffusion theory of thermic neutrons is described for calculating the distribution of resonance neutrons in a sphere of paraffin. The Fermi  $1/v^2$  law is shown to hold for all parts within the sphere. Calc. and experimental vals. of certain consts. are compared. L. G. G.

**Disintegrations and production of neutrons by bombardment of Be and of B with  $\alpha$ -particles from Po.** G. BERNARDINI (Nuovo Cim., 1938, 15, 220—225).—Range-distribution curves for the emission of neutrons from Po + Be and Po + B have been obtained. The group of neutrons from Be of 2.7 Me.v. is due to an excited  $^{12}\text{C}$  level. The energies of other groups of neutrons emitted are 4.4, 6.5, and 8 Me.v. With B two groups of neutrons of 3.2 and 4.3 Me.v. have been studied. The latter are probably due to  $^{11}\text{B}$ . O. J. W.

**Photographic effects produced by cadmium and other elements under neutron bombardment.** J. G. HOFFMAN and R. F. BACHER (Physical Rev., 1938, [ii], 54, 644—645).—Investigations show that the blackening of X-ray film in contact with Cd exposed to a neutron source is due to slow neutrons and not to  $\gamma$ -rays. If foils of C, Al, Ni, Mo, Sn, W, and Pb are substituted for Cd in thicknesses containing the same no. of atoms per sq. cm. the blackening is much less intense but increases with at. no. Possible mechanisms are discussed. N. M. B.

**Production of collimated beams of monochromatic neutrons in the temperature range 300—10° K.** L. W. ALVAREZ (Physical Rev., 1938, [ii], 54, 609—617).—An electrical velocity selector for the production and use of highly collimated beams of pure thermal neutrons, variable as to mean temp. over a wide temp. range, is described. Fast neutron effects are entirely eliminated. Qual. verification of the  $1/v$  law for B has been extended to 30° K. N. M. B.

**Neutron groups.** Y. SUGIURA and O. MINAKAWA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 1299—1307).—The activity of  $D + D$  neutrons has been measured by means of detectors placed at a fixed distance from the neutron source,

with paraffin plates of various thicknesses interposed between the source and the detector. The detectors used were Ag (22 sec.), Rh (44 sec. and 4.2 min.), In (54 min.), and I (25 min.). Comparison of the curves of activity against thickness of paraffin plate for the various detectors indicates approx. the order of the lowest resonance energies of different neutron groups as Rh (44 sec.) > In > Ag > I > Rh (4.2 min.).

W. R. A.

**Scattering of slow neutrons by paramagnetic salts.** M. D. WHITAKER, H. G. BEYER, and J. R. DUNNING (Physical Rev., 1938, [ii], 54, 771; cf. A., 1937, I, 544).—Measurements of the effective cross-section of MnSO<sub>4</sub>, MnS, MnO, and Fe<sub>2</sub>O<sub>3</sub> compared with the additive cross-sections of the constituent elements are tabulated. Results show an increase in scattering of the salts over the additive cross-sections. Measurements of the angular distribution of the scattered neutrons are discussed.

N. M. B.

**Resonance absorption of slow neutrons.** A. E. DOWNING and C. D. ELLIS (Nature, 1938, 142, 793).—The positions of resonance levels of certain elements for slow neutrons have been measured by a paraffin absorption method. Bi has levels at ~1 v. and ~11 v., representing high excited states of Ra-E, Th near 2 and 18 v., U at ~5 and ~30 v., and Co at ~1 v. Two resonance levels indicated for I explain the anomalous results obtained recently by Michiels (A., 1938, I, 547).

L. S. T.

**Neutron-proton ratio of natural radioactive elements and relationships in the disintegration series.** W. MINDER (Helv. Phys. Acta, 1938, 11, 497—506).—A plot of the neutron-proton ratio (*R*) against *Z* shows that the three known disintegration series are entirely analogous between *Z* = 82 and 90. A gap between the U and Th series suggests the existence of a fourth disintegration series involving the known  $\alpha$ -emission reaction of Ac. A no. of hypothetical reactions giving rise to such a series, and providing links between the known series, are discussed. Relationships between *R* and nuclear stability are also discussed.

A. J. E. W.

**Capture of protons by oxygen.** L. A. DUBRIDGE, S. W. BARNES, and J. H. BUCK (Physical Rev., 1937, [ii], 51, 1012).—The capture of protons of various energies by O<sub>2</sub> to yield radio-F has been investigated by means of the cyclotron. The reaction commences at a proton energy of ~1.4 Me.v., rising sharply as far as 2.5 Me.v. The preliminary val. obtained for the period of radio-F is 81 sec., which is > that reported for the radio-F produced in other reactions. The presence also of a much longer period is indicated.

L. S. T.

**Transmutation of argon and chlorine by  $\alpha$ -particles.** E. POLLARD, H. L. SCHULTZ, and G. BRUBAKER (Physical Rev., 1937, [ii], 51, 1014).—When bombarded by  $\alpha$ -particles from Ra-C or Th-C', A and Cl emit neutrons; the yield from A is > that from Al, whilst that from Cl is approx. one quarter as great. Suggested reactions are  $^{40}\text{A} + ^4\text{He} = ^{43}\text{Ca} + ^1_0\text{n}$  and  $^{37}\text{Cl} + ^4\text{He} = ^{40}\text{K} + ^1_0\text{n}$ . Vals. for the nuclear radii are discussed.

L. S. T.

**K-Electron capture in  $^7\text{Be}$ .** G. BREIT and J. K. KNIPP (Physical Rev., 1938, [ii], 54, 652—656).—A discussion of various data and related theory.

N. M. B.

**Nuclear transmutations of the lithium isotopes.** L. H. RUMBAUGH, R. B. ROBERTS, and L. R. HAFSTAD (Physical Rev., 1938, [ii], 54, 657—680; cf. A., 1937, I, 5, 438; 1938, I, 427).—Yield curves were obtained for 8 main transmutation processes of  $^6\text{Li}$  and  $^7\text{Li}$  produced by proton and deuteron bombardment. Relative and approx. abs. yields are computed. The formation and decay processes of  $^8\text{Li}$  were investigated; the mass is  $8.02499 \pm 0.00020$ . The range-distribution of the delayed  $\alpha$ -particles from  $^8\text{Li}$  was measured and its interpretation is discussed. The observed reaction energy of  $^6\text{Li} + n \rightarrow ^4\text{He} + ^3\text{H}$  is 4.97 compared with 4.56 Me.v. derived from the masses involved. There was no evidence of  $^7\text{Li} + n \rightarrow ^8\text{Li}$ . The process  $^6\text{Li} + ^2\text{D} \rightarrow ^7\text{Be} + n$  was indicated by measurements of energies of the neutrons produced.  $^7\text{Be}$  is radioactive and is converted into  $^7\text{Li}$  by K-electron capture followed by  $\gamma$ -ray emission in ~10% of the transitions.

N. M. B.

**Radioactivity induced by  $\alpha$ -particles.** L. N. RIDENOUR, W. J. HENDERSON, M. C. HENDERSON, and M. G. WHITE (Physical Rev., 1937, [ii], 51, 1013).—The radioactivity produced by the bombardment of light elements with 0.05  $\mu\text{amp.}$  of 9-Me.v.  $\alpha$ -particles produced by a cyclotron has been investigated. The accepted val. of 3.3 min. for the half-life of  $^{30}\text{P}$  is probably incorrect; the val. now obtained is  $2.52 \pm 0.05$  min. Half-life periods for the radioelements produced from B, N, and Al are 10.5 min. ( $^{13}\text{N}$ ), 69 sec. ( $^{17}\text{F}$ ), and 2.52 min. ( $^{30}\text{P}$ ), respectively.

L. S. T.

**Energy levels of the  $^{24}\text{Mg}$  nucleus.** A. SUGIMOTO (Nature, 1938, 142, 754—755).—An energy level scheme for  $^{24}\text{Mg}$  which accounts for the energy and relative intensities of the  $\beta$ - and  $\gamma$ -radiations emitted by  $^{24}\text{Na}$  is outlined.

L. S. T.

**Decay constant of  $^{32}\text{P}$ .** N. B. CACCIAPUOTTI (Nuovo Cim., 1938, 15, 213—219).—The half-life period of  $^{32}\text{P}$  obtained by the bombardment of P with deuterons is 14.295 days.

O. J. W.

**Nuclear transformations produced in zinc by  $\alpha$ -particle bombardment.** W. B. MANN (Physical Rev., 1938, [ii], 54, 649—652).—Zn bombarded with 17-Me.v.  $\alpha$ -particles gives rise to activities:  $^{70}\text{Ga}$   $19.8 \pm 0.4$  min.,  $^{67}\text{Ga}$   $37 \pm 1.5$  hr.,  $^{67}\text{Ga}$   $79 \pm 2$  hr., and  $^{68}\text{Ge}$  ~195 days. The disintegration products are mainly positrons.

N. M. B.

**Resonance transmutation of Se (34) by protons.** J. H. BUCK, C. V. STRAIN, and G. VALLEY (Physical Rev., 1937, [ii], 51, 1012).—The excitation function for induced radioactivity of Se has been determined over the range 1.7 to 3.6 Me.v. Measurable activity begins at 2.3 Me.v. and increases sharply at ~3.1 Me.v.

L. S. T.

**Transmutation of aluminium by polonium  $\alpha$ -particles.** W. R. KANNE (Physical Rev., 1937, [ii], 51, 1013).—A redetermination of the absorption curve of the protons emitted from an Al target confirms the results of Chadwick and Constable (A., 1932,

318). The energy of the  $\gamma$ -ray from the final  $^{30}\text{Si}$  nucleus is 2.5 Me.v., and the ratio of the intensities of the short- and long-range groups is 3.5. L. S. T.

**Deuteron bombardment of barium, lanthanum, and cerium.** M. L. POOL and J. M. CORK (Physical Rev., 1937, [ii], 51, 1010).—On bombardment with 6.5-Mv. deuterons Ba becomes strongly radioactive with a half-life period of 85.6 min. The  $\beta$ -particles have the negative sign, and chemical analysis shows that the activity is probably due to  $^{139}\text{Ba}$ .  $^{139}\text{La}$  gives a radioactivity with a half-life period of 31 hr. The  $\beta$ -particles are negative, and the activity is attributed to  $^{140}\text{La}$ . Ce gives a 2.4 hr. period.

L. S. T.

**Radioactivity in iron by deuteron bombardment.** B. T. DARLING, B. R. CURTIS, and J. M. CORK (Physical Rev., 1937, [ii], 51, 1010—1011).—After bombardment of electrolytic Fe by 6.3-Me.v. deuterons, chemical separations show that the Co ppt. has a strong positive activity of 18.2 hr. half-life, corresponding with the capture of a proton with the probable ejection of a neutron. The Mn ppt. shows an activity of 21 min. half-life, indicating the capture of the deuteron with the ejection of an  $\alpha$ -particle. No activity of half-life long enough to be observed after the chemical separation could be found in the Fe itself due to neutron capture.

L. S. T.

**Production of radium isotopes from uranium by irradiation with rapid and slow neutrons.** O. HAHN and F. STRASSMANN (Naturwiss., 1938, 26, 755—756).—The nature of the product of half-life period 3.5 hr. obtained by Curie *et al.* (A., 1938, I, 291) by irradiation of U by neutrons is discussed. It is regarded as a mixture of products already isolated. Irradiation of U by neutrons gives rise to three isomeric Ra isotopes, which must be produced by two successive  $\alpha$ -ray transformations through Th. The half-life periods are approx. 25 min., 110 min., and several days. These Ra isotopes give rise to three isomeric Ac isotopes with emission of  $\beta$ -rays, of half-life periods approx. 40 min., 4 hr., and 60 hr. Three Th isotopes are formed from the Ac isotopes. The production of Ra from U is the first case of  $\alpha$ -transformations brought about by the use of retarded neutrons. Irradiation of  $^{238}\text{U}$  with neutrons gives rise to 16 different artificially radioactive nuclei of at. nos. 88—90 and 92—96.

A. J. M.

**Counting losses in Geiger-Müller counter circuits and recorders.** H. LIFSCHUTZ and O. S. DUFFENDACK (Physical Rev., 1938, [ii], 54, 714—725).—Detailed experimental investigations are described, and results are considered in relation to various theoretical equations.

N. M. B.

**Cosmic-ray showers from lead plates.** R. B. BRODE and M. A. STARR (Physical Rev., 1937, [ii], 51, 1006).—Results obtained from 8000 photographs of showers produced in Pb plates of thickness 1.5—16.5 mm. placed in a Wilson cloud chamber are summarised.

L. S. T.

**Cosmic-ray showers produced under 30 m. of clay.** J. D. CRAWSHAW (Proc. Physical Soc., 1938, 50, 783—787).—The approx. equality of the ratio of the vertical intensity to the max. shower rate

at ground level and under 30 m. of clay is confirmed (cf. Follett, A., 1936, 1174). A transition curve for showers from Pb at the lower level is discussed.

N. M. B.

**Relation of shower frequency to general cosmic-ray intensity.** L. JÁNOSSY (Proc. Roy. Soc., 1938, A, 167, 499—508).—Observations were carried out at sea level and under 30 m. of clay to ascertain how the form of the shower transition curves at the two levels depends on the presence of large masses of light material (stone) over the Pb absorber producing the showers. It is concluded that most of the showers at sea level and underground are due to secondaries produced by the penetrating particles, and that relatively few can be due to primary electrons.

G. D. P.

**Quantum theory and origin of some swarms of cosmic rays.** G. WATAGHIN (Atti R. Accad. Lincei, 1938, [vi], 27, 675—678).—Mathematical.

O. J. W.

**Cosmic-ray showers and bursts.** D. K. FROMAN and J. C. STEARNS (Rev. Mod. Physics, 1938, 10, 133—192).—A comprehensive report of available experimental and theoretical data with detailed bibliography.

N. M. B.

**Theory of energy losses of high-energy particles.** L. W. NORDHEIM (J. Franklin Inst., 1938, 226, 575—597; cf. A., 1938, I, 550).—The absorption of cosmic radiation and the majority of its secondary effects can be explained by electromagnetic theory if the soft component is identified with electrons and protons, and the hard component with barytrons. An extension of the theory of Yukawa (Proc. Phys. Math. Soc. Japan, 1938, 20, 1 and *loc. cit.*) may provide the explanation of the remaining phenomena (the production of hard rays in the atm., hard showers, and some bursts).

O. D. S.

**Primary and secondary cosmic rays, showers, and bursts.** W. M. NELSEN. Survey of evidence for the nature of the hard component. J. C. STEARNS. Copper shows an anomalously high efficiency for the production of showers when compared with zinc. D. K. FROMAN (J. Franklin Inst., 1938, 226, 601—622, 628, 629—630).—Nos. of triple and quadruple coincidences under varying thicknesses of Pb have been compared at altitudes 36 m. and 4300 m. Results are in qual. agreement with the multiplicative theory of shower production. The ratio of triple to quadruple coincidences is greater at the greater altitude.

O. D. S.

**Production of showers by cosmic rays.** C. G. MONTGOMERY and D. D. MONTGOMERY (J. Franklin Inst., 1938, 226, 623—627).—When the "background" is very small the shower-producing capacity of an atom will be approx.  $\propto Z^4$ . This prediction is supported by preliminary experiments in the open air. Some showers of an explosive type have been observed, apparently formed in the air. A comparison has been made between the no. of showers due to electrons and protons and the no. due to the whole cosmic radiation in varying thicknesses of Pb. At thicknesses  $> 10$  cm. Pb the no. produced by electrons is  $\ll$  that produced by the whole radiation.

O. D. S.

**Effect of galactic rotation on the intensity of cosmic radiation.** W. F. G. SWANN (Physical Rev., 1937, [ii], 51, 1006). L. S. T.

**Orbital electronic network of several elements.** R. FORRER (Ann. Physique, 1938, [xi], 10, 407—425; cf. A., 1937, I, 231).—Using the law  $T = F\sqrt{N}$  (A., 1935, 1305), the electronic networks of the alkali and alkaline-earth metals, Se, Te, P, and I have been determined. W. R. A.

**Photo-electric absorption of radiation in gases.** R. W. DITCHEBURN (Nature, 1938, 142, 756).—A discussion (cf. A., 1938, I, 543). L. S. T.

**Wave functions for  $1s2s^3S$   $\text{Li}^+$ .** H. M. JAMES and F. L. YOST (Physical Rev., 1938, [ii], 54, 646—647; cf. A., 1937, I, 391).—The comparative results of alternative methods of determining at. wave functions are examined. N. M. B.

**Test of the wave mechanics in molecular spectra and some recent developments in the spectrum of  $\text{H}_2$ .** O. W. RICHARDSON (Nuovo Cim., 1938, 15, 232—245).—A brief account of recent improvements in the experimental and theoretical determinations of some of the fundamental consts. connected with the electronic states of  $\text{H}_2$  and of  $\text{H}_2^+$ . Two new states of  $\text{H}_2$  have been found in which apparently both electrons are excited. O. J. W.

**Wave functions and potential curves for excited  $\text{H}_2$ .** A. S. COOLIDGE and H. M. JAMES (J. Chem. Physics, 1938, 6, 730—734).—Mathematical. W. R. A.

**Binding energy of  $^6\text{Li}$ .** H. MARGENAU and K. G. CARROLL (Physical Rev., 1938, [ii], 54, 705—713).—Mathematical. N. M. B.

**$\alpha$ -Particle model of the nucleus.** L. R. HAFSTAD and E. TELLER (Physical Rev., 1938, [ii], 54, 681—692).—The theory of nuclei composed of  $\alpha$ -particles alone is reviewed and extended to cases where, in addition, a single neutron or proton is present, and to light nuclei in which a single neutron or proton is missing. Configurations are considered and rough vals. for the binding energies are compared with the results of the Hartree model. Rotations of the nuclei and symmetry properties and spacing of some of the excited states are examined. N. M. B.

**Magnetic moments of heavy nuclei.** T. NEUGEBAUER (Z. Physik, 1938, 111, 125—132).—Theoretical. H. C. G.

**Determination of  $e/m$  from the  $\text{H}_\alpha$ — $\text{D}_\alpha$  interval.** R. C. WILLIAMS (Physical Rev., 1938, [ii], 54, 568—572).—Calculations based on the corr. interval  $4.14700 \pm 0.0004 \text{ cm}^{-1}$  between the  $2p^2P_{3/2}$ — $3d^2D_{5/2}$  components of  $\text{H}_\alpha$  and  $\text{D}_\alpha$ , the new val. 9651.3 for the physical Faraday adjusted to the at. mass scale, and the most recent at. wt. vals. of H and D lead to the val.  $1.7579 \pm 0.0004 \times 10^7$  for  $e/m$ . N. M. B.

**Most probable values of  $e$ ,  $e/m$ , and  $h$ .** III. K. SHIBA (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 1308—1321; cf. A., 1933, 884).—From the available data the following most probable vals. are deduced:  $e = (4.8025 \pm 0.02\%) \times 10^{-10} \text{ e.s.u.}$ ;  $e/m =$

$1.7589 \pm 0.02\% \times 10^7 \text{ e.m.u.}$ ;  $h = (6.625 \pm 0.04\%) \times 10^{27} \text{ erg sec.}$ ;  $hc/2\pi e^2 = 137.04 \pm 0.02\%$ . W. R. A.

**Determination of  $e/m$  from the refraction of X-rays in a diamond prism.** J. A. BEARDEN (Physical Rev., 1938, [ii], 54, 698—704).—Measurements accurate to 1 part in  $10^4$  for  $n$  of the  $\text{Cu } K\beta$  line by a diamond prism, together with the quantum theory of dispersion and the ruled grating  $\lambda$  of the  $\text{Cu } K\beta$  line, lead to a val.  $e/m = (1.7610 \pm 0.0003) \times 10^7 \text{ e.m.u.}$ , in good agreement with the free electron results of Dunnington (cf. A., 1937, I, 595). N. M. B.

**Maximum energy of the protons emitted by boron under  $\alpha$ -particle bombardment.** G. BRUBAKER and E. POLLARD (Physical Rev., 1937, [iii], 51, 1013). L. S. T.

**Coulomb wave functions for high energies.** L. E. HOISINGTON and G. BREIT (Physical Rev., 1938, [ii], 54, 627—628).—Mathematical. N. B. M.

**Influence of radiation on ionisation equilibrium.** B. N. SRIVASTAVA (Proc. Roy. Soc., 1938, A, 167, 484—499).—A theoretical investigation of the equilibrium of an assembly of atoms, ions, electrons, and radiation, the particles being supposed to obey any statistics. G. D. P.

**Physical processes in gaseous nebulae. III. The Balmer decrement.** J. G. BAKER and D. H. MENZEL (Astrophys. J., 1938, 88, 52—64).—A numerical solution of the equations derived formerly (A., 1938, I, 1) is given. L. S. T.

**CN bands in the night sky spectrum.** J. CABANNES, J. DUFAY, and J. GAUZIT (Nature, 1938, 142, 755).—The night sky spectrum appears to contain violet CN bands the intensity of which varies little from the zenith to the horizon. L. S. T.

**Predissociation in the spectra of diatomic molecules.** B. GRUNDSTRÖM (Z. Physik, 1938, 111, 55—60).—The course of predissociation in the  $C$ -terms of Ba and Ca hydrides is discussed. H. C. G.

**Application of the new analysis of molecular spectra.** H. DESLANDRES (Compt. rend., 1938, 207, 753—757; cf. A., 1938, I, 435).—An analysis of Raman  $\nu$  for  $\text{PCl}_3$  and  $\text{PCl}_5$  is discussed with reference to the excitation of electrons and the grouping of atoms in the mols. A. J. E. W.

**Molecular spectra of halides of the iron group, particularly  $\text{FeCl}$ .** E. MIESCHER (Helv. Phys. Acta, 1938, 11, 463—468; cf. A., 1937, I, 216, 442).—The spectrum of an electrodeless discharge in  $\text{FeCl}_2$  vapour contains 8 groups of  $\text{FeCl}$  bands between 3300 and 3700 Å. The principal group (3400—3450 Å.) includes the (0, 0) bands of six systems, of which partial analyses are given; all the bands are degraded towards the violet, and two ( $P$  and  $Q$ ) band-heads occur in most cases. Preliminary data for  $\text{FeBr}$ , indicating a frequency of  $\sim 310 \text{ cm}^{-1}$ , are given. Absorption max. for  $\text{FeCl}_2$  (2400, 2730),  $\text{CoCl}_2$  (3000), and  $\text{NiCl}_2$  (3450 Å.) are in accord with the heats of formation. A. J. E. W.

**Absorption spectrum of cobaltous chloride in deuterium oxide.** D. C. MARTIN (Nature, 1938,

142, 756).—The absorption curves of anhyd.  $\text{CoCl}_2$  in  $\text{H}_2\text{O}$  and in 99.6%  $\text{D}_2\text{O}$  show that the mol. extinction coeff. in  $\text{D}_2\text{O}$  is smaller throughout the region of absorption (4000—6000  $\text{\AA}$ .), and the height of the max. is lower. L. S. T.

**Band spectrum of lead fluoride ( $\text{PbF}$ ).** II. G. D. ROCHESTER (Proc. Roy. Soc., 1938, A, 167, 567—580; cf. A., 1936, 405).—The band systems are examined in emission and absorption; six new systems are analysed and two continua described. Vibrational consts. are tabulated. The width of the ground state is  $8266 \text{ cm.}^{-1}$ , the highest yet recorded. G. D. P.

**Absorption spectra of solutions of the more important acids of elements of the sulphur group.** H. LEY and E. KÖNIG (Z. physikal. Chem., 1938, B, 41, 365—387; cf. A., 1932, 319).—Non-conformity to Beer's law by dil.  $\text{H}_2\text{SO}_3$  solutions can be explained by the assumption that absorption is due to the more or less hydrated  $\text{SO}_2$  mols. The influence of  $\text{H}_2\text{SO}_4$ ,  $\text{Na}_2\text{SO}_4$ , and  $\text{NaHSO}_3$  on the absorption spectrum of aq. solutions of  $\text{H}_2\text{SO}_3$  in the  $\lambda$  region 2000—3500  $\text{\AA}$ . supports this view. Observations on  $\text{NaHSO}_3$  and  $\text{Na}_2\text{SO}_3$  indicate that  $\text{HSO}_3'$  shows very little absorption, and that previously reported max. in the absorption curves of  $\text{SO}_3''$  and  $\text{HSO}_3'$  do not exist. Only slight continuous absorption is shown by the anions of org. sulphonic acids,  $\text{S}_2\text{O}_3''$ , and  $\text{S}_2\text{O}_6''$ . Continuous absorption, beginning at about 2500  $\text{\AA}$ ., is also observed with  $\text{Na}_2\text{SeO}_3$ ,  $\text{NaHSeO}_3$ ,  $\text{H}_2\text{SeO}_3$ ,  $\text{H}_2\text{SeO}_4$ ,  $\text{Na}_2\text{SeO}_4$ , and  $\text{H}_6\text{TeO}_6$ . J. W. S.

**Structure and absorption spectra of polymerides of aromatic compounds having a propenyl or isopropenyl side-chain.** (MLLE.) M. GRUMEZ (Ann. Chim., 1938, [xi], 10, 378—396).—Absorption spectra are given for  $\text{CHPh:CHMe}$  and its dimeride (I), b.p.  $315^\circ$ , and metastyrene (II),  $\text{PhEt}$ ,  $o\text{-OH}\cdot\text{C}_6\text{H}_4\cdot\text{CH:CHMe}$  and its trimeride (III),  $o\text{-cresol}$ ,  $o\text{-OH}\cdot\text{C}_6\text{H}_3\cdot\text{CMe:CH}_2$  and its dimeride (V),  $p\text{-OMe}\cdot\text{C}_6\text{H}_4\cdot\text{CH:CHMe}$  and its liquid (VI) and solid (VII) dimerides,  $p\text{-cresol}$ ,  $p\text{-OMe}\cdot\text{C}_6\text{H}_4\cdot\text{CMe:CH}_2$  and its dimeride (VIII). These accord with the following structures: (II), (IV), (V), (VI), and (VII)  $\text{CHAR}\langle\begin{smallmatrix} \text{CHMe} \\ \text{CHMe} \end{smallmatrix}\rangle\text{CHAR}$ ; (I)  $\text{CHPhMe}\cdot\text{CH:CHPh}$ ; (III) 2:4:6-tri- $o$ -hydroxyphenylmesitylene; (VIII)  $\text{CMeR}\cdot\text{CH}\cdot\text{CH}_2\cdot\text{CHMeR}$  or  $\text{CMeR}\cdot\text{CH}\cdot\text{CMe}_2\text{R}$  ( $\text{R} = p\text{-C}_6\text{H}_4\cdot\text{OMe}$ ). R. S. C.

**Structure and absorption spectra of  $o$ -benzoylbenzoic acid and derivatives.**—See A., 1939, II, 25.

**Spectrochemical study of complex colouring matters.** Metallic complexes of 2:2'-dihydroxyazobenzene.—See A., 1939, II, 16.

**Modifications in the near infra-red absorption spectra of protein and of light and heavy water molecules when water is bound to gelatin.** J. W. ELLIS and (MISS) J. BATH (J. Chem. Physics, 1938, 6, 723—729).—A detailed account of work already noted (A., 1938, I, 174) and an extension to the influence of  $\text{D}_2\text{O}$  instead of  $\text{H}_2\text{O}$  reveals similarity in effects. W. R. A.

**Vibrational-rotational radiation transitions in water molecules in non-polar solvents.** J. W. ELLIS and E. L. KINSEY (Physical Rev., 1938, [ii], 54, 599—601; cf. A., 1937, I, 443).—Transmission curves showing the 1.875 and 1.379  $\mu$ . absorption bands of  $\text{H}_2\text{O}$  mols. in  $\text{CCl}_4$  and  $\text{CS}_2$  solutions and the 1.985  $\mu$ . band of  $\text{D}_2\text{O}$  in  $\text{CCl}_4$  are given. They are interpreted as indicating free rotation of  $\text{H}_2\text{O}$  vapour-like mols. in solution; the main feature of each band is an enhanced  $Q$ -branch. N. M. B.

**Water of crystallisation in gypsum.** J. CABBANES (Compt. rend., 1938, 207, 700—702).—The  $\nu$  and polarisation of Raman radiation have been studied for different orientations of a single gypsum crystal. The structure found by Wooster (A., 1937, I, 17) accounts for two modes of vibration of the  $\text{H}_2\text{O}$  mol. which are symmetrical with respect to the binary axis, and correspond with the observed Raman lines,  $\nu_A$  3404 and  $\nu_B$  3495  $\text{cm.}^{-1}$ . The action of the attached O and Ca ions causes displacement from the  $\nu$  observed in  $\text{H}_2\text{O}$  vapour. A. J. E. W.

**Absorption spectra in the very near infra-red (6000—10,000  $\text{\AA}$ .) of ammonium salts.** P. BARCHWITZ and G. COSTEANU (Compt. rend., 1938, 207, 722—724).—Aq.  $\text{NH}_4\text{X}$  ( $\text{X} = \text{Cl}, \text{I}, \text{NO}_3, \text{CNS}$ , or  $\text{NH}_4\text{SO}_4$ ) gives a  $\text{H}_2\text{O}$  band at 8480  $\text{\AA}$ . and a weak band at  $\sim 8160 \text{\AA}$ . which decreases in intensity on dilution; the latter corresponds with the 3200  $\text{cm.}^{-1}$   $\text{NH}_4$  frequency observed in cryst.  $\text{NH}_4$  salts. The 8160  $\text{\AA}$ . band is not given by Divers' liquid, possibly owing to masking by a strong  $\text{NH}_3$  band. A solution of  $\text{NH}_4\text{CNS}$  in liquid  $\text{SO}_2$  ( $-20^\circ$ ) and fused  $\text{NH}_4\text{NO}_3$  and  $\text{NH}_4\text{CNS}$  give bands at 8135, 8180, and 8250  $\text{\AA}$ ., respectively; no marked change of intensity occurs on diluting the  $\text{SO}_2$  solution. A. J. E. W.

**Near infra-red and Raman spectra of ammonium salts.** (MME.) M. FREYMANN, R. FREYMANN, and Y. TA (Compt. rend., 1938, 207, 728—731).—Infra-red absorption and Raman  $\nu$  for cryst., fused, and conc. aq.  $\text{NH}_4\text{NO}_3$  are reported. The  $\nu$  ( $\text{NH}$ ) frequencies and their harmonics are observed, but at lower  $\nu$  than the corresponding  $\text{NH}_3$  bands. These frequencies disappear on dilution of the aq. solution, probably owing to displacement of the ionisation equilibrium. Bands at  $\sim 1400 \text{ cm.}^{-1}$  which are less intense in aq.  $\text{NH}_4\text{NO}_3$  probably correspond with valency frequencies. A. J. E. W.

**Infra-red absorption spectrum of some silicates.** F. MATOSI and O. BRONDER (Z. Physik, 1938, 111, 1—17).—The absorption spectra of 7 silicates and a glass are measured over the range 1—15  $\mu$ . and explained as combination frequencies of fundamental vibrations of the  $\text{SiO}_4$  tetrahedron. The influence on the spectrum of  $\text{H}_2\text{O}$  content is discussed. L. G. G.

**Molecular structures of carbon and silicon tetrafluorides.** C. R. BAILEY, J. B. HALE, and J. W. THOMPSON (Proc. Roy. Soc., 1938, A, 167, 555—567).—Absorption spectra of gaseous  $\text{CF}_4$  and  $\text{SiF}_4$  have been examined in the infra-red from 1 to 18  $\mu$ . The mol. structures are discussed with reference to interat. distances and the extent of electron pair bond formation. G. D. P.

**Infra-red and Raman spectra of polyatomic molecules. III. Ethane.** B. L. CRAWFORD, jun., W. H. AVERY, and J. W. LINNETT. **IV. Allene.** J. W. LINNETT and W. H. AVERY. **V. cyclo-Propane and ethylene oxide.** J. W. LINNETT (*J. Chem. Physics*, 1938, **6**, 682—685, 686—691, 692—702).—**III.** The Raman and infra-red spectra of  $C_2H_6$  have been re-examined, the Raman spectrum at  $-60^\circ$  and the infra-red spectrum of gaseous  $C_2H_6$  from 3 to 15  $\mu$ . by a prism spectrometer. Of the four principal Raman lines those at 993, 2900, and 2955  $cm^{-1}$  are polarised and 1460  $cm^{-1}$  is depolarised. Results are compared with recorded data; two very faint Raman displacements of 620 and 820  $cm^{-1}$  are reported. The strong infra-red peak at 1480  $cm^{-1}$  is single; the existence of a weak infra-red band at 1740  $cm^{-1}$  has been confirmed. Possible assignments of existing spectral data are made on the basis of the symmetry requirements of the  $D_{3h}$  and  $D_{3d}$  models. The "uncertain" frequency, indicated by heat capacity data as 1100  $cm^{-1}$  and by examination of the overtone region as 740  $cm^{-1}$ , is discussed. By accepting a single peak at 1480  $cm^{-1}$  it is possible to account for all observed  $\nu$  without using the 740  $cm^{-1}$  frequency. For both models selection rules are satisfied by assignments based on the existence of a restricting potential of 3000 g.-cal. per mol., an "uncertain frequency" of 1100  $cm^{-1}$ , and an internal torsional oscillation of  $\sim 300$   $cm^{-1}$ . The  $D_{3h}$  assignment is slightly more satisfactory but the  $D_d$  model is not finally excluded.

**IV.** The Raman spectrum of allene at  $\sim -45^\circ$  consists of ten displacements; the infra-red spectrum of gaseous allene has six intense and three weak bands. The symmetry ( $V_d$ ) demands seven non-degenerate and four doubly degenerate modes of vibration, divisible into four symmetry classes; four  $\nu$  appear in Raman effect only and the other seven are common to both spectra. With the aid of heat capacity data, all  $\nu$  have been assigned and vals. for each of the eleven fundamentals have been ascertained. All observed  $\nu < 3000$   $cm^{-1}$  are accounted for as fundamentals, over- or binary combination-tones. The weak infra-red band is supposed to originate from the superposition of several possible ternary combinations. The free energy, entropy, and heat capacity of gaseous allene have been deduced for the temp. range 100—1000° K.

**V.** Raman and infra-red spectra (from 1.5 to 25  $\mu$ .) of cyclopropane (I) and  $(CH_2)_2O$  (II) have been determined. The symmetries [(I) =  $D_{3h}$ , (II) =  $C_{2v}$ ] selection rules, and spectroscopic activities are given. A complete assignment of all observed  $\nu$  of (I) has been made, but only a partial assignment of those of (II). The vals. of fundamental  $\nu$  of (I) and (II) are compared. The free energy, entropy, and heat capacity of (I) have been evaluated from 100 to 1000° K.

W. R. A.

**Partial analysis of some infra-red absorption spectra of organic molecules in dilute solution.** O. R. WULF and (Miss) L. S. DEMING (*J. Chem. Physics*, 1938, **6**, 702—711).—The infra-red absorption curves of a no. of mols. containing OH have been analysed on the assumption that the complicated curves in the region of the first overtone of OH

are due to superposition of several single curves of varying position and intensity, each of which, in turn, characterises a definite position and orientation of the OH mol. For relatively simple substances this hypothesis is fulfilled. In isomeric benzoinoxime acetates the OH of the  $\beta$ -isomeride appears to occupy two orientations, whilst in the  $\alpha$ -isomeride the OH has four orientations, of which two are practically the same as those of the  $\beta$ -form. The no. of possible orientations in  $\beta$ -*D*-glucose 2:3:4:6-tetra-acetate is discussed; their different orientations appear to confer variability of properties on the substance.

W. R. A.

**Infra-red absorption spectra (7—20  $\mu$ .) of several compounds possessing rings of five or six carbon atoms.** J. LECOMTE and G. CHIURDOGLU (*Bull. Soc. chim. Belg.*, 1938, **47**, 429—447).—The absorption spectra of 30 compounds possessing 5- or 6-membered C rings, including saturated and unsaturated hydrocarbons, ketones, and alcohols, have been examined in the region 7—20  $\mu$ . The  $\nu$  are recorded, and an attempt is made to identify them with the modes of vibrations of the mols. The influence of spatial configuration of *cis*- and *trans*-isomerides on the positions of the characteristic bands is considered.

W. R. A.

**Absorption spectra in the near infra-red (6000 to 11,500 Å.) of several compounds possessing rings of five or six carbon atoms.** G. CHIURDOGLU, P. BARCHEWITZ, and R. FREYMANN (*Bull. Soc. chim. Belg.*, 1938, **47**, 448—460).—The absorption of 30 compounds, including saturated and unsaturated hydrocarbons, ketones, and alcohols, which possess 5- or 6-membered C rings have been examined in the near infra-red. The spectra of stereoisomerides are compared and discussed. A new method of determining the spatial configurations of stereoisomeric *tert.* cyclanols is based on the observation that the (OH) $\nu$  band, found in acyclic saturated alcohols at  $\sim 9630$  Å., is displaced towards greater  $\lambda$  by 40 Å. for *trans*- and by 80 Å. for *cis*-derivatives of cyclanols.

W. R. A.

**Infra-red absorption spectra of sugars and furans.** L. H. ROGERS and D. WILLIAMS (*J. Amer. Chem. Soc.*, 1938, **60**, 2619—2621).—Spectra between 2 and 12  $\mu$ . have been determined for furfuraldehyde, furfuryl and tetrahydrofuryl alcohols, and hydro-furamide, and between 3 and 12  $\mu$ . for *d* and *l*-arabinose, *d*-lyxose, *l*-xylose, *d*-galactose, *d*-mannose, fructose, and glucose. The results are compared with published Raman and infra-red spectral data.

E. S. H.

**Band envelopes of unsymmetrical rotator molecules. I. Calculation of the theoretical envelopes.** R. M. BADGER and L. R. ZUMWALT (*J. Chem. Physics*, 1938, **6**, 711—718).—The band envelopes of three elementary types of band of unsymmetrical rotator mols. have been calc. by an approximation method for nine different sets of mol. parameters.

W. R. A.

**Raman effect and organic chemistry.** K. W. F. KOHLRAUSCH (*Ber.*, 1938, **71**, [A], 171—187).—A lecture dealing with the fundamental principles of the



Raman effect, the characteristic frequencies, rotation isomerism, tautomerism, and ring tension. H. W.

**Raman spectrum of thiophosgene.** H. W. THOMPSON (J. Chem. Physics, 1938, 6, 748).—CSCL<sub>2</sub> liquid gives seven Raman displacements, six of which correspond with fundamental  $\nu$ . W. R. A.

**Raman spectrum of trialkyl borates.** M. MILONE (Gazzetta, 1938, 68, 582—583).—Polemical against Kahovec (A., 1938, I, 386). O. J. W.

**Raman-spectroscopic studies. XIII. Structure of perchloric acid.** A. SIMON [with H. REUTHER and G. KRATZSCH] (Z. anorg. Chem., 1938, 239, 329—344).—The prep. of pure anhyd. HClO<sub>4</sub> is described. The Raman spectra of 68—100% HClO<sub>4</sub> have been determined. The work of Fonteyne (A., 1937, I, 10) is criticised. 100% HClO<sub>4</sub> is a pseudo-acid, HOCIO<sub>3</sub>, having a pyramidal structure, symmetry C<sub>3v</sub>. There are no indications of the existence of an acidium salt such as [ClO<sub>2</sub>(OH)<sub>2</sub>]<sup>+</sup>[ClO<sub>4</sub>]<sup>-</sup>. On dilution dissociation to ClO<sub>4</sub><sup>-</sup> and H<sup>+</sup> occurs and is already well-marked in the 97% acid but is not complete even in the fused monohydrate, which in the liquid state is not simply [OH<sub>3</sub>]<sup>+</sup>[ClO<sub>4</sub>]<sup>-</sup> but still contains some HOCIO<sub>3</sub>. The binding energy for Cl—O in the ClO<sub>4</sub><sup>-</sup> ion is ~105 kg.-cal. and the force const.  $8.1 \times 10^5$  dynes per cm. F. J. G.

