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# BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

**JANUARY, 1944**

## A I—GENERAL, PHYSICAL, AND INORGANIC CHEMISTRY

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**BUREAU OF CHEMICAL AND PHYSIOLOGICAL ABSTRACTS**

(Supported by the Chemical Society, the Society of Chemical Industry, the Physiological Society, the Biochemical Society, the Anatomical Society of Great Britain and Ireland, and the Society for Experimental Biology.)



## Copper Determination with Benzotriazole

Reference : A. J. Curtis,  
*Ind. Eng. Chem. (Anal.)* 13, 349, (1941)

Copper may be separated from metals which interfere in the iodide-thiosulphate titration, by precipitation, at pH 7.0 to 8.5, with benzotriazole. The reagent can afford a gravimetric determination as the copper compound, in the absence of  $\text{Ag}^+$ ,  $\text{Ni}^{++}$ ,  $\text{Fe}^{++}$ ,  $\text{Cd}^{++}$ ,  $\text{Zn}^{++}$ , and  $\text{Co}^{++}$ . In the analysis of iron and steel precipitation is followed by ignition to copper oxide, solution in nitric acid and titration by the iodide-thiosulphate procedure.

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# BRITISH CHEMICAL AND PHYSIOLOGICAL ABSTRACTS

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

JANUARY, 1944.

### I.—SUB-ATOMICS.

Comparison of the prototype metre with the wave-length of the red line of cadmium. M. F. Romanova, G. V. Varlich, A. I. Kartashev, and N. R. Batartshukova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **37**, 46—51).—A high-precision method based on interference and reflexion photographs is described. Data for measurements in air and in vac. taken at intervals over 2 years give: in air  $\lambda = 6438.4687$ , in vac.  $\lambda = 6440.2488$  Å., in accord with the results of previous investigators.  $\lambda$  can be expressed in terms of a metre fraction with an accuracy of  $\pm 0.0004$  Å. N. M. B.

Transition probabilities in the subordinate series of thallium. G. S. Kvater (*J. Physics U.S.S.R.*, 1942, **6**, 145—162).—Measurements of the anomalous dispersion of the lines  $\lambda 3776$  and  $\lambda 5350$  Å. of Tl are used for the determination of the abs. transition probabilities, 0.0417 and 0.0424, respectively. Equations for the temp. variation of the optical densities for these frequencies lead to the evaluation of the heat of evaporation at abs. zero (43,390 g.-cal.). An equation for the v.p. of Tl at  $612-1063^\circ$  C. is derived. Boltzmann's law is confirmed for the distribution of atoms in the levels  $6^2P_{1/2}$  and  $6^2P_{3/2}$ , and a val. for the ratio  $h/k$  ( $4.82 \times 10^{-11}$  degree-sec.) is deduced. The sum rule does not hold for the sharp or diffuse subordinate series of Tl i. H. J. W.

Spectra of the rare gases and their Zeeman effects. J. B. Green (*Physical Rev.*, 1943, [ii], **64**, 151—155).—The Zeeman effect of the rare gases is discussed on the basis of the Shortley-Fried coupling scheme (cf. A., 1939, I, 1). Matrices for this type of interaction and the  $g$  factors from the transformation to  $LS$  coupling for the  $p^2f$  configurations are calc. The derived Paschen-Back patterns agree well with observed structures. N. M. B.

Mercury arc cathode. C. G. Smith (*Physical Rev.*, 1943, [ii], **64**, 40; cf. A., 1942, I, 381).—A correction. N. M. B.

Electric breakdown and cumulative ionisation. B. Davydov (*Physical Rev.*, 1943, [ii], **64**, 156—158).—Mathematical. Calculations lead to an interpretation of the breakdown as a transition from the lower to the upper branch of an S-like current-field strength curve. An expression for the breakdown field strength is obtained. N. M. B.

Shape of betatron pole faces. J. H. Bartlett (*Physical Rev.*, 1943, [ii], **64**, 185; cf. Kerst, A., 1941, I, 358).—The requirements to be fulfilled by the magnetic field near the electron beam as related to the shape of pole face are calc. N. M. B.

Report of the Committee on at. wts. of the American Chemical Society. G. P. Baxter (*J. Amer. Chem. Soc.*, 1943, **65**, 1443—1447).—The period since September, 1940, is reviewed for C, O, F, Zn, Ag, Br, K, Sm, Ga, Yb, and Pb. The val. of 65.377 for Zn is 0.05 Åg the mass-spectral val. of 65.33. The val. for Sm is probably 0.05 < the present val. of 150.43, and that for Yb 0.06 higher. W. R. A.