**Raman spectra of acetylenes. I. Derivatives of phenylacetylene, CPh:CR.** M. J. MURRAY and F. F. CLEVELAND (J. Amer. Chem. Soc., 1938, 60, 2664—2666).—The principal lines for CPh:C-CH<sub>2</sub>Cl, CPh:C-[CH<sub>2</sub>]<sub>2</sub>-Cl, CPh:C-[CH<sub>2</sub>]<sub>3</sub>-Cl, CPh:C-CH<sub>2</sub>Br, CPh:C-CH<sub>2</sub>-OH, CPh:C-[CH<sub>2</sub>]<sub>2</sub>-OH, and CPh:CH:CH<sub>2</sub>Cl have been determined, and the structures are discussed. E. S. H.

**Raman effect and dipole moment in relation to free rotation. X. Molecular structure of *o*-chloroanisole, dimethoxybenzene, and diethoxybenzene.** S. MIZUSHIMA, Y. MORINO, and H. OKAZAKI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 1147—1163).—The Raman spectra and dipole moments of *o*-C<sub>6</sub>H<sub>4</sub>Cl-OMe, *o*-*m*-, and *p*-C<sub>6</sub>H<sub>4</sub>(OMe)<sub>2</sub>, and *p*-C<sub>6</sub>H<sub>4</sub>(OEt)<sub>2</sub> have been determined in C<sub>6</sub>H<sub>6</sub> and C<sub>6</sub>H<sub>14</sub> and at different temp. The mol. structure of these compounds is discussed. The more stable form of *o*-C<sub>6</sub>H<sub>4</sub>Cl-OMe is different in structure from that of *o*-C<sub>6</sub>H<sub>4</sub>Cl-OH, but it is not possible to decide whether the difference is due to a change in the resonance effect or to steric repulsion between Cl and Me. In *o*-C<sub>6</sub>H<sub>4</sub>(OMe)<sub>2</sub> the resonance effect is much reduced; its dipole moment varies considerably with temp., indicating that the configuration of the mol. is readily affected by thermal energy. The Raman spectra of *p*-C<sub>6</sub>H<sub>4</sub>(OMe)<sub>2</sub> and *p*-C<sub>6</sub>H<sub>4</sub>(OEt)<sub>2</sub> in the solid and liquid states are different, but the spectrum of *o*-C<sub>6</sub>H<sub>4</sub>(OMe)<sub>2</sub> is the same in both states.

A. J. M.

**Debye heat waves in highly viscous liquids.** (SIR) C. V. RAMAN and C. S. VENKATESWARAN (Nature, 1938, 142, 791).—A Zn-Hg amalgam lamp in Pyrex glass gives sharp and intense lines at 4680, 4722, and 4811 Å. without accompanying hyperfine structure or continuous spectrum. Using this lamp, the light scattered backwards by glycerol (I) and liquid PhOH

at 20° shows well-defined Brillouin components on either side of the incident lines together with a continuous background. The  $\eta$  of (I) appears to have little effect on the propagation of sound waves of high  $\nu$ . L. S. T.

**Relation between fluorescence and chemical constitution in laccol, moreacol, and their derivatives.** G. BROOKS (Compt. rend., 1938, 207, 726—728).—Structureless fluorescence bands due to double linkings in the C chain occur at 419—465 m $\mu$ . with laccol and moreacol; an additional band at 533—543 m $\mu$ . is given by dimethyl- and diacetyl-laccol and -moreacol. A. J. E. W.

**Fluorescent chromium ion in ruby.** B. V. THOSAR (Phil. Mag., 1938, [vii], 26, 878—887; cf. A., 1938, I, 495).—Further support is found for the author's previous idea that the fluorescent Cr<sup>+++</sup> ions replace a few Al<sup>+++</sup> ions in the lattice. The intense anti-Stokes bands are due to the superposition of the vibrational frequencies of the Cr<sub>2</sub>O<sub>3</sub> thus formed. If the *L-S* interaction is weak in the ion, the magnetic dissymmetry of the Zeeman pattern is explicable. The validity of the inner quantum no. *J* and the spin multiplicity are discussed and the lines at  $\lambda = 7017$  and 7049 Å. are shown to be due to transitions between the <sup>4</sup>P levels of the Cr IV and the <sup>4</sup>F levels. T. H. G.

**Electric actions in a system of isotropic bodies.** L. ROY (Compt. rend., 1938, 207, 757—759).—Theoretical. A. J. E. W.

**Contact difference of potential between barium and magnesium.** P. A. ANDERSON (Physical Rev., 1938, [ii], 54, 753—757).—The electronic method of contact potential measurement was compared with photo-electric work function determinations by measuring the Volta potential Ba-Mg for 30 pairs of surfaces and examining the results in relation to recent precision photo-electric data. General agreement within the limits 1.08—1.16 v. was obtained. Assuming a work function 2.52 e.v. for Ba, the val. for Mg is 3.78 e.v. Observations on the optical reflexion of Mg surfaces suggest the val.  $3.65 \pm 0.05$  for mirror-like surfaces and 3.78 e.v. for macrocryst. surfaces.

N. M. B.

**Rectifier action.** F. H. MÜLLER (Physikal. Z., 1938, 39, 793—795).—Theoretical. The mechanism of the polarity of Cu<sub>2</sub>O rectifiers is discussed.

A. J. M.

**Action of soft X-rays on selenium barrier layer cells.** A. E. SANDSTRÖM (Phil. Mag., 1938, [vii], 26, 906—920).—These cells respond to soft X-rays ( $\lambda$  3.5—20 Å.) in much the same way as to visible light, although in one experiment a remarkable deviation from the linear relationship between current and intensity for low intensities was found. The resistance of the barrier varies in an inexplicable manner. The photo-currents are too small to permit use of the elements for intensity measurements in spectrally dispersed radiation. T. H. G.

**Origin of multiple spectral maxima observed with composite photo-cathodes, on the basis of spectral sensitivity curves.** R. SUHRMANN and A. MITTMANN (Z. Physik, 1938, 111, 18—35).—The spectral sensitivity of photo-cathodes consisting of

alkali metal containing traces of alkali hydride or  $C_{10}H_8$  or anthracene (I) has been measured at  $293^\circ$  and at  $83^\circ K$ . A sensitivity max. was observed in the visible region in all cases; its position is characteristic of the alkali metal and is shifted toward shorter  $\lambda$  at low temp. Cathodes containing  $C_{10}H_8$  show an additional max. between 2900 and 3000 Å., the position of which is independent of temp. and of the alkali metal. Cathodes containing (I) show an additional series of short-wave max. The long-wave max. are ascribed to finely distributed, surface-adsorbed alkali metal and the short-wave max. to inner centres in the auxiliary substance.

H. C. G.

**Conductivity of solid lead and potassium chlorides.** K. VISCHNEVSKA (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 161—173).—The vals. found for sp. conductivity  $\kappa$  of compressed  $PbCl_2$  at  $160^\circ$ ,  $290^\circ$ , and  $300^\circ$  are closest to those of Seith (A., 1929, 1136). The  $\kappa$ -composition curves of the system  $PbCl_2$ -KCl, at  $290^\circ$ ,  $340^\circ$ , and  $360^\circ$ , suggest the compound  $2PbCl_2 \cdot KCl$ .

R. T.

**Pre-breakdown phenomena in insulators and electronic semi-conductors.** J. FRENKEL (Physical Rev., 1938, [ii], 54, 647—648).—Mathematical. Phenomena can be explained on the theory that the normal state of the dielectric may be described as a system of neutral atoms rather than of free electrons moving in a self-consistent periodic field of force.

N. M. B.

**Dispersion and absorption by polar substances.** P. DEBYE and W. RAMM (Nuovo Cim., 1938, 15, 226—231).—A summary of modern views on dispersion and absorption by liquid dielectrics.

O. J. W.

**Dipole moment, Raman spectrum, and structure of chlorine heptoxide.** R. FONTEYNE (Natuurwetensch. Tijds., 1938, 20, 275—278).—The  $Cl_2O_7$  mol. is dipolar ( $\mu_{20} = 0.72 \pm 0.02$  in  $CCl_4$ ) and angular in structure, consisting of two  $ClO_3$  groups connected through an O bridge, which is bent at an angle of  $128^\circ$ . These conclusions are supported by measurements of the Raman spectrum.

S. C.

**Electric dipole moments of diphenyl ether and some derivatives in the vapour phase, and a revision of the oxygen valency angle in these compounds.** I. E. COOP and L. E. SUTTON (J.C.S., 1938, 1869—1872).—The dipole moments of  $Ph_2O$  and its *p*-Br-, *pp'*-Br<sub>2</sub>-, *pp'*-Me<sub>2</sub>-, *p*-NO<sub>2</sub>-, and *p*-bromo-*p'*-methyl derivatives have been determined in the vapour state. The angle between the C—O valencies is calc. to be  $124^\circ \pm 5^\circ$ , in satisfactory agreement with the val. previously obtained ( $128^\circ \pm 4^\circ$ ) from determinations of the dipole moments in solution.

A. J. M.

**Dipole moments of (a) 4 : 4'-dinitro- and 4 : 4'-dicyano-diphenyls, and (b) the isomeric diphenyl-4 : 4'-bisdiazocyanides.** R. J. W. LE FEVRE and H. VINE (J.C.S., 1938, 1878—1882).—The apparent dipole moments of 4 : 4'-dinitro- and -dicyano-diphenyl in  $C_6H_6$  solution are 1.3<sub>2</sub> and 1.0<sub>2</sub>, respectively. These moments are to be regarded as anomalous, since the mols. have axial symmetry. The dipole moments of the isomeric diphenyl-4 : 4'-bisdiazocyanides have been determined, the two forms being shown to be geometrical isomerides. The less stable form is either the *cis-cis* or the *trans-cis* form. The spontaneous isomerisation of the less stable form has been followed by observations of dielectric const., and appears to be unimol.

A. J. M.

**Refraction, dispersion, and related properties of pure hydrocarbons arranged for use in the analysis of hydrocarbon mixtures.** A. L. WARD and S. S. KURTZ, jun. (Ind. Eng. Chem. [Anal.], 1938, 10, 559—576).—The following data are tabulated for members of the different hydrocarbon series boiling between  $10^\circ$  and  $200^\circ$  or slightly higher: b.p. at 760 or 10 mm.,  $d_4^{20}$ ,  $n_D^{20}$ , dispersion, the refractivity intercept, and sp. dispersion. Tables showing averaged data for specified boiling ranges are given, and curves based on these averaged properties are drawn. The relationship between  $\rho$  and  $n$  for groups of paraffin and olefine isomerides is represented graphically. The effect of temp. and pressure on  $\rho$  and  $n$  is discussed. 177 references to the lit. are given.

L. S. T.

**Rotatory dispersion in the amine series. IV. Optical activity of diamines.** W. C. G. BALDWIN (Proc. Roy. Soc., 1938 A, 167, 539—554).—The changes in  $[\alpha]$  which occur on neutralisation are used to detect induced dissymmetry in the  $NH_2$ -radical of optically active bases. The rotatory dispersion of cryst.  $(CH_2 \cdot NH_2)_2 \cdot H_2SO_4$  is compared with that of  $CH_2(CH_2 \cdot NH_2)_2$ , 1-diaminocyclohexane, and of their salts in solution. The results are interpreted in terms of Boys' molecular model and the configuration of  $CH_2(CH_2 \cdot NH_2)_2$  is defined.

G. U. P.

**Relation between the degree of depolarisation of molecularly scattered light in liquids, and the Kerr constant.** H. A. STUART and W. BUCHHEIM (Z. Physik, 1938 111, 36—45).—The ratio of  $B$  (observed) and  $B$ , calc. from measurements of the degree of depolarisation on liquids by means of the Gans equation, is  $\pm 1$ . The deviations are outside experimental error and attempts are made to explain them theoretically.

L. G. G.

**Variation with temperature of electrical and magnetic double refraction of liquids.** K. H. GRODDE (Physikal. Z., 1938, 39, 772—783).—The electrical and magnetic double refraction of some org. liquids has been determined at temp. between  $20^\circ$  and  $170^\circ$ . The results are compared with the theory of Langevin, Born, and Gans, which holds only for gases. The Kerr effect is not greatly affected by temp., decreasing a little with increase of temp. The Cotton-Mouton const., however, decreases to a greater extent with increase of temp. Polar liquids show a greater decrease than theoretical with rising temp. The results are discussed.

A. J. M.

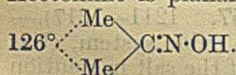
**Stereochemistry of quadricovalent atoms: thallium.** E. G. COX, A. J. SHORTER, and W. WARDLAW (J.C.S., 1938, 1886—1888).—X-Ray analysis of tetrakis-thioureathalloyl nitrate and chloride indicates that if these are 4-co-ordinated compounds of the type  $[TlR_4]X$ , the four valencies of Tl are coplanar, or nearly so. Dimethylthallacetylacetonate has also been investigated. The four valencies of Tl

in this compound are arranged tetrahedrally, as would be expected since the effective at. no. is 86 (*i.e.*, that of Rn). A. J. M.

**Molecular potential curves from spectroscopic data.** A. S. COOLIDGE, H. M. JAMES, and E. L. VERNON (*Physical Rev.*, 1938, [ii], 54, 726—738).—Mathematical. A crit. examination of the accuracy of various methods leads to preference for a method of successive approximations. Formulæ for the treatment of potential curves of various types are obtained, and results are illustrated by reference to the lowest  $^3\Sigma_g$  state of  $H_2$ . N. M. B.

**Systematics of band-spectral constants. IV. Inter-relation of equilibrium vibration frequency and distance for diatomic nuclei in ground and excited states.** C. H. D. CLARK and J. L. STOVES (*Trans. Faraday Soc.*, 1938, 34, 1324—1328; cf. A., 1937, I, 602).—The formula proposed (*ibid.*, 67) gives better correlation with experimental data than does that of Huggins (A., 1936, 781). E. S. H.

**Calculation of the frequencies of the symmetrical modes of vibration for molecules with various types of symmetry.** H. J. BERNSTEIN (*J. Chem. Physics*, 1938, 6, 718—722).—Secular equations for the  $\nu$  of the symmetrical modes of vibration of mols. possessing various symmetries have been set up and applied to the structure of oximes. Acetoxime is planar and has the structural formula



W. R. A.

**Potential energies of the alkali halides: errata and extension of the semi-empirical formula.** A. MAY (*Physical Rev.*, 1938, [ii], 54, 629—633).—Previous calculations for CsCl (cf. A., 1937, I, 552) are corr. Six consts. in the potential energy expression for CsCl are evaluated from data on the lattice and vapour, and from the results, applied to other halides, interionic distances in the gas, lattice energies, and heats of sublimation are determined. Agreement with experimental data is satisfactory for the first, and poor for the two last-named. N. M. B.

**Ordering and transformations in condensed phases.** F. C. FRANK and K. WIRTZ (*Naturwiss.*, 1938, 26, 687—693, 697—705).—A review. The thermodynamic classification of transformations is discussed, and examples of various transformations are given, *e.g.*, that of the second kind in the case of He, and the rotational transformations of  $CH_4$  and  $CD_4$ . The course of different transformations is considered. The problem is also dealt with from the mol. viewpoint. Liquid crystals, superstructural transformations, and the phenomenon of fusion are considered. A. J. M.

**Ordering and transformations in condensed phases.** M. VON LAUE (*Naturwiss.*, 1938, 26, 757).—An addition to a paper by Frank *et al.* (preceding abstract). A. J. M.

**Statistical theory of superlattices with long-range interaction. I. General theory. II. The simple cubic lattice and the body-centred**

**cubic lattice.** J. S. WANG (*Proc. Roy. Soc.*, 1938, A, 168, 56—67, 68—77).—I. Bethe's theory is extended to include long-range interactions.

II. The results are applied to the simple and body-centred cubic lattices and effect an improvement in the agreement of theory and experiment. G. D. P.

**Relation between surface tension and internal heat of vaporisation.** O. ALBERT and F. EIRICH (*Z. physikal. Chem.*, 1938, 183, 9—18).—The change in the ratio between heat of vaporisation and surface tension with mol. wt. and temp. is discussed in relation to theories of mol. orientations in surface layers. Surface energy, to which free and internal energy contribute, increases more slowly than heat of vaporisation with increase in chain length. Data for nonoic, nonenoic, and oleic esters are recorded. C. R. H.

**Organic parachors. I. Parachors of a series of isomeric esters.** O. R. QUAYLE, (MISS) K. OWEN, and R. R. ESTES (*J. Amer. Chem. Soc.*, 1938, 60, 2716—2719).—Parachors of the complete series,  $H \cdot [CH_2]_x \cdot CO_2 \cdot [CH_2]_y \cdot Me$  ( $x + y = 14$ ), are measured at 26°, 35°, 50.5° (or 50°), and 65°. Parachors and mol. vols. vary gradually, being a min. for  $n\text{-C}_5\text{H}_{11} \cdot CO_2 \text{C}_8\text{H}_{17}\text{-}n$ . In general parachors increase with temp. R. S. C.

**Increase of X-ray reflexion from quartz due to a strong electric field.** Y. KAKIUCHI (*Physical Rev.*, 1938, [ii], 54, 772).—The intensity of reflexion increases with duration of application of the field to a max. after several hr. of application. The effect is strongly structure-sensitive, and dies away very slowly after removal of the field, but more rapidly at high temp. or under irradiation with X-rays or  $\gamma$ -rays. Explanations are discussed. N. M. B.

**Order versus disorder in ternary structures including certain spinels.** F. C. BLAKE (*J. Chem. Physics*, 1938, 6, 630—635).—The doubling process suggested by Laue (*Ann. Physik.*, 1918, 56, 497) has been employed in studying Li ferrite. All superlattice lines disappear when the lattice edge is 8 times that of the small disordered lattice of Posnjak and Barth (A., 1936, 830). The simple space-group  $O_h^1$  of this large (33 Å.) lattice gives only face-centred lines on the powder photograph. The disappearance of the superlattice lines for this lattice may be due to the coherence of the X-rays which cause the destructive interference involved. W. R. A.

**X-Ray test of superstructure in  $FeNi_3$ .** F. E. HAWORTH (*Physical Rev.*, 1938, [iii], 54, 693—698).—In view of strong indirect evidence of superstructure, the specimen of approx. composition  $FeNi_3$ , and containing 70% Ni, was placed in a focussing camera in a beam of Fe  $K\beta$ -rays, which should give the strongest superstructure lines, and exposed for 100 hr. No superstructure lines appeared, and the negative result indicates that no long-range order exists in  $FeNi_3$ . N. M. B.

**Barker's systematic crystallography.** P. TERPSTRA and W. J. VAN WEERDEN (*Natuurwetensch. Tijds.*, 1938, 20, 285—293).—Barker's directions for the systematic description of triclinic crystals are insufficient. 552 configurations are possible, corre-

sponding with 202 different complexes of which 94 are ambiguous. The 202 complexes have been tabulated on Groth's system. A simple and convenient form of goniometer manufactured by Stoe, Heidelberg, is illustrated. S. C.

**Atomic distribution in the allotropic forms of phosphorus at different temperatures.** C. D. THOMAS and N. S. GINGRICH (*J. Chem. Physics*, 1938, 6, 659—665).—Monochromatic X-ray diffraction patterns of liquid yellow P, amorphous red P, and amorphous black P have been obtained using Mo  $K\alpha$  radiation, and the effect of temp. on the patterns of the two first forms has been investigated. Analysis of the patterns gave the at. distribution curves, which indicate that for all forms the no. of nearest neighbours is 3, i.e., P is present in all forms as  $P_4$ . W. R. A.

**Lattice distortions in pyrophoric metals. I. II. Lead and nickel.** G. R. LEVI and G. ROSSI (*Gazzetta*, 1938, 68, 570—576, 576—581).—I. The quant. determination of lattice distortions from Debye-Scherrer photographs (cf. Brill, A., 1937, I, 399) is discussed and sources of error are pointed out. Measurements with pyrophoric Fe agree with those of previous workers.

II. X-Ray measurements with ordinary and pyrophoric Pb show that the lattice distortion in both forms is small and approx. equal. Ordinary Ni shows no lattice distortion, whereas pyrophoric Ni shows a mean distortion of 0.16 Å. The pyrophoric behaviour is due to lattice distortion in the case of Ni but not of Pb. O. J. W.

**Growth of a magnesium crystal in its vapour.** S. SAKUI (*Sci. Papers Inst. Phys. Chem. Res. Tokyo*, 1938, 34, 1131—1146).—Rapid growth of Mg crystals from Mg vapour occurs at a temp. as high as possible but < the m.p. and at a place of high v.d. The higher is the temp. the larger the crystal grows. The most favourable pressure is 0.8—2.7 mm. A. J. M.

**Crystal structure of  $Co_2Al_5$ .** A. J. BRADLEY and C. S. CHENG (*Z. Krist.*, 1938, 99, 480—487).—From powder X-radiograms, the hexagonal cell, with 4  $Co_2Al_5$ , has  $a$  7.656<sub>0</sub>,  $c$  7.593<sub>2</sub> Å.;  $\rho$  4.14; space-group  $D_{6h}^{2h}$ - $C6/mmc$ . Complete at. parameters derived from abs. intensities by the use of structure factor graphs, figure fields, and Fourier synthesis, yield a 4-sheet structure of puckered hexagonal rings. Interat. distances indicate a new type of structure. I. McA.

**X-Ray analysis of the structure of water.** J. MORGAN and B. E. WARREN (*J. Chem. Physics*, 1938, 6, 666—673).—Monochromatic X-ray diffraction patterns of  $H_2O$  have been obtained at 1.5°, 13°, 30°, 62°, and 83°, using Cu  $K\alpha$  and Mo  $K\alpha$  radiations. The distribution curves do not yield quant. information on the structure of  $H_2O$ , but indicate that the tendency of the  $H_2O$  mol. to link itself tetrahedrally to 4 neighbouring mols. is only partly satisfied. W. R. A.

**Some sulphides obtained by decomposition of the corresponding thiosulphates.** D. GHIRON (*Gazzetta*, 1938, 68, 559—566).—The structures of the sulphides of Pb, Ni, Cu, Zn, and Cd, obtained from the thermal decomp. of the corresponding thiosulph-

ates, have been studied by X-rays. Only PbS is obtained in a pure state. The sulphides of Pb, Zn, and Cu have the structures of galena, blende, and covellite, respectively; that of Ni has the composition  $NiS_2$  and a pyrites type structure. O. J. W.

**Structures of molybdenum pentachloride and tungsten hexachloride.** R. V. G. EWENS and M. W. LISTER (*Trans. Faraday Soc.*, 1938, 34, 1358—1362).—Electron-diffraction investigation of the vapour shows that  $MoCl_5$  is a trigonal bipyramid, with Mo—Cl 2.27±0.02 Å., and  $WCl_6$  a regular octahedron with W—Cl 2.26±0.02 Å. E. S. H.

**Structure of pale yellow crystalline basic mercuric chloride,  $HgO, 2HgCl_2$ .** G. GAWRUCH (*Rocz. Chem.*, 1938, 18, 217—219).—The crystals belong to the cubical system. The elementary cell, containing 4  $HgO, 2HgCl_2$  mols., has  $a$  9.211±0.009 Å. R. T. I.

**Crystal structure of potassium fluorochromate.** J. A. A. KETELAAR and (FRL.) E. WEGERIF (*Rec. trav. chim.*, 1938, 57, 1369—1275).—The dimensions of tetragonal  $KCrO_3F$  are  $a$  5.46±0.01,  $c$  12.89±0.02 Å.,  $a : c$  1 : 2.36; space-group  $C_{4v}^2$ . From a determination of the at. distances, the probable structure is shown to be of scheelite type. C. R. H.

**Crystallography and certain other physico-chemical properties of potassium lead copper hexanitrite.** J. E. MACKENZIE and R. L. SMITH (*Rec. trav. chim.*, 1938, 57, 1211—1217).— $K_2PbCu(NO_2)_6$  crystallises in the cubic system, class 32;  $n$  is < 1.8. The ionisation of the salt in solution increases with dilution. C. R. H.

**Structure of ammonium heptafluozirconate and potassium heptafluozirconate and the configuration of the heptafluozirconate ion.** G. C. HAMPSON and L. PAULING (*J. Amer. Chem. Soc.*, 1938, 60, 2702—2707).—X-Ray evidence shows that  $(NH_4)_3ZrF_7$  has a holohedral face-centred cubic unit, with  $a_0$  9.365 Å., containing 4 simple mols.  $K_3ZrF_7$  has a similar structure with  $a_0$  8.95 Å. The proposed structure involves some random distribution of atoms among positions provided by the space-group  $O_h^2$ , and is closely related to that of  $(NH_4)_3AlF_6$ ;  $AlF_6'''$  is replaced by  $ZrF_7'''$ , in which the co-ordination no. of Zr is 7. E. S. H.

**Structure of olivenite,  $Cu_2(OH)AsO_4$ .** H. HE-RITSCH (*Z. Krist.*, 1938, 99, 466—479; cf. A., 1938, I, 421).—The corr. space-group is  $D_{2h}^{22}$ , an anomalous reflexion being due to indirect excitation (A., 1937, I, 117, 446; 1938, I, 179). After interchange of  $a$  and  $b$  axes, at. parameters and interdistances determined in accord with listed X-ray intensities establish a structure similar to those of adamine and andalusite (Strunz, A., 1936, 1483). Optical data are recorded and the structures compared. I. McA.

**Crystal structure of some ferricyanides with bivalent cations.** A. K. VAN BEVER (*Rev. trav. chim.*, 1938, 57, 1259—1268).—The determination of the at. distances and the crystal structure of  $M_2[Fe(CN)_6]$  ( $M = Cd, Mn, Zn, Co, Cu, \text{ and } Ni$ ) and of  $Fe[Fe(CN)_6]$  is described. After drying at 86° for 3 hr., 1 mol. of the compounds contains approx. 8 mols.

of  $H_2O$ , which is reduced to approx. 2 mols. of  $H_2O$  after further drying in vac. The intensity ratios of the X-ray reflexions remain unchanged during drying, and no change in cell dimensions has been observed. It is argued that in the "dry" crystal powder,  $H_2O$  remains enclosed between the crystal particles and not within the lattice. C. R. H.

**Electron-diffraction investigation of chromium, molybdenum, and tungsten hexacarbonyls.** L. O. BROCKWAY, R. V. G. EWENS, and M. W. LISTER (Trans. Faraday Soc., 1938, **34**, 1350—1357).—Recorded data for interat. distances (in Å.) are: Cr(CO)<sub>6</sub>, Cr—C 1.92±0.04, Cr—O 3.08±0.05, C—O 1.16±0.05; Mo(CO)<sub>6</sub>, Mo—C 2.08±0.04, Mo—O 3.23±0.05, C—O 1.15±0.05; W(CO)<sub>6</sub>, W—C 2.06±0.04, W—O 3.19±0.05, C—O 1.13±0.05. The mol. model is represented by a regular octahedron with the metal atom at the centre and the CO groups directed towards the apices. E. S. H.

**Enlargement of lattice of cellulose hydrate by absorptive linking of water.** I. SAKURADA and K. HUTINO (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, **34**, 1164—1173).—Cellulose hydrate undergoes a small reversible lattice change on rapid drying. By absorptive linking of  $H_2O$  the separation of the (101) planes is increased by 0.3 Å., and the vol. of the elementary cell increased by about 4%. Other planes are not appreciably affected. A. J. M.

**Orientation of high mol. wt. linear polymerides in unstretched films.** G. H. YOUNG, W. K. SCHNEIDER, and J. G. ASTON (J. Amer. Chem. Soc., 1938, **60**, 2825—2826).—Recent observations (A., 1938, I, 503) confirm Young's theory of partly oriented film structure (B., 1938, 940). E. S. H.

**Electron-diffraction effects from polished zinc surfaces.** M. L. FULLER (Amer. Inst. Min. Met. Eng., Tech. Publ. 965, 1938, 11 pp.; Met. Tech., 1938, 5, No. 6).—In certain circumstances polished Zn surfaces have been found to yield electron-diffraction effects which indicate the surface to be definitely crystal. These effects are in the form of diffraction lines perpendicular to the shadow edge of the reflexion type of photogram. It is surmised that the polished surface consists of minute Zn crystals oriented with their basal planes parallel to the plane of polish. Experimental evidence shows that the diffuse halo pattern alone has no significance with respect to the composition and crystal structure of a surface, and that whether or not such a diffraction pattern is obtained depends on the surface texture of the specimen. R. B. C.

**Relation of ferromagnetic anisotropy to atomic structure.** L. W. MCKEEHAN (Physical Rev., 1937, [ii], **51**, 1010).—Ferromagnetic atoms of Fe, Co, and Ni are assigned simple distributions of magnetic moment consistent with what is known concerning the 3d electrons in these atoms. The resultant anisotropy calc. for the observed cubic and hexagonal arrangements agrees with experimental results concerning these metals and their alloys. L. S. T.

**Magneto-electrolytic anisotropy.** A. PERRIER and C. MERMOD (Helv. Phys. Acta, 1938, **11**, 468—469).—Specimens of Fe and Ni possessing a high C (A., I.)

stable anisotropy have been prepared by electro-deposition in a magnetic field. A. J. E. W.

**Variation in the longitudinal incremental permeability due to a superimposed circular field.** J. S. WEBB (Nature, 1938, **142**, 795).—Large increases in this permeability of a Fe-Ni wire serving as the core of a solenoid occur when a d.c. is passed through the wire to produce a superimposed circular field. Graphs showing the variation of the inductance of the solenoid as a function of the d.c. through the conducting core, and the variation of the longitudinal incremental permeability as a function of the degree of twist of the core, are reproduced. L. S. T.

**Single crystals with exceptionally high magnetic permeabilities.** P. P. CIOFFI, H. J. WILLIAMS, and R. M. BOZORTH (Physical Rev., 1937, [ii], **51**, 1009).—Single crystals of purified Fe and of an Fe-Ni alloy (66% Ni) having max. permeabilities of 680,000 and 1,040,000, respectively, have been prepared. The combination of factors necessary for the attainment of high permeability is given. L. S. T.

**Behaviour of extremely thin metallic films under various conditions.** M. KINDINGER and K. KOLLER (Mikrochim. Acta, 1938, **3**, 317—325).—A review. The physical, electrical, and optical properties of very thin metallic films are compared with those of the metals in bulk. Theories to account for these properties and their changes on ageing are summarised and discussed. J. W. S.

**Transformations of organic compounds in the solid state (long-chain compounds).** I. Stearic acid. P. A. THIESSEN and C. STÜBER (Ber., 1938, **71**, [B], 2103—2123).—The course of the  $\beta \rightarrow \alpha$  transformation in stearic acid has been investigated by observations on the double refraction and on  $\epsilon$  (apparatus for the measurement of which is described). The transformation is irreversible under ordinary pressure, but the  $\beta$ -form is not totally unstable. The change is slow but complete at 46°, whilst in the range 43—46° it is only partial, and below 40° it never occurs even on prolonged tempering. On crystallising below 40°, the  $\beta$ -form is deposited from  $C_6H_6$  and xylene, the  $\alpha$ -form from AcOH, PhCl, and ligroin, and a mixture from *p*-cymene, PhMe, and EtOH. F. J. G.

**Physico-chemical revision of mol. and at. wts. New results.** E. MOLES (Bull. Soc. chim. Belg., 1938, **47**, 405—428).—The method of limiting densities is revised and discussed, and various precautions are indicated which must be taken to ensure accuracy. The following at. wts. have been determined: N = 14.0083, C = 12.007, S = 32.0635, and F = 18.995. W. R. A.

**Electrical conductivity of the transition metals.** A. H. WILSON (Proc. Roy. Soc., 1938, **A**, **167**, 580—593).—A theoretical investigation of the *s-d* transitions, in a metal containing incomplete *d*-bands, shows that these should fall exponentially as the temp. is lowered. A suggestion is put forward to explain the change of sign of the thermo-electric power of Pt at low temp. G. D. P.

**Influence of magnetic fields on persistent currents in a closed superconducting circuit.** K. C. MANN, H. G. SMITH, and J. O. WILHELM (Physical Rev., 1938, [ii], 54, 758—766).—Experiments on Sn show that no resistance appears until the mean magnetic induction within the specimen becomes considerable. Results are markedly influenced by the presence of traces of impurities. N. M. B.

**Relaxation effects connected with the transition between the superconducting and normal states.** H. G. SMITH and K. C. MANN (Physical Rev., 1938, [ii], 54, 766—770).—The relaxation effects are similar to those found in a closed superconducting circuit (cf. preceding abstract), and confirm the view that they are due to the slow decay, caused by a very small resistance, of eddy currents in the specimen. It is shown thermodynamically that the same cause will produce relaxation in the thermal equilibrium, accounting for observed time effects in calorimeter experiments. N. M. B.

**Physical phenomena at the temperature of liquid helium.** E. F. BURTON (J. Appl. Physics, 1938, 9, 489—499).—A review of recent work at very low temp., with special reference to experiments on anomalous properties of liquid He II, and electrical and magnetic properties of superconducting metals. J. A. K.

**Magnetic studies on rhodochrosite,  $MnCO_3$ .** K. S. KRISHNAN and S. BANERJEE (Z. Krist., 1938, 99, 499—508).—From measurements on  $MnCO_3$  (96% corr.), the mean molar susceptibility ( $\chi$ ) is given as a function of temp. by  $\chi = 3.81/(T + 13)$ ; the const. corroborate theory for  $Mn^{++}$  ions. The feeble anisotropy (0.06% of  $\chi$ ), corroborating Tutton's vals. for  $Mn^{++}$  salts, corresponds with a Stark splitting of the  $Mn^{++}$  s levels of  $\sim 0.07$  cm.<sup>-1</sup> Results are discussed. I. McA.

**Velocity of sound.** R. C. COLWELL and A. W. FRIEND (Science, 1938, 88, 244).—Using a relatively short base line and an oscilloscope the val. obtained is 331.57 m. per sec. at 0°. L. S. T.

**Dispersion of ultrasonic waves in liquids.** R. BÄR (Helv. Phys. Acta, 1938, 11, 472—475).—No dispersion can be detected from measurements of the velocity of sound in  $H_2O$  and EtOAc at  $\sim 20^\circ$ , using frequencies of 7.5 and 53 Mc. per sec. A. J. E. W.

**Influence of ultrasonics on the discharge potentials of hydrogen, oxygen, and chlorine.** R. PRONTELLI (Atti R. Accad. Lincei, 1938, [vi], 27, 581—586; cf., A., 1938, I, 486).—Further evidence of the depolarising action of ultrasonics on discharge potentials at various electrodes and in various electrolytes is described. O. J. W.

**Thermodynamic scale of temperature.** N. KÜRTI and F. SIMON (Phil. Mag., 1938, [vii], 26, 840—849).—The growing use of the thermodynamic scale as a consequence of the magnetic method of reaching extremely low temp. ( $< 1^\circ$  K.) has led to the use of "provisional temp."  $T^*$  obtained from the magnetic susceptibilities by extrapolating Curie's law into the unknown regions. This gives wrong results. Other methods are discussed and a new

procedure is described in which it is not necessary to determine the amount of heat supplied to the system, or to measure any property of the substance which characterises its state in the additional field. It can be used particularly for correlation of abs. temp. in an additional field and in zero field, for studying the Curie point, or for measuring the abs. temp. of some point in the system. T. H. G.

**"Curie" scale of temperature.** N. KÜRTI and F. SIMON (Phil. Mag., 1938, [vii], 26, 849—854; cf. preceding abstract).—In the region obtained by the magnetic method, the "temp." is usually determined by measuring the susceptibility of the salt and extrapolating it according to Curie's law. It is shown that although the relation between susceptibility and  $1/T$  is linear for salt specimens of all shapes at the temp. of liquid He, considerable deviations occur at very low temp. An unambiguous definition of the "Curie" scale is therefore suggested in which reference is made to a sphere as the standard shape. T. H. G.

**Latent heat of fusion of aluminium.** J. H. AWBERY (Phil. Mag., 1938, [vii], 26, 776—784).—Published vals. show a max. difference of about 50% and fall into two groups with mean vals.  $\sim 92$  and  $\sim 77$  g.-cal. per g. The electrical energy required to melt a known mass has now been measured and gives a result of 91 g.-cal. per g. The most probable val. is 92.4. T. H. G.

**Specific heat of water ( $H_2O$ ) between  $0^\circ$  and  $100^\circ$ .** W. A. ROTH (Z. physikal. Chem., 1938, 183, 38—42).—From vals. for the sp. heat,  $c$ , of D-free  $H_2O$  the following empirical equations have been derived:  $c = 1.0066 - 0.0_356960 + 0.0_587420^2$  between  $0^\circ$  and  $40^\circ$ , and  $c = 0.9989 - 0.0_31110 + 0.0_518890^2$  between  $40^\circ$  and  $100^\circ$ . C. R. H.

**Exact measurements of the specific heat of solid substances at high temperatures.** X. Specific heat, electrical resistance, thermo-electrical behaviour, and thermal expansion of some rare-earth metals. F. M. JAEGER, J. A. BOTTEMA, and E. ROSENBOHM (Rec. trav. chim., 1938, 57, 1137—1182).—Ce and La both exist in four modifications, but at any one temp. several of these modifications co-exist simultaneously. On account of the slow rate of change from one modification to another, the exact transition temp. cannot be ascertained. Each modification is truly stable only within a very limited temp. range, and is characterised by highly discrepant vals. of the temp. coeff. of its electrical resistance. The at. heats of both metals are  $> 3R$  g.-cal. at low temp. Nd is even more complex in its behaviour since it exhibits a remarkable cyclic hysteresis effect if successively heated and cooled near the  $\beta$ - $\gamma$  transition temp., approx.  $508^\circ$ . Like Ce and La, Nd has an at. heat  $> 3R$  g.-cal. at low temp. Didymium, the solid solution of Pr and Nd, has similarly been examined. C. R. H.

**Free-energy relations among the paraffin and olefine hydrocarbons.** G. S. PARKS (Chem. Rev., 1936, 18, 325—334).—Among the paraffin hydrocarbons the free energy increases with increasing length of chain, and with increased branching in a

group of isomerides. In the olefines the position of the double linking and geometric isomerism are also important factors. CH. ABS. (e)

**Nuclear spin and symmetry effects in the heat capacity of ethane gas.** E. B. WILSON, jun. (J. Chem. Physics, 1938, 6, 740—745).—A detailed account of work already noted (cf. A., 1938, I, 438).

W. R. A.

**Liquids.** N. BĂRBULESCU (Bul. Soc. Stiințe Cluj, 1936, 8, 462—476; Chem. Zentr., 1937, i, 5).—Integration of the Clausius-Clapeyron equation between the temp. limits  $T_e$  (the abs. b.p.) and  $T_c$  gives the relation  $L = 4.571 \log p_c \{T_c T_e / (T_c - T_e)\}$ . The calc. vals. of  $L$  for  $H_2$ ,  $N_2$ ,  $O_2$ ,  $NH_3$ ,  $H_2O$ , and a no. of org. liquids are in good agreement with experiment. Vals. of van der Waals' consts. are deduced, the derived mol. diameter vals. agreeing with those calc. from  $[R]$ . The square of the sp. mol. attraction is an additive property of chemical compounds.

A. J. E. W.

**Densities of fine powders. II.** J. L. CULBERTSON and M. K. WEBER (J. Amer. Chem. Soc., 1938, 60, 2695—2697; cf. A., 1937, I, 175).—Measurements with finely divided  $SiO_2$  and C in different liquids show that polar liquids yield high  $d$  vals. for  $SiO_2$  and non-polar liquids yield low vals. Higher vals. are obtained for C in the more compressible liquids. Polar liquids with large compression coeffs. yield high  $d$  vals. for  $SiO_2$  and C. Measurements with  $SiO_2$  powders of different particle size in  $C_6H_6$  and in  $H_2O$  indicate that the degree of penetration of liquids into the solid surface has little influence on the variations of apparent  $d$ .

E. S. H.

**Reflexion coefficient of mercury.** R. C. MASON (J. Appl. Physics, 1938, 9, 535—539).—Two methods for measuring the reflexion coeff. of Hg atoms from a Hg surface are described: (i) change of pressure on the surface when exposed near a liquid-air-cooled target is measured by a micromanometer; (ii) the v.d. between evaporating and condensing surfaces is measured by an ionisation gauge. A reflexion coeff. of 0.07 was found with carefully purified Hg but after exposure to air the reflexion rose to 0.8. The val. for ordinary "clean" Hg is 0.92—0.99.