Spontaneous fission of uranium and thorium. G. N. Flerov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **37**, 58; cf. A., 1941, I, 287; 1942, I, 5).—The possibility of a difference between the spectra of fragments obtained by spontaneous fission and by induced fission is postulated and an explanation proposed. N. M. B.

Neutron polarisation and ferromagnetic saturation. F. Bloch, M. Hamermesh, and H. Staub (*Physical Rev.*, 1943, [ii], **64**, 47—56).—The transmission of thermal neutrons through magnetised Fe was measured in its dependence on % deviation from saturation and on the thickness of the sample. Results agree with the theory of Halpern and Holstein (cf. A., 1941, I, 359). Terms in the theoretical expression are evaluated. The calc. linear dimensions of the micro-crystals is  $1.4 \times 10^{-4}$  cm. N. M. B.

Branching ratio of  $^{22}\text{Na}$ . H. Weltin (*Physical Rev.*, 1943, [ii], **64**, 128).—Using micro-gas analysis, the amount of Ne was compared with the no. of positrons emitted for the decay reactions  $^{22}\text{Na} \rightarrow ^{22}\text{Ne} + e^+$ ,  $^{22}\text{Na} + e^- \rightarrow ^{22}\text{Ne}$ . Results show that the ratio of the no. of nuclei excited to the no. of positrons emitted is 3.2. This supports the Fermi  $\beta$ -decay theory, provided that the change in nuclear spin is  $\Delta i = 1$ . N. M. B.

Energies of the  $\gamma$ -rays from radioactive scandium, gallium, tungsten, and lanthanum. C. E. Mandeville (*Physical Rev.*, 1943, [ii], **64**, 1

147—151).—Energies determined by the method of semicircular focussing of Compton recoils in a magnetic spectrograph arc:  $^{48}\text{Sc}$ ,  $1.35 \pm 0.03$ ;  $^{72}\text{Ga}$ ,  $1.17 \pm 0.02$  and  $2.65 \pm 0.06$ ;  $^{187}\text{W}$ ,  $0.94 \pm 0.02$ ;  $^{140}\text{La}$ ,  $2.04 \pm 0.04$  Me.v. The quanta emitted by  $^{72}\text{Ga}$  are present with equal intensity, suggesting that they may be in cascade. The  $\gamma$ -ray activity of  $^{72}\text{Ga}$  has a half-period of  $14.25 \pm 0.20$  hr. N. M. B.

Nuclear chemistry. R. Fleischmann (*Angew. Chem.*, 1940, **53**, 485—498).—A lecture.

Altitude-dependence of Auger showers and the primary spectrum of cosmic radiation. D. V. Skobeltzin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **37**, 52—57; cf. A., 1943, I, 294).—Mathematical. N. M. B.

Large cosmic-ray bursts in an unshielded ionisation chamber. R. E. Lapp (*Physical Rev.*, 1943, [ii], **64**, 129—130).—The bursts coincide with extensive atm. (Auger) showers as detected with Geiger-Müller counters, and represent regions of very high particle density in an Auger shower. N. M. B.

Theory of cosmic-ray mesons. J. Hamilton, W. Heitler, and H. W. Peng (*Physical Rev.*, 1943, [ii], **64**, 78—94).—Mathematical. The quantum theory of damping is applied to the production of mesons by proton-proton collisions. The variation of meson intensity with energy, height, and geomagnetic latitude is in good agreement with experiment. Decay of transverse mesons, which have a very short lifetime, accounts satisfactorily for the soft component in the high atm. Meson showers, transformation into neutrons, and other effects are discussed. N. M. B.

Production of mesons by proton-proton collisions. W. Heitler and H. W. Peng (*Proc. Roy. Irish Acad.*, 1943, **49**, A, 101—133).—Mathematical. The meson spectrum of a moving nucleon is obtained by a method similar to that used by Weizsäcker (A., 1934, 712) for collisions of fast electrons. A fast-moving nucleon can be considered as being equiv. to a free meson pulse moving in the same direction. The scattering of a meson by a nucleon, the production of mesons by collision of two nucleons, and the energy loss of the nucleon are considered. A. J. M.

Dipole character of the mesotron and the polarisation of vacuum. D. Ivanenko and A. Sokolov (*J. Physics, U.S.S.R.*, 1942, **6**, 175—179).—Theoretical. An effective dipole moment for the mesotron is deduced from Proca equations, and its effect on nuclear and electromagnetic processes is discussed. Smaller cross-sections at high energies follow from damping effects and by introducing the higher excited nucleon states postulated by Heitler. L. J. J.