J. A. K.

**Rate of vaporisation of mercury from an anchored cathode spot.** L. TONKS (Physical Rev., 1938, [ii], 54, 634—639).—Difficulties due to spray are eliminated by use of an anchored cathode spot, and those due to normal evaporation from the free surface by confining the spot to a very small area. This is achieved by the special water-cooled cathode structure described. By means of a calibrated feed mechanism, Hg is fed to the cathode as fast as it vaporises. Measurements over a range show a rate of vaporisation increasing with arc current, temp., and exposed area. The rate, extrapolated to zero arc current, is approx.  $2.5 \times 10^{-4}$  g. per coulomb.

N. M. B.

**Calculation of thermodynamic functions from spectroscopic data.** L. S. KASSEL (Chem. Rev., 1936, 18, 277—313).—A review. CH. ABS. (e)

**Effusion phenomena in relativistic quantum statistics.** B. N. SRIVASTAVA (Proc. Roy. Soc.,

1938, A, 167, 516—526).—A theoretical investigation of effusion in non-degenerate and degenerate matter; both Fermi-Dirac and Bose-Einstein statistics are considered. G. D. P.

**Viscosity of light hydrogen gas and deuterium between 293° and 14° K.** A. VAN ITTERBEEK and (Miss) A. CLAES (Nature, 1938, 142, 793—794).—Data obtained by the oscillating-disc method are recorded. At room temp., the ratio  $\eta_{D_2} : \eta_{H_2}$  is  $\infty$  to the ratio of (mol. wts.)<sup>1</sup>, but at lower temp. the ratio decreases regularly. L. S. T.

**Viscosity of aniline between 20° and 100°.** L. A. STEINER (Ind. Eng. Chem. [Anal.], 1938, 10, 582—584).—The  $\eta$  of vac.-distilled  $NH_2Ph$ ,  $d_4^{20}$  1.0208  $\pm$  0.0003,  $d_4^{100}$  0.9527  $\pm$  0.0003, has been determined at 5° intervals from 20° to 100° with an accuracy of  $\pm 0.20$  to  $\pm 0.30\%$ . At 20°,  $\eta$  is  $4.400 \pm 0.25\%$  centipoises. The results are compared with those given in the lit.  $NH_2Ph$  is more suitable than  $H_2O$  for the calibration of viscosimeters at high temp. When protected from light and the atm., it remains unchanged for 2 months. L. S. T.

**Internal friction and internal lubrication.** H. HARMS, H. RÖSSLER, and K. L. WOLF (Z. physikal. Chem., 1938, B, 41, 321—364).—A mol. theory of internal friction is developed in which the mol. viscosity of a liquid mixture is related to the mol. viscosities of the pure components and their mol. vols. in the mixture. The theory is tested by application to a series of measurements on mixtures of  $C_6H_6$  and  $C_6H_{14}$  with cyclohexane,  $CCl_4$ , and  $COMe_2$ ,  $CS_2$  with  $CCl_4$ , and of various alcohols with  $C_6H_6$ ,  $CCl_4$ , cyclohexane,  $CS_2$ , and dioxan. Deviations from the theory are discussed with reference to changes in intermol. forces and the depolymerisation of polar mols.

J. W. S.

**Vapour pressure of saturated aqueous sucrose at low temperatures.** K. P. VOLKOV and E. A. SAVOSTIANOV (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 103—120).—The v.p. of saturated aq. sucrose, determined for the range 13.7—43°, is expressed by Bertrand's formula  $P = G\{(T - \lambda)/T\}^{50}$  ( $\lambda = 75.62$ ,  $\log G = 7.65013$ ); Raoult's and Speransky's formulæ are not applicable. The integral heat of dissolution of sucrose is 284.1 g.-cal. at 22°. R. T.

**Solutions of sodium in liquid ammonia; magnetism, thermal expansion, state of the dissolved sodium.** E. HUSTER (Ann. Physik, 1938, [v], 33, 477—508; cf. A., 1937, I, 137).—The density of solutions of concn. 0.01—0.17 mol. fraction Na have been measured between  $-34^\circ$  and  $-75^\circ$ . The magnetic susceptibility ( $\chi$ ) of the solutions has been determined at  $-35^\circ$  and  $-75^\circ$ . The general variation of  $\chi$  with concn. agrees with the theory that the dissolved Na is in the metallic state at all concns. (cf. A., 1932, 1206). Deviations at low and medium concns. can be explained by the presence of  $Na_2$  mols. The conclusions of Krüger (A., 1938, I, 572) are criticised. O. D. S.

**Sp. gr. of pure and mixed salt solutions in the temperature range 0—25°.** R. W. BREMNER, T. G. THOMPSON, and C. L. UTTERBACK (J. Amer. Chem. Soc., 1938, 60, 2616—2618).—Data are

recorded for aq. NaCl, KCl, MgSO<sub>4</sub>, NaCl + KCl, NaCl + MgSO<sub>4</sub>. Concns. of the binary solutions were in the same ratios as those that occur in ocean-H<sub>2</sub>O. Root's equation (A., 1933, 347) is applicable to the results; the appropriate consts. for the above solutions have been calc. E. S. H.

Densities of aqueous solutions of carbamide at 25° and 30° and the apparent molal volume of carbamide. F. T. GUCKER, jun., F. W. GAGE, and C. E. MOSER (J. Amer. Chem. Soc., 1938, 60, 2582—2588).—Data for 0.1—4M. solutions at 30° and 0.1—9.5M. at 25° are recorded. The apparent mol. vol. of CO(NH<sub>2</sub>)<sub>2</sub> is a linear function of the vol. concn. over the range examined at 30° and up to 3M. at 25°. Equations relating apparent mol. vol. and *d* to concn. are given. Solid CO(NH<sub>2</sub>)<sub>2</sub> has *d* 1.329 g. per ml. at 25°, mol. vol. 45.19 ml. E. S. H.

Compressibility and solvation of solutions of electrolytes. A. PASSINSKI (Acta Physicochim. U.R.S.S., 1938, 8, 385—418).—A formula for the solvation of electrolytes in terms of the compressibility ( $\kappa$ ) of their solutions is given, and a method for determining the  $\kappa$  of electrolyte solutions from measurements of the velocity of propagation of ultrasonic waves is described. Data recorded for aq. LiCl (6), LiBr (5), NaF (9), NaCl (8), NaBr (7), NaI (7), KF (9), KCl (7), KBr (7), KI (6), BeCl<sub>2</sub> (9), MgCl<sub>2</sub> (17), BaCl<sub>2</sub> (16), and AlCl<sub>3</sub> (31) over a wide range of concn. show that the variation of  $\kappa$  of electrolytes with concn. is nearly linear, and almost independent of the ionic radii. It is  $\propto$  the no. of ions in solution and to their (charge)<sup>1.5</sup>. In the main, the results substantiate Debye's theory of compressibility. The calc. solvation vals. decrease somewhat with a rise in concn. Extrapolation to infinite dilution gives the limiting vals. recorded above in parentheses. The solvation of cations follows the series Li<sup>+</sup> < Na<sup>+</sup>, K<sup>+</sup>, and of anions F<sup>-</sup> > Cl<sup>-</sup> > Br<sup>-</sup>, I<sup>-</sup>. The results are best interpreted from the point of view of Bernal and Fowler's theory of hydration of ions (A., 1934, 13). All the cations studied, and among the anions only OH<sup>-</sup> and F<sup>-</sup>, show const. hydration. L. S. T.

Viscosity in the system AsBr<sub>3</sub>-PhNO<sub>2</sub>. I. L. KATZNELSON and A. V. BERNSCHEIN (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 187—196).—The  $\eta$ -composition curves at 0°, 20°, 30°, 40°, and 50° suggest the occurrence of compounds AsBr<sub>3</sub>.PhNO<sub>2</sub> and AsBr<sub>3</sub>.2PhNO<sub>2</sub>. R. T.

Origin of colour in paramagnetic ions in solution. D. M. BOSE and P. C. MUKHERJI (Phil. Mag., 1938, [vii], 26, 757—776).—The available data on the absorption spectra of solutions containing paramagnetic ions (except the rare earths) are collected and an empirical formula is suggested to account for the no. and frequency of the principal bands, their fine structure being omitted. The paramagnetic ions form complexes with the dipole mols. of the solvent (if polar) and are acted on by an induced electric field in which the ground term of an ion of orbital moment *L* is split into *L* + 1 equidistant sub-levels having quantum nos.  $e_L = 0, 1, 2 \dots L$ . The absorption spectra are due to

transition from the lowest to higher levels and hence there are *L* absorption bands of frequency  $\Delta\nu = Ne|\Delta e_L| \cdot K_0/\epsilon$  where  $\epsilon =$  dielectric const.  $K_0/\epsilon$  is approx. const. T. H. G.

Spectrophotometric study of neutralisation indicators. W. B. FORTUNE [with M. G. MELLON] (J. Amer. Chem. Soc., 1938, 60, 2607—2610).—Spectral transmittancy curves for several simple, modified, and mixed indicators at different  $p_H$  have been obtained. E. S. H.

X-Ray investigation of the form of acetylsalicylic acid in certain sugars. S. S. SIDHU (J. Appl. Physics, 1938, 9, 546—550).—X-Ray diffraction patterns of combinations of sucrose, glucose, and acetylsalicylic acid show only lines characteristic of the pure components and give no indication of complex formation or solid solutions. J. A. K.

Systematic magnetic measurements on iron compounds, especially the course of the magnetic properties in the transition from bivalent to trivalent iron. O. GOTT and W. KRINGS (Z. anorg. Chem., 1938, 239, 345—364).—Magnetic properties in the systems FeO-Fe<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub> and FeO-Fe<sub>2</sub>O<sub>3</sub>-P<sub>2</sub>O<sub>5</sub>, and in Fe-borax glasses, have been studied, with a view to their possible use for determining the degree of oxidation of Fe in insol. compounds. Paramagnetism extends throughout the system Fe<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub> in the absence of Fe<sup>II</sup> but does not follow the mixture law: there is a sharp max. of  $\chi$  at 10% SiO<sub>2</sub>. Even the slightest degree of oxidation of Fe<sub>2</sub>SiO<sub>4</sub> or reduction of Fe<sub>2</sub>O<sub>3</sub>-SiO<sub>2</sub> preps. gives rise to ferromagnetic products, so that magnetic measurements give no information as to the degree of oxidation. In the systems Fe<sub>2</sub>O<sub>3</sub>-P<sub>2</sub>O<sub>5</sub> and FeO-P<sub>2</sub>O<sub>5</sub>,  $\chi$  increases linearly with [Fe] up to the compositions FePO<sub>4</sub> and Fe<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> and then decreases, in the Fe<sup>III</sup> system to the val. for Fe<sub>2</sub>O<sub>3</sub>, and in the Fe<sup>II</sup> system until the composition 63% FeO is attained, further increase in [Fe] then giving ferromagnetic products. By partial reduction of FePO<sub>4</sub> and preps. poorer in Fe, paramagnetic products are obtained, but there is no simple connexion between the % reduction and  $\chi$ . Paramagnetic Fe-borax glasses containing both Fe<sup>II</sup> and Fe<sup>III</sup> can be obtained, but there is no simple connexion between  $\chi$  and the degree of oxidation, and on tempering they all become ferromagnetic. F. J. G.

Dissociation of mixed isomorphous crystal hydrates. K. P. VOLKOV (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 91—102).—The dissociation pressures, *P*, of mixed crystals of MgSO<sub>4</sub>.7H<sub>2</sub>O and ZnSO<sub>4</sub>.7H<sub>2</sub>O (10—90 mol.-%) at 16°, 20°, and 25° are < for the pure salts. The *P*-composition curves do not exhibit abrupt breaks, whence it is concluded that the crystals are physically homogeneous mixed crystals, and that double compounds are not formed. R. T.

Solubility of hydrogen in the iron lattice.—See B., 1938, 1426.

Solubility of hydrogen, deuterium, and nitrogen in iron. A. SIEVERTS, G. ZAPF, and H. MORITZ (Z. physikal. Chem., 1938, 183, 19—37).—Data are recorded for various Fe samples over a range 500—



1650°, and are compared with earlier data. The solubility of D<sub>2</sub> in any one Fe sample is < that of H<sub>2</sub>, the difference increasing with rise of temp.

C. R. H.

**Solubility of hydrogen in tungsten-iron alloys.** W. BAUKLOH and K. GEHLEN (Arch. Eisenhüttenw., 1938—9, 12, 39—40).—At temp. up to 800° the solubility of H<sub>2</sub> in W-Fe alloys falls to a min. at 1.5% W, increases linearly up to 8.6% W, and finally decreases rapidly to 10.35% W, then more slowly. At 900° the min. at 1.5% W does not occur and at 1000—1050° there is no initial increase in H<sub>2</sub> solubility with increasing W content. These changes in H<sub>2</sub> solubility with variations in temp. and W content are correlated with the equilibrium diagram of the Fe-W system.

A. R. P.

**Comparison of volume and [interatomic] distance contractions in intermetallic compounds.** F. LAVES (Metallwirts., 1936, 15, 631—639; Chem. Zentr., 1936, ii, 2674—2675).—Deviations from Biltz and Weibke's additive rule are considered (cf. A., 1935, 1199). The varying contraction of the Li atom in alloys with Zn, Cd, Al, Ga, and In is due to incomplete filling of the lattice spaces which the Li atoms occupy. The contractions of Mg, Cu, and Zn atoms are calc. from measured interat. distances in MgNi<sub>2</sub>, MgCu<sub>2</sub>, MgZn<sub>2</sub>, and mixed crystals; the contractions for Zn and Mg are respectively > and < Biltz and Weibke's mean vals. for other alloys. Interat. distances in other AB<sub>2</sub>-type structures are considered. Vals. of the mean at. radius in alloys, which are < the normal at. radii, may be assigned to a no. of elements. A spatial interpretation of at. contractions is given.

A. J. E. W.

**"Difference effect" of amalgams.** P. Z. FISHER and T. E. KOVAL (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 151—159).—Positive and negative "difference effects" were obtained with Na, K, and Zn amalgams in 0.1N- and 15% HCl. It is concluded that the effect cannot be connected with the formation of a protective film, and that none of the theories advanced adequately explains the phenomenon.

R. T.

**Magnetic susceptibility of dilute sodium amalgams.** S. ARAVAMUTHACHARI (Current Sci., 1938, 7, 179—181).—The magnetic susceptibilities of 20 dil. Na amalgams (<1.3 wt.-% Na) have been determined by the Curie method. As the at.-% of the Na rises the diamagnetic susceptibility,  $\chi$ , decreases slowly, then rapidly; it falls to a min. at approx. 4.5 at.-% Na, then increases slowly. The great deviation from the law of additivity may be due to (a) dissolution of the Na in the Hg, (b) formation of solid compounds in which the paramagnetic contribution of the free electrons in the atoms disappears and  $\chi$  rises.

W. R. A.

**Dependence of diffusion coefficients of metals on grain size.** W. BUGAKOV and F. RIBALCO (Tech. Phys. U.S.S.R., 1935, 2, 617—623; cf. Fonda et al., A., 1933, 771).—With varied temp. (*T*) and grain diameter (*d*), the diffusion coeff. (*D<sub>T</sub>*) and heat of diffusion (*Q*) of Zn in brass have been determined by the evaporation method (B., 1937, 48). *D<sub>T</sub>* increases with *T* and with decreasing *d*. For polycryst. metal

*Q* is const. (18,700 g.-cal.); a higher val. is claimed for single crystals. An interpretation in terms of the intergranular structure is supported by available evidence.

I. McA.

**Theory of the transition of metallic mixed phases. V. Fluctuations and formation of nuclei in supercooled phases.** G. BORELIUS (Ann. Physik, 1938, [v], 33, 517—531; cf. A., 1937, I, 223).—The theory of concn. fluctuations in alloys with disordered at. arrangement is developed and is related to the previously derived equation for the variation with concn. of free energy. Wictorin's vals. for the time of half separation of Au-Pt alloys (cf. following abstract) agree with the theory.

O. D. S.

**Separation of gold-platinum alloys.** C. G. WICTORIN (Ann. Physik, 1938, [v], 33, 509—516; cf. Johansson and Hagsten, A., 1937, I, 233).—The velocity of the separation on annealing at temp. in the two-phase region of Au-Pt alloys from 25 to 96 at.-% Pt has been followed by measurements of the electrical resistance. In a central region of concn. which broadens with decreasing annealing temp. separation is uninhibited. Limiting curves for the metastable state are calc. by the method of Borelius (*loc. cit.*) and agree with previous data.

O. D. S.

**Silver-mercury complex.** P. SPACU (Bul. Soc. Stiinte Cluj, 1936, 8, 354—355; Chem. Zentr., 1936, ii, 2692).—The salt described by Wöhler (A., 1936, 1079) is considered to be Ag[HgNO<sub>3</sub>(CN)<sub>2</sub>], 2H<sub>2</sub>O, since when electrolysed it gives Ag at the cathode, and Hg and HCN at the anode. When treated with *o*-C<sub>6</sub>H<sub>4</sub>Me·NH<sub>2</sub> (tol) in light petroleum it gives [Ag toI<sub>3</sub>][HgNO<sub>3</sub>(CN)<sub>2</sub>].

A. J. E. W.

**Systems copper-germanium and silver-germanium.** H. MAUCHER (Forschungsarb. Metallk. Röntgen-Metallogr., 1936, 20, 22 pp.; Chem. Zentr., 1936, ii, 2438).—As-free Ge has been prepared by repeated distillation of GeCl<sub>4</sub> in HCl solution, followed by hydrolysis and reduction of GeO<sub>2</sub> with KCN + C. Corr. temp. and composition data for the Cu-Ge phase diagram are given. A compound Cu<sub>3</sub>Ge, which melts without decomp., gives mixed crystals with melts of the peritectic composition, having a very narrow region of stability. The  $\alpha$ - and  $\beta$ -phases have been studied with X-rays. Previous work on the system Ag-Ge is confirmed.

A. J. E. W.

**Magnetic susceptibility of the [binary] systems of zinc with nickel, cobalt, and iron.** J. SCHRAMM (Z. Metallk., 1938, 30, 327—334).—Temp.-susceptibility curves of alloys in these systems show points of inflexion at temp. at which three-phase reactions or phase changes occur, and composition-susceptibility curves similar points at phase field boundaries. In the Ni-Zn system these boundaries are  $\delta/\delta + \eta$  at 10% Ni up to 400°,  $\Gamma/\Gamma + \Gamma_1$  at 20% Ni,  $\beta_1/\beta_1 + \Gamma_1$  at 45.5% Ni up to 675°,  $\beta_1/\alpha + \beta_1$  at 52% Ni up to 750°, and  $\beta/\alpha + \beta$  at 50% Ni above 850°; in the Fe-Zn system they are  $\delta_1/\zeta + \delta_1$  at 7% Fe up to 530°,  $\delta_1/\Gamma + \delta_1$  at 11.5% Fe up to 600°, and  $\Gamma/\alpha + \Gamma$  at 28% Fe up to 700°. The various temp. horizontals determined by this method confirm those previously found by thermal analysis.

A. R. P.

**Diffraction of X-rays by an age-hardening alloy of aluminium and copper. Structure of an intermediate phase.** G. D. PRESTON (Phil. Mag., 1938, [vii], 26, 855—871; cf. A., 1938, I, 611).—Attempts have been made to estimate the dimensions of the regions into which the Cu segregates in an alloy containing 4 or 5% Cu during age-hardening at room temp. and at 200°. The regions appear to consist of  $\gt$  five (100) planes of Cu atoms with  $\gt$  100 atoms per layer at room temp. Heat-treatment of crystals previously age-hardened at room temp. suggests that the Cu atoms first redissolve and later reappear as similar sheets of larger area. The thickness gradually increases and finally a new phase appears. This phase is of the  $\text{CaF}_2$  type but is tetragonal and has 4 Cu and 8 Al per cell. Its structure differs from that of the  $\text{CuAl}_2$  usually obtained, and whether it is a metastable intermediate phase or the form of  $\text{CuAl}_2$  stable at low temp. is not clear.

T. H. G.

**Irregular dilatometric anomalies in aluminium-copper alloys.**—See B., 1938, 1432.

**Crystal structure of intermetallic compounds of aluminium with titanium, zirconium, thorium, niobium, and tantalum.** G. BRAUER (Naturwiss., 1938, 26, 710).—In the binary systems of Al with Ti, Zr, Th, Nb, and Ta the intermediate type of crystal richest in Al possesses in each case the formula  $\text{MAl}_3$ . The tetragonal cryst. structure of  $\text{TiAl}_3$  obtained by Fink *et al.* was confirmed.  $\text{NbAl}_3$  and  $\text{TaAl}_3$  also crystallise in the tetragonal system. Lattice consts. for  $\text{TiAl}_3$ ,  $\text{NbAl}_3$ , and  $\text{TaAl}_3$  are  $a$  5.425, 5.427, 5.422;  $c$  8.579, 8.584, and 8.536 Å., respectively.  $\text{ZrAl}_3$  is tetragonal,  $a$  4.00,  $c$  17.3 Å., 16 atoms in cell.  $\text{ThAl}_3$  is hexagonal,  $a$  6.480,  $c$  4.601 Å., 8 atoms in cell.

A. J. M.

**Solubility of chromium in aluminium.** W. KOCH and H. WINTERHAGER (Metallwirts., 1938, 17, 1159—1163).—Dilatometric, resistivity, and X-ray methods were employed. The solid solubility is 0.87% Cr at 660° and  $\sim$  0.05% Cr at 300°.

C. E. H.

**System manganese-aluminium.** W. KÖSTER and W. BECHTHOLD (Z. Metallk., 1938, 30, 294—296).—The system was re-examined by thermal and magnetic analysis and by micrographic examination. On adding Al to Mn the m.p. rises to a max. at 1287°, 15% Al; further addition of Al produces a peritectic reaction at 1160° resulting in the formation of  $\text{MnAl}$ , and a second similar reaction at 995° with the formation of  $\text{MnAl}_3$ . The first horizontal extends from 63 to 72.5% Mn and the second from 38 to 49% Mn.  $\text{MnAl}$  dissolves up to 18% Al but no Mn; between 41 and 49% Mn the alloys consist of  $\text{MnAl}_3 + \text{MnAl}$  saturated with Al. The  $\delta$ -field extends to 72.5% Mn at 1160° and to 82% Mn at 1005°; at the latter point there is a eutectoidal transformation into  $\gamma$ -Mn +  $\text{MnAl}$ . The  $\delta$ - $\gamma$  transformation point of Mn is lowered progressively to 1005° with 14% Al and the  $\gamma$ - $\beta$  to 930° with 13% Al; both transformations occur in all alloys with  $\gt$  67% Mn. The  $\beta$ - $\alpha$  transformation is lowered to room temp. with  $\gt$  5% Al.

A. R. P.

**System manganese-vanadium.**—See B., 1938, 1435.

**System iron-iron silicide (FeSi)-graphite.** H. JASS and H. HANEMANN (Giesserei, 1938, 25, 293—299).—Thermal and micrographic investigations were carried out on alloys containing up to C 4.24 and Si 22.3%, and an equilibrium diagram is given. In the graphite system, the binary eutectic curves studied run from 4.23% C at 1152° on the C side to 21.2% Si at 1205° on the Si side. The eutectic C content is approx. 4.23 — ( $\text{Si}\% \div 3.2$ ). Two transformation surfaces involving the liquid have been found at 1172° and 1200°. In the course of the binary eutectic curves the eutectoid change appears up to 8% Si, primary and eutectic grains only are seen above 10% Si, and the  $\epsilon$ - and  $\delta$ -phases appear at 16% Si. Above 20% Si all C is in solution. Dendrites are always seen in specimens of eutectic C content, indicating a strong tendency to undercooling. Si reduces the size of the eutectic graphite particles.

C. E. H.

**Equilibrium diagram iron-niobium.** H. EGGERS and W. PETER (Mitt. Kaiser-Wilh.-Inst. Eisenforsch., 1938, 20, 199—203).—The system has been studied by means of cooling curves, photomicrography, and X-rays, and the equilibrium diagram constructed up to 70% Nb. There are two compounds,  $\text{Fe}_3\text{Nb}_2$  (I), m.p. 1650—1660°, and another (II) richer in Nb, the composition of which was not determined. The eutectics are at 1356° with 17.5—18% Nb and 1560° with 67—67.5% Nb. (I) takes up a considerable % of Fe, but very little Nb, into solid solution.  $\delta$ -Fe dissolves up to 12% of Nb at 1356°, but  $\alpha$ - and  $\gamma$ -Fe take up much smaller amounts and there is a eutectoid at 1220° and 10% Nb, where the  $\delta$ -phase decomposes into  $\gamma$  and (I) saturated with Fe. (I) and (II) are both stable down to room temp. The systems Fe-Nb, Fe-V, Fe-Ta, Fe-Zr, and Fe-Mo are compared.

F. J. G.

**Two-component system iron-rhenium.** H. EGGERS (Mitt. Kaiser-Wilh.-Inst. Eisenforsch., 1938, 20, 147—152).—The system has been studied up to 70% Re by means of cooling curves, photomicrography, and X-rays, and an equilibrium diagram constructed. There are five homogeneous phases,  $\alpha$ ,  $\gamma$ ,  $\delta$ , and  $\eta$  mixed crystals, and a compound  $\text{Fe}_3\text{Re}_2$  which is stable over the whole temp. range.  $\alpha$ -,  $\gamma$ -, and  $\delta$ -Fe take up considerable amounts of Re in solid solution, e.g., 29% at room temp., 40% at 1205°, and 7% at 1540°; the  $\eta$ -mixed crystals are deposited from melts containing  $\gt$  15% of Re, and the region of stability extends down to a eutectoid at 1205°, composition approx.  $\text{Fe}_3\text{Re}$ , where  $\gamma$  and  $\text{Fe}_3\text{Re}_2$  are deposited. The systems Fe-Re, Fe-Os, and Fe-W are compared.

F. J. G.

**Systems of cobalt with boron, arsenic, zirconium, niobium, and tantalum.** W. KÖSTER and W. MULFINGER (Z. Metallk., 1938, 30, 348—350).—All these systems contain a binary compound which forms a eutectic with Co.  $\text{Co}_2\text{B}$ , m.p. 1265°, is ferromagnetic,  $\text{Co}_2\text{Zr}$  has a very high m.p.,  $\text{Co}_5\text{Nb}_2$  melts at 1500°, and  $\text{Co}_5\text{Ta}_2$  at 1550°. The eutectic points are: Co-B 1102°, 5.5% B; Co-As 920°,

30% As; Co-Zr 1460°, 12% Zr; Co-Nb 1235°, 21% Nb; Co-Ta, 1275°, 31% Ta. The saturated Co-rich solid solutions contain: 1% B (20—1100°); 5% As at 20° and 7% at 900°; 2% Zr up to 1200°; 4% Nb at 20° and ~8% above 1200°; 8.5% Ta at <1000° and 13% at 1275°. Alloys with 4—8% Nb and 8—13% Ta can be pptn.-hardened. A. R. P.

**Mg-MgCd<sub>2</sub>-Mg<sub>5</sub>Tl<sub>2</sub> portion of the ternary magnesium-cadmium-thallium system.** W. KÖSTER and E. WAGNER (Z. Metallk., 1938, 30, 335—338).—Replacement of Tl in Mg-Tl alloys by increasing amounts of Cd narrows the solidification range and extends the range of homogeneous  $\epsilon$  solid solution. There is a four-phase reaction at 320°: liquid +  $\epsilon$  (Mg 40, Cd 45, Tl 15%) = MgCd<sub>2</sub> + Mg<sub>5</sub>Tl<sub>2</sub>. A small amount of pptn.-hardening can be obtained with an alloy of Mg 30, Cd 35, Tl 35%, but the alloy is very susceptible to corrosion by air and tap-water, as are most of the alloys with a low proportion of Mg. A. R. P.

**Mg-Al<sub>3</sub>Mg<sub>4</sub>-Mg<sub>5</sub>Tl<sub>2</sub> portion of the ternary magnesium-aluminium-thallium system.** W. KÖSTER and E. WAGNER (Z. Metallk., 1938, 30, 338—342).—Al<sub>3</sub>Mg<sub>4</sub> and Mg<sub>5</sub>Tl<sub>2</sub> form a quasi-binary simple eutectiferous system with a eutectic at 398°, Mg 28, Al 7, Tl 65%; the solid solubility range at this temp. extends at the Al<sub>3</sub>Mg<sub>4</sub> end to Mg 51, Al 40, Tl 9% and at Mg<sub>5</sub>Tl<sub>2</sub> end to Mg 24, Al 1, Tl 75%. In the pseudoternary system Mg-Al<sub>3</sub>Mg<sub>4</sub>-Mg<sub>5</sub>Tl the ternary eutectic is at 395°, Mg 32.5, Al 5, Tl 62.5%; the solid compounds consist of  $\epsilon$  (Mg 52, Al 5, Tl 43%),  $\theta$  (Mg 51.5, Al 39.5, Tl 9%), and almost pure Mg<sub>5</sub>Tl<sub>2</sub>. The  $\epsilon$ -Mg-rich solid solution extends over a wider range at the eutectic temp. than at room temp. and hence these alloys can be pptn.-hardened; thus the alloy with Mg 72, Al 8, Tl 20% shows an increase in tensile strength and hardness of 80—100% after quenching from 400° and reheating at 200° for 2 hr. The alloys, however, have a very poor resistance to corrosion in moist air. A. R. P.

**System aluminium-iron-magnesium.** M. BARNICK and H. HANEMANN (Aluminium, 1938, 20, 533—535).—The Al corner of the equilibrium diagram of the system Al-Fe-Mg has been studied by microscopic, thermal, and X-ray methods. The only solid phases occurring are solid solutions in Al ( $\alpha$ -phase), Al<sub>3</sub>Fe, and Al<sub>3</sub>Mg<sub>2</sub> ( $\beta$ -phase). These form a ternary eutectic at 445° with Al 68%, Fe 3%, and Mg 29%. The corresponding  $\alpha$ -phase contains 13.3% of Mg and very little Fe. J. W. S.

**Iron corner of the iron-titanium-carbon system.** W. TOFAUTE and A. BÜTTINGHAUS (Arch. Eisenhüttenw., 1938—9, 12, 33—37).—Addition of C to Ti-Fe alloys enlarges the  $\gamma$ -field from 0.8% Ti to 1% Ti with 0.35% C; with more C this field steadily becomes smaller, hence the  $\alpha$ - $\gamma$  transformation of Fe-C alloys is displaced to higher C content and higher temp. by addition of Ti so that low-C alloys with 3% Ti are always ferritic. The ternary alloys can be age-hardened provided that sufficient Ti (4—22%) is present in solid solution; TiC takes no part in this action. Alloys which remain ferritic up to the m.p. cannot be hardened by quenching. TiC and Fe<sub>3</sub>C

appear to have no mutual solubility but form a pseudobinary eutectiferous system, as also do Fe<sub>3</sub>Ti and TiC. In the ternary system there are four points of four-phase equilibrium: (a) at 1340° between liquid (Ti 10, C 1.65%),  $\alpha$  (Ti 5.5, C 0.2%), Fe<sub>3</sub>Ti, and TiC; (b) at 1320° between liquid (Ti 1.6, C 2%),  $\alpha$  (Ti 1.27, C 0.07%),  $\gamma$  (Ti 1.0, C 0.1%), and TiC; (c) at 1140° between liquid (Ti 0.8, C 3.9%),  $\gamma$  (Ti 0.22, C 1.61%), TiC, and Fe<sub>3</sub>C; and (d) at 740° between  $\alpha$  (Ti 0.18, C 0.05),  $\gamma$  (Ti 0.1, C 0.72%), TiC, and Fe<sub>3</sub>C. A. R. P.

**System nitrogen-steel.** L. PALATNIK (Tech. Phys. U.S.S.R., 1935, 2, 598—616).—An analysis (mainly X-ray) of Cr-Mn-Si steels nitrified in NH<sub>3</sub> at 500—650° is compared with the extensively reviewed results of the substantially similar Fe-N system. An important factor is the stability of the metal component nitrides, which varies in periodic column order. The disputed  $\zeta$ -phase occurs, probably a metastable form of Fe<sub>2</sub>N in the Fe-N system. Cubic (and tetragonal ?) nitrified martensite occurs in a Cr-Mo-Al steel. Decomp. of the  $\epsilon$ -phase by diffusion is discussed in relation to the finely-dispersed  $\gamma'$ -phase. The  $\alpha$ -phase (solid solution of at. N) is an infusible type; mechanisms and structure are discussed.

I. McA.

**Iron corner of the equilibrium diagram iron-niobium-carbon below 1050°.** H. EGGERS and W. PETER (Mitt. Kaiser-Wilh.-Inst. Eisenforsch., 1938, 20, 205—211).—Nb-C steels contain a Nb carbide, Nb<sub>4</sub>C<sub>3</sub>, which is cubic with  $a$  4.46 Å. There are no double Fe-Nb carbides. Fe-Nb-C alloys having up to 2% Nb and 2.4% C have been studied by means of cooling curves and photomicrography. There are two four-phase planes corresponding with the reactions  $\gamma \rightleftharpoons \alpha + Nb_4C_3 + Fe_3C$  at 705° and  $\gamma + Fe_3Nb_2 \rightleftharpoons \alpha + Nb_4C_3$  at 920°. F. J. G.

**Cobalt corner of the iron-cobalt-vanadium system.** W. KÖSTER and K. LANG (Z. Metallk., 1938, 30, 350—352).—Alloys of Co with 5:95 Fe-V form a eutectic at 42% V, 1150°, the two constituents being  $\gamma$ -Co solid solution and an intermediate phase  $\theta$ . The  $\gamma$ -phase extends to 31% V and the  $\gamma + \theta$  field from 31 to 48% V. Addition of V to Co increases the hysteresis of the  $\gamma$ - $\epsilon$  transformation, which reaches 680° at 15% V, and depresses the magnetic transformation point of Co progressively to room temp. at ~26% V. With an increasing Fe-V ratio the  $\gamma$ -range is considerably extended whilst the  $\gamma + \theta$  field becomes narrower and eventually disappears with a 4:1 Fe-V ratio; with this Fe-V ratio alloys with 35—65% Co consist entirely of  $\alpha$  at room temp. and entirely of  $\gamma$  at above 800—850°. A. R. P.

**Ternary system cobalt-manganese-copper.** W. KÖSTER and E. WAGNER (Z. Metallk., 1938, 30, 352—353).—The miscibility gap in the Co-Cu system is hardly affected by addition of up to 40% Mn, so that homogeneous alloys, which can be pptn.-hardened and thus given useful ferromagnetic properties, cannot be obtained in this system. A. R. P.

**System cobalt-manganese-aluminium.** W. KÖSTER and E. GEBHARDT (Z. Metallk., 1938, 30, 281—286).—The equilibria in the system between the Co-Mn and the CoAl-MnAl lines of the ternary

diagram were established by thermal and magnetic analysis and by micrographic examination. CoAl and MnAl form a continuous series of solid solutions and the alloys are ferromagnetic over a wide range of composition. CoAl and Mn form a pseudobinary system with a peritectic reaction at  $1245^{\circ}$ , the liquid containing Co 23, Al 11, and Mn 66%; the  $\beta$ -Mn solid solution extends to 22% CoAl and the  $\alpha$ -CoAl solid solution to 17% Mn at  $20^{\circ}$ , 20% at  $800^{\circ}$ , and 69% Mn at  $>1050^{\circ}$  so that alloys with  $>20\%$  Mn can be pptn.-hardened by suitable heat-treatment. In the ternary system there are four-phase reactions at  $1170^{\circ}$  (liquid +  $\delta_{Mn} = \alpha + \gamma_{Mn}$ ),  $1160^{\circ}$  (liquid +  $\gamma_{Mn} = \alpha + \gamma$ ), and  $1030^{\circ}$  ( $\gamma_{Mn} = \alpha + \gamma + \beta_{Mn}$ ). Equilibrium diagrams are given for alloys with const. Mn contents of 10, 30, and 50%, for const. Al contents of 5, 15, and 25%, and for the CoAl-Mn system. A. R. P.

**Magnetic properties of cobalt-manganese-aluminium alloys.** W. KÖSTER and E. GEBHARDT (Z. Metallk., 1938, 30, 286—290).—The highest magnetic saturation (7500 gauss) is shown by homogeneous alloys consisting of CoAl saturated with Co; addition of Al or Mn reduces the saturation progressively to 3800 gauss. In homogeneous  $\alpha$ -alloys with an ordered at. structure the Curie temp. falls almost linearly with increasing quenching temp., but in alloys of the system CoAl-Mn the Curie temp. and magnetisation rise with increasing quenching temp. owing to the increased solubility of Mn at high temp.; reheating of the latter alloys to produce pptn. of  $\beta$ -Mn considerably reduces the magnetisation since both the pptd. phase and the remaining solid solution are only slightly magnetic. With alloys in the  $\alpha + \gamma$  range good magnetic properties are obtained by quenching from  $1300^{\circ}$  and reheating for 30 min. at  $650^{\circ}$ ; after this treatment the alloy with Co 79, Mn 10, Al 11% has a coercivity of 300 oersteds with a remanence of 7000 gauss, vals. which are about 60 times as great as those shown by the quenched alloy. The mechanism of the pptn. processes in these two types of alloys is discussed. A. R. P.

**System nickel-manganese-aluminium.** W. KÖSTER and E. GEBHARDT (Z. Metallk., 1938, 30, 291—293).—The equilibria in this system resemble closely those in the corresponding Co system. NiAl and Mn form a quasi-binary system with a min. m.p. of  $1120^{\circ}$  at 66% Mn and a wide  $\alpha$ -range extending to 80% Mn at  $1050^{\circ}$  and 23% at  $20^{\circ}$ ; alloys quenched from above the solubility line are all ferromagnetic. There is a peritectic reaction at  $1170^{\circ}$  in liquid containing Mn 78, Ni 15, Al 7% due to the separation of  $\gamma$ -Mn. The solidification of alloys in the ternary system is controlled by the broad range of homogeneous  $\alpha$  solid solution at high temp.; the equilibria in this system are shown in diagrams for const. Mn contents of 20 and 40% and for const. Al contents of 10 and 15%. A. R. P.

**Solutions and solubility.** A. E. VAN ARKEL (Chem. Weekblad, 1938, 35, 768—771).—A general discussion of some of the factors involved in solubility, including heat of mixing, van der Waals-London forces, and in the case of electrolytes the electrical properties. S. C.

**Theory of miscibility.** A. J. STAVERMAN (Chem. Weekblad, 1938, 35, 772—776).—The theory of miscibility is discussed mathematically, particularly from the point of view of the significance of London, Debye, and Keesom energies. Positive heats of mixing are explained by a new definition of Keesom energy, and from a consideration of the entropies of normal and abnormal liquids suggestions are made for predicting energies, v.p., partition coeffs., etc. S. C.

**Solubility of carbon dioxide in deuterium oxide at  $25^{\circ}$ .** J. CURRY and C. L. HAZELTON (J. Amer. Chem. Soc., 1938, 60, 2771—2773).—The mol. solubility in  $D_2O$  is 0.902 of that in  $H_2O$ . E. S. H.

**Hydrogen bonds involving the C-H link. IV. Effect of solvent association on solubility. V. Solubility of methylene chloride in donor solvents.** M. J. COPLEY, G. F. ZELHOFER, and C. S. MARVEL (J. Amer. Chem. Soc., 1938, 60, 2666—2673, 2714—2716; cf. A., 1938, I, 394).—IV. The solubility of  $CH_2Cl_2$  in PhOH, 2 glycols, 6 ethers, 2 acids, 6 esters, 7 amines, 9 amides, 10 CO-compounds, and CMeEt.N.OH is measured. The observed results are accounted for as follows, if high solubility is due to formation of C-H $\leftarrow$ O and C-H $\leftarrow$ N linkings. Alcohols form linear polymerides, the H $\leftarrow$ O linking being too strong to be broken. Ethers, esters, NN-disubstituted amides, ketones, and aldehydes do not polymerise and are good solvents. Acids and CMeEt.N.OH, giving cyclic dimerides, are rather poor solvents, and similarly diketones which chelate internally are not such good solvents as those which do not. Amides are poor solvents, although not poor enough to necessitate consideration of linear polymerides; a probable mode of polymerisation is suggested. Unsaturation may sometimes cause association. Ph decreases the donor power of N or O. V. The solubility of  $CH_2Cl_2$  in 35 solvents is explained on the basis of C-H $\leftarrow$ O and C-H $\leftarrow$ N linkings, as with  $CHHal_3$ . R. S. C.

**Aqueous solubilities of isomeric heptanols.** P. M. GINNINGS and M. HAUSER (J. Amer. Chem. Soc., 1938, 60, 2581—2582).—Data are recorded for  $\beta\gamma\gamma$ -trimethylbutan- $\beta$ -ol at  $40^{\circ}$  and  $\beta\gamma$ -,  $\beta\beta$ -, and  $\beta\delta$ -dimethylpentan- $\gamma$ -ol,  $\beta\gamma$ - and  $\beta\delta$ -dimethylpentan- $\beta$ -ol,  $\gamma$ -methylhexan- $\gamma$ -ol,  $\beta$ -methylhexan- $\beta$ -ol, and  $\gamma$ -ethylpentan- $\gamma$ -ol at  $20^{\circ}$ ,  $25^{\circ}$ , and  $30^{\circ}$ . The seven *tert.* isomerides are more sol. than the two most compact *sec.* isomerides. Max. solubility occurs when the OH is as close as possible to the centre of a compact *tert.* mol. The solubility of the isomerides decreases with rising temp. from  $20^{\circ}$  to  $30^{\circ}$ . E. S. H.

**Influence of the method of preparation and physical structure of silver chloride on its solubility.** A. PINKUS and P. HANREZ (Bull. Soc. chim. Belg., 1938, 47, 532—574).—Potentiometric measurements indicate that, with the exception of colloidal suspensions, the solubility of AgCl is independent of its method of prep. and of its physical structure. The almost insol. granular form of Stas could not be obtained. The ionic solubility of all samples at  $25^{\circ}$  and in 0.1N- $KNO_3$  is  $1.58 \times 10^{-5}$  g.-mol. per l. Very fine colloidal suspensions show a solubility about 5%  $>$  this val. J. W. S.

**Solubility of sodium borates in saturated solutions of sodium chloride in the presence of magnesium sulphate.** N. A. SCHLESINGER, I. B. FEIGELSON, and A. I. SPIRAGINA (Compt. rend. Acad. Sci. U.R.S.S., 1938, 20, 141—143).—The solubility of  $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$  in saturated NaCl solutions at 35° is  $\ll$  in pure  $\text{H}_2\text{O}$ . It increases in the presence of increasing proportions of  $\text{MgSO}_4$  and eventually exceeds the solubility in pure  $\text{H}_2\text{O}$ . Its solubility in pure dil.  $\text{MgSO}_4$  at 35° is  $<$  in pure  $\text{H}_2\text{O}$  but decreases further with increasing concn. of  $\text{MgSO}_4$ . At 50°  $\text{Na}_2\text{B}_4\text{O}_7$  exists in pure  $\text{H}_2\text{O}$  as the pentahydrate but in solutions of NaCl or  $\text{MgSO}_4$  at 50° passes into the decahydrate again. As before, the solubility in saturated NaCl increases with increasing [ $\text{MgSO}_4$ ].  
T. H. G.

**Calcium sulphate in sea-water. II. Solubilities of calcium sulphate hemihydrate in sea-water at various concentrations at 60—150°.** T. TORIUMI, T. KUWAHARA, and R. HARA (Tech. Rep. Tôhoku, 1938, 12, 560—571).—See A., 1934, 139.  
J. W. S.

**Arsenophosphoric and arsenoarsenic acids. Solubility of monomeric arsenious anhydride in monobasic phosphates and arsenates.** D. GHIRON and M. MONTICELLI (Gazzetta, 1938, 68, 555—559; cf. A., 1936, 560).—The solubility of  $\text{As}_2\text{O}_3$  in aq. solutions of  $\text{NaH}_2\text{PO}_4$ ,  $\text{KH}_2\text{PO}_4$ ,  $\text{NaH}_2\text{AsO}_4$ , and  $\text{KH}_2\text{AsO}_4$  (Na salts 1.0 and 5.0M., K salts 1.0M.) has been determined at 25°, 60°, and 100°. The solubility is  $>$  in the corresponding acid of the same concn. This is taken to indicate the existence of arseno-phosphoric and -arsenic acids.  
O. J. W.

**Diffusion of hydrogen through metals.**—See B., 1938, 1436.

**Partition of sulphur dioxide between water and light petroleum.** A. SCHAAFSMA (Chem. Weekblad, 1938, 35, 821—823).—The partition coeff. of undissociated  $\text{SO}_2$  mols. between  $\text{H}_2\text{O}$  and petroleum is const. at concns. of 0.027—0.5%. The solubility of  $\text{SO}_2$  in petrol depends on the aromatic hydrocarbon content and is much greater in  $\text{C}_6\text{H}_6$  than in aromatic-free spirit of the same b.p. The reduced partition coeff. has a high negative temp. coeff. in non-aromatic hydrocarbons and is nearly const. in aromatic spirits ( $\text{C}_6\text{H}_6$ ). The theoretical aspect is also discussed.  
S. C.

**Absorption of gases by tantalum.** D. A. WRIGHT (Nature, 1938, 142, 794).—The absorption of  $\text{H}_2$  and  $\text{N}_2$  by Ta at different temp. and low pressures ("clean-up") is described. Absorption is modified by the presence of surface oxide, and the variations shown in earlier work are due to this cause.  
L. S. T.

**Conventions and assumptions in the interpretation of experimental data by means of the Gibbs adsorption theorem.** P. VAN RYSSELBERGHE (J. Physical Chem., 1938, 42, 1021—1029).—Theoretical. The interpretation of surface tension ( $\gamma$ ) data for binary mixtures is discussed, and the simplest possible mixture rule is considered in reference to data for the  $\gamma$  of EtOH— $\text{H}_2\text{O}$  mixtures. C. R. H.

**Relative adsorbabilities of hydrogen and deuterium.** A. WHEELER (J. Chem. Physics, 1938, 6, 746—748).—A statistical-mechanical treatment of the relative adsorbabilities of  $\text{H}_2$  and  $\text{D}_2$  on metal surfaces, in terms of partition functions for the adsorbed mols. and atoms, predicts equal adsorption at low temp. and an inversion temp. at higher temp.; these are in agreement with the experimental data of Beebe *et al.* (cf. A., 1936, I, 282) and Klar (cf. A., 1935, 27) for Cu and Ni, respectively. W. R. A.

**Sorption of chlorine by active charcoal. III. Rate of sorption.** K. ARII (Bull. Inst. Phys. Chem. Res. Japan, 1938, 17, 717—738; cf. A., 1937, I, 129).—The rate of sorption of  $\text{Cl}_2$  by sugar-C activated by heating at 900° for 2 hr. has been determined at 20°, 30°, and 40°, and at const. pressures of 200, 400, and 600 mm. The results agree with the equation  $x = At^B$  ( $x = \text{mg. sorbed by 1 g. of C in time } t$ ;  $A$  and  $B$ , consts.). An equation for sorption velocity at const. pressure, and another for const. temp., are derived. The fact that it takes 65 days for sorption equilibrium to be reached at const. pressure, but that 8.5—23% of the equilibrium val. is sorbed in 1 min., indicates that the sorption of a gas by a porous adsorbent consists of a primary adsorption followed by absorption. A. J. M.

**Binary systems. I. Adsorption from binary mixtures of toluene and acetic acid by charcoal and silica gel.** J. G. KANE and S. K. K. JATKAR (J. Indian Inst. Sci., 1938, 21, A, 331—344).—The adsorption of AcOH and of PhMe from their mixtures on  $\text{SiO}_2$  gel, sugar C, and animal C has been investigated. AcOH is preferentially adsorbed on  $\text{SiO}_2$  gel, and PhMe on C, from all mixtures. Animal C adsorbs PhMe preferentially from mixtures containing  $>60\%$  of AcOH, but AcOH from less conc. mixtures. This behaviour is attributed to the presence of ash in the C. The curves show either zero selective adsorption, or else a min. or a max., at compositions corresponding with compounds of AcOH and PhMe in the proportions 2:1, 4:1, 6:1, and 8:1.  
F. J. G.

**Chemisorption on charcoal. XII. The isoelectric point.** H. L. BENNISTER and A. KING (J.C.S., 1938, 1888—1891).—The cataphoretic velocities of charcoals activated at various temp. and suspended in acid or alkaline solutions have been studied. All the specimens examined were negatively charged at  $p_H > 4.0$ , and isoelectric between  $p_H 3.0$  and  $p_H 4.0$ ; there are indications of a second isoelectric point at  $p_H 1—1.5$ . At  $p_H > 4.0$  the effect of the temp. of activation was marked, specimens activated at 850° having the max. negative velocity.  
F. J. G.

**Electric double layer, an effective potential barrier for the accumulation of the solute at surfaces of solutions of capillary-active electrolytes.** K. S. G. DOSS (Current Sci., 1938, 7, 182).—The electric double layer, formed on the solution side of the interface between an aq. solution of a capillary-active electrolyte and the adsorption film produced on its surface by ageing, presents an effective potential barrier for the further accumulation of the capillary-

active ions, especially when the adsorption film is of the gaseous type.

W. R. A.

**Adsorption of electrolytes from non-aqueous solutions.** D. M. STRASHESKO (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 197—220).—Active C adsorbs salts of heavy metals ( $\text{CoCl}_2$ ,  $\text{CuCl}_2$ ,  $\text{HgCl}_2$ ), but not KI or  $\text{NH}_4\text{CNS}$ , from  $\text{COMe}_2$  solution. Adsorption of salts is inversely  $\propto$  their degree of dissociation in  $\text{COMe}_2$ , but is not related to their solubility. R. T.

**Adsorption at crystal-solution interfaces. X. Adsorption of monoazo-dyes by crystals of potassium sulphate during their growth from solution.** M. D. RIGTERINK and W. G. FRANCE (J. Physical Chem., 1938, 42, 1079—1088).—Dye adsorption depends on the residual valency force fields of the crystal faces, the interionic distances between the faces, the concn. of the dye, and the presence and distribution of polar groups in the dye mol. The mode of attachment of the dye mol. is probably through the O triangle possessed by the  $\text{SO}_3\text{Na}$  group, the most active positions being *m* and *p* to the  $\cdot\text{N}\cdot\text{N}\cdot$  group in the  $\text{C}_6\text{H}_6$  ring, and in the 6- and 7-positions in the  $\text{C}_{10}\text{H}_8$  ring. The presence of an unsubstituted  $\text{C}_6\text{H}_6$  ring is detrimental to adsorption. Dyes produced from  $\beta$ - are more adsorbed than those from  $\alpha$ -naphtholsulphonic acids, but the reverse is the case if  $\text{NH}_2$  is substituted for OH, suggesting that the dipole moment of the dye must be considered in the adsorption process. Twinning appears to be caused by the adsorption of a minute amount of impurity at some point favourable to the growth of a new crystal. C. R. H.

**Adsorption of constituents of a solid phase on the surface.** S. DOBIŃSKI (Bull. Acad. Polonaise, 1938, A, 169—178).—Previous explanations of the production of surface layers (e.g., of pure ZnO in the high-temp. oxidation of brass) are based chiefly on chemical arguments which assume that before oxidation the concn. of the constituents of the brass on the surface is the same as in bulk. Experiments indicate that diffusion can occur under suitable conditions, causing a concn. of one constituent in the surface layer. This can be effected in Cu containing 0.01% of S by (i) heating in vac. at  $800^\circ$  for 4 hr., (ii) subjecting the specimen to alternating stresses, and (iii) polishing the surface. By comparison with adsorption of constituents of a liquid phase, the solid with the smallest surface tension should concentrate in the surface layer. This is approx. confirmed for brass, Cu-Be and Cu-Al alloys. W. R. A.

**Statistical mechanics of mobile monolayers.** W. BAND (J. Chem. Physics, 1938, 6, 748; cf. A., 1938, I, 603).—The methods of Mayer and Ackermann (cf. *ibid.*, 1937, 3, 74) have been adapted to the problem of mobile monolayers. A relation between the saturated vapour tension  $F_c$  and the crit. area  $A_c$  for a monolayer of mols. is deduced, and yields information on the fatty acids in agreement with recorded data. W. R. A.

**Boundary layer at membrane and monolayer interfaces.** J. H. SCHULMAN and T. TEORELL

(Trans. Faraday Soc., 1938, 34, 1337—1342).—Technique for flowing monolayers over aq. solutions of different viscosities is described. An apparent boundary layer about 0.03 mm. thick was observed, the thickness of which varied with the  $\eta$  of the underlying solution but not with the velocity of the monolayer. It is suggested that the mol. density of the film changes with velocity so that the no. of mols. per unit area  $\times$  rate of flow = const. By applying Fick's equation to  $\text{H}^+$  diffusing through Cellophane membranes in a stirred solution, an apparent unstirred boundary layer of 0.03 mm. was obtained. The effect of this layer can be eliminated by buffering the  $\text{H}^+$  by means of gelatin as they leave the membrane. E. S. H.

**Structure of the surfaces of solutions as shown by their resistance to the spreading of insoluble films.** T. F. FORD and D. A. WILSON (J. Physical Chem., 1938, 42, 1051—1061).—After a very short time the rate of spreading of oleic acid films on  $\text{H}_2\text{O}$  is const., therefore the changes in rate observed with solutions must be due to the presence of solute films. From experiments with solutions of  $\text{Ph}[(\text{CH}_2)_2\text{CO}_2\text{H}]_2$ ,  $\text{C}_7\text{H}_{15}\text{CO}_2\text{H}$ , and  $\text{PhOH}$  it has been shown that films of solute mols. exist on the surface of aged solutions, but that immediately after sweeping the solution surface with paper strips, the surface resembles that of  $\text{H}_2\text{O}$ . The analogy between these films and two-dimensional insol. films has been demonstrated. C. R. H.

**Built-up films of esters.** E. STENHAGEN (Trans. Faraday Soc., 1938, 34, 1328—1337).—The type of deposition is nearly independent of the substrate, but depends on the piston pressure. At normal rates of withdrawal, Y-deposition generally occurs with an oleic acid piston, and X-deposition is always obtained with a triolein piston. At low piston pressures, slow withdrawal enables the film to return to the  $\text{H}_2\text{O}$  surface, medium speed permits X-deposition, and Y-deposition is obtained at high speed. Optical measurements of the thickness of the layers and X-ray measurements of the long spacing in the built-up films have been made in the case of Me and Et stearate, octadecyl acetate, trimyristin, and  $\alpha\alpha'$ - and  $\alpha\beta$ -dipalmitin. Preliminary work on the contact potentials of ester films shows that they are complicated functions of the constitution of the film substance, of the composition of the substrate, and treatment of the film. E. S. H.

**Properties of chlorophyll multifilms.** M. F. E. NICOLAI and C. WEURMAN (Proc. K. Akad. Wetensch. Amsterdam, 1938, 41, 904—908).—Modified technique for building up the films is described. Differences between the uptake of "A" and "B" layers, and the influence of the substrate on which the films are deposited, are discussed. E. S. H.

**Expansion patterns of protein monolayers on water.** V. J. SCHAEFER (J. Physical Chem., 1938, 42, 1089—1098).—A simple technique for rendering protein monolayers visible is described. The effect of heating, ultra-violet radiation, shaking, dissolved salts, and  $p_{\text{H}}$  on the nature of expansion patterns has been investigated. C. R. H.

**Salted-out protein films.** I. LANGMUIR and V. J. SCHAEFER (J. Amer. Chem. Soc., 1938, 60, 2803—2810).—Compact films of protein (200—1000 Å.) are salted-out on to metal or glass plates when the plate is dipped into a protein solution and then into aq. NaCl,  $(\text{NH}_4)_2\text{SO}_4$ , etc. The film can be washed with  $\text{H}_2\text{O}$  without loss after fixing by 1% tannic acid. Protein films (up to 7000 Å.) are formed on the surface of salt solutions by applying a few drops of the protein solution. Such films can be deposited on to plates and transferred to  $\text{H}_2\text{O}$  surfaces, where the amount of protein can be determined from the area of the monolayer produced. Dried, salted-out films of cryst. egg-albumin have  $n$  1.48; the low val. and the power to absorb hydrocarbon vapours indicate a skeletal structure. E. S. H.

**Boundary tension by pendant drops.** J. M. ANDREAS, E. A. HAUSER, and W. B. TUCKER (J. Physical Chem., 1938, 42, 1001—1019).—The mathematical theory of the shape of static liquid drops is revised, and an apparatus is described whereby the silhouette of a hanging drop can be photographed and the boundary tension calc. from the dimensions of the silhouette. The method is applicable to a wide range of tensions and both surface and interfacial tension can be measured. Other advantages are enumerated and typical measurements are presented. C. R. H.

**Lowering of surface tension of water by electrolytes.** J. J. BIKERMAN (Trans. Faraday Soc., 1938, 34, 1268—1274).—Theoretical. The work associated with increase of surface of solution consists in (1) bringing  $\text{H}_2\text{O}$  mols. on to the surface (this is independent of concn.), (2) compressing the ions into a smaller vol. (increases with increasing concn.), and (3) separating positive and negative charges under the surface (this decreases with increasing concn.). The combined effect produces a surface tension-concn. curve which agrees with experimental data (A., 1937, I, 126). E. S. H.

**Surface tension of soap solutions.**—See B., 1938, 1447.

**Ultrasonic waves in colloid chemistry.** K. SÖLLNER (J. Physical Chem., 1938, 42, 1071—1078).—A short account is given of the author's published work (cf. A., 1935, 820 and subsequently). C. R. H.

**Study of colloidal solutions by combined measurements of viscosity and optical density.** A. BOUTARIC (Compt. rend., 1938, 207, 802—804).—Combination of the Rayleigh formula for the optical density ( $h$ ) with the Einstein  $\eta$  relation leads to the relationship  $(1/h) \log_e (\eta/\eta_0) = aN/bm$  ( $N$ ,  $m$  = no. and mass of dispersed particles per unit vol.;  $a$ ,  $b$ , const.). A. J. E. W.

**Green gold sols.** H. B. FRIEDMAN and J. J. DAVIS, jun. (J. Physical Chem., 1938, 42, 1149—1150).—Au sols, prepared by reducing  $\text{AuCl}_3$  with tannic acid (I), are red or green according to whether the solution of (I) is fresh or old. C. R. H.

**Colloidal clays.** I. E. A. HAUSER and D. S. LE BEAU (J. Physical Chem., 1938, 42, 1031—1049).—The apparent sp. gr. and abs. viscosity of mono-

disperse montmorillonite fractions of extremely low concns. increase with decreasing particle size and increasing concn. The sp. gr. data show that  $\text{H}_2\text{O}$  must be strongly adsorbed and compressed on to the clay particles. C. R. H.

**Thorium hydroxide sols as opaque media in roentgenography.** T. O. MENEES and J. D. MILLER (Amer. J. Roentgenol., 1936, 35, 194—199).— $\text{Th}(\text{OH})_4$  forms stable sols, but is coagulated in an alkaline medium. Coagulation occurs readily in an organ with an alkaline secretion, especially in the presence of mucus, such as is found in the uterus. Coagulation occurs on the inner surface of the organ, rendering it highly opaque to X-rays. CH. ABS. (e)

**Ferromagnetic ferric oxide aerosols and hydrosols.** A. WINKEL and R. HAUL (Z. Elektrochem., 1938, 44, 823—831).—The prep. of  $\gamma\text{-Fe}_2\text{O}_3$  aerosols by thermal decomp. of  $\text{Fe}(\text{CO})_5$  in a stream of  $\text{N}_2 + \text{O}_2$  is described. In certain cases aggregation into chains of particles occurs. The product of decomp. at  $900^\circ$  gives an X-ray diagram with sharp interference lines, but as the temp. of decomp. is lowered the product appears to be more amorphous; the product of decomp. at  $200^\circ$  is paramagnetic. The sediment of the aerosol has a high sp. surface; it is peptised by  $\text{H}_2\text{O}$ , forming electrolyte-free hydrosols. The particle size, charge, and stability of such hydrosols have been studied. E. S. H.

**Viscosity of semi-colloidal solutions of starch hydrolysis products.** K. P. VOLKOV and A. M. ALMAZOV (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 121—138).—Einstein's and Arrhenius' formulæ are applicable only to a limited concn. range of starch hydrolysis products, and not at all to starch sols. The mol. wts. calc. from Staudinger's formula are: potato starch 165,000, sol. starch 9000—13,500, amylopectin 12,350, erythropectin 4000, and achroodextrin 2900. R. T.

**Hydrophilic properties of cellulose.**—See B., 1938, 1396.

**Conversion of cellulose hydrate into natural cellulose.**—See B., 1938, 1397.

**Fractional precipitation and viscosity of cellulose acetates.** G. R. LEVI (Gazzetta, 1938, 68, 589—592).—[with U. VILLOTTA]. Vals. of  $\eta$  for solutions of fractionally pptd. cellulose di- and triacetates in various solvents are recorded.

[with M. MONTICELLI]. Milling of cellulose diacetate before dissolving it brings about a marked decrease in  $\eta$  of the resulting solution in  $\text{COMe}_2$ . O. J. W.

**Heterogeneous equilibrium of protein solutions. II. Interaction of salts with proteins. New type of calcium amalgam electrode.** N. R. JOSEPH (J. Biol. Chem., 1938, 126, 389—402; cf. A., 1937, I, 80).—Decomp. of amalgam in the electrode cell is prevented by a Cellophane membrane which, when in equilibrium with the solution, introduces no significant potential. Results obtained with the electrode agree with those of solubility studies and with those obtained with flowing amalgam electrodes. The effect of  $\text{CaCl}_2$  on the activity coeff. of serum-albumin (I), of  $\text{CaCl}_2$  and NaCl on those of  $\psi$ -globulin

(II) and carboxyhaemoglobin (III), and of  $\text{CaCl}_2$ ,  $\text{MgCl}_2$ , and  $\text{ZnCl}_2$  on that of gelatin (IV) has been measured. In each case the coeff. is reduced, the magnitude of the reduction increasing in the order (III), (I), (IV), (II).

W. McC.

**Solubility of "lyophile" gelatins.**—See B., 1938, 1461.

**Emission of short-wave ultra-violet radiation in structure building. I. Radiation in typical coagulation.** A. RABINERSON and M. FILIPPOV (*Acta Physicochim. U.R.S.S.*, 1938, 8, 419—440).—Investigations with a photo-electron counter (data given) show that the coagulation of sols of  $\text{Fe}(\text{OH})_3$  by  $\text{Na}_2\text{SO}_4$  or  $(\text{NH}_4)_2\text{SO}_4$ , of  $\text{V}_2\text{O}_5$  by  $\text{KCl}$ , and of  $\text{Na}$  oleate, but not of  $\text{As}_2\text{S}_3$ , by  $\text{NaCl}$  is accompanied by the emission of ultra-violet radiation of low intensity. Data obtained with yeast as detector, in agreement with the above, show that these coagulations are accompanied by a mitogenetic effect. Dilution of the sols or of the coagulating electrolytes does not produce the effect. Biological detectors should be used in the investigation of radiation due to physico-chemical processes.

L. S. T.

**Electrolyte coagulation and coefficient of electrolyte activity.** W. OSTWALD (*J. Physical Chem.*, 1938, 42, 981—1000).—A summary of work previously published (A., 1936, 157, and subsequent abstracts).

C. R. H.

**Specific effects of cations in the flocculation and discharge of negative bio-colloids.** H. G. B. DE JONG (*Chem. Weekblad*, 1938, 35, 783—790).—A review of the flocculation of org. colloids containing  $\text{CO}_2\text{H}$  (arabates, pectates), phosphatide (lecithin, nucleates) and  $\text{SO}_3\text{H}$  (agar, carrageen, chondroitin- $\text{H}_2\text{SO}_4$ ) groups with electrolytes and dehydrating agents ( $\text{EtOH}$ ,  $\text{COMe}_2$ ). The results can be explained on modern electrochemical theory.

S. C.

**Surface solvation in disperse systems. IV. Desolvation of rubber sols in media of different polarities.** V. MARGARITOV and B. KOVARSKAJA (*Acta Physicochim. U.R.S.S.*, 1938, 8, 377—384).—The coagulation of rubber sols in  $\text{C}_6\text{H}_{14}$ ,  $\text{C}_8\text{H}_{18}$ ,  $\text{C}_2\text{HCl}_3$ ,  $\text{CCl}_4$ ,  $\text{C}_6\text{H}_6$ , and cyclohexane by  $\text{COMe}_2$ , and in  $\text{C}_6\text{H}_{14}$ , cyclohexane, and  $\text{C}_6\text{H}_6$  by  $\text{PrOH}$ ,  $\text{BuOH}$ , and  $\text{C}_9\text{H}_{19}\text{OH}$  has been investigated. The amount of  $\text{COMe}_2$  or  $\text{PrOH}$  or  $\text{BuOH}$  required to coagulate the sols increases with the mol. wt. of the dispersion media.  $\text{C}_9\text{H}_{19}\text{OH}$  produces no coagulation of rubber sols in  $\text{C}_6\text{H}_6$  or  $\text{C}_6\text{H}_{14}$ . Systems in which surface solvation is probable ( $\text{C}_6\text{H}_{14}$ ) are more stable than those in which rubber undergoes vol. solvation ( $\text{CCl}_4$ ).

L. S. T.

**Dissolution of insoluble dyes in aqueous detergents.** J. W. MCBAIN and T. M. WOO (*J. Physical Chem.*, 1938, 42, 1099—1111).—The partition of Yellow AB between  $\text{C}_6\text{H}_6$  or  $\text{PhMe}$  and detergents, pure soaps, and laurylsulphonic acid has been investigated. The dye is brought into aq. solution by spontaneous colloid stabilisation, the amount increasing with increasing concn. of the detergent or stabilising colloid. Stabilisation is more closely related to surface activity than to colloidal of the detergent.

C. R. H.

**Peptisation of "oleocarbons" in benzene solution by organic acids.** A. GILLET, A. PIRLOT, and F. MONFORT (*Bull. Soc. chim. Belg.*, 1938, 47, 525—531).—By addition of a large vol. of light petroleum to the solution obtained by extracting coal with anthracene oil and oleic acid (I) a ppt. is obtained of "oleocarbon," apparently a compound of (I) with C. After washing thoroughly to remove residual (I) the product is only partly sol. in  $\text{C}_6\text{H}_6$ , but is peptised by small amounts of  $\text{AcOH}$ , (I), or anthracene oil.

J. W. S.

**Cataphoresis of gas bubbles.** A. KLEMM (*Physikal. Z.*, 1938, 39, 783—793).—Although the cataphoretic velocity of solid particles is independent of their size, gas bubbles migrate the more rapidly the smaller is their diameter. The theory of cataphoresis of solid particles is extended to cover cataphoresis of spheres with a given viscosity.

A. J. M.

**Equilibrium between molecular and colloidal substances in aqueous soap solutions. I. Hydrolysis of fatty acid salts.** J. STAUFF (*Z. physikal. Chem.*, 1938, 183, 55—85).—The  $\text{OH}'$  activities of solutions of  $\text{Na}$  stearate, palmitate, myristate, and laurate have been determined potentiometrically, and the data are compared with data of other investigators. The increase in  $\text{OH}'$  activity which accompanies increase in concn. ceases at a crit. concn.,  $c$ , characteristic of each salt, above which micelle formation takes place. With increase in the no. of C in the acid mol.,  $\log c$  decreases linearly. A mechanism for the hydrolysis based on the formation of fatty acid double ions is discussed. The mol. solubility =  $Fc$ , where  $F$  ( $\approx 1$ ), is a function of the total concn. and depends on the individual properties of the colloid.

C. R. H.

**Acid-base theory of Brönsted.** P. C. VAN KEEKEM (*Chem. Weekblad*, 1938, 35, 815—821).—A review and a discussion.

S. C.

**Dissociating powers of chlorinated hydrocarbons.** J. P. W. A. VAN BRAAM HOUCKGEEST (*Chem. Weekblad*, 1938, 35, 790—795).—Ionisation consts. ( $\alpha$ ) for  $\text{NPr}_2\text{I}$  dissolved in  $\text{EtCl}$ ,  $(\text{CH}_2\text{Cl})_2$  (I),  $\text{CHMeCl}_2$  (II),  $\text{CH}_2\text{Cl}\cdot\text{CHCl}_2$  (III),  $\text{CMeCl}_3$  (IV),  $(\text{CHCl}_2)_2$  (V),  $\text{CH}_2\text{Cl}\cdot\text{CCl}_3$  (VI), and  $\text{CHCl}_2\cdot\text{CCl}_3$  (VII) are calc. from conductivity measurements at 25°. In dissociating power. (I) > (II), (III) > (IV), (V) > (VI), and in the group (I), (III), (V), (III) is the weakest.  $\alpha$  increases with solubility except with (III), in which the salt dissolves in the undissociated state. This is ascribed to the high solvation energy of the dipolar solvent.

S. C.

**Standardisation of hydrogen-ion determinations. II. Standardisation of the  $p_{\text{H}}$  scale at 38°.** D. I. HITCHCOCK and A. C. TAYLOR (*J. Amer. Chem. Soc.*, 1938, 60, 2710—2714; cf. A., 1937, I, 620).—From e.m.f. measurements of cells of the type  $\text{H}_2$ |buffer or acid solution,  $\text{KCl}$  (satd.),  $\text{HCl}$  (0.1N.)| $\text{H}_2$  (+),  $p_{\text{H}}$  vals. have been assigned to several standard solutions at 38°, including 0.1N-HCl ( $p_{\text{H}}$  1.082), and 0.1N-AcOH in 0.1N-NaOAc ( $p_{\text{H}}$  4.655). These vals. serve to establish a  $p_{\text{H}}$  scale, which may be used to obtain the vals. of thermodynamic dissociation consts. at 38°.

E. S. H.



**First thermodynamic ionisation constant of deuterocarbonic acid at 25°.** J. CURRY and C. L. HAZELTON (J. Amer. Chem. Soc., 1938, 60, 2773—2776).—The ratio of the constns. for  $H_2CO_3$  and  $D_2CO_3$ , determined potentiometrically using a cell without transference and having quinhydrone and Ag—AgCl electrodes, is  $K_H : K_D :: 2.68 : 1$ .

E. S. H.

**Calculation of the dissociation constant of weak acids in water—deuterium oxide mixtures.** F. BRESCHIA (J. Amer. Chem. Soc., 1938, 60, 2811—2813).—Good agreement with experimental data is obtained when a correction is applied to the equation of Korman and La Mer (A., 1936, 1202).

E. S. H.

**Conductance and ionisation constants of propionic and *n*-butyric acids in water at 25°.** D. BELCHER [with, in part, T. SHEDLOVSKY] (J. Amer. Chem. Soc., 1938, 60, 2744—2747).—Data for the above acids and their Na salts have been determined and limiting conductances and ionisation constns. derived. Limitations of the extrapolation method for deriving these vals. for weak electrolytes are discussed.

E. S. H.

**Reactivities and basic strengths of *p*-alkyldimethylanilines.** W. C. DAVIES (J.C.S., 1938, 1865—1869).—The dissociation constns. ( $p_K$ ) of the bases  $p-C_6H_4R \cdot NMe_2$  at 20° in 50% EtOH (R = H, Me, Et, Pr<sup>α</sup>, Pr<sup>β</sup>, Bu<sup>α</sup>, *sec.*-Bu, Bu<sup>β</sup>, Bu<sup>γ</sup>) have been determined, and the rates of their reactions with MeI in aq. COMe<sub>2</sub> at 35°, 45°, and 55° measured. There is a linear relationship between  $p_K$  and the log of the velocity coeff. The effects of the various substituents in increasing the basic strength and the reactivity to MeI are in the order Me > Pr<sup>β</sup> > Bu<sup>γ</sup> and Et > Bu<sup>α</sup> > Pr<sup>α</sup> > H ~ Bu<sup>β</sup>. Possible explanations of this order are discussed. The factor *E* in the Arrhenius equation is almost const., the changes in rate being due to changes in the factor *P*.

F. J. G.

**Dissociation constants of piperidine and its homologues.** W. F. K. WYNNE-JONES and G. SALOMON (Trans. Faraday Soc., 1938, 34, 1321—1324).—Data are recorded for  $(CH_2)_8 > NH$ ,  $(CH_2)_{17} > NH$ ,  $(CH_2)_{15} > NMe$ , and  $(CH_2)_5 > NMe$ . The differences are small; the introduction of Me has a greater effect than the size of the ring. Heats of ionisation follow the same course. The dissociation constns. of piperidine in H<sub>2</sub>O determined at 15° and 25° are respectively 1.10 and  $1.15 \times 10^{-3}$ . E. S. H.

**Intra-complex coloured compounds. III. Constants of alizarin and alizarates. Colorimetric determination of iron and aluminium.** A. K. BABKO (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 49—69).—The absorption spectra of alizarin (I) solutions at  $p_H$  3—13 have been studied, using a series of colour filters. (I) behaves as a dibasic acid, H<sub>2</sub>A, with  $K_1 = 3 \times 10^{-6}$  and  $K_2 = 3 \times 10^{-10}$ . Formation of Al alizarate (II) begins at  $p_H$  3, and is complete at  $p_H$  5; the salt is stable up to  $p_H$  11.5, above which it decomposes, yielding aluminate and fully dissociated (I). The absorption spectrum of (II) is almost identical with that of HA', over the range 300—700  $m\mu$ .; its dissociation const. is  $3 \times 10^{-6}$ .

That of Fe alizarate is  $1.6 \times 10^{-6}$ , and its absorption spectrum does not differ from that of (II) or HA' at 450—580  $m\mu$ ., but has an additional band at 600—630  $m\mu$ .. Traces of Al and Fe are determined in the following way. 2 ml. of 0.03% (I) are added to the solution (containing 2—40 g. of Al<sub>2</sub>O<sub>3</sub> + Fe<sub>2</sub>O<sub>3</sub>), followed by 1 ml. each of *n*-NaOAc and -AcOH ( $p_H$  4.6), and the vol. is made up to 15 ml. The absorption given by the resulting solution, using a filter absorbing light of  $\lambda$  other than 450—520  $m\mu$ ., is determined, and the Fe + Al content is read from an empirical curve. Fe alone is determined similarly, using a filter transmitting light of  $\lambda$  600—640  $m\mu$ .; Al is given by difference.

R. T.

**Association of acetic acid, of its three chlorinated derivatives, and of *n*-butyric and hexoic acids dissolved in benzene: dielectric polarisation compared with cryoscopic measurements.** R. J. W. LE FÈVRE and H. VINE (J.C.S., 1938, 1795—1801).— $\rho$  and  $\epsilon$  have been determined for solutions in C<sub>6</sub>H<sub>6</sub> at 25° down to high dilution of the above acids and of CH<sub>2</sub>Cl·CO<sub>2</sub>Et, CHCl<sub>2</sub>·CO<sub>2</sub>Et, and CCl<sub>3</sub>·CO<sub>2</sub>Et. The three esters show a linear dependence of  $\epsilon$  on concn., and their dipole moments are 2.64, 2.61, and 2.55 D., respectively. With the three fatty acids small departures from linearity are found at concn. <2%, indicating incipient dissociation of the double mols., whilst with the chloroacetic acids, especially CCl<sub>3</sub>·CO<sub>2</sub>H (I), there are marked deviations indicating dissociation to a more polar single mol. From the results the degree of association of (I) has been calc.; the equilibrium const. is 24 l. g.-mol.<sup>-1</sup>, and the apparent moment of the double mol. is 1.1 D.

F. J. G.

**Association of *p*-toluenesulphonmethylamide and related compounds in solution: comparison of dielectric polarisation and cryoscopic measurements.** R. J. W. LE FÈVRE and H. VINE (J.C.S., 1938, 1790—1795).—If a solute is associated to a definite polymeride the dipole moment of which may be assumed = 0, measurements of  $\epsilon$  may be used to determine the degree of association. Vals. obtained for NPh·N·NHPh do not agree with those obtained cryoscopically by Hunter (A., 1937, II, 144), so that some of the polymeric mols. are probably of the highly polar open-chain form.  $\epsilon$  has been measured for *p*-C<sub>6</sub>H<sub>4</sub>Me·SO<sub>2</sub>·Ome (I), *p*-C<sub>6</sub>H<sub>4</sub>Me·SO<sub>2</sub>·NMe<sub>2</sub> (II), and *p*-C<sub>6</sub>H<sub>4</sub>Me·SO<sub>2</sub>·NHMe (III), in C<sub>6</sub>H<sub>6</sub>, CHCl<sub>3</sub>, and Et<sub>2</sub>O, at 25°.  $\epsilon$  is a linear function of concn. for (I) and (II) which are not associated, and for (III) in Et<sub>2</sub>O, but in C<sub>6</sub>H<sub>6</sub> and CHCl<sub>3</sub> (III) shows a marked deviation from linearity due to association. Vals. for the degree of association calc. on the assumption that a non-polar dimeride is present are < those found cryoscopically by Chaplin and Hunter (A., 1937, I, 513) and are not in agreement with the mass law. The dipole moments of (I), (II), and (III), in C<sub>6</sub>H<sub>6</sub> are 5.18, 5.48, and 5.4 D., respectively.

F. J. G.

**Use of dielectric polarisations in the investigation of the formation of intermolecular complexes in solution.** D. L. HAMMICK, A. NORRIS, and L. E. SUTTON (J.C.S., 1938, 1755—1761).—The assumptions and the reasoning employed by Earp and

Glasstone (A., 1936, 150) in interpreting their results are criticised. Other methods for deriving vals. of the association const. and mol. polarisation of an intermol. complex from measurements of  $\epsilon$  for binary mixtures are discussed, and shown to give improbable results when applied to typical systems. It is concluded that measurements of  $\epsilon$  for solutions of the two components in a third inert liquid, combined with independent (e.g., cryoscopic) estimates of the degree of association, can alone give significant results, and that even when the degree of association is unknown they permit a qual. comparison of various systems. In this way it is shown that  $\text{NEt}_3$  combines readily,  $\text{Pr}^\beta_2\text{O}$  less readily, and  $\text{MeNO}_2$  scarcely at all, with  $\text{CHCl}_3$ . Data on  $\epsilon$  for the following systems are recorded:  $\text{CHCl}_3$ - $\text{Et}_2\text{O}$  at  $0^\circ$ ,  $\text{CHCl}_3$ - $\text{Pr}^\beta_2\text{O}$  at  $0^\circ$  and  $25^\circ$ , mixed solutions in  $\text{C}_6\text{H}_6$  at  $25^\circ$  of  $\text{CHCl}_3$  and  $\text{Pr}^\beta_2\text{O}$ ,  $\text{CHCl}_3$  and  $\text{NEt}_3$ ,  $\text{CHCl}_3$  and  $\text{MeNO}_2$ , and solutions in  $\text{C}_6\text{H}_6$  at  $25^\circ$  of  $\text{CHCl}_3$ ,  $\text{Pr}^\beta_2\text{O}$ ,  $\text{NEt}_3$ , and  $\text{MeNO}_2$ . F. J. G.