Pseudo-scalar theory of the mesotron. V. L. Ginzburg (*J. Physics, U.S.S.R.*, 1942, **6**, 180—184).—Interactions of mesotrons with photons and with heavy particles are discussed on the basis of a pseudo-scalar wave-function for the mesotron. Its application to mesotron spin and excited states of heavy particles is discussed. L. J. J.

Observable magnitudes in the theory of elementary particles. II. W. Heisenberg (*Z. Physik*, 1943, **120**, 673—702; cf. A., 1943, I, 271).—The author's  $\eta$ -matrix wave theory is applied to scattering of elementary particles on the basis of two types of interaction. A  $\delta$ -function interaction leads to results corresponding with those given by existing theory. The second type of interaction gives effective cross-sections tending to limiting vals. at high energies. Formation of new particles may have an explosive multiple character at high collision energies. The theory is free from divergence difficulties. L. J. J.

### II.—MOLECULAR STRUCTURE.

Spectral and collision data of  $\text{CO}^+$  and dissociation energy of carbon monoxide. R. K. Asundi (*Proc. Indian Acad. Sci.*, 1943, **18**, A, 8—10).—Vals. for the dissociation energy of CO deduced from extrapolation of spectral data of  $^2\Sigma^+$  and  $^2\Pi$  states of  $\text{CO}^+$  are 10.45 and 10.4 e.v., and from collision data involving the same states, 9.75 and 9.7 e.v., respectively. L. J. J.

Excitation processes in the night sky and the aurora. T. Y. Wu (*Proc. Indian Acad. Sci.*, 1943, **18**, A, 40—66).—The forbidden O I lines, the  $\text{N}_2$ ,  $\text{N}_2^+$ , and  $\text{O}_2$  band systems, and the anomalous



intensity features, characteristic of night-sky and auroral spectra, can be explained on the basis of collisions of the second kind between metastable O and N atoms and mols. The latter are formed by recombination of atoms formed by photo-dissociation during the day, and produce the former in collision among themselves. L. J. J.

**Nuclear spin of  $^{37}\text{Cl}$ .** E. F. Shrader (*Physical Rev.*, 1943, [ii], 64, 57—59).—The nuclear spin was determined by observing the line intensities in the band spectrum of  $^{36}\text{Cl}_2$  and in that of  $\text{Cl}_2$  gas containing 45% of  $^{37}\text{Cl}_2$ . The alternating intensity ratio vals. for lines of odd and even  $J$  vals. were 1:26 for  $^{36}\text{Cl}_2$  and 1:28 for  $^{37}\text{Cl}_2$ , indicating that the nuclear spin is 5/2 in each case. N. M. B.

**Light absorption of nickel thiocyanate solutions. II. Non-aqueous solutions.** A. von Kiss and P. Csokan (*Z. anorg. Chem.*, 1941, 247, 205—210; cf. A., 1942, I, 205).—The extinction curves of  $\text{Ni}(\text{CNS})_2$  in  $\text{H}_2\text{O}$  and in various  $\text{H}_2\text{O}$ -non-electrolyte mixtures, and of anhyd.  $\text{Ni}(\text{CNS})_2$  in org. solvents, were determined. The org. substances used were MeOH, EtOH, PrOH,  $\text{CO}(\text{NH}_2)_2$ ,  $\text{C}_6\text{H}_5\text{N}$ , quinoline, and glycerol. The alteration of the extinction curves in the org. solvents is due to the formation of the complex  $[\text{Ni}(\text{CNS})_2\text{L}_2]$  where L is the org. solvent. In presence of excess of  $\text{CNS}'$  ions the complex  $[\text{Ni}(\text{CNS})_4]^{2-}$  generally arises. In some solvents the complex  $[\text{Ni}(\text{CNS})_2\text{L}_2]^{2-}$  occurs. J. F. H.