**Physico-chemical study of reactions in organic solution. Use of the specific inductive capacity.** P. LAURENT (Ann. Chim., 1938, [xi], 10, 397—483; cf. A., 1931, 894; 1934, 1212; 1935, 1488).—Details are given of the use of measurements of  $\epsilon$  to detect compound-formation between org. substances in inert solvents. Data on  $\epsilon$  for a large no. of systems consisting of solutions of pairs of substances (carboxylic acids, phenols, N bases) in  $\text{C}_6\text{H}_6$  and other solvents are recorded. The existence in solution of the following compounds in addition to those already reported is indicated: 2 : 4- $\text{C}_6\text{H}_3(\text{NO}_2)_2\cdot\text{OH}\cdot\text{NH}_2\text{Ph}$ ;

$o$ - $\text{C}_6\text{H}_4(\text{NO}_2)\cdot\text{OH}\cdot\text{NPhMe}_2$ ;  
 $o$ -,  $m$ -, and  $p$ - $\text{C}_6\text{H}_4\text{Me}\cdot\text{NH}_2\cdot\text{PhOH}$ ;  $\text{AcOH}\cdot\text{C}_5\text{H}_5\text{N}$ ;  
 $\text{BzOH}\cdot\text{C}_5\text{H}_5\text{N}$ ;  $o$ - $\text{C}_6\text{H}_4(\text{NO}_2)\cdot\text{OH}\cdot\text{C}_5\text{H}_5\text{N}$ ;  
 $\beta$ - $\text{C}_{10}\text{H}_7\cdot\text{OH}\cdot\text{C}_5\text{H}_5\text{N}$ ; pyrrole,  $\text{C}_5\text{H}_5\text{N}$ ;  
 $o$ - $\text{NH}_2\cdot\text{C}_6\text{H}_4\cdot\text{CO}_2\text{H}\cdot\text{C}_5\text{H}_5\text{N}$ ;  $o$ - $\text{C}_6\text{H}_4(\text{OH})_2\cdot 2\text{C}_5\text{H}_5\text{N}$ ;  
 $(\text{CMe}\cdot\text{N}\cdot\text{OH})_2\cdot 2\text{C}_5\text{H}_5\text{N}$ ; 1 : 3 : 5- $\text{C}_6\text{H}_3(\text{OH})_2\cdot 2\text{C}_5\text{H}_5\text{N}$ ;  
 1 : 3 : 5- $\text{C}_6\text{H}_3(\text{OH})_3\cdot 3\text{C}_5\text{H}_5\text{N}$ ; quinoline,  $\text{PhOH}$ ;  
 azoxybenzene, 2 : 4- $\text{C}_6\text{H}_3(\text{NO}_2)_2\cdot\text{OH}$ ;  
 phenazine,  $o$ - $\text{NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{OH}$ ;  
 phenazine,  $2o$ - $\text{NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{OH}$ ;  
 phenazine, 2 : 4- $\text{C}_6\text{H}_3(\text{NO}_2)_2\cdot\text{OH}$ ;  
 phenazine, 2[2 : 4- $\text{C}_6\text{H}_3(\text{NO}_2)_2\cdot\text{OH}$ ];  
 $(\text{C}_6\text{H}_4\cdot\text{NH}_2)_2\cdot o$ - $\text{NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{OH}$ ;  
 $(\text{C}_6\text{H}_4\cdot\text{NH}_2)_2\cdot 2o$ - $\text{NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{OH}$ ;  
 $(\text{C}_6\text{H}_4\cdot\text{NH}_2)_2\cdot 2$  : 4- $\text{C}_6\text{H}_3(\text{NO}_2)_2\cdot\text{OH}$ ;  
 $(\text{C}_6\text{H}_4\cdot\text{NH}_2)_2\cdot 2$ [2 : 4- $\text{C}_6\text{H}_3(\text{NO}_2)_2\cdot\text{OH}$ ]  
 $\text{NHPh}\cdot\text{NH}_2\cdot\text{C}_5\text{H}_5\text{N}$ ;  $\text{NHPh}\cdot\text{NH}_2\cdot o$ - $\text{NO}_2\cdot\text{C}_6\text{H}_4\cdot\text{OH}$ ;  
 $\text{NHPh}\cdot\text{NH}_2\cdot 2$ [2 : 4- $\text{C}_6\text{H}_3(\text{NO}_2)_2\cdot\text{OH}$ ];  
 $(\text{NHPh})_2\cdot 2$  : 4- $\text{C}_6\text{H}_3(\text{NO}_2)_2\cdot\text{OH}$ ;  
 $(\text{NHPh})_2\cdot 2$ [2 : 4- $\text{C}_6\text{H}_3(\text{NO}_2)_2\cdot\text{OH}]$ ;  $(\text{NHPh})_2\cdot\text{C}_5\text{H}_5\text{N}$ ;  
 $(\text{NHPh})_2\cdot 2\text{C}_5\text{H}_5\text{N}$ .  $\text{PhOH}$  with  $\text{C}_5\text{H}_5\text{N}$  and piperidine with  $\text{PhOH}$  give abnormal curves which are interpreted as indicating an equilibrium between 1 : 1 and 2 : 1 compounds. F. J. G.

**Evidence of a complex between nitrobenzene and carbon tetrachloride.** B. SOUČEK (Coll. Czech. Chem. Comm., 1938, 10, 459—465).—Variations with composition of  $\gamma$ ,  $\rho$ , and  $n$ , measured at  $15^\circ$ ,  $20^\circ$ , and  $44^\circ$  for mixtures of  $\text{PhNO}_2$  and  $\text{CCl}_4$ , indicate the existence of a complex  $\text{PhNO}_2\cdot\text{CCl}_4$ . The determined  $[P]$  of the complex is 486.2, and since the determined  $[P]$  of the mixtures agree closely with those calc. from the vals. for the complex and the pure

components, simple dissolution of the complex in excess of either component is indicated. F. H.

**Theory of fugacity. I. M. V. TOVBIN. II. Fugacity of real gases. M. V. TOVBIN and KOZAKOVA. III. Fugacity and activity of solutions. IV. Thermodynamics of real solutions. V. Velocity of dissolution, and activity of solutions. VI. Heat of evaporation of solutions. VII. Diffusion coefficient, conductivity, and activity of solutions. VIII. Activity and heat of solution of dissolved substances.** M. V. TOVBIN (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 221—227, 229—233, 235—240, 241—245, 247—250, 251—258, 259—263, 265—279).—I. The fugacity of liquids and solids is assumed to be identical with the rate of (hypothetical) expansion into vac. under given conditions. On this assumption many of the characteristic properties of gases and solutions may be derived, on the basis of the kinetic theory.

II. The vals. of the fugacity coeff.  $F_\psi$  of  $\text{O}_2$  and  $\text{CO}_2$ , at 1—90 atm., calc. from  $F_\psi = Ve^{-a/RTV}/(V-b)$ , where  $V$  is the vol. of 1 g.-mol. of gas under the given conditions, and  $a$  and  $b$  are van der Waals consts., agree well with those derived by Lewis' method.

III. The expression  $F_\psi = RTe^{L/RT}/1.325P(v-b)$ , where  $L$  is the latent heat of vaporisation of the solvent,  $P$  is its saturated v.p., and  $v$  is the vol. of solution containing 1 g.-mol. of solvent, is derived; as a first approximation  $F_\psi =$  the accommodation coeff. Expressions for the activity of the solvent and solute in solutions, and for calculating the  $L$  of the solvent, are further derived from this expression.

IV. Expressions for the saturated v.p., osmotic pressure, depression of f.p. and elevation of b.p., of solutions are derived, on the above theoretical assumptions.

V. Expressions connecting the fugacity and activity of a dissolved solid with its velocity of dissolution are derived; a conclusion is that the activity of solutes in dil. solutions is  $\propto$  concn.

VI. Expressions for calculating the true heat of vaporisation of solvents from solutions, and for the approx. evaluation of the activity of such solvents, are given. It is shown, on theoretical grounds, that the processes of vaporisation and condensation of pure solvents have definite activation energies, which differ from those in solutions by amounts equal to the differential heat of dilution of the solutions. An expression approx. connecting heat of dilution with temp. is derived.

VII. Kohlrausch's empirical equation connecting equiv. conductivity with concn. is derived theoretically. An equation relating the diffusion coeff. with the activity coeff. for dil. solutions is derived from the Einstein-Smoluchowski formulæ.

VIII. Expressions for the fugacity and activity of dissolved substances are derived, and a method of calculating by their use the heat of solvation of solutes is given; the method applies only to cases in which compounds with solvent are not formed. R. T.

**Determination of activity coefficients from the potentials of concentration cells with transference.** D. A. MACINNES and A. S. BROWN (Chem. Rev., 1936, 18, 335—346).—Vals. of the activity

coeffs. of NaCl and AgNO<sub>3</sub> in aq. solution at 25° are calc. from measured potentials of concn. cells with liquid junctions, and transference nos. CH. ABS (e)

**Copper thioaluminates.** G. G. MONSEISE (Gazetta, 1938, 68, 600—601; cf. A., 1937, I, 628).—The thermal diagram of the system Cu<sub>2</sub>S—Al<sub>2</sub>S<sub>3</sub> up to about 1200° shows the existence of the compound 4Cu<sub>2</sub>S, Al<sub>2</sub>S<sub>3</sub>, analogous to 4Cu<sub>2</sub>S, SiS<sub>2</sub>. O. J. W.

**Relationship of beryllium to the vitriol-forming group and the alkaline-earth metals. IV. III. Double-salt formation between potassium and beryllium sulphates in comparison with that of the vitriols. (Polytherms of the ternary system BeSO<sub>4</sub>—K<sub>2</sub>SO<sub>4</sub>—H<sub>2</sub>O between 0° and 100°.)** W. SCHRÖDER [with W. KLEESE] (Z. anorg. Chem., 1938, 239, 399—417).—The 0°, 25°, 50°, 75°, and 99.5° isotherms of the system have been determined. The only double salt is K<sub>2</sub>SO<sub>4</sub>·BeSO<sub>4</sub>·2H<sub>2</sub>O, which has a wide region of stability over the whole temp. range. The 25° isotherm differs markedly from that given by Britton and Allmand (J.C.S., 1921, 119, 1463), whose work is criticised. F. J. G.

**Transition point of calcium sulphate in water and concentrated sea-water.** T. TORIUMI and R. HARA (Tech. Rep. Tôhoku, 1938, 12, 572—590).—The transition points between CaSO<sub>4</sub>·2H<sub>2</sub>O (I) and CaSO<sub>4</sub>·0.5H<sub>2</sub>O, and between (I) and the insol. form of CaSO<sub>4</sub> (III), as measured by solubility determinations, are 98.4° and 38°, respectively, in contact with pure H<sub>2</sub>O. The transition points are lowered progressively with increasing [NaCl], and from the data obtained the free energy changes of the transitions at various temp. and the heats of hydration at the transition points are deduced. The solubility of (III) in H<sub>2</sub>O and in NaCl solutions (16—163 g. per l.) has been measured at 40—100°. J. W. S.

**Alkaline earth arsenates. System As<sub>2</sub>O<sub>5</sub>—BaO—H<sub>2</sub>O at 17°.** H. GUÉRIN (Bull. Soc. chim., 1938, [v], 5, 1472—1478).—A detailed account of work already noted (A., 1938, I, 359). E. S. H.

**Binary system cadmium nitrate—water: vapour pressure—temperature relations.** W. W. EWING and W. R. F. GUYER (J. Amer. Chem. Soc., 1938, 60, 2707—2710).—Data for the concn. range 0—86% and 20—60° are recorded. Babo's const. increases appreciably with rising temp. in this system. E. S. H.

**System water—sulphur trioxide.** H. C. S. SNETHLAGE (Rec. trav. chim., 1938, 57, 1311).—Incorrect vals. for  $k = Ae^{-E/RT}$  previously published (cf. A., 1937, I, 517) are corr. C. R. H.

**Magnetochemical studies. XXX. Phase relationships and magnetic behaviour in the system chromium—selenium.** H. HARALDSEN and F. MEHMED (Z. anorg. Chem., 1938, 239, 369—394).—X-Ray investigations, and measurements of  $\chi$ , in the system Cr—Se between 50 and 60 at.-% of Se show the existence of three homogeneous phases separated by two-phase regions, viz., a hexagonal  $\alpha$ -phase, B-8 type, a  $\beta$ -phase of lower symmetry, possibly monoclinic, and a hexagonal  $\gamma$ -phase which has a structure nearly related to that of the  $\alpha$ -phase and is probably of B-8 type with vacant spaces in the Cr

lattice. The  $\alpha$ -phase extends from 50 at.-% Se, with  $a$  3.68,  $c$  6.02 Å. (cf. A., 1927, 815), to ~53.5 at.-% Se, with  $a$  3.67,  $c$  5.985 Å. The  $\beta$ -phase extends from ~54.5 at.-% Se, with  $a$  6.35,  $b$  3.64,  $c$  5.93 Å., to ~58 at.-% Se, with  $a$  6.29,  $b$  3.60,  $c$  5.84 Å. The  $\gamma$ -phase extends from ~59 to ~60 at.-% Se, the lattice dimensions being approx. const., viz.,  $a$  3.60,  $c$  5.78—5.77 Å.  $\chi$  has been measured from -183° to 320°. Ferromagnetism does not occur, and from 57.85 to 58.85 at.-% of Se the simple Curie law holds; for the other preps. the Curie-Weiss law holds, with negative and usually small vals. for  $\theta$ . The mol. moments are in approx. agreement with the theoretical vals. for ionic binding. The systems Cr—S, Cr—Se, and Cr—Te are compared. F. J. G.

**Piezometric researches. IV. Influence of high pressures on the fusion curve of binary mixtures.** L. DEFFET (Bull. Soc. chim. Belg., 1938, 47, 461—517).—Data are recorded for the binary systems  $p$ -C<sub>6</sub>H<sub>4</sub>Cl<sub>2</sub>— $p$ -C<sub>6</sub>H<sub>4</sub>Br<sub>2</sub>, NH<sub>2</sub>Ph—PhOH, *o*-cresol—*m*-cresol, cyclohexane—NH<sub>2</sub>Ph, and C<sub>6</sub>H<sub>14</sub>—PhNO<sub>2</sub>. The variations in the fusion curves with increasing pressure are in accord with previous observations (cf. A., 1935, 1060). J. W. S.

**Heats of combustion of diamond and of graphite.** R. S. JESSUP (J. Res. Nat. Bur. Stand., 1938, 21, 475—490).—The average val. for the heat of combustion to CO<sub>2</sub> of three graphites is 393.396 international kilojoules per mol. at 25° and 1 atm. Of two samples of diamond, the finer gave 395.771 and the coarser 395.287 international kilojoules per mol. at 25° and 1 atm. The difference between the two vals. is not explained, but it is not considered to be due to the two types of diamond discovered by Robertson *et al.* (cf. A., 1934, 583). The val. for the coarser specimen is considered the more reliable as the possibility of surface effects is less. C. R. H.

**Heat and free energy of formation of carbon dioxide, and of the transition between graphite and diamond.** F. D. ROSSINI and R. S. JESSUP (J. Res. Nat. Bur. Stand., 1938, 21, 491—513).—Existing data for the entropies of O<sub>2</sub>, CO<sub>2</sub>, graphite, and diamond, and for the heats of combustion of the two latter substances, are reviewed, and "best" vals. for the heats, entropies, and free energies of formation of CO<sub>2</sub> and of transition between graphite and diamond are selected. C. R. H.

**Heats of combustion of anthracite cokes and of artificial and natural graphites.** P. H. DEWEY and D. R. HARPER (J. Res. Nat. Bur. Stand., 1938, 21, 457—474).—The heats of combustion,  $q$ , of 30 anthracite cokes of six different H contents and of two artificial and four natural graphites have been measured.  $q$  increases almost linearly with H content, but there is no definite relation between  $q$  and adsorptive capacity towards CO<sub>2</sub>. C. R. H.

**Heats of formation of various nitrides.** S. SATOH (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 1356—1363).—By tabulating the heats of formation of various nitrides and azides against the at. nos. of their constituent elements, the heats of formation of the nitrides of As, Se, Br, and Hf have

been predicted as follows:  $0.5(N_2) + As = AsN - 33.9$ ;  $0.5(N_2) + Sc = ScN + 75.0$ ;  $0.5(N_2) + 1.5(Br_{2liq.}) = NBr_3 - 80.3$ ;  $0.5(N_2) + Hf = HfN + 78.3$  g.-cal. W. R. A.

**Heats of organic reactions. VII. Additions of halogens to olefines.** J. B. CONN, G. B. KISTIAKOWSKY, and E. A. SMITH (J. Amer. Chem. Soc., 1938, 60, 2764—2771; cf. A., 1938, I, 199).—The following heats of reaction (in g.-cal. per g.-mol.) refer to 355° K. and 1 atm. total pressure:  $C_2H_4 + Br_2 = C_2H_4Br_2 - 29,058 \pm 300$ ,  $C_3H_6 + Br_2 = C_3H_6Br_2 - 29,412 \pm 200$ ,  $CH_2=CHEt + Br_2 = CH_2Br-CHBrEt - 29,585 \pm 200$ , *trans*-CHMe:CHMe +  $Br_2 = i$ -CHBrMe-CHBrMe - 29,075  $\pm$  200, *cis*-CHMe:CHMe +  $Br_2 = d, l$ -CHBrMe-CHBrMe - 39,177  $\pm$  200,  $CM_2=CHMe + Br_2 = CM_2Br-CHBrMe - 30,394 \pm 200$ ,  $C_2H_4 + Cl_2 = C_2H_4Cl_2 - 43,653 \pm 120$ . A rule, which permits the calculation of accurate heats of addition of H halides and of substitution of Br, is formulated. E. S. H.

**Relation between heats of fusion of intermetallic compounds and the m.p.; calculation of heats of formation and of mixing.** O. KUBASCHIEWSKI and F. WEIBKE (Z. Metallk., 1938, 30, 325—326).—If, in the formation of a compound  $A_mB_n$  (m.p. =  $T^\circ$  abs.) between two metals *A* and *B* with heats of fusion  $Q_1$  and  $Q_2$ , the heat evolved in mixing the liquid metals is  $Q_3$ , and  $Q_4$  is the heat of formation of the compound, then  $Q_4 - Q_3 = 3.5T - (mQ_1 + nQ_2)$ , where *m* and *n* are the at.-% of the components. Vals. of  $Q_4$ ,  $Q_3$ , and  $T$  are tabulated for 21 intermetallic compounds. A. R. P.

**Heats of dissolution and heats of reaction in liquid ammonia. V. Alkali and alkaline-earth metals.** F. C. SCHMIDT, F. J. STUDEF, and J. SOTTYSIAK (J. Amer. Chem. Soc., 1938, 60, 2780—2782; cf. A., 1937, I, 138).—Procedure for the prep. of pure Rb and Cs from their halides is described. The at. heats of dissolution of K, Rb, and Cs over a fairly wide concn. range are zero; those of Li, Ca, Ba, and Sr have been determined at different concns. and these metals are shown to have a negative heat of dilution. E. S. H.

**Heats of dissolution of gaseous di- and trimethylamines.** A. PATTERSON, jun. [with W. A. FELSING] (J. Amer. Chem. Soc., 1938, 60, 2693—2695).—The relation between the heat of dissolution in g.-cal. per mol. ( $-\Delta H$ ) and dilution in mol.  $H_2O$  per mol. amine (*N*) is given by  $-\Delta H_1(NHMe_2) = 12,470 + 0.35149N$  and  $-\Delta H_2(NMe_3) = 12,344 + 0.31645N$ . E. S. H.

**Effects of dipole interaction on heats of adsorption.** J. K. ROBERTS (Trans. Faraday Soc., 1938, 34, 1342—1346).—Theoretical. The variation of heat of adsorption with fraction of surface covered is considered for the adsorption of vapours with a permanent dipole moment on conductors. The variation is small for typical mols., since the effects of dipole interaction and of the van der Waals attraction between the adsorbed mols. are of the same order and of opposite sign. E. S. H.

**Induced dipoles and the heat of adsorption of argon on ionic crystals.** J. K. ROBERTS and

W. J. C. ORR (Trans. Faraday Soc., 1938, 34, 1346—1349).—The electrostatic field at points equidistant from four ions near the surface of a 100 plane in a body-centred alkali halide crystal has been calc. The effect of the dipole induced by this field in A adsorbed by CsI makes the variation in heat of adsorption with fraction of surface covered considerably < it would be if only van der Waals forces were acting. E. S. H.

**Conductance of dilute solutions of alkali iodides in dimethylamine.** E. SWIFT, jun. (J. Amer. Chem. Soc., 1938, 60, 2611—2614).—Data recorded for NaI, KI, and LiI agree qualitatively with the Kraus and Fuoss theory (A., 1934, 967). Li<sup>+</sup> is probably solvated by  $NHMe_2$ . E. S. H.

**Conductivities of concentrated mixtures of the nitrates of uni-, bi-, and ter-valent cations in aqueous solution.** P. VAN RYSELBERGHE and G. LEE (J. Amer. Chem. Soc., 1938, 60, 2776—2779).—Conductivities of 20 binary mixtures have been measured at total equiv. concns. of 1—5N. The vals. are < those calc. from the simple mixture rule, except for  $Cr(NO_3)_3 + Cd(NO_3)_2$  and  $Cr(NO_3)_3 + Al(NO_3)_3$ . The deviation is the greater the greater is the difference of the conductivities of the single salts. E. S. H.

**Dispersion of conductivity of multivalent electrolytes in aqueous solution.** J. P. VAN DER HAMMEN (Physica, 1938, 5, 833—844; cf. A., 1938, I, 519).—The increase in conductivity of aq. solutions of multivalent electrolytes at high frequency ( $\lambda$  8 m.) is only qualitatively in accord with the Debye-Falkenhagen theory. For aq.  $[Coen_3][Fe(CN)_6]$  the effect is > that calc. on the assumption that free ions only contribute to the increase. It is considered probable that ion pairs may also add to the effect through dipolar adsorption. J. W. S.

**Conductivity of hydrogen halides in anhydrous acetic and propionic acids.** M. HŁASKO and E. MICHALSKI (Rocz. Chem., 1938, 18, 220—227).—The conductivity ( $\kappa$ ) of HCl in anhyd. AcOH is < of HBr; that of HI cannot be determined, owing to decomp. The  $\kappa$  of HCl in anhyd.  $EtCO_2H$  is zero, and of HBr < HI. In AcOH max.  $\kappa$  is obtained with *m*-HCl or 1.4*m*-HBr, and min.  $\kappa$  with 0.3*m*-HCl or 0.025*m*-HBr; this is in disagreement with the Walden formula, according to which the concn. at which min.  $\kappa$  is obtained depends only on the  $\epsilon$  of the solvent. R. T.

**Effect of a non-conducting admixture of  $Sb_2S_3$  on the conductivity of solid  $Ag_2S$ .** P. Z. FISHER (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 139—149).—The conductivity of  $Ag_2S$  is lowered by admixture of  $Sb_2S_3$ , to an extent  $\propto$  concn. of the latter. It rises with increasing temp., gradually below 120°, rapidly above it, owing to formation of a conducting double compound. R. T.

**Transport numbers of paraffin chain salts in aqueous solution. II. Reply to objections.** G. S. HARTLEY. III. Measurements on salts: influence of valence and nature of the gegenion. C. S. SAMIS and G. S. HARTLEY (Trans. Faraday

Soc., 1938, 34, 1283—1288, 1288—1305).—II. A reply to criticism (cf. A., 1936, 799).

III. Conductivities and transport nos. have been determined for cetylpyridinium chloride, acetate, iodide, oxalate, and sulphate, trimethylcetylammonium sulphate, trimethyldodecylammonium bromide, and Ag, Zn, and Cu dodecyl sulphates in  $H_2O$  at 35—50°. Changes in conductivity observed when the gegenion associated with a given paraffin chain ion is changed are due to changes in the fraction of gegenions attached to the micelle and in the size of the micelle. In this respect, sp. properties of the gegenions are at least as important as their valency; as regards mobility of the micelle, the valency of the gegenion appears to be predominant, and there is little sp. influence. Sp. variations of size are levelled out by admixture with simple salts.

E. S. H.

Interpretation of an experiment of Chanoz and Pontus on the electrolysis of dichromated gelatin. J. SWYNGEDAUF (Compt. rend. Soc. Biol., 1938, 128, 1144—1146).—The coloured zones described by Chanoz and Pontus (*ibid.*, 1934, 115, 522) are due to formation of a colourless isoelectric zone, development of a red zone of chromic acid being caused by migration of  $Cr_2O_7^{2-}$  across the isoelectric portion.

H. G. R.

Thermodynamics of a two-electrode system with two unretarded ionic transitions in the absence of a current. E. LANGE and K. NAGEL (Z. Elektrochem., 1938, 44, 792—813; cf. A., 1935, 1204; 1936, 430).—Theoretical.

J. W. S.

Theoretical studies on electrode potential. III. Absolute value of single electrode potential.

IV. Solvent action of liquid ammonia on ionic crystals. V. Standard electrode potentials in liquid ammonia. S. MAKISHIMA (J. Chem. Soc. Japan, 1935, 56, 1192—1198; 1936, 57, 285—296, 297—307).—The standard electrode potential of halogens and metals in liquid  $NH_3$  has been calc.

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Studies with the glass electrode in alkaline solutions. D. O. JORDAN (Trans. Faraday Soc., 1938, 34, 1305—1310).—The deviation  $\Delta$  of glass electrode potentials from H electrode potentials for alkaline solutions of  $Na^+$ ,  $Li^+$ ,  $K^+$ ,  $Ca^{++}$ ,  $Sr^{++}$ , and  $Ba^{++}$  at different  $p_H$  and ionic concns.  $m$  is given by  $\log \Delta = A p_H' + B \log m - C$ , where  $p_H'$  is the apparent  $p_H$  obtained if the glass electrode potentials are treated as H electrode potentials, and  $A$ ,  $B$ , and  $C$  are const.

E. S. H.

Metal-metal oxide electrodes. I. Tungsten and molybdenum electrodes. C. T. ABICHANDANI and S. K. K. JATKAR (J. Indian Inst. Sci., 1938, 21, A, 345—361).—The dependence of the potential on  $p_H$  for a no. of metallic electrodes has been studied.

W, Mo, and Sb give a linear relationship over the range  $p_H$  3 to 8. In an atm. of  $H_2$ , but not in air or  $O_2$ , a bright W electrode gives the theoretical relationship from  $p_H$  2.8 to 9.4, the e.m.f. against the saturated calomel electrode being given by  $E = -0.212 + 0.0591 p_H$ , at 25°, and the temp. coeff. being 0.00116 v. per degree. From these data the heat

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of formation of the surface oxide is 194 kg.-cal., in agreement with thermochemical vals. for  $WO_3$ . A polished Mo electrode in  $H_2$  gives the theoretical relationship from  $p_H$  5 to 7.

F. J. G.

Electrolytic reduction potentials of organic compounds. XXVI. Standard electrolytic reduction potential- $p_H$  curve. I. TACHI (J. Agric. Chem. Soc. Japan, 1938, 14, 1286—1296; cf. A., 1937, I, 567).—The relation of the standard electrolytic reduction potential  $\Pi_0'$  to the  $p_H$  of the electrolytic solution is discussed with regard to the dissociation const. of a reducible compound as well as of its reduced form. The inflexions of the  $\Pi_0'-p_H$  curve for neutral-red (redox system) are in fair agreement with theory.  $K_b$  for neutral-red, and  $K_b$  and  $K_a$  for the leuco-base, calc. from the inflexion points, are  $3.2 \times 10^{-7}$ ,  $1.3 \times 10^{-9}$ , and  $3.2 \times 10^{-9}$ , respectively, at 25°. In the case of benzoylacetone (irreversible reduction system) the inflexions of the curve do not agree so well with theory, but its shape approximates to the theoretical form. At 25° the calc.  $K_a$  is  $3.2 \times 10^{-7}$ , and the first and second  $K_a$  for reduced benzoylacetone are  $4.0 \times 10^{-4}$  and  $1.0 \times 10^{-11}$ , respectively.

J. N. A.

Streaming of electrolytes in reduction at the dropping mercury electrode. H. J. ANTWEILER (Z. Elektrochem., 1938, 44, 831—840).—Anomalous max. in the c.d.-p.d. curves for the electrolysis of solutions with a dropping Hg cathode are traced to disturbances in the diffusion layer at the Hg surface, due to streaming in the electrolyte solution. The streaming can be rendered visible; it is influenced by the positions of the electrodes, but not by a strong magnetic field or by superimposing an a.c. Streaming can be caused by momentarily breaking the circuit.

E. S. H.

Cathodic polarisation of iron in nitric acid. M. KARSCHULIN (Arch. Hemiju, 1938, 12, 125—131).—Fluctuations of the potential developed at an Armco-Fe cathode (Pt anode) in 9.2, 14.5, and 11.6N- $HNO_3$  at different c.d. are recorded. The results obtained are analogous to those reported by Ellingham (A., 1932, 705) for a Pt cathode in  $HNO_3$ , and are explained on the basis of Ellingham's results, taking into consideration Karschulin's previous findings (A., 1935, 706, 1325).

R. T.

Passivity of iron and steel in nitric acid solution. XXIII. Y. YAMAMOTO (Bull. Inst. Phys. Chem. Res. Japan, 1938, 17, 751—794).—The electrode potential of Fe in  $HNO_3$  is raised by addition of  $Fe(NO_3)_3$ ,  $Hg(NO_3)_2$  or  $AgNO_3$ , and the metal becomes more readily passive in these solutions. The addition to  $HNO_3$  of nitrates of Na, Mg, Al, Mn, Zn, Cr, Co, Ni, and Cu has no effect on the passivity.

A. J. M.

Oxidation-reduction phenomena in electrolysis by sparking. P. JOLIBOIS (Bull. Soc. chim., 1938, [v], 5, 1429—1441).—A lecture.

Classical statistical mechanical formulation of the absolute rate of reaction in a general chemical system. K. HIROTA and J. HORIUTI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 1174—1180).—The statistical mechanical method of calculat-

ing the abs. rate of reaction (A., 1938, I, 255) has been extended to cover thermal reactions. A. J. M.

**Hydrodynamic theory of detonation.** H. LANGWEILER (Z. tech. Physik, 1938, 19, 271—283).—Theoretical. A. J. M.

**Theory of explosion phenomena.** W. JOST and L. VON MÜFFLING (Z. physikal. Chem., 1938, 183, 43—54).—The mathematical theory of chain reactions during explosions is discussed. C. R. H.

**Explosion wave in gas mixtures.** P. LAFFITTE (Recz. Chem., 1938, 18, 195—209).—A lecture. R. T.

**Auto-inflammation of gaseous mixtures at short [time] lags. I. Auto-inflammation of mixtures of hydrogen with air.** V. STERN, B. KRAVETZ, and A. SOKOLIK (Acta Physicochim. U.R.S.S., 1938, 8, 461—480).—The auto-inflammation of  $H_2$  + air mixtures has been investigated over a wide range of composition, pressure, and temp. Semenov's formula is applicable to the upper limit of inflammation. Inflammation lags are independent of temp.  $\tau p^{1.5} = \text{const.}$  expresses the relationship between pressure and lag. The lag has a min. val. for a mixture containing 34% of  $H_2$ . The auto-inflammation of  $H_2$ -air mixtures in an explosion engine is discussed. L. S. T.

**Energetic study of combustion at constant volume. Fictitious and actual combustion.** L. REINGOLD (Compt. rend., 1938, 207, 717—719; cf. B., 1938, 1120).—A general expression is derived by which the temp. of combustion of gaseous mixtures containing hydrocarbons and  $H_2$  may be calc. from a "fictitious" combustion temp., obtained by assuming no dissociation of the products. A. J. E. W.

**Existence of two slow homogeneous mechanisms in the oxidation of mixtures of hydrogen and carbon monoxide.** M. PRETIRE (Compt. rend., 1938, 207, 674—676; cf. A., 1937, I, 523).—Introduction of  $H_2$  into  $CO-O_2$  mixtures at  $540^\circ$  results in complete oxidation of the  $H_2$  and of part of the  $CO$ . The initial rate of oxidation at first increases rapidly with the  $[H_2]$ , and then remains const. or decreases slowly over a large  $[H_2]$  range; a less pronounced increase occurs at high  $H_2$  pressures. These results indicate the existence of two mechanisms, in close analogy with the oxidation of  $H_2$ . Inflammation at low pressures is prevented by partial inhibition of chain branching by the  $CO$ . A. J. E. W.

**Application of the tube method for the measurement of the normal speed of flame propagation in gases.** L. CHITRIN (Tech. Phys. U.S.S.R., 1937, 4, 110—120).—Investigations with mixtures of  $C_6H_6$  or  $CO$  with air show that the speed of uniform flame movement is not characteristic of the normal speed of propagation but  $\propto$  the quantity of mixture ignited in unit time, and depends on the dimensions of the flame surface and conditions of propagation. The val. of the normal speed of inflammation must be determined as the ratio of the vol. of fuel mixture consumed in unit time to the area of surface of inflammation. The tube method allows accurate determination of the normal speed if the shape and

dimensions of the flame surface corresponding with the stage of uniform movement are recorded. N. M. B.

**Systems of "Knallgas" with hydrogen chloride, carbonyl chloride, and difluorodichloromethane ("freon") as extinguishers.** J. J. VALKENBURG (Rec. trav. chim., 1938, 57, 1283—1293).—When plotted on triangular diagrams the explosion regions of  $H_2-O_2-HCl$  and of  $H_2-O_2-COCl_2$  are bounded by parabolic curves, but an irregular curve is obtained with  $H_2-O_2-CCl_2F_2$ . The irregularities are attributed to side reactions. The data are discussed. C. R. H.

**Explosion limit curves. III. Systems  $H_2-O_2-N_2$ ,  $H_2-O_2-CO_2$ , and  $H_2-O_2-A$ .** A. J. VALKENBURG (Rec. trav. chim., 1938, 57, 1276—1282).—The transition from non-explosive to explosive state at the lower explosion limit previously observed (cf. A., 1938, I, 626) is discussed theoretically. C. R. H.

**Oxidation of monogermane and digermane.** H. J. EMELÉUS and E. R. GARDNER (J.C.S., 1938, 1900—1909).—Slow oxidation of  $GeH_4$  at  $160-183^\circ$  occurs in accordance with  $GeH_4 + 2O_2 = GeO_2 + 2H_2O$ . The reaction is catalysed by  $GeO_2$  which is deposited on the walls of the reaction vessel and permits oxidation to occur about  $100^\circ$  lower than on a clean glass surface. At  $160-183^\circ$  the catalysed reaction is approx. of zero order with respect to  $O_2$  and second order with respect to  $GeH_4$ . Ignition of  $GeH_4-O_2$  mixtures in glass vessels is preceded by an induction period. The ignition temp. is lowered by increasing the proportion of  $GeH_4$  and by the presence of  $GeO_2$ , which also eliminates the induction period. Photochemical oxidation of  $GeH_4$  takes place in accordance with  $2GeH_4 + 3O_2 = H_2 + 2H_2O + Ge_2O_4H_2$ . The ignition temp. of  $Ge_2H_6-O_2$  mixtures is about  $150^\circ$  < that of  $GeH_4-O_2$  mixtures; the reaction is represented by  $2Ge_2H_6 + 7O_2 = 4GeO_2 + 6H_2O$ . E. S. H.

**Explosive limits of gaseous mixtures. IV. Acetylenic mixtures.** R. BRESQUER, M. RIVIN, and A. SOKOLIK (Acta Physicochim. U.R.S.S., 1937, 7, 749—754; cf. A., 1936, I, 1468).—The possibility of a spontaneous growth of the explosion wave has been demonstrated in the case of  $C_2H_2$ -air mixtures. The zone defined by the explosive limits has two min., as previously found for  $H_2$ -air mixtures. This is probably due to a fall of the temp. of ignition in the short lag depending on the dilution of both types of mixtures. W. R. A.

(A) Mechanism of chain breaking in the thermal decomposition of ethane. (B) Reaction chains in the thermal decomposition of hydrocarbons. Comparison of methane, ethane, propane, and hexane. J. E. HOBBS and C. N. HINSHELWOOD. (C) Chain reaction in the thermal decomposition of diethyl ether. J. E. HOBBS (Proc. Roy. Soc., 1938, A, 167, 438—446, 447—455, 456—463).—(A) The inhibition of the reaction by the presence of  $NO$  has been investigated at four different  $C_2H_6$  pressures, between 50 and 450 mm. The predominant mechanism for chain ending in the absence of  $NO$  is a ternary collision between two radi-

cals and a  $C_2H_6$  mol.; binary collisions are in some degree effective.

(B) A comparison is made of the inhibition by NO of the thermal decomp. The mean chain length shows no marked change as the series is ascended. Curves showing the decrease in rate as a function of [NO] are explained in terms of a simple theory of chain breaking. Approx. evaluation of the energy of activation of chain propagation shows that it tends to decrease with the higher hydrocarbons.

(C) The reaction inhibited by NO has been studied at  $504^\circ$  at four pressures between 50 and 400 mm. The course of the inhibition curve is independent of the pressure of  $Et_2O$ . A chain mechanism explaining the results is put forward. G. D. P.

**Low-temperature oxidation of acetaldehyde.** B. V. AIVAZOV (Acta Physicochim. U.R.S.S., 1938, 8, 617—622).—The induction periods ( $\tau_1$  and  $\tau_2$ ) of cold and hot flames in mixtures of  $MeCHO$  and  $O_2$  have been investigated.  $\tau_1$  decreases with increasing pressure and with increasing [MeCHO], tending to a limit.  $\tau_2$ , which is small ( $< 0.1$  sec.), increases with temp., and decreases with increasing pressure as for  $C_4H_{10}-O_2$  mixtures (cf. A., 1937, I, 34). W. R. A.

**Kinetics of the decomposition of chloropicrin at low pressures.** E. W. R. STEACIE and W. MCF. SMITH (Canad. J. Res., 1938, 16, B, 222—226).—The fall in the rate of decomp. at low pressures can be explained on the basis of the Kassel theory for a model with 15 oscillators, a mol. diameter of  $8 \times 10^{-8}$  cm., and a frequency of 779  $cm^{-1}$ . C. R. H.

**Decomposition and ignition of peroxides. I. Diethyl peroxide.** E. J. HARRIS and A. C. EGERTON (Proc. Roy. Soc., 1938, A, 168, 1—18; cf. A., 1938, I, 256).—The reaction is studied in the temp. range  $130-190^\circ$ ; it is unimol. and is not affected by surface condition of the reaction vessel or by the addition of diluents ( $He$ ,  $H_2$ ,  $CO_2$ ). A short induction period, which is increased by the addition of NO, is observed. Above a crit. pressure the decomp. becomes explosive.  $Et_2O_2$  ignites in air at temp.  $<$  those corresponding with the crit. explosion pressure in a neutral atm. In a  $C_3H_8-O_2$  mixture ignition occurs at temp.  $<$  those at which  $C_3H_8$  will ignite, without igniting the  $C_3H_8$ . The induction period of the slow combustion of  $C_3H_8$  is greatly diminished by the presence of  $Et_2O_2$ . G. D. P.

**Polymerisation of styrene in a 50-cycle electrical field, and polymerisation of oil in electrical condensers.** A. LIECHT (Helv. Phys. Acta, 1938, 11, 477—496).—Application of an a.c. field has no effect on the rate of polymerisation ( $k$ ) of styrene (I) until the potential gradient ( $X$ ) reaches a crit. val. [ $43.5$  kv. per mm. for pure (I) at  $80^\circ$ ];  $k$  then increases suddenly, but is progressively reduced on further increasing  $X$ . A preliminary treatment in the a.c. field ( $X >$  the crit. val.) increases the rate of purely thermal polymerisation, re-application of the field during the process having a retarding effect. These phenomena explain certain polymerisation effects in condenser oil. A. J. E. W.

**Kinetics of the nitrite-bromine reaction.** L. S. CLARKSON, R. O. GRIFFITH, and A. MCKEOWN (Trans. D\* (A., I.)

Faraday Soc., 1938, 34, 1274—1282).—The reaction in  $H_2O$  at  $0-40^\circ$  takes place by two simultaneous processes, both unimol. with respect to Br. The rates are proportional to  $[NO_2']/(K_3 + [Br'])$  and  $[NO_2']^2/[Br'](K_3 + [Br'])$ , respectively. Temp. coeffs. and the influence of KBr, NaBr,  $NaNO_3$ , and  $KNO_3$  have been determined for both reactions. The mechanism of reaction is discussed. E. S. H.

**Factors determining the velocity of reactions in solution. Formation of quaternary ammonium salts.** K. J. LAIDLER (J.C.S., 1938, 1786—1789).—In each of the series of reactions between substituted dimethylanilines or pyridines and MeI in  $PhNO_2$  the term  $PZ$  of the Arrhenius equation is approx. const., changes in velocity being due to changes in  $E$ . The order of activation energies is in accordance with the electronic effects of the substituent groups, assuming that a low energy is associated with a high density of electrons on N.  $\alpha$ -Picoline is an exception, since  $E$  is abnormally high owing to steric hindrance, which is not reflected in a low val. of  $PZ$ . The influence of substituents on the velocity of decomp. of the quaternary salts is opposite to that on the velocity of their formation. E. S. H.

**Activation energy of organic reactions. IV. Transmission of substituent influences in ester hydrolysis.** E. TOMMILA and C. N. HINSHELWOOD (J.C.S., 1938, 1801—1810; cf. A., 1938, I, 405).—Transmission coeffs. have been determined for the influence of various electron-attracting and -repelling groups in the  $m$ - and  $p$ -position of the  $C_6H_6$  ring on the hydrolysis by acids and alkalis, respectively, in aq.  $COMe_2$ , of esters of the types  $C_6H_4X \cdot CO_2Et$ ,  $C_6H_4X \cdot CO_2Me$ ,  $C_6H_4X \cdot CH_2 \cdot OAc$ , and  $C_6H_4X \cdot OAc$ . Consts. of the Arrhenius equation have been determined; for alkaline hydrolysis  $PZ$  is nearly const., the changes due to substituents being measured by  $\Delta E$ . The relative influence of different substituents in a given series is fairly const. from one series to another, and the relative transmissibility of the electronic effect is fairly const. for different substituents, so that relative transmission coeffs. for different types of structure can be determined. In acid hydrolysis the influence of the substituents is smaller and less regular. E. S. H.

**Kinetics of neutralisation of pseudo-acids in water and deuterium oxide.** S. H. MARON and V. K. LAMER (J. Amer. Chem. Soc., 1938, 60, 2588—2596).—The rates of neutralisation of nitro-methane, -ethane, (I) and -isopropane (II) by  $OH'$  in  $H_2O$  and  $OD'$  in  $D_2O$  at  $0^\circ$  and  $5^\circ$  have been measured by a conductance method. The rate coeffs. in  $H_2O$  decrease in the above order; the rates for (I) and (II) in  $D_2O$  are 40%  $>$  in  $H_2O$  at the same temp. The rate coeffs. have been expressed as functions of temp., and energies and entropies of activation calc. E. S. H.

**Effect of the triple linking on the rate of reaction of  $\omega$ -chlorides with potassium iodide in absolute acetone.** M. J. MURRAY (J. Amer. Chem. Soc., 1938, 60, 2662—2664).—The reaction velocities of  $Bu^*Cl$ ,  $CPh:CCl$ ,  $CPh:C \cdot CH_2Cl$ ,  $CPh:C \cdot [CH_2]_2Cl$ ,  $CPh:C \cdot [CH_2]_3Cl$ ,  $CHPh:CH \cdot CH_2Cl$ , and  $CH_2:CH \cdot CH_2Cl$

at 60° have been determined. Alternation in activity is observed throughout the acetylenic series; the activity of the most active acetylenic chloride is < that of the corresponding ethylenic compound.

E. S. H.

**Mechanism of the aqueous hydrolysis of  $\beta$ -butyrolactone.** A. R. OLSON and R. J. MILLER (J. Amer. Chem. Soc., 1938, 60, 2687—2692).— $\beta$ -Bromobutyric acid (I) has been resolved with morphine in MeOH; the mol. rotation  $[M]_{5461}^{25}$  in acid solution is 116.5°; that of the Na salt is 106.6°. The rate of hydrolysis of optically active  $\beta$ -butyrolactone prepared from optically active (I) has been measured at different  $[H^+]$ . The rates and the optical activity of the hydrolysis products show that the mechanisms of hydrolysis by  $H_2O$ ,  $H^+$ , and  $OH^-$  are distinct. The addition of an ion such as  $CO_3^{2-}$  has a great influence on the  $H_2O$  and  $OH^-$  rates. The heats of activation for the reactions involved in the production of lactone from  $CHBrMe \cdot CO_2'$  (II) and the racemisation of (I) by  $Br^-$  have been determined. The rate of the bimol. reaction between (II) and  $OH^-$  has been measured. The reaction between (II) and  $S_2O_3^{2-}$  involves the unimol. formation of lactone as a primary step.

E. S. H.

**Kinetics and mechanism of  $\alpha$ -aminoisobutyronitrile formation.** T. D. STEWART and C. LI (J. Amer. Chem. Soc., 1938, 60, 2782—2787).—Sp. reaction rates for  $CN \cdot CMe_2 \cdot OH + NH_4Et_2 \rightarrow CN \cdot CMe_2 \cdot NEt_2 + H_2O$  at 25° have been determined, using EtOH and  $COMe_2$  as solvents. The rate laws deduced for the reactions in EtOH and  $COMe_2$ , respectively, are:  $d(P)/dt = k'[COMe_2][amine]$  and  $d(P)/dt = k''[amine][cyanohydrin]$ . These are shown to be related by a common reaction mechanism.

E. S. H.

**Kinetics of the periodate oxidation of  $\alpha$ -glycols.** C. C. PRICE and H. KROLL (J. Amer. Chem. Soc., 1938, 60, 2762—2729).—Oxidation of  $(CMe_2 \cdot OH)_2$  by  $NaIO_4$  is a bimol. reaction, dependent on the concn. of  $(CMe_2 \cdot OH)_2$  and of  $IO_4^-$  and catalysed by acids or bases.  $(CMe_2 \cdot OH)_2$  is oxidised faster than is  $(CH_2 \cdot OH)_2$  in alkaline, but more slowly in acid, solution; alternative explanations are offered.

R. S. C.

**Kinetics of polymeric aldehydes. X. Course of reaction in the system polyoxymethylene-concentrated formaldehyde solution.** J. LÖBERING (Z. Elektrochem., 1938, 44, 781—790; cf. A., 1937, II, 399).—Mainly theoretical. The kinetics and mechanism of the process are considered in the light of previous work, and illustrated by reference to measurements with polyoxymethylene  $Me_2$  ethers.

E. S. H.

**Relative rate of ring-closure reactions.** G. SALOMON (Trans. Faraday Soc., 1938, 34, 1311—1320).—Published work is discussed (cf. A., 1936, 940; 1937, II, 88), with additional observations. The formation of 5- and 6-membered rings from halogenoalkylamines by the Menschutkin reaction can be observed in such different solvents as  $H_2O$  and  $C_6H_6$ . The variation of reaction rate with the halogenoalkylamine and the solvent is discussed. Using  $H_2O$  as solvent, ring-closure may occur simultaneously with hydrolysis, depending partly on the

length of chain. The general relations between chain length and ease of ring formation are discussed.

E. S. H.

**Investigation of radium and barium precipitations using thorium-X as indicator.** E. FÖYN, E. GLEDITSCH, and S. HANNEBORG (Mikrochim. Acta, 1938, 3, 253—257).—A method for determining the rate of pptn. of Th-X in solutions containing  $SO_4^{2-}$ , in which the  $[Th-X]$  is found by measuring the thoron evolved, is described. The pptn.-time curves show that pptn. of Th-X requires a certain time depending on the concn. of  $SO_4^{2-}$  and  $BaCl_2$  added, and on the presence of foreign ions. The assumption that pptn. is immediate, and that in time the ppt. changes from a finely-cryst. condition with large emanating power to a coarsely-cryst. state with smaller emanating power, is disproved. An apparatus for measuring thoron content is described. It can be applied to the determination of Th in natural waters.

L. S. T.

**Amorphous and crystallised oxide hydrates and oxides. XLVII. Restriction of the "catalase" and "peroxidase" action of amorphous ferric hydroxide.** A. KRAUSE [with Z. ALASZEWSKA and A. SOBOTA] (Ber., 1938, 71, [B], 2392—2398).—Investigation of the influence of various restricting agents on the peroxidase action and catalase action of röntgenographically amorphous  $Fe^{III}$  hydroxide (orthoferic hydroxide) in heterogeneous system shows that although the same OH group is present in both inorg. enzymes the "peroxidase" action is more readily poisoned than the "catalase" action. The latter is measured by the decomp. of  $H_2O_2$ , the former by the oxidation of  $HCO_2H$  by  $H_2O_2$ . The rate of oxidation is diminished as the concn. of  $HCO_2H$  increases. Dil.  $H_3PO_4$ ,  $H_3PO_3$ , and  $H_2SO_4$  are markedly,  $HNO_3$  feebly, restrictive. The reaction,  $2Fe^{III} + H_2O_2 \rightarrow 2Fe^{II} + 2H^+ + O_2$ , is not observed. Strong mineral acids at high concn. are destructive since they dissolve the catalyst and nullify the active OH. As compounds, particularly  $As_2O_3$ , are strongly and irreversibly restrictive. HCN distinctly restricts the peroxidase action whereas CO does not. The difference between peroxidase and catalase action is here particularly marked since the latter is not sensitive to I or KCN. KCN actually activates the decomp. of  $H_2O_2$  since  $OH^-$  ions are formed as a consequence of hydrolysis. On the other hand the salts of heavy metals appear somewhat restrictive.

H. W.

**Thermal dissociation of chromium trioxide.** J. G. RISS and A. I. SELJANSKAJA (Acta Physicochim. U.R.S.S., 1938, 8, 623—640).—The thermal decomp. of cryst.  $CrO_3$  is a very slow process. At <180° decomp. of liquid  $CrO_3$  is undetected even on prolonged heating; at 240°, however, the dissociation pressure is  $\sim 1$  atm. The first decomp. product,  $Cr_5O_{13}$  ( $Cr_2O_3 \cdot 5 \cdot 5CrO_3$ ), is produced in a unimol. reaction having activation energy of 33,970 g.-cal. and  $\log_e k = -7427.55/T + 13.1248$ . Other intermediate oxides,  $Cr_7O_{18}$  ( $Cr_2O_3 \cdot 5CrO_3$ ),  $Cr_8O_{21}$  ( $Cr_2O_3 \cdot 6CrO_3$ ), and  $Cr_5O_{12}$  ( $Cr_2O_3 \cdot 3CrO_3$ ), are formed.  $Cr_5O_{12}$  decomposes autocatalytically to  $Cr_2O_3$  at 400°. Quartz and cast Fe have no significant catalytic activity;  $H_2SO_4$



and  $\text{NaHSO}_4$  increase the decomp. velocity very sharply owing to salt formation. W. R. A.

**Kinetics of reactions in heterogeneous systems (dissolution etc.).** Application to the excretion of urea by the kidney. J. CLARENS and H. CLARENS (Bull. Soc. chim., 1938, [v], 5, 1516—1521).—The amount of substance dissolved or filtered in a given time is related to concn. by a curve which is linear over a certain range. This relation is discussed in general terms and with special reference to the excretion of  $\text{CO}(\text{NH}_2)_2$ . E. S. H.

**Commercial active charcoal. Influence of humidity on the velocity of adsorption of chloropicrin.** R. LOISY (Bull. Soc. chim., 1938, [v], 5, 1509—1516).—The rates of adsorption of  $\text{CCl}_3\cdot\text{NO}_2$  vapour (5 mg. per l.) in an air stream at  $18^\circ$  by three different steam-activated charcoals have been determined. The rates and the equilibrium concns. decrease with increasing  $[\text{H}_2\text{O}]$  in the air stream. E. S. H.

**Rate of dissolution of iron, manganese, and ferromanganese in molten copper.**—See B., 1938, 1432.

**Influence of inorganic compounds on combustion of coal.**—See B., 1938, 1379.

**Catalytic effect of buffers on reaction  $\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3$ .** F. J. W. ROUGHTON and V. H. BOOTH (Biochem. J., 1938, 32, 2049—2069).—The rates of  $\text{CO}_2$  uptake of buffer solutions and of  $\text{CO}_2$  output by  $\text{HCO}_3^-$  solution suddenly mixed with buffer have been measured by an improved manometric technique. Buffers have a direct effect on  $\text{CO}_2$  uptake other than removal of  $\text{H}^+$  in the ionisation  $\text{H}_2\text{CO}_3 \rightarrow \text{H}^+ + \text{HCO}_3^-$ . The effect cannot be due to impurities or to "neutral salt" action but  $\propto$  concn. of the more negative constituent of the buffer. Since similar catalytic coeffs. were obtained for these ions in buffers working at  $p_{\text{H}}$  6—9, during  $\text{CO}_2$  uptake and also  $\text{CO}_2$  output, the effect must be catalytic. The buffers catalyse only  $\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3$  and not  $\text{CO}_2 + \text{OH}^- \rightleftharpoons \text{HCO}_3^-$  and a mechanism for the catalysis is suggested. Straight-chain N bases do not act catalytically but combine with  $\text{CO}_2$  giving carbamyl compounds. The effects of phosphate and cacodylate are additive but of carbonic anhydrase and phosphate are multiplicative. Biochemical implications are indicated. F. H.

**Catalytic action of tetra-ammonium salts.** V. A. HOLZSCHMIDT and I. V. POTAPOV (Acta Physicochim. U.R.S.S., 1937, 7, 778—790).—The kinetics of the reactions  $\text{NPhMe}_2 + \text{C}_3\text{H}_5\text{Br} \rightarrow \text{NPhMe}_2(\text{C}_3\text{H}_5)\text{Br}$  (I), and  $\text{C}_5\text{H}_5\text{N} + \text{C}_3\text{H}_5\text{Br} \rightarrow \text{C}_5\text{H}_5\text{N}(\text{C}_3\text{H}_5)\text{Br}$  (II), have been measured at  $30^\circ$ ; measurements of (I) were made in solutions of MeOH and EtOH, and of (II) in MeOH. In both cases the "tetra-ammonium" salts formed act as catalysts for the reaction. W. R. A.

**Catalytic reaction between sodium nitrite and dichlorodiethylenediaminecobaltic chloride.** J. P. McREYNOLDS and J. C. BAILAR, jun. (J. Amer. Chem. Soc., 1938, 60, 2817—2818).—The reaction  $[\text{Co en}_2\text{Cl}]^+ + 2\text{NaNO}_2 \rightarrow [\text{Co en}_2(\text{NO}_2)_2]^+ + 2\text{NaCl}$  is catalysed by traces of  $\text{Co}^{2+}$ . Evidence of the inter-

mediate formation of  $\text{Na}_2\text{Co}(\text{NO}_2)_4$  is given and the mechanism discussed. E. S. H.

**Acid catalysis in non-aqueous solvents. VI. Racemisation of phenylmethylacetophenone and phenylisobutylacetophenone in various solvents.** R. P. BELL, O. M. LIDWELL, and J. WRIGHT (J.C.S., 1938, 1861—1865; cf. A., 1938, I, 258).—Reaction velocities have been determined at  $100^\circ$  for phenylmethylacetophenone in PhCl and phenylisobutylacetophenone in anisole,  $\text{PhNO}_2$ , PhCl, and decahydronaphthalene in presence of acids. The results are similar to those reported for the inversion of menthone in PhCl (*loc. cit.*). A mechanism is suggested to explain the observed dependence of velocity on acid concn. The racemisation is catalysed by  $\text{NEt}_3$  in PhCl in absence of acid. E. S. H.

**Kjeldahl determination of nitrogen.**—See B., 1938, 1465.

**Reactions in concentrated sulphuric acid. XII. Destruction of acetylene in the cold.** J. MILBAUER (Chem. Obzor, 1938, 13, 89—91, 118—120, 147—149, 163—165).—The reaction of  $\text{C}_2\text{H}_2$  with  $\text{H}_2\text{SO}_4$  is followed with a photo-cell since the colour of the solution changes from yellow to black with passage of the gas. Catalysts in order of decreasing activity are  $\text{HgSO}_4$ ,  $\text{SeO}_2$ ,  $\text{CuSO}_4$ , reduced  $\text{V}_2\text{O}_4$ ,  $\text{Ag}_2\text{SO}_4$ , reduced  $\text{MoO}_3$ ,  $\text{As}_2\text{O}_3$  and  $\text{SiO}_2$  are inactive, whilst  $\text{Sb}_2\text{O}_3$ ,  $\text{PbSO}_4$ ,  $\text{HCl}$ ,  $\text{ZnSO}_4$ ,  $\text{SO}_2$ ,  $\text{K}_2\text{SO}_4$ , and especially  $(\text{NH}_4)_2\text{SO}_4$  are inhibitors, the last keeping colourless for 6 hr. acid which with  $\text{HgSO}_4$  would be instantly coloured, and neutralising the action of  $\text{HgSO}_4$  present at the same time. Minute quantities of  $\text{SO}_2$  or  $\text{H}_2\text{O}$  do not alter the reaction velocity, although at acid concn.  $< 95\%$  it falls considerably. The effect of a catalyst  $\propto$  its concn. up to the saturation point, and reduces the time before coloration commences (with  $\text{HgSO}_4$  to 0), which without a catalyst may be quite considerable.  $\text{SeO}_2$  added to  $\text{HgSO}_4$  does not give an enhanced catalytic effect as in kjehldahlisation.

F. R.

**Sorption properties of mixed catalysts. II. Desorption of ammonia by the poisoning of ammonia-catalysts with oxygen-containing gases.** N. M. MOROZOV and M. J. KAGAN (Acta Physicochim. U.R.S.S., 1938, 8, 549—564; cf. A., 1937, I, 76).—The abundant liberation of  $\text{NH}_3$  by poisoning of  $\text{NH}_3$  catalysts with  $\text{O}_2$ -containing gases in presence of  $\text{H}_2$  is due to acceleration of the reduction of the  $\text{N}_2$  adsorbed on the surface of the catalyst. The rate of reduction for catalyst  $\text{Fe} + \text{Al}_2\text{O}_3 + \text{K}_2\text{O}$  (I) is  $>$  that for  $\text{Fe} + \text{Al}_2\text{O}_3$  (II), but the total amount of  $\text{N}_2$  reduced is greater for (II) than for (I). W. R. A.

**Catalytic action of various kinds of ferric hydroxide in presence of promoters.** O. BELFIORI (Gazzetta, 1938, 68, 405—411).—The oxidation of  $\text{HCO}_2\text{H}$  with  $\text{H}_2\text{O}_2$  catalysed by  $\text{Fe}(\text{OH})_3$  is strongly promoted by small amounts of Cu, but not of Mn, Ni, Co, or Zn. The promoter action of Cu has been studied using various preps. of  $\text{Fe}(\text{OH})_3$ . O. J. W.

**Phosphoric oxide as catalyst of the polymerisation of olefines.**—See A., 1939, II, 3.

**Catalyst poisoning from the viewpoint of the specificity of active centres. VI. Temperature-**

dependence of the relative duration of stay of water and ethyl alcohol molecules on copper. A. BORK. VII. Kinetics of the dehydration of ethyl alcohol on aluminium oxide. VIII. Orientation of the molecules of the aliphatic alcohols  $C_nH_{2n+2}O$  in the dehydration of the alcohols on aluminium oxide. IX. Influence of methyl substituents on the activation energy of the dehydration of the aliphatic alcohols  $C_nH_{2n+2}O$  on aluminium oxide. A. BORK and A. A. TOLSTOPJATOVA (Acta Physicochim. U.R.S.S., 1937, 7, 745—748; 1938, 8, 577—590, 591—602, 603—616; cf. A., 1937, I, 573).—VI. The temp.-independence of the relative stay of the  $H_2O$  mol., with the active Cu surface at temp. 240—266.5°, has been experimentally demonstrated.

VII. The dehydration of EtOH by  $Al_2O_3$  obeys the equation previously obtained for the dehydrogenation of EtOH (A., 1936, I, 1472). The ratio  $\alpha_2/\alpha_1$  of the adsorption coeffs. of  $H_2O$  to that of EtOH at 350° is 0.65.

VIII. The dehydration of both  $Pr^{\alpha}OH$  and  $Pr^{\beta}OH$  also follows the same equation.  $\alpha_2/\alpha_1$  for  $Pr^{\alpha}OH$  and  $Pr^{\beta}OH$  is identical with that for EtOH and thus, presumably, the orientation of the mols. of the different alcohols on the surface of the catalyst is similar.

IX. The influence of Me substituents on the activation energy of the dehydration of 6 aliphatic alcohols has been experimentally investigated. W. R. A.

**Catalytic properties of the phthalocyanines.** I. Catalase properties. II. Oxidase properties. IV. Chemiluminescent reactions. A. H. COOK (J.C.S., 1938, 1761—1768, 1768—1774, 1845—1847; cf. A., 1939, II, 25).—I. The catalytic effect of metal phthalocyanine pigments on the decomp. of  $H_2O_2$  has been investigated; that of Fe pigments is outstanding. The influence of  $p_H$ , poisons, etc. has been examined, and the results are compared with those for Fe porphyrins.

II.  $Fe^{2+}$  and  $Fe^{3+}$  phthalocyanines, Fe octatetra-porphine, and to a limited extent a  $H_2O$ -sol. monosulphonated Fe phthalocyanine are outstanding in their ability to catalyse oxidations by  $O_2$ . Typical oxidations have been observed qualitatively, and the catalysed oxidation of PhCHO has been studied quantitatively. The results are discussed with special reference to biochemical reactions.

IV. Fe pigments of the phthalocyanine type catalyse the chemiluminescent oxidation of luminol by  $H_2O_2$  or  $O_2$ . The oxidation of fluorescent phthalocyanines of metals of group II and also of chlorophyll by org. peroxides at elevated temp. is usually accompanied by emission of red light. E. S. H.

**Chromium oxide deposit on magnesium.** R. DELAVAILLÉ (Bull. Soc. chim., 1938, [v], 5, 1522—1523).—The formation of the protective oxide film, acquired by Mg when immersed in aq.  $K_2Cr_2O_7$ , is catalysed by  $SO_4^{2-}$  and  $S_2O_8^{2-}$ . E. S. H.

**Production of oxidic catalysts by separation of aerosols.** I. Catalytic activity of separated aerosols of copper oxide. P. BESSALOV and N. I. KOBOSEV (Acta Physicochim. U.R.S.S., 1937, 7, 649—666).—The catalytic activities of CuO aerosol

(I) from 30° to 400°, and of CuO powder (II) from 150° to 400°, have been investigated for the oxidation of CO to  $CO_2$ . The catalytic activity of both becomes apparent around 200°. Comparison of the observed velocity coeffs. with those calc. by the Arrhenius equation shows that this equation is valid for (I) but not for (II). The relative activity of (I) increases with temp., and at 250° is 765 times that of (II). X-Ray photographs of the catalysts before and after the reaction show that, although their structure is unchanged, the crystal size of (I) has been diminished considerably, and this is confirmed by photomicrographic tests. (I) adsorbs twice as much air as (II) at the temp. of liquid air. W. R. A.

**Aerogel catalysts.**—See B., 1938, 1388.

**Phosphatatic actions of hydrogels.** II. Behaviour of metallic hydroxides towards phosphoric esters. IV. Catalytic fission of pyro- and poly-phosphates. E. BAMANN and M. MEISENHEIMER (Ber., 1938, 71, [B], 1980—1983, 2233—2236; cf. A., 1938, I, 629).—II. Hydrolysis of phosphoric esters is accelerated by the hydroxides of Ce, Pr, Nd, Sm, Er, Y, Zr, Th, Pb (slightly), and Mn, whereas those of Be, Mg, Ca, Zn, Cd, Al, Bi, Cu, and Sb are ineffective.

IV. In the conversion of  $H_4P_2O_7$  into  $H_3PO_4$  the hydroxides of La, Ce, Zr, and Th are very active, those of Y, Pb, and Mn have medium activity, whereas little activity is shown by those of Mg, Zn, Al, and Fe.  $H_5P_3O_{10}$  is rapidly converted into  $H_3PO_4$  by the hydroxides of La and Y, readily by those of Mn and Fe, and less easily by those of Al and Zn. Under identical conditions  $La(OH)_3$  causes 14%, 14%, 8%, and 4% conversions of  $(NaPO_3)_3$ ,  $Na_5P_3O_{10}$ ,  $Na_4P_2O_7$ , and Na glycerol- $\beta$ -phosphate in equal intervals of time. Esters of  $H_4P_2O_7$  are converted into  $H_3PO_4$  by suitable gels. H. W.

**Dehydration of hydrated magnesium chloride.** I. Mutual relation between potassium and sodium chlorides as addition agents. S. IMATOMI (Sci. Papers Inst. Phys. Chem. Res. Tokyo, 1938, 34, 1364—1376).—Experiments on the dehydration of  $MgCl_2 \cdot 6H_2O$  with KCl-NaCl mixtures as addition agents are described. A relation  $y = ax$  between  $x$ , the decrease in the "addition rate" of KCl, and  $y$ , the "addition rate" of NaCl which is needed for the decrease  $x$  to keep the amount of MgO formed const., is indicated.  $a$  is a numerical coeff. dependent on the temp. of the dehydration; for the production of Mg electrolyte it is 3. The significance of this equation is discussed from the industrial viewpoint.

W. R. A.

**Rôle of catalysts in formation of phenol-formaldehyde condensation products.**—See B., 1938, 1450.

**Rôle of catalysts in textile chemistry.**—See B., 1938, 1402.

**Gas development at a graphite electrode after opening the circuit.** V. SIHVONEN and P. SARKAMIES (Suomen Kem., 1938, 11, B, 19—21; cf. A., 1937, I, 573).—From the amount of gas held in a graphite electrode during electrolysis at various c.d. it is deduced that the evolution of  $H_2$  and  $O_2$

from graphite electrodes follows approx. a second-order equation, so long as the graphite surface is only slightly charged with gas and hence the discharge of ions is the velocity-determining reaction. By measuring the vol. of gas evolved at various periods after interruption of the current it is found that the evolution of  $H_2$  follows a second-order equation in NaOH but a third-order equation in  $H_2SO_4$ , whilst the evolution of  $O_2$  follows a first-order equation in NaOH or in  $H_2SO_4$  at low c.d., but a second-order equation after a higher c.d. has been employed. These results are discussed with reference to the various forms in which the gases may be adsorbed.

J. W. S.

**Electrolysis of magnesium chloride hexahydrate and -alcoholate in methyl and ethyl alcohol.** (MLLE.) M. L. QUINET (Bull. Soc. chim., 1938, [v], 5, 1568—1572).—Saturated solutions of  $MgCl_2$  in MeOH or EtOH yield  $MgCl_2 \cdot 3Mg(OMe)_2$  or  $MgCl_2 \cdot 3Mg(OEt)_2$  at the cathode. Solutions of  $MgCl_2 \cdot 6H_2O$  in the same solvents deposit  $[Mg(H_2O)_6]^{++}$ , which reacts with the alcohol forming a white ppt.,  $Mg(OR)_2 \cdot (H_2O)_6$ , which slowly decomposes:  $Mg(OR)_2 \cdot (H_2O)_6 \rightarrow Mg(OH)_2 + 2ROH + 4H_2O$ .

E. S. H.

**Electrochemistry of niobium.** G. GRUBE and H. L. GRUBE (Z. Elektrochem., 1938, 44, 771—780).—Aq.  $Nb^V$  in HCl is reduced at Pt or Hg cathodes to a bluish solution, which on titration with  $KMnO_4$  is shown to contain  $Nb^{III}$ . The solutions evolve  $H_2$  in contact with Pt, but potential measurements have been made with Hg electrodes. The normal potential of the process,  $Nb^{III} + H_2O \rightleftharpoons NbO^{III} + 2H^+ + 2e$ , at room temp. is  $-0.344 \pm 0.002$  v. in HCl and  $-0.342 \pm 0.001$  v. in  $H_2SO_4$ .

E. S. H.

**Determination of cathode current density in connexion with the structure of electrolytic metal deposits.** A. T. WAHRAMIAN (Acta Physicochim. U.R.S.S., 1937, 7, 683—690).—Theoretical considerations indicate that an accurate calculation of the cathode surface actually participating in electrolysis explains the effect of the change of current strength in cells on the structure of the cathode deposit. Calculation of the thickness of the newly-formed layers in conjunction with the theory of cathode passivity explains the shape of the crystals formed, and their deformation.

W. R. A.

**Stannous ammonium oxalate electroplating bath.**—See B., 1938, 1440.

**Electrodeposition of tin.**—See B., 1938, 1440.

**Electrodeposition of lead on base metals.**—See B., 1938, 1440.

**Electrodeposition of manganese.**—See B., 1938, 1440.

**Kolbe's synthesis in the electrolysis of butyric acid.** E. DENINA (Gazzetta, 1938, 68, 443—458).—The conductivity of solutions of  $PrCO_2H$  and of  $PrCO_2Na$  has been determined. In the electrolysis of  $PrCO_2Na$  solutions with smooth Pt electrodes the Kolbe synthesis commences at an anode potential of 2.18 v. Under the best conditions found the current efficiency for the formation of  $C_6H_{14}$  is 40%.

$C_3H_6$  is formed simultaneously with a current efficiency of about 40%.

O. J. W.

**Surrounding gaseous medium and the Herschel effect.** M. THURSTON and J. M. BLAIR (J. Opt. Soc. Amer., 1938, 28, 348).—Measurements of the rate of the Herschel effect have been made with various photographic emulsions in atm. of  $H_2$ ,  $O_2$ , or air. Contrary to the results obtained by Vnukova (A., 1937, I, 626) with Russian diapositive plates, the effect was independent of the gas.

J. A. K.

**Action of light on bismuth carbonate.** N. GLASS (Quart. J. Pharm., 1938, 11, 468—477).—The purer is the sample the greater is the darkening on exposure to light in the presence of sugars. The cause of light-sensitivity has been investigated.

P. G. M.

**Primary process in the photodecomposition of aldehydes and ketones.** E. GORIN (Acta Physicochim. U.R.S.S., 1938, 8, 513—515).—To prove the presence or absence of the Norrish type of reaction in the photodecomp. of  $COMe_2$ ,  $MeCHO$ ,  $CH_2O$ , and  $COMeEt$ , and to determine the no. of free radicals produced per quantum of light absorbed, the free radicals formed were fixed by means of I vapour. In all cases the no. of free radicals formed is independent of temp., the pressure of I, and the aldehyde or ketone. With  $COMe_2$  the no. of Me radicals formed per quantum absorbed is 1. The Ac radicals react incompletely with I, the remainder recombining to give  $Ac_2$ . Above  $100^\circ$ , CO is formed according to  $COMe \rightarrow Me + CO$  (min. activation energy 20 kcal.). The primary process over the photochemically active spectrum is  $COMe_2 + h\nu \rightarrow Me + COMe$ . With  $MeCHO$  two primary reactions  $h\nu + MeCHO \rightarrow CH_4 + CO$  or  $Me + CHO$  occur; < 90% of the CHO react:  $CHO + CHO = CH_2O + CO$ . In absence of I, < 85% of the Me and CHO radicals recombine to form  $MeCHO$ . With  $CH_2O$  the primary process at 3130 and 2536 Å. is  $CH_2O + h\nu \rightarrow H + CHO$ , and at 3650 Å.,  $CH_2O + h\nu \rightarrow H + CHO$  and  $H_2 + CO$ . With  $COMeEt$  the primary process at 3130 Å. is almost completely  $COMeEt \rightarrow Et$  (or  $Me$ ) +  $COMe$  (or  $COEt$ ). In unfiltered light several % of the reaction  $COMeEt \rightarrow C_3H_5 + CO$  occurs.

L. S. T.

**Effect of atomic hydrogen on synthesis of ammonia under positive-ion impact.** A. GELBART and I. MOCHAN (Acta Physicochim. U.R.S.S., 1937, 7, 767—777).—Using artificial spodumene samples as source of positive ions, the synthesis of  $NH_3$  under positive-ion impact has been investigated. The absence of proportionality between the ionic current and the yield of  $NH_3$  has been substantiated. With additional generation of at. H on a glowing W filament the reaction rate increases with the ionic current. The yield per ion in the latter case is independent of the ionic current, and lies between 0.1 and 0.3. This indicates that the synthesis of  $NH_3$  depends on the presence of activated N and H atoms. Various possible mechanisms are considered; the reaction is believed to proceed on a cooled wall where an adsorbed layer of at. H is available.

W. R. A.

**Interaction between methylene radicals and hydrogen.**—See A., 1939, II, 6.

**General and inorganic chemistry of deuterium.** I.—IV. E. EINECKE (Österr. Chem.-Ztg., 1938, 41, 331—340, 355—359, 371—376, 395—400).—I. The discovery, isolation, and physical properties of  $D_2$  are summarised. The reactions of D atoms and of  $D_2$  mols. are discussed and compared with the corresponding reactions of H and  $H_2$ .

II. The methods of prep. of compounds of D with H, C, N, P, As, O, S, Se, and halogens, and of  $ND_4$  halides are described. The physical properties of these compounds, so far as known, are tabulated and compared with those of the corresponding H compounds.

III. The concn. of  $D_2O$  by electrolysis of aq. NaOH using various forms of electrode, and the relative concns. of  $D_2O$  in various natural sources of  $H_2O$ , are discussed. The physical properties of  $D_2O$  and  $H_2O$  are compared. The methods of determining  $D_2$  in  $H_2$  are described.

IV. The differences in reaction velocity in  $D_2O$  and  $H_2O$ , due to the physical properties of the solvent, to interaction of the solvent with the reactants, and through differences in ionisation, are discussed. The dissociation consts. of various electrolytes in  $D_2O$  are compared with those in  $H_2O$ . The ease of replacement of H by D, and vice versa, in various inorg. and org. mols. are discussed in relation to the various types of linkage involved. J. W. S.

**Bi- and ter-valent silver compounds.** W. LIMANOWSKI (Rocz. Chem., 1938, 18, 228—233).—The black ppt. obtained by the action of  $S_2O_8^{2-}$  on  $Ag^+$  contains  $Ag^{III}$  and  $Ag^{II}$  in equal amounts. After 7 days at room temp., under  $H_2O$ , the ppt. contains only  $Ag^{II}$ , which does not change further during 12 months. R. T.

**Reactions in the solid state at high temperatures.** XXI. Formation of magnesium titanates from the oxides in the solid state. W. JANDER and K. BUNDE (Z. anorg. Chem., 1938, 239, 418—426).—When MgO and  $TiO_2$  are heated together at 850—1090° in any proportions the first product is  $MgTiO_3$ . When  $TiO_2$  is in excess the subsequent formation of  $Mg_2Ti_2O_5$  is fairly rapid, whereas with excess of MgO the formation of  $Mg_2TiO_4$  is much slower. F. J. G.

**Deleterious effects of corrosive waters on zinc.**—See B., 1938, 1512.

**Lower hydrates of lanthanum and praseodymium nitrates.** J. N. FRIEND and D. A. HALL (J.C.S., 1938, 1920—1921).—The residue obtained when  $La(NO_3)_3 \cdot 6H_2O$  is exposed over conc.  $H_2SO_4$  for some years is  $La(NO_3)_3 \cdot H_2O$ . In similar circumstances  $Pr(NO_3)_3 \cdot 6H_2O$  yields  $Pr(NO_3)_3 \cdot 2H_2O$ . E. S. H.

**Oxidation of carbon at atmospheric pressure.** V. SIHVONEN and J. JÄRVINEN (Suomen Kem., 1938, 11, B, 27—28).—When heated in a stream of  $O_2$  at 900—1200° diamonds yield exclusively  $CO_2$ , but graphite gives some CO as well. Attack on the diamond leads to etching along the cleavage planes. Diamonds burn readily at a white heat. Diamonds are much more resistant than graphite to attack by  $H_2O$  vapour or CO at 900—1200°, but oxidation leads to

non-oriented pitting of the crystal. In  $H_2O$  both CO and  $CO_2$  are formed, the latter being attributed to secondary reaction of the primarily formed CO with  $H_2O$ . When graphite is heated in  $H_2O$  vapour both CO and  $CO_2$  seem to be formed as primary products. The results are discussed with reference to the difference in degree of unsaturation of the surface atoms in diamond and graphite and Sihvonen's views of the mechanism of oxidation of C. J. W. S.

**Attempted exchange of phosphorus between phosphorous and phosphoric acids.** J. N. WILSON (J. Amer. Chem. Soc., 1938, 60, 2697—2699).—No exchange in acid or alkaline solution could be detected by the radioactivity method. If the P atoms in  $H_4P_2O_6$  are equiv., the equilibrium const.  $K = [H_4P_2O_6]/[H_3PO_4][H_3PO_3] = < 8 \times 10^{-5}$  mol.<sup>-1</sup> l. at 25° in 5.6 formal HCl. E. S. H.

**Tantalum iodides.** F. KÖRÖSY (Tech. Kurir, 1938, 9, 81—83).— $TaI_5$ , formed when Ta is brought into contact with an excess of I vapour, is a brownish-black microcryst. powder, m.p. 365°,  $d^{150}$  4.68; electrical conductivity  $< 10^8 \Omega$  in the cold,  $7 \times 10^6 \Omega$  at 100°.  $TaI_5$  hydrolyses rapidly:  $2TaI_5 + 5H_2O = 2Ta(OH)_5 + 10HI$ . In the atm. traces of I are formed. With  $O_2$  it reacts quantitatively at 100°; at higher temp. the reaction is very vigorous:  $4TaI_5 + 5O_2 = 2Ta_2O_5 + 20I$ . With  $H_2$  at 450° for several hr.  $TaI_5$  does not react. On dissolution in  $H_2SO_4$ , I is formed, and on dilution tannic acid is pptd.  $CCl_4$ ,  $CHCl_3$ ,  $CS_2$ ,  $C_6H_6$ , PhMe, and  $C_5H_{12}$  do not dissolve  $TaI_5$ . With EtOH, PrOH, glycerol,  $C_5H_5N$ , and  $NH_2Ph$   $TaI_5$  forms a white ppt., whilst the solution becomes yellow owing to traces of I.  $TaI_5$  decomposes, but yields a clear solution, in  $Ac_2O$  and BuOAc. It reacts at high temp. with Ta, yielding a mixture of  $Ta$ ,  $TaI_5$ , and possibly  $TaI_3$ . E. P.

**Stable sulphur dithiocyanate.** P. A. BOND and G. A. WEAVER, jun. (J. Amer. Chem. Soc., 1938, 60, 2614—2615).— $S(SCN)_2$ , prepared by the action of  $S_2Cl_2$  on metallic thiocyanates, is stable below 500—600°. E. S. H.

**Preparation of molybdate-orange.**—See B., 1938, 1451.

**Reduction of tungstic oxide with solid carbon and hydrogen.** W. BAUKLOH and F. JAEGER (Z. anorg. Chem., 1938, 239, 365—368).—Reduction of  $W_4O_{11}$  by solid C begins at 800° and is complete in 8 hr. at 950°. In presence of Fe the reduction begins at 700° and is complete in 8 hr. at 850°. With  $H_2$  reduction begins at 450° and is complete in 1 hr. at 700°, these temp. being  $<$  those given by earlier workers as a result of the use of a rapid stream of very dry  $H_2$ ; in presence of Fe the reaction begins at 400° and is complete in 2 hr. at 600°. The product of reduction below 600° is pyrophoric. F. J. G.

**Residual affinity and co-ordination.** XL. Complex compounds of rhenium. (SIR) G. T. MORGAN and G. R. DAVIS (J.C.S., 1938, 1858—1861).— $K_2Na[ReO_2(CN)_4] \cdot 6H_2O$  has been prepared from  $K_2ReO_4$ , KCN, and  $N_2H_4 \cdot H_2O$ ; by similar methods  $Na_3[ReO_2(CN)_4] \cdot 2H_2O$  and  $K_3[ReO_2(CN)_4]$  (I) have been obtained. From 9- $\omega$ -phenanthridylmethyl-N-pyridinium chloride and (I) in  $H_2O$  the product is

( $C_{13}H_{15}N_2H_3$ )[ $ReO_2(CN)_4$ ] $4H_2O$ ; similarly, in 0.5N-HCl ( $C_{13}H_9NH_3$ )[ $ReO_2(CN)_4$ ] $2H_2O$  (II) and ( $C_{10}H_8N_2H_2$ )[ $ReO_2(CN)_4$ ] $3H_2O$  are obtained from phenanthridine and 2:2'-dipyridyl, respectively. (II) yields ( $C_{13}H_9NH_2$ )H[ $ReO_2(CN)_4$ ] when dissolved in hot 4N-HCl and crystallised out.  $K_2ReCl_6$  reacts with 2:2'-dipyridyl in very dil. HCl yielding ( $C_{10}H_8N_2H_2$ ) $ReCl_6$ ; in 4N-HCl the product is ( $C_{10}H_8N_2H_2$ ) $ReCl_6$ ; with 2:2':2''-tripyrindyl the product is ( $C_{15}H_{11}N_3H_2$ ) $ReCl_6 \cdot H_2O$  independently of [HCl].  $H_2ReO_4$  reacts with 2:2'-dipyridyl and 2:2':2''-tripyrindyl in dil. AcOH yielding ( $C_{10}H_8N_2H_2$ ) $ReO_4$  and ( $C_{15}H_{11}N_3H$ ) $ReO_4$ , respectively. Properties of the above compounds are described. The Re content of Australian molybdenite is about 1 p.p.m. E. S. H.

**Production of different magnetic substances from  $FeOOH$ .** R. FORRER (Compt. rend., 1938, 207, 670—671).—Four products are described. (A), obtained by rapid heating, is non-ferromagnetic. (B), obtained by slow heating, exhibits ferromagnetism at 250—275° (© 350°); at >275° this gives a second ferromagnetic form, (C) (© 520°). Prolonged heating at ~600° gives non-ferromagnetic (D). (A), (C) and (D) have an  $\alpha$ - $Fe_2O_3$  lattice, and (A) and (D) are probably identical. (B) contains a  $\gamma$ - $Fe_2O_3$  lattice. A. J. E. W.

**Amorphous and crystallised oxide-hydrates and oxides. XLVIII. Activity of iron rust.** A. KRAUSE and A. LEWANDOWSKI (Z. anorg. Chem., 1938, 239, 395—398).—Ordinary Fe rust reacts with  $Ag_2O$  gel affording  $AgFeO_2$ . The catalytic activity of rust in the rusting process is connected with the presence of "active" H atoms in  $\gamma$ - $FeO \cdot OH$ . F. J. G.

**Tables for derivation of  $p_H$ , using the quinhydrone electrode.** A. M. KASCHPUR (Ukrain. Biochem. J., 1938, 11, 449—463). R. T.

**Application of conductometric titration to acidimetry.** M. I. LAPSCHIN (Zavod. Lab., 1938, 7, 479—481).—Conductometric titration is preferred for titration of mixtures of strong and weak acids, of salts of weak acids with strong bases, or vice versa, and of coloured or turbid solutions. R. T.

**Potassium hydrogen phthalate as a buffer for use with the hydrogen electrode.** J. RUSSELL and R. E. STAUFFER (J. Amer. Chem. Soc., 1938, 60, 2820—2821).—0.05M-K H phthalate is satisfactory for temp. as high as 40°. E. S. H.

**Application of sodium phenolphthaleinate to volumetric microanalysis.** L. M. KULBERG (Zavod. Lab., 1938, 7, 417—421).—A solution of phenolphthalein in 20%  $Na_2CO_3$  is evaporated to dryness, the residue is extracted with EtOH, the extract is evaporated to dryness, the residue is again extracted, and the final extract is evaporated, to yield pure Na phenolphthaleinate, solutions of which serve for the titration of acids the  $P_s$  of which <7.96. R. T.

**Acidimetric titration of coloured solutions.** R. C. BURSCHEIN and T. V. GATOVSKAJA (Zavod. Lab., 1938, 7, 345—346).—Titration of a no. of coloured solutions in presence of fluorescein (A., 1938,

II, 210) gives results in good agreement with those obtained electrometrically. R. T.

**Determination of dissolved water in liquefied gases.**—See B., 1938, 1410.

**Ammonium chloride-sodium sulphide solutions for organic nitro-reductions and for inorganic qualitative analysis.** M. J. MURRAY and D. E. WATERS (J. Amer. Chem. Soc., 1938, 60, 2818—2819).—Reductions are performed with good yields by adding the mixture to the  $NO_2$ -derivative dissolved in aq.  $NH_3$  or EtOH + aq.  $NH_3$ . Conc.  $NH_4$  polysulphide for qual. analysis is conveniently prepared by adding S to the above mixture. E. S. H.

**Photo-nephelometric determination of chloride in chromate and dichromate reagents.** L. E. SABININA and L. I. ROZENGARD (Zavod. Lab., 1938, 7, 727—729).—Small amounts of chloride are determined by a photo-nephelometric method. R. T.

**Pontius' chlorometric method.** M. CHAMBON (Bull. Soc. chim., 1938, [v], 5, 1458—1463).—The mechanism of reaction between  $CaCl \cdot OCl$  and KI in presence of  $NaHCO_3$  at  $p_H$  8—9 is discussed. Observations recorded point to the intermediate formation of I, according to (a)  $HOCl + 2KI \rightarrow 2I + KCl + KOH$ , and (b)  $5OCl + 2I + H_2O \rightarrow 2IO_3 + 5Cl + 2H^+$ . E. S. H.

**Analytical notes. I.** C. W. DAVIES (Canad. J. Res., 1938, 16, B, 227—229).—(1) Org. compounds containing Se or Hg can be decomposed without loss of Se or Hg by means of "nitro-chlorate" mixture before determining the Se or Hg gravimetrically. (2) Solutions containing unknown amounts of  $Cl'$  and  $Br'$  are treated with a known excess of  $AgNO_3$ . From the wt. of the ppt. and the wt. of the Ag in it, the amounts of Cl and Br can be calc. (3) By the addition of 2 g. of powdered  $Ca(OAc)_2$  to 20—30 g. of soya-bean oil before ignition, the P in the oil is retained as  $Ca_3(PO_4)_2$ . C. R. H.

**Potentiometric determination of small amounts of bromide.** S. K. AFANASIEV, M. A. PORTNOV, and J. N. TSCHPEL'KIN (Zavod. Lab., 1938, 7, 547—550).—Tschirkov's method (A., 1935, 316) gives satisfactory results for determination of  $Br'$  in Karabugaz saline, on condition that empirical corrections are applied for reaction of other constituents with  $NaOCl$ , and for the Br content of the latter reagent. R. T.

**Colorimetric determination of bromides in presence of chlorides.** A. V. VINOGRADOV (Zavod. Lab., 1938, 7, 426—428).—In Sweeney and Withrow's method (A., 1917, ii, 423) the coloration rises to a max., and then falls, as the vol. of aq.  $Cl_2$  added is increased; this is due to formation of  $BrCl$ . The following modification is proposed: the amount of 0.05N-K $BrO_3$  giving max. coloration in a series of 8 test-tubes each containing 3 ml. of solution (<0.6 mg.  $Br'$ ), 0.3 ml. of 10N- $H_2SO_4$ , and 3 ml. of  $CCl_4$  is determined, and this ratio is applied in the colorimetric determination of  $Br'$  by the above method, substituting  $KBrO_3$  for  $Cl_2$ .  $I'$  does not interfere if  $[I']/[Br'] \geq 0.3$ . R. T.

**Titration with adsorption indicator.** Argentometry of strongly acidic solution of halide with

metanil-yellow, and its mechanism of adsorption. Y. MIYAKE (*J. Chem. Soc. Japan*, 1936, 57, 277—284).—By utilising the amphoteric property of metanil-yellow, the end-point of the titration of Br' or I' by 0.1N-AgNO<sub>3</sub> in acid solution can be easily detected. CH. ABS. (e)

Determination of iodine in drinking water, urine, and substances containing only about 1000 times as much organic matter as iodine. A. C. BRATTON and J. F. McCLENDON [with W. FOSTER and R. WHITE] (*Ind. Eng. Chem. [Anal.]*, 1938, 10, 600—605).—The material is fused with NaOH in presence of rare-earth oxides as catalysts. IO<sub>3</sub>' is reduced and NO<sub>2</sub>' is destroyed by addition of Na<sub>3</sub>N. The I from oxidation of I' by Fe<sup>+++</sup> in acid solution is distilled into aq. Br which oxidises it to IO<sub>3</sub>'. Excess of Br is blown out by means of air at 100°, and after addition of KI the I is titrated electrometrically by means of 0.001N-Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>. The method is applicable to samples containing only mg. amounts of org. matter, Cl', and silicates, and <0.2 µg. of I. It is thus applicable to drinking-water and soil solution provided that [Cl'] is >0.5 millimol., to urine, thyroid gland, seaweed, etc. It is not applicable to sea-water, brine, and some mineral waters, or to soil samples. L. S. T.

Methyl-red as an indicator in titration of fluorides by thorium salts. (A) I. V. ILJIN. (B) V. A. ZACHAREVSKI (*Zavod. Lab.*, 1938, 7, 637, 637—638).—A criticism of Zacharevski (*A.*, 1938, I, 211), and a reply. R. T.

Test of suitability of pyrogallol solutions [for absorption of oxygen]. A. V. MAZOV (*Zavod. Lab.*, 1938, 7, 359—360).—The no. of times a given vol. of air has to be passed through the pyrogallol absorption bulb of an Orsat apparatus for full absorption of O<sub>2</sub> rises from 5 for fresh solution to 7 for a solution which has absorbed 20 c.c. of O<sub>2</sub> per g.-mol., and to 9 for one containing 30 c.c. of O<sub>2</sub>. Solutions not giving full absorption after 5 passages should be replaced. R. T.

Determination of dissolved oxygen by means of the dropping mercury electrode, with applications in biology. H. G. PETERING and F. DANIELS (*J. Amer. Chem. Soc.*, 1938, 60, 2796—2802).—The modified polarographic procedure described is particularly suited to systems which involve changing [O<sub>2</sub>]. Applications to the photosynthesis and respiration of algæ, and the respiration of yeast and blood cells, are described. E. S. H.

Bromatometric determination of thiocyanate. L. SZEBELLÉDY and W. MADIS (*Z. anal. Chem.*, 1938, 114, 343—346).—The neutral CNS' solution is diluted to 35 c.c., and 3 g. of NaBr, 15 c.c. of 2N-HCl, and 5 mg. of Fe<sup>III</sup> alum are added. 0.1N-KBrO<sub>3</sub> is added to the red coloured solution until the colour is discharged. 1 c.c. of 0.1% AuCl<sub>3</sub> solution is added and, after 30 sec., the titration is completed dropwise until a permanent yellow colour, matching that of a comparison solution, is obtained. The reaction between CNS' and Br is slower in aq. H<sub>2</sub>SO<sub>4</sub> than in aq. HCl. The results agree with those obtained by the Volhard method. L. S. T.

Use of Trautz's micro-Dumas method [for determining nitrogen] with the apparatus of Pregl. C. W. BEAZLEY (*Ind. Eng. Chem. [Anal.]*, 1938, 10, 605).—Trautz's method (*A.*, 1931, 752, 971) can be used with a slightly modified Pregl apparatus and is widely applicable. Typical results are given, and the necessary modifications described. A complete analysis requires 30 min. L. S. T.

Colorimetric determination of oxides of nitrogen. I. N. KUZMINICH and E. J. TURCHAN (*Zavod. Lab.*, 1938, 7, 635—636).—Polemical, against Varlamov (*A.*, 1938, I, 211). R. T.

Determination of nitrite in waters.—See B., 1938, 1512.

Rapid determination of phosphorus in steel.—See B., 1938, 1431.

Drop method of approximate determination of phosphoric acid. G. T. MICHALTSCHISCHIN (*Bull. Sci. Univ. Kiev*, 1937, 3, No. 3, 79—84).—The solution is evaporated to dryness with HCl, and the residue is heated with 0.5 ml. of conc. H<sub>2</sub>SO<sub>4</sub> to evolution of SO<sub>3</sub>. 4—6 ml. of H<sub>2</sub>O and a few drops of H<sub>2</sub>O<sub>2</sub> are added to the cooled residue, and the solution is boiled and filtered. The filtrate + washings are made up to 25 ml., and a drop is placed on a spot of aq. (NH<sub>4</sub>)<sub>2</sub>MoO<sub>4</sub> on filter-paper; the spot is dried, and a drop of benzidine solution is placed on it. The coloration developing after exposure to NH<sub>3</sub> is compared with that given by a series of standard solutions. 0.1—0.5 mg. of P<sub>2</sub>O<sub>5</sub> may so be determined, with an error of 0—20%, in presence of all the ordinary anions. R. T.

Reaction of metaphosphoric acid with basic triphenylmethane dyes. H. HERRMANN (*Mikrochim. Acta*, 1938, 3, 193—196).—Aq. HPO<sub>3</sub> gives with aq. crystal-violet (I) dark blue, rod-shaped crystals, limiting sensitivity 3 µg.; fuchsin gives a brownish-green fluorescence and a ppt., sensitivity 10 µg.; Victoria-blue, a greenish fluorescence, and an amorphous ppt., sensitivity 10 µg. Malachite-green and Me-green give no reaction. The crystals obtained with (I) are readily sol. in n-HCl, sparingly sol. in H<sub>2</sub>O, and insol. in light petroleum, C<sub>6</sub>H<sub>6</sub>, PhMe, and xylene. Their analysis corresponds with 3HPO<sub>3</sub>·2(I)·8H<sub>2</sub>O. H<sub>3</sub>PO<sub>4</sub> gives none of the above reactions. L. S. T.

Determination of arsenic with the use of amalgamated aluminium in place of zinc. M. P. BOLOTOV (*Vopros. Pitaniya*, 1934, 3, No. 4, 1—17).—Zn may be replaced by amalgamated Al in the determination of As as AsH<sub>3</sub>. CH. ABS. (e)

Determination of boron in cast iron and steel.—See B., 1938, 1425.

Detection of boric acid in [natural] waters by the curcumin reaction. J. NĚMEJC (*Chem. Listy*, 1938, 32, 340—345, 361—364).—NO<sub>2</sub>', NO<sub>3</sub>', I', Br', K', NH<sub>4</sub>', SO<sub>4</sub>'', Ca'', and Mg'' may interfere with detection of H<sub>3</sub>BO<sub>3</sub> in H<sub>2</sub>O by the curcumin reaction. The first four ions are eliminated by evaporation in presence of H<sub>3</sub>PO<sub>4</sub>, and SO<sub>4</sub>' is pptd. as BaSO<sub>4</sub>; the [K'] and [NH<sub>4</sub>'] of natural H<sub>2</sub>O are too low to interfere. Ca and Mg are pptd. as phosphates by

adding 2.1 c.c. of 2.6%  $\text{Na}_2\text{HPO}_4$  in 1.54%  $\text{NaHCO}_3$  to 30 c.c. of the  $\text{H}_2\text{O}$ , and boiling. The final solution is tested for  $\text{H}_3\text{BO}_3$  in the usual way with curcumin paper ( $\leq 0.3 \mu\text{g. of H}_3\text{BO}_3$ ). R. T.

**Reducing the evaporation time in the determination of silicon by the Otis-Handy method.** H. FUCHSHUBER (Chem.-Ztg., 1938, 62, 743).—The method is modified to avoid spurting during evaporation by adding to the acid solution, after dissolution of the silumin, small amounts of 96% EtOH until foaming ceases, and then 10 c.c. in excess. The covered beaker is heated on a hot plate at 250–300°. The solution forms a jelly and then a blistery mass which is easily broken by a glass rod. I. C. R.

**Determination of carbon in iron and steels.**—See B., 1938, 1431.

**Determination of carbon monoxide in gas and air.**—See B., 1938, 1410.

**Baryta method of determining small amounts of carbonates.** G. N. EVETSKI and E. I. ZLOBINSKAJA (Zavod. Lab., 1938, 7, 484–486).— $\text{CO}_2$ -free air is aspirated through the boiling acidified carbonate solution, and the  $\text{CO}_2$  evolved is absorbed by 0.1N-Ba(OH) $_2$ , excess of which is titrated with 0.1N-HCl. R. T.

**Standard method of determination of potassium.** V. M. TICHOMIROV (Zavod. Lab., 1938, 7, 729).—In the industrial method of determination of K as  $\text{KClO}_4$ , one evaporation to dryness is sufficient to remove  $\text{NH}_4\text{Cl}$ , in place of three ordinarily applied. R. T.

**Rapid separate determination of potassium and sodium. II. Determination of sodium.** M. A. PORENOV and S. K. AFANASIEV (Zavod. Lab., 1938, 7, 421–425; cf. A., 1938, I, 269).—K is pptd. with Mg dipicrylamine, and Na is determined polarographically in the filtrate, applying a correction for the residual  $[\text{K}^+] = 0.98 \times 10^{-3} + 0.0747(t - 10)10^{-3}$ . R. T.

**Polarographic method as applied to chemical analysis of metals.**—See B., 1938, 1437.

**Bromatometric determination of calcium.** L. SZEBELLÉDY and W. MADIS (Z. anal. Chem., 1938, 114, 350–352).—The  $\text{Ca}^{++}$  is pptd. as  $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$  by Winkler's method and, after treatment of the ppt. with 2N- $\text{H}_2\text{SO}_4$ , the oxalate is determined as described previously (cf. A., 1938, II, 43). L. S. T.

**Application of spectral analysis to determination of calcium, sodium, potassium, and strontium in the production of rare elements.** L. I. GREENHOUSE and G. M. LERMAN (Zavod. Lab., 1938, 7, 314–321).—The most accurate results are given by Rusanov's extinction method (B., 1934, 1211). The curves connecting thickness of layer of absorbent with  $[\text{Ca}]$  are displaced by Co and Sr, but not by Ni, using 0.04%  $\text{KMnO}_4$  absorbent solution, and by Ni and Na, but not Co or Sr, with 0.017% methylene-blue. Sr, Co, and Ni have no effect on the curves for Na ( $\text{KMnO}_4$  absorbent). Sr is determined similarly, with 0.026% Me-violet absorbent solution; Ca, Ba, Al, Fe, and Mn displace the curves. R. T.

**Detection and determination of small amounts of metals in organic material.** C. J. VAN NIEUWENBURG (Chem. Weekblad, 1938, 35, 799–802).—A review of the general questions involved in finding a satisfactory solution of this problem. A more satisfactory wet method of destroying org. matter is required. S. C.

**Detection of zinc with  $\beta$ -naphthoquinoline and thiocyanate.** E. B. SANDELL, D. M. WISHNICK, and E. L. WISHNICK (Mikrochim. Acta, 1938, 3, 204–209).—With neutral or weakly acid solutions of Zn, KCNS +  $\beta$ -naphthoquinoline give a finely-divided ppt. which soon recrystallises as thin, colourless, lath-shaped crystals showing parallel extinction and strong birefringence. The vols. of reagent and test drop should be approx. equal, and well mixed. When this is the case, the limiting concn. in neutral or in solutions 1 to 2N. with respect to  $\text{H}_2\text{SO}_4$  is  $1 : 2 \times 10^5$ ; in 2N-HCl, it is  $1 : 10^5$ . Alkali metals do not interfere, and 0.001% of Zn can be detected in a saturated solution of  $\text{K}_2\text{SO}_4$  which is 2N. with respect to  $\text{H}_2\text{SO}_4$ . In alkali chloride solution, the sensitivity is decreased, and  $\text{NO}_3^-$  should be absent. Ca, Ba (AcOH solution), Mn, Mg, Be, Al,  $\text{Cr}^{III}$ ,  $\text{Ce}^{III}$ , As, and Ni give no ppts. with the reagent. The reaction is suitable for the detection of Zn in presence of much  $\text{Mn}^{++}$ .  $\text{Pb}^{++}$  may interfere somewhat with the detection of  $\text{Zn}^{++}$ .  $\text{Cu}^{++}$ ,  $\text{Ag}^+$ , Au, Hg $^{++}$ ,  $\text{Ti}^+$ , Sn $^{++}$ , Sb, Bi, V $^V$ ,  $\text{Mo}^{VI}$ ,  $\text{W}^{VI}$ ,  $\text{UO}_2^{++}$ ,  $\text{PtCl}_6^{--}$ ,  $\text{Fe}^{++}$ ,  $\text{Fe}^{+++}$ , and  $\text{Co}^{++}$  give ppts. with the reagent, but low concns. of  $\text{Fe}^{++}$  or  $\text{Fe}^{+++}$  in presence of  $\text{H}_3\text{PO}_4$  do not spoil the test. Zn cannot be detected in presence of Co, which gives blue prisms with the reagent. The corresponding compound of Cd is more sol. and, in concns.  $< 0.5\%$  of Cd, does not interfere. Owing to its slight solubility, the compound  $(\text{C}_{13}\text{H}_9\text{N})_2 \cdot \text{H}_2\text{CdI}_4$  is not entirely satisfactory for the identification of  $\text{Cd}^{++}$ . L. S. T.

**Determination of cadmium.** E. I. NIKITINA (Zavod. Lab., 1938, 7, 409–412).—5 ml. of 1% brucine in aq.  $\text{H}_2\text{SO}_4$  and 10 ml. of 10% KBr are added to the neutral solution (containing  $< 5$  mg. Cd), and the ppt. of  $[\text{brucine}]_2 \cdot \text{CdBr}_2 \cdot 2\text{HBr}$  is collected after 1 hr., washed with 1 : 7 EtOH-Et $_2$ O, dried at 130–150°, and weighed. Mg, Al, Cu, Mn, and Zn do not interfere. R. T.

**Selective micro-chemical test for cadmium.** C. MAHR (Mikrochim. Acta, 1938, 3, 300–303).—One or two drops of test solution are evaporated on a microscope slide, and treated with a small drop of 1–2N-HCl, a large drop of 1.5% solution of Reinecke's salt, and a drop of 5%  $\text{CS}(\text{NH}_2)_2$ . In presence of Cd characteristic crystals of  $\text{Cd}[\text{CS}(\text{NH}_2)_2][\text{Cr}(\text{NH}_3)_2(\text{CNS})_4]_2$  are formed. About 0.1% of Cd can be detected in presence of metals of the  $(\text{NH}_4)_2\text{S}$  and alkaline-earth groups and 0.2% in presence of metals of the HCl and  $\text{H}_2\text{S}$  groups. J. W. S.

**Micro-detection and -determination of lead.** N. D. COSTEANU (Mikrochim. Acta, 1938, 3, 236–238).—A strip of filter-paper is soaked with the test solution, free from metals other than Pb, and dried. One drop of aq. HI, prepared by the action of  $\text{H}_2\text{S}$  on a suspension of I in  $\text{H}_2\text{O}$ , is added, and the colour of the  $\text{PbI}_2$  spot is compared with a series of standards

prepared similarly from  $\text{Pb}(\text{NO}_3)_2$  solutions. 0.1  $\mu\text{g}$ . of Pb can be determined in this way. L. S. T.

**Analysis of dust and fumes for lead and zinc.**—See B., 1938, 1509.

**Volumetric determination of lead and acetic acid in neutral and basic lead acetates.**—See B., 1938, 1499.

**Quantitative spectral analysis of solutions. III. Determination of thallium and indium.** A. K. RUSANOV and B. I. BODUNKOV (Zavod. Lab., 1938, 7, 573—579).—The [Tl] in solutions is determined by comparing the intensity of the Tl 5350.47 line with that of the Fe 5270.36—5269.54 lines, and of In by comparing In 4511.31 with Cs 4555.3 A.

R. T.

**Determination of copper as thiocyanate by a rapid extraction method.** A. G. KULMAN and G. A. CHRAPOV-SCHMAROV (Zavod. Lab., 1938, 7, 290—295).—The accuracy of Rivot's method (Compt. rend., 1854, 38, 868) is enhanced, and the time required reduced, by introducing a no. of modifications in the technique of pptn. of CuCNS, and of washing and drying the ppt.

R. T.

**Reactions of thiolbenzothiazole.** M. KURAŠ (Chem. Obzor, 1938, 13, 95—96).—Thiolbenzothiazole reacts with cations of the  $\text{H}_2\text{S}$  group and can be used for the determination of Cu, Cd, Bi, Pb, Au, Ag, and Hg. Indications are given of the conditions for pptn., and the colours and properties of the ppts. for the above cations.

F. R.

**Paper as medium for analytical reactions. Method of applying reagent papers to large volumes of solutions.** B. L. CLARKE and H. W. HERMANC (Ind. Eng. Chem. [Anal.], 1938, 10, 591—600; cf. A., 1937, I, 429).—A general technique for the removal of  $\mu\text{g}$ . quantities of an ion from large vols. of solution and its determination is described. The solution is passed through a known and restricted area of paper impregnated with a reagent sufficiently insol. to withstand the action of a large vol. of solution flowing through it, but capable of reacting with the ion being determined and fixing it on the reagent-coated fibres of the paper. When a colour change results, direct comparison of the coloured area with similarly-prepared standards, or ashing and digestion of the spot and the use of a suitable micro-method, allows a determination to be made. Apparatus for confining the flow of large vols. of liquid through small, definite areas of papers, for the prep. and preservation of standard spots, for the comparison of spots, and a micro-crucible for ashing are described. Precautions to be observed in the prep. of the papers are discussed. Results obtained in a typical application, viz., the removal of  $\text{Cu}^{++}$  on paper impregnated with CdS, are described and illustrated, with particular reference to the various factors affecting the accuracy of the results. Recovery on three paper discs is complete for amounts up to 50  $\mu\text{g}$ ., and the amount of  $\text{Cu}^{++}$  detectable is  $<1 \mu\text{g}$ . per 500 c.c. Other applications described are the separation of a few  $\mu\text{g}$ . of Cu from solutions containing a very large excess of  $\text{Ni}^{++}$  by retention of the  $\text{Cu}^{++}$  on CdS-paper, the separation of Cu from Pb, the determination of

traces of Pb in  $\text{H}_2\text{O}$  and air, and the detection and determination of  $\text{S}^{--}$  in tarnish films after cathodic reduction of the film.

L. S. T.

**Determination of copper in pig iron and steel.**—See B., 1938, 1424.

**Determination of mercury with s-diphenylcarbazine.** F. W. LAIRD and A. SMITH (Ind. Eng. Chem. [Anal.], 1938, 10, 576—578).—The reagent should be dissolved in abs. EtOH, prepared fresh each day, and protected from light. When the ratio of reagent to Hg is  $<2:1$ , the colour intensity is independent of the amount of diphenylcarbazine. Max. colour intensity is reached within 15 min. Cd does not interfere with the reaction, and neither does Zn in a concn.  $<5$  times the [Hg] (cf. A., 1926, 814). A [Cl<sup>-</sup>]  $>0.0001\text{N}$ . destroys the colour. An electrolyte concn.  $>0.003\text{N}$ . usually ppts. the coloured Hg compound in  $<1$  hr., and the higher is the [Hg] the smaller is this concn. needed to produce flocculation. The colour can exist with varying intensities at  $p_{\text{H}}$  between 2.6 and 7; the optimum  $p_{\text{H}}$  is 4 and this must be kept const. to  $\pm 0.3$  unit if the error from this source is to be  $>5\%$ . A satisfactory  $p_{\text{H}}$  can be attained by titration of an aliquot portion with dil. AcOH or NaOAc (bromophenol-blue). With a layer of solution 10 cm. thick, 0.4 mg. of Hg per l. can be determined with a precision (photo-electric colorimeter) of  $\sim 5\%$ ; for 5—50  $\mu\text{g}$ . of Hg per 10 ml., the average precision is  $\sim 3\%$ .

L. S. T.

**Determination of mercury and silver in presence of other metals by means of diphenylthiocarbazon.** R. I. ALEXEEV (Zavod. Lab., 1938, 7, 415—417).—30 ml. of 0.1M- $\text{Na}_4\text{P}_2\text{O}_7$  and 3 ml. of diphenylthiocarbazon solution (25 mg. in 100 ml. of 0.1M- $\text{Na}_4\text{P}_2\text{O}_7$ ) are added to 10 ml. of the solution under analysis, and the red coloration obtained is compared with that given by standard  $\text{Hg}^{II}$  or Ag solutions. 0.001—1 mg. of  $\text{Hg}^{II}$  or Ag may thus be determined in presence of  $> \text{Ti } 200$ ,  $\text{As}^V 100$ ,  $\text{Al } 20$ ,  $\text{Mn}^{III} 15$ ,  $\text{Bi}$ ,  $\text{Fe}^{III}$ , or  $\text{Pb } 10$ ,  $\text{U } 5$ ,  $\text{Zn } 1.5$ ,  $\text{Cd}$  or  $\text{Ni } 1$ , or  $\text{Co}$  or  $\text{Mo}^{VI} 0.05$  mg.;  $\text{As}^{III}$ ,  $\text{Cu}^{II}$ , and  $\text{Cr}^{VI}$  should be absent.

R. T.

**Rapid determination of aluminium, calcium, magnesium, potassium, and sodium in the salts of heavy metals.** I. SACHIEV (Prom. Org. Chim., 1936, 1, 164—165).—Electrolysis of dil.  $\text{H}_2\text{SO}_4$  solutions with a Hg cathode deposits heavy metals on the Hg. Al, Ca, Mg, K, and Na are then determined in the solution as usual.

CH. ABS. (e)

**Titration of manganates in presence of permanganates.** M. CENTNERSZWER and J. SZEDROWICZ (Bull. Soc. chim., 1938, [v], 5, 1530—1531).—Modified procedure is described (cf. B., 1926, 351). When  $[\text{KMnO}_4]$  is small, low results for  $\text{K}_2\text{MnO}_4$  are obtained by the  $\text{CO}_2$  method, but when  $[\text{KMnO}_4] = 5 \times [\text{K}_2\text{MnO}_4]$  the reaction proceeds quantitatively according to  $3\text{K}_2\text{MnO}_4 + 2\text{CO}_2 = 2\text{KMnO}_4 + \text{MnO}_2 + 2\text{K}_2\text{CO}_3$ .  $\text{MnO}_2$  is determined by adding excess of  $\text{H}_2\text{C}_2\text{O}_4$  and titrating with  $\text{KMnO}_4$ .

E. S. H.

**Macro- and micro-reaction of iron with thio-gallic acid.** J. V. DUBSKÝ and V. ŠINDELÁŘ (Mikrochim. Acta, 1938, 3, 258—262).—When air is excluded,  $\text{Fe}^{++}$  ions give no colour reaction with



SH-CH<sub>2</sub>-CO<sub>2</sub>H (I), even after addition of aq. NH<sub>3</sub>. When air is admitted, an intense violet colour is produced. Fe<sup>+++</sup> ions produce first a blue colour due to the formation of Fe(S-CH<sub>2</sub>-CO<sub>2</sub>H)<sub>3</sub>, and then, in presence of NH<sub>3</sub>, the violet-red colour due to Fe(S-CH<sub>2</sub>-CO<sub>2</sub>NH<sub>4</sub>)<sub>3</sub>. Excess of FeCl<sub>3</sub> gives not Fe(OH)<sub>3</sub> but the ochre-brown aquo-salt of Fe<sup>III</sup> ferrithioglycollate. For Fe<sup>+++</sup>, the limiting sensitivity is 0.13 μg., and for (I), 60 μg. L. S. T.

**Micro-determination of bivalent iron in rocks and silicate minerals.** M. SHIOIRI and S. MITSU (Mikrochim. Acta, 1938, 3, 291—299).—5—30 mg. of the mineral is treated in a Pt basin with two quantities of 0.2 c.c. of 25 vol.-% H<sub>2</sub>SO<sub>4</sub>, the solution being evaporated after each addition. The mixture is then treated with about 0.3 c.c. of 40% HF in a current of CO<sub>2</sub> and subsequently heated in steam for 30 min. After cooling in a stream of dry CO<sub>2</sub> the contents are transferred to a vessel containing 0.3 g. of powdered H<sub>3</sub>BO<sub>3</sub> and 7 c.c. of 2.5 vol.-% H<sub>2</sub>SO<sub>4</sub> saturated with H<sub>3</sub>BO<sub>3</sub>, and titrated with 0.02N-KMnO<sub>4</sub>. Apparatus required for the determination is described and data are recorded for results obtained with FeSO<sub>4</sub>(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>·6H<sub>2</sub>O, augite, olivine, olivinepyroxeneandesite, hornblende, and granite. J. W. S.

**Cerimetric determination of ferrum oxalicum oxydulatum.**—See B., 1938, 1499.

**Magnetic determination of iron in brass.**—See B., 1938, 1433.

**Spectroscopic analysis of steel alloys.**—See B., 1938, 1432.

**Micro-gravimetric determination of cobalt with 1-nitroso-β-naphthol.** F. HECHT and F. KORKISCH (Mikrochim. Acta, 1938, 3, 313—316).—The solution containing CoCl<sub>2</sub> is evaporated to dryness and the residue taken up in a few drops of H<sub>2</sub>O. 2 drops of conc. H<sub>2</sub>O<sub>2</sub> and 1 drop of N-NaOH are added. When vigorous action has ceased the Co(OH)<sub>3</sub> is dissolved in AcOH (1.5—3 c.c.), the solution is diluted with hot H<sub>2</sub>O (2—5 c.c.), and Co is pptd. with 1 : 2-NO·C<sub>10</sub>H<sub>6</sub>·OH (2% in 70% AcOH). The mixture is heated in a covered vessel at 125—130° for 5—7 min., and after cooling the coagulated ppt. is collected, washed with AcOH and then with H<sub>2</sub>O, and dried at 130°. The use of a crucible fitted with a porcelain filter-tube is recommended. Separation from Ni, Zn, and Al is not so efficient as in the macro-procedure but is probably sufficient for normal rock analyses. J. W. S.

**Separation of cobalt and nickel from manganese.** E. A. OSTROUMOV and G. S. MASLENNIKOVA (Zavod. Lab., 1938, 7, 267—269).—C<sub>5</sub>H<sub>5</sub>N, HCl and C<sub>5</sub>H<sub>5</sub>N are added to the solution containing Co, Ni, and Mn, and H<sub>2</sub>S is passed; CoS and NiS are pptd., leaving Mn in solution. R. T.

**Volumetric determination of cobalt and nickel.**—See B., 1938, 1440.

**Micro-gravimetric separation of nickel and uranium.** E. KROUPA (Mikrochim. Acta, 1938, 3, 306—312).—A solution of the mixed nitrates is evaporated to dryness and the residue is treated with 50% HNO<sub>3</sub> (1 drop) and H<sub>2</sub>O (5—10 c.c.). After

warming, six times the theoretical amount of dimethylglyoxime (1% in EtOH) is added, then 0.5—1 c.c. of 50% NH<sub>4</sub>OAc, and the solution approx. neutralised with aq. NH<sub>3</sub> to ppt. the Ni. The solution is filtered immediately, the ppt. being washed three times with 0.5 c.c. of hot H<sub>2</sub>O and three times with 0.5 c.c. of 25% EtOH. The filtrate, containing the U, is evaporated, ignited, dissolved in HNO<sub>3</sub>, again evaporated to dryness, and taken up in AcOH (1 drop) and hot H<sub>2</sub>O (0.5 c.c.). After adding 1 drop of aq. NH<sub>3</sub> and 0.5 c.c. of 50% NH<sub>4</sub>OAc the mixture is warmed for 5 min. (water-bath) and then thrice the theoretical amount of 8-hydroxyquinoline (4% in 8 vol.-% AcOH) is added, excess of AcOH being neutralised with 2—4 drops of aq. NH<sub>3</sub>. The ppt. is filtered, ignited, and weighed as U<sub>3</sub>O<sub>8</sub>. J. W. S.

**Detection of nickel in very dilute solutions.** I. M. KORENMAN (Zavod. Lab., 1938, 7, 428—429).—1—2 drops of conc. aq. ZnSO<sub>4</sub> and of (NH<sub>4</sub>)<sub>2</sub>Hg(CNS)<sub>4</sub> are added to 20 ml. of solution (containing < 0.01 μg. Ni), and the solution is centrifuged. The ppt. is collected on a filter-paper spill, which is ignited, the ash is dissolved in a drop of HCl, which is made neutral with NH<sub>3</sub>, and dimethylglyoxime in aq. NH<sub>3</sub> is added. The red needles of Ni salt may be detected microscopically. R. T.

**Conductometric determination of nickel.** J. H. BOULAD (J.S.C.I., 1938, 57, 323—326).—A volumetric method for the determination of Ni, using electrical conductance as indicator, is described. Ni, best in neutral solution (0.003—0.015N.), is pptd. with an alcoholic solution of dimethylglyoxime (I) (about 0.1N.), in presence of Ca(OAc)<sub>2</sub> as buffer and flocculant. Titration is carried out either by adding the precipitant by successive measured amounts, or by adding an excess of (I), which is then titrated back with a solution of Ni(NO<sub>3</sub>)<sub>2</sub> or Ni(OAc)<sub>2</sub> (0.1—0.3N.). Zn and Mn do not interfere, but in presence of Co, Fe, and Cu, slight modifications are necessary. The accuracy is about ±1% of the nickel present.

**Drop method of approximate determination of chromium.** G. T. MICHALTSCHISCHIN (Bull. Sci. Univ. Kiev, 1937, 3, No. 3, 85—89).—Aq. Na<sub>2</sub>CO<sub>3</sub> and KMnO<sub>4</sub> are added, and the solution is boiled for 5—10 min., a few drops of EtOH are added, and boiling is continued to decolorisation of the solution and to evaporation of excess of EtOH and MeCHO, when it is cooled and diluted to 25 ml. The solution is filtered, a few drops of filtrate are made acid with AcOH, and a drop is placed on a spot of saturated benzidine in 30% AcOH on filter-paper. The intensity of the coloration obtained is compared with those given by a series of standard K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> solutions. R. T.

**Colorimetric determination of chromium in plant ash, water, and rocks.**—See A., 1939, III, 110.

**Potentiometric determination of molybdenum and copper in steel.**—See B., 1938, 1431.

**Photometric determination of tungsten in steel.**—See B., 1938, 1431.

**Dihydroxytetrachloroplatinic acid as a reagent for tin.** J. P. CHOTULEV (Zavod. Lab., 1938, 7,

358—359).—Aq.  $H_2[PtCl_4(OH)_2]$  and  $Sn^{II}$  give a red ppt. of  $Sn[PtCl_4(OH)_2]$ , sol. in  $Et_2O$ , and not affected by heating at  $100^\circ$ . The reaction serves for detection of 1—10 p.p.m. of  $Sn^{II}$ . Ag,  $Hg^I$ ,  $Hg^{II}$ ,  $Pb^{II}$ ,  $Bi^{III}$ ,  $Sb^{III}$ , Fe, Co, Ni, and Cr do not interfere. R. T.

**Analytical use of cacothelin.** L. ROSENTHALER (Mikrochim. Acta, 1938, 3, 190—192; cf. A., 1935, 319).—Cacothelin (I) is reduced (lilac colour) directly by  $Sn^{II}$ ,  $Fe^{II}$  in presence of  $H_3PO_4$  or  $F^-$ ,  $K_4Co(CN)_6$ ,  $H_2S$ ,  $H_2Se$ ,  $CuCl$ ,  $HgCl$  (in presence of  $HCl$ ), and many org. substances such as  $NHPh\cdot NH_2$ , cysteine, glutathione, neosalvarsan, and ascorbic acid. In presence of  $Zn + HCl$  it is also reduced by As, Sb, and Te compounds, and many org. compounds containing As, Sb, or S. In order to differentiate between Sn and Mo,  $HgCl_2$  is added after reduction with Zn and  $HCl$  to oxidise the  $SnCl_2$  and prevent it reducing the (I) (cf. A., 1938, I, 325). L. S. T.

**Nephelometric and colorimetric determination of vanadium by means of cupferron.** D. N. FINKELSCHTEIN and L. P. ELENEVITSCH (Zavod. Lab., 1938, 7, 665—670).—The solution of  $V^V$ , not containing Fe, Ti,  $F^-$ , or  $Na_2O_2$ , is made neutral with  $H_2SO_4$ , and 1 ml. of 8N- $H_2SO_4$  is added per 10 ml. of solution, followed by 2 ml. of 25%  $K_2SO_4$ . Should  $[Cr]$  be 5 times  $[V]$ , the solution is boiled with a few drops of  $H_2O_2$ , cooled, and the vol. is made up to 50—250 ml. 1 ml. of 2% gum arabic (centrifuged and filtered) and 1 ml. of 1% cupferron are added to 10 ml. of the solution, at  $20^\circ$ , and the coloration is compared with that given by standard solutions, not earlier than 5 or later than 40 min. after addition of the reagents. R. T.

**Determination of vanadium.** A. F. ANDREEV (Zavod. Lab., 1938, 7, 258—262).— $V^V$  is reduced with  $Hg-Cd$ , according to Someya (A., 1928, 387), and  $V^{III}$  is titrated with trypan-red in 2N- $H_2SO_4$ . The method is applicable to the analysis of steels containing also Ti, Mo, or P, but not W. R. T.

**Volumetric determination of vanadium in presence of tungsten, with diphenylamine-sulphonic acid as indicator.** G. A. PEVTZOV (Zavod. Lab., 1938, 7, 286—289).—A sharp end-point is obtained in the titration of  $V^V$  with  $Fe^{II}$  in presence of  $NHPh\cdot C_6H_4\cdot SO_3H$  when the solution contains 10% of  $H_3PO_4$ . R. T.

**Photolorimetric determination of vanadium in iron ores and slags.**—See B., 1938, 1424.

**Analytical applications of certain oxidation reactions in alkaline media.** O. TOMIČEK (Arh. Hemiju, 1938, 12, 105—110).—The results of potentiometric titration of  $V^{IV}$  with 0.1M- $K_3Fe(CN)_6$  in strongly alkaline solution are 2—23% low, owing to incidental oxidation of  $H_2O$ .  $VOSO_4$  in alkaline solution reduces  $Te^{IV}$  or  $Te^{VI}$  to  $Te^{II}$ , and  $Se^{IV}$ , but not  $Se^{VI}$ , to  $Se^{II}$ ; the method cannot, however, be applied to determination of Se or Te. R. T.

**Analysis of antimony-tin alloys.**—See B., 1938, 1432.

**Determination of antimony in lead and lead alloys.**—See B., 1938, 1434.

**Spectrographic examination of assay beads for platinum, palladium, and gold.**—See B., 1938, 1435.

**High-precision calorimeter.** A. WELSCH (Bull. Soc. roy. Sci. Liège, 1937, 11, 316—325).—The construction of a calorimeter which can determine the evolution of very small amounts of heat over long periods, and the method of working, are described. Temp. control is such that the interior temp. of the calorimeter can be maintained over 4 consecutive days at any appropriate temp. within  $0.0005^\circ$ . J. N. A.

**Gas thermometer for use at very low temperatures.** A. H. WOODCOCK (Canad. J. Res., 1938, 16, A, 133—137).—A thermometer, suitable for temp. 4— $14^\circ$  K., is described in which the vol. of gas which remains at room temp. is ~ ten times that of the thermometer bulb proper. It is shown theoretically that with this design the sensitivity is increased at the lowest temp. C. R. H.

**Simple appliance for exact regulation of constancy of temperature of nichrome ovens.** V. A. ZACHAREVSKI (Zavod. Lab., 1938, 7, 353—354).—Apparatus is described. R. T.

**Liquid bath m.p. apparatus.** E. C. WAGNER and J. F. MEYER (Ind. Eng. Chem. [Anal.], 1938, 10, 584—585). L. S. T.

**Use of the calorimetric bomb for determination of carbon in coal.**—See B., 1938, 1377.

**Thermo-electric measurement of vapour pressure.** R. R. ROEPKE and E. J. BALDES (J. Biol. Chem., 1938, 126, 349—360; cf. A., 1934, 983).—Comparison, by the authors' method, of the v.p. of biological material (e.g., egg yolk, centrifuged blood cells, blood-serum, crushed muscle) with that of nearly isosmotic aq. NaCl has shown the method to possess great accuracy. The procedure is applicable also to determination of the v.p. of solutions of org. compounds and of the mol. wt. of the compounds. Methods of evaluating or diminishing errors due to heat production within the material under examination are described. W. McC.

**Modern microscopic apparatus in chemical research and industrial laboratories.** A. KUFERATH (Österr. Chem.-Ztg., 1938, 41, 359—363).—Various forms of microscopes and micro-cameras, and the different types of illumination which can be used in conjunction with them, are described. J. W. S.

**Taking photomicrographs with the aid of a simple and inexpensive apparatus.** R. B. JACKSON (Chinese Med. J., 1938, 54, 367—371).—The adaptation of a Baker (London) Metron reflex drawing outfit to the production of photomicrographs is described. W. J. G.

**Simple electron microscopes.** R. P. JOHNSON (J. Appl. Physics, 1938, 9, 508—516).—The simple instruments described require only a few  $\mu$ a. at 2000—5000 v. and a small low-tension supply. Electrons emitted from the cathode are pulled across to a fluorescent screen so rapidly that they travel in straight lines and produce a sharp image of the

emitting surface. Magnification up to  $10^5$  can be obtained. The method reveals the micro-cryst. structure of the metal etc. Activation and poisoning of the surface can be observed in great detail.

J. A. K.

**Direct-view particle counter and portable ultramicroscope.** S. C. BLACKTIN (J.S.C.I., 1938, 57, 361—363).—The instrument described embodies an inductor for maintaining the flow of gas and its fine particle content, and a cell for the viewing and counting of the particles in a known vol. of gas or liquid. Test data are reported.

N. M. B.

**Source of mercury resonance radiation of high intensity for photochemical purposes.** E. W. R. STEACIE and N. W. F. PHILLIPS (Canad. J. Res., 1938, 16, B, 219—221).—The inexpensive lamp-reaction vessel described has a high intensity of Hg resonance radiation, viz.,  $1.5 \times 10^{-5}$  einstein per sec., and can be operated without flickering at currents as low as 2.5 ma.

C. R. H.

**Departures from additivity among Lovibond red glasses in combination with Lovibond 35 yellow.** G. W. HAUPT (Oil & Soap, 1938, 15, 282—287; cf. A., 1934, 624).—The statistical analysis of the regreded vals. (Priest-Gibson  $N''$  scale) of 2700 Lovibond red glasses, which is illustrated graphically, shows the existence of important differences among the chromaticities of several glasses of nominally the same Lovibond grade, and indicates the magnitude of both regular and erratic departures (two types in each case) from additivity in the  $N$  scale.

E. L.

**Photographic colorimetry of dark substances.** E. VON ANGERER and J. O. BRAND (Z. tech. Physik, 1938, 19, 254—259).—A method for the photographic determination of the  $\lambda$  of light reflected from dark-coloured surfaces is described.

A. J. M.

**Construction of a recording spectrophotometer.** J. L. MICHAELSON (J. Opt. Soc. Amer., 1938, 28, 365—371).—Constructional details of a commercial recording photo-electric spectrophotometer are explained. The instrument consists of a monochromator combined with a photometer and integrating sphere. A photo-cell, suitably amplified via a thyatron stage, records optical densities on a chart, the  $\lambda$  scale being automatically provided by a cam connected with the monochromator system.

J. A. K.

**Calibration of recording spectrophotometer.** K. S. GIBSON and H. J. KEEGAN (J. Opt. Soc. Amer., 1938, 28, 372—385).—The accuracy of a commercial recording spectrophotometer (cf. preceding abstract) has been thoroughly tested for transmission, reflexion, and  $\lambda$  at the National Bureau of Standards. Full details of the tests are given.

J. A. K.

**Photo-electric colorimetry and the application of selenium photo-elements.** B. LANGE (Chem.-Ztg., 1938, 62, 737—741).—A review. The construction of several commercial instruments is described and figured.

I. C. R.

**Photo-electric nephelometer-colorimeter.** V. A. SUCHICH (Zavod. Lab., 1938, 7, 348—350).—Apparatus is described.

R. T.

**Accuracy of rectifier photo-electric cells.** J. R. ATKINSON, N. R. CAMPBELL, E. H. PALMER, and G. T. WINCH (Proc. Physical Soc., 1938, 50, 934—946).—An investigation of the effect of a resistance in series with the cell on the linearity of the response and on the temp. coeff. of the sensitivity is reported. Results can be qualitatively explained by assuming the presence of a series resistance in the cell in addition to the shunt resistance; these two do not vary in the same manner with temp. or with illumination.

N. M. B.

**Photometer with a selenium photo-element.** M. Z. KRIVOV (Zavod. Lab., 1938, 7, 744—745).

R. T.

**Photo-electric apparatus for determining intensity of coloration of solids and powders.** V. I. JUSCHANTZEV (Zavod. Lab., 1938, 7, 492—493).—Apparatus is described.

R. T.

**Spectrochemical study of microscopic crystals.**

**I. Application of microscopes in spectrography.** R. TSUCHIDA and M. KOBAYASHI (Bull. Chem. Soc. Japan, 1938, 13, 619—623).—A new method of measuring absorption spectra of microscopic crystals is described. The measurement of the pleochroism of microcryst. substances by means of a polarizing microscope is illustrated by reference to *cis*-dichlorotetramminocobaltic chloride.

W. R. A.

**Concave-grating vacuum spectrograph for wave-lengths 15—1000 Å.** F. C. CHALKLIN, S. S. WATTS, and S. P. HILLSON (Proc. Physical Soc., 1938, 50, 926—933).—The instrument described allows adjustment of the optical system before placing in the vac. chamber, thus minimising trial-and-error focusing. The grazing angle may be varied without readjustment. Tests are described and discussed.

N. M. B.

**Double crystal [X-ray] spectrometer with photographic recording; measurement of the imperfection of crystals.** J. FEJFER and M. JAHODA (Compt. rend., 1938, 207, 737—739).—The use of a spectrograph with fixed non-parallel crystals is described. Data for the degree of imperfection of NaCl, ZnS (sphalerite), and SnO<sub>2</sub> crystals, obtained by photographic measurements of the resolving power, show that each crystal has a characteristic min. imperfection corresponding with a regular mosaic structure. The mosaic structure of NaCl becomes more pronounced on depositing a film of Al on the reflecting face, ZnS being unaffected. Application of a potential gradient reduces the mosaic structure of ZnS.

A. J. E. W.

**Express method of X-ray structural analysis.** V. I. ARCHAROV (Zavod. Lab., 1938, 7, 440—443).—A method depending on focusing of X-ray beams by "lenses" of the substance under examination is described (cf. Tech. Phys. U.S.S.R., 1936, 6, 1771).

R. T.

**Powerful X-ray tube.** A. I. KRASNIKOV (Zavod. Lab., 1938, 7, 307—312).—Apparatus is described.

R. T.

**Electrical and luminescence properties of willemite screen material.** W. B. NOTTINGHAM (Physical Rev., 1937, [ii], 51, 1008).—Surface poten-

tial, resistivity, and luminous output have been determined. L. S. T.

**Differential titrations with tungsten electrode.** C. T. ABICHANDANI and S. K. K. JATKAR (J. Indian Inst. Sci., 1938, 21, A, 363—367).—W electrodes may be used for acid-alkali titrations by the differential method. F. J. G.

**Automatic potentiometric titration apparatus.** C. T. ABICHANDANI and S. K. K. JATKAR (J. Indian Inst. Sci., 1938, 21, A, 369—371).—The apparatus uses differential electrodes of W and Ag connected to a valve system so that the p.d. can be recorded on a rotating drum by a mirror galvanometer, while the rotation of the drum automatically delivers liquid to the titration cell by lowering a sinker into the burette. F. J. G.

**Apparatus with a valve amplifier for measurement of conductivity.** I. V. MALASCHENKO (Zavod. Lab., 1938, 7, 741—744).—Apparatus is described. R. T.

**Differential pre-amplifier for electro-physiological purposes and for bridge measurements.** H. KÖNIG (Helv. Phys. Acta, 1938, 11, 507—512).—The amplifier described is free from magnetic interaction effects, and may be used to determine the p.d. between two points irrespective of their abs. potential. A. J. E. W.

**Counter systems for measuring cosmic radiation of very small intensity.** A. VAN GEMERT (Physica, 1938, 5, 811—816).—Diagrams are given of two counter systems, used in determining the intensities of cosmic radiation in H<sub>2</sub>O to depths >440 m. and in a colliery to depths >620 m. (equiv. to 1600 m. of H<sub>2</sub>O) (cf. A., 1938, I, 549). J. W. S.

**Investigations with detectors in the region of short electric waves.** J. ROTTGARDT (Z. tech. Physik, 1938, 19, 262—264).—The sensitivity of a no. of crystal detector combinations for dm. and cm. waves has been determined. Si-W is the most satisfactory combination in the range 50—1.4 cm. The connexion between the sensitivity of the detector and its resistance has been investigated. A. J. M.

**Purification of crystalloids and colloids by electro-dialysis.** N. R. JOSEPH (J. Biol. Chem., 1938, 126, 403—405).—A simple apparatus similar to that of Adair and Keys (A., 1935, 52) is described. Hg within Cellophane membranes forms the electrodes. Electro-dialysis is continued until the conductivity of the solution reaches a limiting val. W. McC.

**Separation of isotopes for the investigation of nuclear transmutations.** E. L. YATES (Proc. Roy. Soc., 1938, A, 168, 148—158).—A simple mass spectrograph, by means of which a few µg. of the separated isotopes of Li, B, and C have been prepared, is described. G. D. P.

**Counting effects in [discharge] tubes with plane parallel electrodes.** B. KWAL (Compt. rend., 1938, 207, 724—726).—The sensitive zone of plane electrodes is at the edges, and efficient counting is obtained only with sharp-edged plates. A. J. E. W.

**Electron-diffraction by the split-shutter method and a new back reflexion method.** R.

JACKSON and A. G. QUARRELL (Proc. Physical Soc., 1938, 50, 776—782).—A method for obtaining comparison reflexion patterns by the split-shutter method is given, and a light-tight split-shutter plate-holder is described. The use of the grazing incidence method for the electron-diffraction study of surface structure is essential, but in view of its limitations the possibility of back-reflexion of electrons is considered, and experiments in which high-speed electrons diffracted through nearly 180° are recorded photographically are described. Results do not admit definite conclusions between the two- or three-dimensional nature of the diffraction mechanism involved, but developments may allow application to specimens not adaptable to direct electron-diffraction study. N. M. B.

**Fixation of magnetic suspension patterns.** K. V. GRIGOROV (Zavod. Lab., 1938, 7, 735—737).—The powder is applied as a suspension in 3—5% celluloid in COMe<sub>2</sub>; the film remaining after drying fixes the pattern. R. T.

**Magnetic powder method in foreign practice.** A. G. SPEKTOR (Zavod. Lab., 1938, 7, 296—303).—Known methods are reviewed. R. T.

**Magnetic suspension method.** V. I. NIKOLIN and I. J. LEVSHUK (Zavod. Lab., 1938, 7, 303—306).—Applications of the method are described. R. T.

**Current balance for measuring magnetic fields and susceptibilities.** A. R. KAUFMANN (Rev. Sci. Instr., 1938, 9, 369—371). L. S. T.

**Effect of heat on an air-damped balance.** E. L. SAYCE (Soc. Chem. Ind. Victoria, 1938, 38, 37—42).—Erratic wandering of the rest point over an amplitude of 3 divisions of the scale, equiv. to 0.0003 g., was due to the conduction of heat from the 24-w. lamp used in the optical system of reading through its metal bracket to the metal sub-frame of the balance. L. S. T.

**Semi-automatic pipette for rapid and exact delivery of solutions.** N. I. STOGNI (Zavod. Lab., 1938, 7, 626). R. T.

**Macro-micro-burette.** N. S. SCHUB (Zavod. Lab., 1938, 7, 627).—A combined macro-micro-burette is described. R. T.

**Titration of small volumes.** (A) E. A. SCHILOV. (B) N. A. TANANAIEV (Zavod. Lab., 1938, 7, 378, 378—379; cf. A., 1937, I, 196).—Polemical. R. T.

**Use of a palladium tube in gas analysis.**—See B., 1938, 1382.

**Portable apparatus for determination of oxygen dissolved in a small volume of water.** H. M. FOX and C. A. WINGFIELD (J. exp. Biol., 1938, 15, 437—445).—A method for determining the amount of O<sub>2</sub> dissolved in H<sub>2</sub>O is described. It requires only 1—2 c.c. of H<sub>2</sub>O and is accurate to 2% even at low [O<sub>2</sub>]. J. M. R.

**Micro-analysis of gases. Apparatus for use in a dry method of analysis for carbon dioxide and oxygen.** D. GILMOUR (Austral. J. Exp. Biol., 1938, 16, 208—218).—Modifications in the method of Blacet and Leighton (A., 1931, 1027) are described,

the chief advantages lying in the facts that the bubble to be analysed is not removed from the apparatus during the course of the analysis and that the apparatus is readily cleaned. D. M. N.

**Apparatus for micro-steam-distillation.** J. ERDŐS and B. LÁSZLÓ (*Mikrochim. Acta*, 1938, 3, 304—305).—Two forms of apparatus are described, one suitable for steam-distillation of readily volatile materials and the other for less volatile materials. J. W. S.

**Automat for mercury distillation.** V. A. ZACHAREVSKI (*Zavod. Lab.*, 1938, 7, 356).—Apparatus is described. R. T.

**Distillation apparatus.**—See B., 1938, 1374.

**Continuous high-vacuum still and b.p. apparatus, and the systematic distillation of a dewaxed lubricant fraction of petroleum.** R. T. LESLIE and W. W. HEUER (*J. Res. Nat. Bur. Stand.*, 1938, 21, 515—533).—The construction of the still and b.p. apparatus and their application to the further fractionation of a lubricating oil fraction which distilled between 135° and 270°/1 mm. are described. C. R. H.

**Glass vapour-density balance.** J. H. SIMONS (*Ind. Eng. Chem. [Anal.]*, 1938, 10, 587).—The apparatus is made entirely from Pyrex glass and gives a precision of 0.2% with pressures ~500 mm. It is useful in determining the mol. wts. of gases, and in following the course of distillation of a mixture containing a homologous series of compounds having a no. of isomerides. L. S. T.

**Apparatus for safeguarding high-vacuum pumps.** K. SEILER (*Z. tech. Physik*, 1938, 19, 283—284).—A simple apparatus for the control of the cooling H<sub>2</sub>O of high-vac. pumps is described. A. J. M.

**Mechanical pump for the drawing of gas samples.** S. B. BARKER and E. SMYTH (*Proc. Soc. Exp. Biol. Med.*, 1938, 38, 745—748).—The pump is for drawing samples from a moving stream of gas. The samples are sucked into a cylinder by a piston which is moved by the same motor that propels the stream of gas, the movement of this piston being produced by the engagement of a ratchet tooth in a cogged wheel which moves the piston by a screw-gear. The extent of the movement is controlled by the no. of teeth through which the wheel is turned. V. J. W.

**Determination of viscosity of extremely viscous liquids and sols, by the falling-sphere method, with counterweight.** A. P. VISCHNIKOV (*Zavod. Lab.*, 1938, 7, 685—688).—The method gives results differing by +6—7% from those given by Ostwald's method. R. T.

**Taking of samples for study of kinetics of chemical reactions in liquid media.** A. F. BOGOJAVLENSKI (*Zavod. Lab.*, 1938, 7, 733—734).—The system is distributed amongst a series of Landolt tubes, which are successively removed for analysis. R. T.

**Printing of millimetre squares on metal surfaces.** O. V. ODING (*Zavod. Lab.*, 1938, 7, 739).—A thin layer of photosensitive dichromated

gelatin is placed on the cleaned surface, and mm. squares are printed out on the film from a negative. The unexposed parts are washed off, and the remaining gelatin is stained with Me-violet. R. T.

**Laboratory study of explosivity of gas mixtures.** M. G. GODSHELLO, I. R. MLINIK, and N. D. TABAKOV (*Zavod. Lab.*, 1938, 7, 558—560).—Apparatus is described. R. T.

**Differential indicator with a combination of membranes of different sensibility.** M. B. NEIMAN (*Zavod. Lab.*, 1938, 7, 624).—An instrument for measuring changes in gas pressures of 0.2—100 atm. is described. R. T.

**Utilisation of broken condensers.** G. A. BUTKEVITSCH (*Zavod. Lab.*, 1938, 7, 628).—Uses for broken condenser jackets are suggested. R. T.

**Microscopic study of processes of dendritic crystallisation, with exact time registration.** B. E. VOLOVIK (*Zavod. Lab.*, 1938, 7, 430—436).—The velocity of linear growth of NH<sub>4</sub>Cl dendrites is registered on a series of photomicrographs, on each of which the position of the hand of a chronometer is indicated. R. T.

**Heated thermometer anemometer.** C. P. YAGLOU (*J. Ind. Hyg.*, 1938, 20, 497—510).—An electrically heated coil surrounds the bulb of a glass thermometer. At any chosen voltage the air velocity can be calc. from the difference in temp. between the heated thermometer and an unheated one. By varying the voltage any velocity from 10 to 6000 ft. per min. can be accurately measured. If the thermometer bulbs are coated with Al paint the reading is unaffected by radiation and the instrument may be used near a source of radiant heat. The instrument is negligibly affected by variations in air temp., humidity, or its own convectional currents. E. M. K.

**Pressure regulator.** S. C. COLLINS (*Rev. Sci. Instr.*, 1938, 9, 374).—A regulator for the control of the pressure drop across a precision calorimeter is described. The regulator reduces the variations to 0.1% of the total pressure over an interval of several hr. and to 0.01% for ~1 hr. The pressure drop varies from 1 to 4 atm. and the exit pressure is slightly >1 atm. L. S. T.

**Centrifuging of liquids.** J. W. BEAMS (*Science*, 1938, 88, 243—244).—A modification of design which increases the efficiency of the vac. centrifuge described formerly (*A.*, 1937, 1, 635) is illustrated. L. S. T.

**Centrifuges.** H. P. MATTHEWS (*Soc. Chem. Ind. Victoria*, 1938, 38, 47—54).—Data concerning speed, power consumption, balance, centrifugal force, etc. are mentioned. L. S. T.

**New type of air bearing for air-driven high-speed centrifuges.** E. G. PICKELS (*Rev. Sci. Instr.*, 1938, 9, 358—364).—An oil-damped air bearing and driving mechanism suitable for routine centrifuging work with large and heavy rotors are described. Operating characteristics are discussed. L. S. T.

**Practical speed-measuring devices for high-speed centrifuges.** E. G. PICKELS (*Rev. Sci. Instr.*, 1938, 9, 354—358).—A direct-reading stroboscope

with slotted disc and friction drive, capable of registering speeds directly with an accuracy  $>99\%$ , and a stroboscope utilising electrical interruption of illumination, and suitable for use with the analytical centrifuge, are described and illustrated. L. S. T.

**Design and operation of the oil-turbine ultracentrifuge.** G. BOESTAD, K. O. PEDERSEN, and T. SVEDBERG (Rev. Sci. Instr., 1938, 9, 346—353).—The development of the oil-turbine centrifuge is traced with special reference to the principles of design for max. resolving power at min. expenditure of energy. The efficiency of various types of rotors, power consumption, and running costs are discussed. L. S. T.

**Opaque ultracentrifuges for direct analysis.** J. W. McBAIN (J. Physical Chem., 1938, 42, 1063—1070).—A no. of inexpensive types of opaque rotors suitable for the investigation of sedimentation equilibrium and velocity are described. C. R. H.

**Centrifuging arrangement for gravimetric micro-determinations.** A. LANGER (Mikrochim. Acta, 1938, 3, 247—252).—The apparatus consists

of a tube for pptn., a small sintered-glass crucible, a receiving vessel, and a stand, all of which are assembled and placed in the metal container of the centrifuge. Transference of the ppt. without loss into the weighed crucible is thus facilitated. Details of construction are illustrated. L. S. T.

**Liquids of standard viscosity.** S. FUJITA (J. Soc. Chem. Ind. Japan, 1938, 41, 288—290B).—One glass and two metal balls for use in the Höppler viscosimeter were calibrated by  $\eta$  measurements on  $H_2O$  (taken as standard) and aq. glycerol at 19—30°. The  $\eta$  of standard liquids 3A and 6H (U.S. Bureau of Standards) were found to agree with the reputed vals. within 0.01 and 0.2% respectively. The  $\eta$  of a transformer and a turbine oil are given from 6° to 30°. W. A. R.

**Hydrogenation technique.** H. JACKSON (Chem. and Ind., 1938, 1076—1077; cf. A., 1936, 1132).—Micro-technique is described, and an all-glass apparatus figured. Decahydronaphthalene and AcOH, alone or mixed, are recommended as solvents. A. T. P.

## Geochemistry.

**Strontium in sea-water and its effect on calcium determinations.** D. A. WEBB (Nature, 1938, 142, 751—752).—Spectrographic examination shows that Sr is pptd. with Ca as oxalate from sea- $H_2O$ . No Sr could be detected in the filtrate and the Ca : Sr ratio in the ppt. was the same as that in the original  $H_2O$ . The errors introduced by neglecting the presence of Sr are discussed. A conventional interpretation suggested for the term "Ca content" is that "calcium" shall be taken to mean "Ca after the Sr and Ba have been replaced by Ca." L. S. T.

**Brackish-water lochs of Orkney.** E. A. T. NICOL (Proc. Roy. Soc. Edin., 1938, 58, 181—191).—The salinity of the Loch of Stenness varies from 9.0 to 26.8 parts per 1000, the  $p_H$  from 9.2 to 9.8, and [Ca] is 56.0—89.0 mg. per l. The deeper  $H_2O$  shows a well-marked difference in salinity at the surface and at the bottom. The  $O_2$  content is plentiful. The salinity of the Loch of Hannay varies from 0.6 to 4.3 parts per 1000, and the  $p_H$  from 9.0 to 9.8; the Ca content is 78 mg. per l. The bottom  $H_2O$  at one station contains 139 mg. of Ca per l. L. S. T.

**Cold water layer of the Scotian shelf.** H. B. HACHEY (Science, 1938, 88, 307—308).—The temp.-salinity data reproduced from a section extending outwards from the coast near Halifax are discussed in relation to the origin of the layer. L. S. T.

**Content of heavy water in the earth at a depth of 1300 metres.** L. SCHAMOVSKI and N. KAPUSTIN-SKAJA (Acta Physicochim. U.R.S.S., 1937, 7, 797—798).—The determination of the  $D_2O$  content of water taken from a depth of  $>1200$  m. has been carried out by the flotation method. The ratio  $D_2O : H_2O = 1 : 4490$  is  $>$  in ordinary water and indicates an enrichment of  $D_2O$  in the water in the deep layers of the earth. This may be due to the separation of the isotopes in the terrestrial gravitation

field and to the dehydration of minerals already enriched in  $D_2O$ . W. R. A.

**Glacial lake deposits in the Isar valley.** E. SAUER (Min. Petr. Mitt., 1938, 50, 305—355).—Mechanical analyses of the sediments and one chemical analysis of a fresh-water limestone are given. L. J. S.

**Radium content of marine sediments from the East Indies, the Philippines, and Japan, and of the Mesozoic fossil clays of the East Indies.** R. D. EVANS and A. F. KIP (Amer. J. Sci., 1938, [v], 36, 321—336; cf. A., 1938, I, 642).—The mean [Ra] in 11 terrigenous-mud, ocean-bottom deposits from the vicinity of Japan, the Philippines, and the East Indies is  $2.5 \times 10^{-12}$  g. per g., which is 5 to 10 times  $>$  the usual vals. for sedimentary rocks. The terrestrial occurrences of so-called fossil deep-sea clays on Borneo, Rotti, and Timor have a lower [Ra] than contemporary deep-sea red clays or terrigenous muds. The results support the view that Ra and not U is primarily pptd. in the ocean-bottom sediments. Pptn. of U does not appear to be responsible for the high Ra content of deep-sea red clays. L. S. T.

**Composition of meteorites.** H. H. NININGER (J. Geol., 1938, 46, 889—891).—The generally-accepted ideas regarding the average composition of meteorites are incorrect since they are based on collections that are not completely representative. L. S. T.

**Application of physico-chemical principles to the investigation of the properties of rocks. III. Porosity: comparison of methods and conclusions.** A. H. NISSAN, C. E. WOOD, L. V. W. CLARK, and A. W. NASH (J. Inst. Petroleum Tech., 1938, 24, 585—597; cf. B., 1938, 1119).—Liquid absorption and gas expansion methods for determining the porosity of rocks are compared. A bulk vol. of 40 c.c.

provides the optimum quantity of sample for accuracy and if this figure is used the methods agree. The gas absorption method is rather more costly but the liquid absorption method takes longer.

T. C. G. T.

**Petrographic analysis of "pelitigartigen" elements of tuffite from Berestowiec.** J. TOKARSKI (Bull. Acad. Polonaise, 1938, A, 252—263).—Analytical data are discussed. W. R. A.

**Geology and petrography of the Rottenmann and Solk Tauern Mts. (Styria).** H. WIESENER (Min. Petr. Mitt., 1938, 50, 273—304).

**"Glorieta" monazite.** O. B. MUENCH (J. Amer. Chem. Soc., 1938, 60, 2661—2662).—The monazite contains Th 7.50, Pb 0.339, U 0.106%. The age of the mineral, estimated from the above ratios, is  $858 \times 10^6$  years. E. S. H.

**Association of several thermal and stress minerals in the Yu Hsi Kou iron-bearing district.** K. TSURU (Mem. Ryojun Coll. Eng., 1935, 8, 167—186). CH. ABS. (e)

**Earths of Salinelles.** V. CHARRIN (Céramique, 1938, 6, 83—84).—The occurrence, nature, and properties of a mineral of the type  $3\text{MgO} \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$  are described. The sedimentary, refractory material has the composition  $\text{SiO}_2$  52—55,  $\text{MgO}$  20—23,  $\text{Al}_2\text{O}_3$  3—4,  $\text{Fe}_2\text{O}_3$  20—22,  $\text{H}_2\text{O}$  0—1%. J. A. S.

[**Structure of francolite. Isomorphism of the apatite group.**] D. MCCONNELL (Amer. Min., 1938, 23, 606).—Corrections (cf. A., 1938, I, 52, 283).

L. S. T.

**Johannsenite, a new manganese pyroxene.** W. T. SCHALLER (Amer. Min., 1938, 23, 575—582).—Johannsenite (I),  $\text{MnO} \cdot \text{CaO} \cdot 2\text{SiO}_2$ ,  $\rho$  3.6 approx., has the same structure (X-ray photographs) as diopside and hedenbergite. (I) occurs at Bohemia mining district, Lane Co., Oregon, Hanover, N.M., Franklin, N.J., near Schio, and at Campiglia, Italy, Puebla and Pachuca, Mexico, and probably at Rezbanya, Hungary, Elba, and Algeria. The indices of refraction calc. for the pure mineral are  $\alpha$  1.710,  $\beta$  1.719,  $\gamma$  1.738; the vals. measured for samples from most of the above localities are, in general, slightly < these figures. (I) readily fuses and is decomposed by evaporation with HCl. Seven chemical analyses of (I) from different localities are tabulated. The relation to other anhyd. Mn silicates is discussed. At  $\sim 830^\circ$ , (I) inverts to bustamite. L. S. T.

**Prehnite from Coopersburg, Pennsylvania.** D. M. FRASER and R. D. BUTLER [with C. S. HURLBUT, jun.] (Amer. Min., 1938, 23, 583—587).—Chemical and spectroscopic analyses and the optical properties of well-developed crystals of prehnite are recorded. L. S. T.

**Andalusite in pegmatite from Fresno County, California.** G. A. MACDONALD and R. MERRIAM (Amer. Min., 1938, 23, 588—594).—The variation in colour from pale pink to dark reddish-violet is attributed to replacement of Al by  $\text{Fe}^{\text{III}}$ . Chemical analyses and optical properties for the light- and dark-coloured materials are given. Spectrographic analyses show that, in addition to other elements, traces of Cu, Ga, and Ge are present in both cases.

The andalusite (I) has been developed by pneumatolytic action following the crystallisation of the surrounding pegmatite. Subsequently, hydrothermal solutions have altered part of the (I) to sericite.

L. S. T.

**Disintegration and exfoliation of granite in Egypt.** R. FARMIN (J. Geol., 1938, 46, 892—893).—Dilation after the removal of load is the only one of suggested processes that is always available at localities where rock exfoliation is found (cf. A., 1938, I, 282). L. S. T.

**Andalusite and sillimanite in uncontaminated igneous rocks.** E. S. HILLS (Geol. Mag., 1938, 75, 296—304).—Evidence that andalusite and sillimanite can crystallise as pyrogenetic minerals and that they are not invariably contamination minerals in igneous rocks is presented. L. S. T.

**Metamorphosis of the amphibolite rocks of the Tatra. II.** S. KREUTZ (Bull. Acad. Polonaise, 1938, A, 265—272; cf. A., 1938, I, 376).—Petrological, Chemical analyses of a gneiss, a biotite schist, etc. from the Wielicka valley are recorded, and discussed. L. S. T.

**Distribution of boron in Alsatian potash salt beds.**—See B., 1938, 1409.

**Weathering of potash-felspar.** C. W. CORRENS and W. VON ENGELHARDT (Chem. Erde, 1938, 12, 1—22).—Details of which a preliminary account has been already given (A., 1938, I, 281). L. J. S.

**Problem of the carbonate-apatites. A carbonate oxy-apatite (dahllite).** D. MCCONNELL (Amer. J. Sci., 1938, [v], 36, 296—303; cf. A., 1938, I, 52, 283).—Chemical (analysis given) and X-ray data for dahllite from Mouillac, France, support the existence of carbonate-apatites with  $\text{CO}_4$ -groups. L. S. T.

**Calcio-gadolinite, a new variety of gadolinite found in Tadati village, Nagano prefecture.** T. NAKAI (Bull. Chem. Soc. Japan, 1938, 13, 591—594).—A variety of gadolinite in which the rare-earth elements are partly replaced by Ca (11.9%) is described. F. J. G.

**Petrology and structure of the Franconia quadrangle, New Hampshire.** C. R. WILLIAMS and M. P. BILLINGS (Bull. Geol. Soc. Amer., 1938, 49, 1011—1043).—The rocks of this quadrangle belong to three chief groups: (i) highly metamorphosed sediments and volcanics, (ii) the sub-alkaline New Hampshire magma series, and (iii) the alkaline White Mountain magma series. In (ii) biotite is the only primary ferromagnesian mineral present in quantity, whilst in (iii) biotite is less important, but fayalite, hastingsite, and hedenbergite are common; fluorite and allanite are characteristic accessories. Chemical analyses of 8 plutonic rocks of this quadrangle are given. L. S. T.

**Valdez Creek mining district, Alaska, in 1936.** R. TUOK (U.S. Geol. Survey, 1938, Bull. 897B, 109—131).—The lode and placer Au deposits are described. L. S. T.

**Alunite deposits of the Marysvale region, Utah.** E. CALLAGHAN (U.S. Geol. Survey, 1938,

Bull. 886p, 91—134).—The geology of the district, and the history, development and production, mineralogy, type, and chemical composition of the deposits are described. The vein alunite is the K variety, whilst the Na variety, natroalunite, makes up some of the replacement deposits; 13 analyses of the vein deposits and their wall rocks, and 39 analyses of the replacement deposits, are recorded. L. S. T.

**Crystallographic study of christianite.** J. WYART and P. CHATELAIN (Bull. Soc. franç. Min., 1938, 61, 121—126).—X-Ray data for christianite (I) from Richmond, Australia, give  $a$  10.00,  $b$  14.25,  $c$  8.62 Å.,  $\beta$  54° 20'; space-group  $C_{2h}^2 = P2_1/m$  or  $C_{2h}^2 = P2_1$ . The unit cell has a vol. of  $998 \times 10^{-24}$  cm.<sup>3</sup>;  $\rho$  2.204. Chemical analyses of specimens from 14 different localities show the formula to be approx.  $K_2Ca_2Al_6Si_{10}O_{32} \cdot 12H_2O$ . (I) is analogous to harmotome in structure. L. S. T.

**Microscopic-planimetric analysis of Osnick granite in Wolhynien.** J. TOKARSKI and (MME.) H. GAWIŃSKA (Bull. Acad. Polonaise, 1938, A, 343—353).—Results are recorded. W. R. A.

**Leaching of granite and some other rocks.** E. H. DAVISON (Min. Mag., 1938, 25, 217—220).—Aerated distilled  $H_2O$  was allowed to drip five times over crushed rocks (granite, gabbro, limestone), then evaporated, and the residue weighed and analysed. This process repeated 25 times seems to show a rhythm in the amount of material dissolved. L. J. S.

**Identity of zinckenite and keeleyite.** G. VAUX and F. A. BANNISTER (Min. Mag., 1938, 25, 221—227).—Zinckenite from the Harz Mts. has hitherto been described as orthorhombic, but pseudo-hexagonal by twinning, and with the composition  $PbSb_2S_4$ , isomorphous with chalcostibite ( $Cu_2Sb_2S_4$ ) and emplectite ( $Cu_2Bi_2S_4$ ). X-Ray photographs prove it to be truly hexagonal with unit cell dimensions  $a$  44.06,  $c$  8.60 Å., and space-group  $C_6^h$  or  $C_6^h$ . Keeleyite from Bolivia gives the same X-ray patterns. Recalculation of published analyses gives a closer approach to  $Pb_{72}Sb_{168}S_{324} = 12(6PbS, 7Sb_2S_3)$  than to  $Pb_{81}Sb_{162}S_{324} = 81(PbS, Sb_2S_3)$  for the contents of the unit cell. L. J. S.

**X-Ray examination of mordenite (ptilolite).** C. WAYMOUTH, P. C. THORNELLY, and W. H. TAYLOR (Min. Mag., 1938, 25, 212—216).—X-Ray photographs of the fibrous zeolites, ptilolite ( $d$  2.15) from Elba, mordenite ( $d$  2.12) from Mull, and flokite ( $d$  2.102) from Iceland, show them to be orthorhombic with dimensions (Mull)  $a$  18.25,  $b$  20.35,  $c$  7.50 Å., and four mols.  $(Ca, Na_2, K)_2Al_2Si_{10}O_{24} \cdot 7H_2O$  in the unit cell. Pyroelectric tests were inconclusive, and the space-group is either  $D_{2h}^{17}$  or  $C_{2h}^{12}$ . L. J. S.

**Low-grade metamorphic actinolitic amphibole from New Zealand.** C. O. HUTTON (Min. Mag., 1938, 25, 207—211).—Chemical analysis and optical data are given of an amphibole isolated from a low-grade metamorphic albite-epidote-actinolite-chlorite-calcite-schist from Coronet Peak, Otago, New Zealand. The formula is deduced as  $(OH)_2(Na, Ca)_2(Mg, Fe, Ti, Al)_5(Si, Al)_8O_{22}$ . It is demonstrated that the max. angle of optical extinction in prism zone is not that on the plane (010). L. J. S.

**The stilpnomelane group of minerals.** C. O. HUTTON (Min. Mag., 1938, 25, 172—206).—Six chemical analyses with optical data are given of stilpnomelane from the original locality (Zuckmantel, Silesia), from Baern in Moravia, and from low-grade metamorphic schists in western Otago, New Zealand, together with seven analyses of the New Zealand rocks. They show a gradation from a dark green hydrous ferrous silicate to a brown hydrous ferric silicate, due to oxidation, and  $n$  increases progressively with the amount of  $Fe_2O_3$ . It is suggested that the original analyses of Rammelsberg (1835) were in error in stating Fe as  $Fe^{II}$  instead of  $Fe^{III}$ , and the new name ferrostilpnomelane is proposed. Parsettensite is included as a Mn member of this series, since X-ray measurements [by I. FANKUCHEN] give similar data. L. J. S.

**Rocks collected by the Italian geographical expedition to Karakorum (1929).** P. COMUCCI (Mem. R. Accad. Lincei, 1938, [vi], 7, 93—235).—A detailed description, with analyses, of the various metamorphic and eruptive rock specimens collected during the expedition. O. J. W.

**Contact relations between rhyolite and basalt on Gardiner River, Yellowstone Park.** C. N. FENNER (Bull. Geol. Soc. Amer., 1938, 49, 1441—1483).—The marked contact effects produced by a flow of mobile rhyolite over a basaltic surface are described. In many places the rhyolite penetrated deeply into the basalt as complex networks of vein and dyke-like bodies. The basalt was vigorously attacked, parts of the surface being removed, whilst near the contacts the composition of the basalt was greatly modified. Basaltic constituents were removed and rhyolite constituents substituted in such a way that the compositions of the altered rocks lie on straight lines between those of rhyolite and basalt. 18 chemical analyses of the modified and unmodified basalts and the rhyolite are given. L. S. T.

**Metalliferous mineral deposits of the Cascade Range in Oregon.** E. CALLAGHAN and A. F. BUDINGTON (U.S. Geol. Survey, 1938, Bull. 893, 136 pp.).—The general geology, the mineral deposits, and numerous mines and prospects are described. L. S. T.

**Clay minerals.**—See B., 1938, 1415.

**Mode of deposition of coal seams. Microscopic study.** R. G. H. B. BODDY (Trans. Inst. Min. Eng., 1938, 96, 100—107).—Petrographic analyses of three Yorkshire seams, differing widely in character and geological age, suggest that no gross changes in manner of deposition occurred during the formation of any of the three seams, such as would be demanded by the *in situ* theory for clarain and the drift theory for durain formation. H. C. M.

**Coal seams of Karawanken [Carinthia].** F. KAHLER (Berg u. Hüttenmänn. Monatsh., 1938, 86, 201—205).—The geological formation is discussed. R. B. C.

**Eolian soils from Brazil.** F. W. FREISE (Chem. Erde, 1938, 12, 42—49).—Chemical analyses of loose soils deficient in humus from the arid region in N.E. Brazil are given. L. J. S.