**Effect of oxygen on the fluorescence of hydrocarbons.** J. A. Miller and C. A. Baumann (*J. Amer. Chem. Soc.*, 1943, 65, 1540—1546).—Intensity of fluorescence of 3:4-benzpyrene, 20-methylcholanthrene, 9:10-dimethyl-1:2-benzanthracene, 1:2:5:6-dibenzanthracene, 1:2-benzanthracene, and anthracene in several solvents, and in the presence and absence of air, has been measured. In air intensities are  $\frac{1}{2}$ — $\frac{1}{3}$  those in the absence of air, but quenching does not always follow solubility of  $\text{O}_2$ .  $\text{SO}_2$  is a more effective inhibitor than  $\text{O}_2$ , whilst HCl and  $\text{NMe}_3$  are less effective. Inhibition changes reversibly with partial pressure of the gas. Equations relating intensity of fluorescence and partial pressure of  $\text{O}_2$  are derived, and agree well with experimental data. The fluorescence in ligroin and  $\text{C}_6\text{H}_5\text{N}$  of the non-saponifiable residue from mouse tissue is investigated, and does not show sensible variation with the pressure of  $\text{O}_2$ . W. R. A.

**Fluorescence of monomethincyanines, especially reversible polymerides. I.** F. Katheder (*Kolloid-Z.*, 1940, 92, 299—324). Solutions of  $\text{NN}'$ -methylene- $\psi$ -isocyanine chloride (I) (quinoline-red) exhibit normal liquid fluorescence, excitable by any  $\lambda$  corresponding with the absorption. The intensity decreases with increasing concn., and is markedly affected by the solvent and by foreign substances. The influence of temp. is negligibly small.  $\text{NN}'$ -Diethyl- $\psi$ -isocyanine chloride (II) and -mononaphtho- $\psi$ -isocyanine chloride (III) both show resonance fluorescence, the intensity of which increases with concn. to a max. and then falls. Dil. solutions of (II) and (III) are very temp.-sensitive, and may show a decrease of 10—15% in intensity for  $1^\circ$  rise; more conc. solutions are less sensitive. The fluorescence is due to polymerised mols., which do not occur in (I), and the effect of temp. is due to depolymerisation, which is hindered in more conc. solutions by their high viscosity. The quenching of the fluorescence of (I) by  $\text{H}^+$ ,  $\text{OH}^+$ , and  $\text{o-C}_6\text{H}_4(\text{OH})_2$  has been studied and is discussed theoretically. F. L. U.

**Mechanism of luminescence of phosphors.** V. V. Antonov-Romanovski (*J. Physics, U.S.S.R.*, 1942, 6, 120—140).—A detailed account of work already noted (A., 1943, I, 114). H. J. W.

**Luminescence of fluorspars.** V. P. Rvatshev (*J. Physics, U.S.S.R.*, 1942, 6, 141—144).—Two types of ultra-violet luminescence of natural  $\text{CaF}_2$  are found; all specimens examined have a band with max. at 300  $\text{m}\mu$ , whilst some specimens show an additional band with max. at 280  $\text{m}\mu$ . The former class have 3 max. in the visible, at  $\sim 480$ , 510, and 590  $\text{m}\mu$ , whilst the latter have additional max. at 540 and 550  $\text{m}\mu$  ascribed to  $\text{Yb}^{++}$  as impurity. The decay of luminescence in photochemically discoloured specimens at  $20^\circ$  and  $180^\circ$  follows a hyperbolic law in agreement with a bimol. process. L. J. J.

**Luminescence of [barium] platinoocyanide.** P. Bergsøe (*5 Nordiske Kemikermode*, 1939, 193—194).—0.1% of Ni completely inhibits the fluorescence of  $\text{BaPt}(\text{CN})_6$  (I) and other Pt complexes; Pd is inactive. The apparent existence of yellow and green forms of (I) (A., 1908, i, 252) is due to partial quenching of the fluorescence by  $\sim 1$  p.p.m. of Ni in acid solution. Highly pure (I) has been prepared. M. H. M. A.

**Depolarisation of Raman lines. A simplified method.** G. Glockler and H. T. Baker (*J. Chem. Physics*, 1943, 11, 446—449).—Two "Polaroid" films followed by two half-wave mica plates in series are placed at the front of the spectrograph slit, so that the initially mutually perpendicular electric vectors of the radiation are oriented to vibrate in the same direction on striking the prism faces, eliminating differential reflexion. L. J. J.

**Raman spectra of acetylenes. VII. Symmetrical-top acetylenes.** F. F. Cleveland and M. J. Murray (*J. Chem. Physics*, 1943, 11, 450—454).—Raman frequencies, relative intensities, and depolaris-

ation factors are recorded for  $\text{CMe}_2\text{Cl}$ ,  $\text{CMe}_2\text{CBr}$ ,  $\text{CMe}_2\text{CCl}$ , and  $\text{CBr}_2\text{CH}$ . Frequency assignments to different vibration types and calc.  $C_\infty$  vals. for 1 atm. in the ideal gaseous state are given for the two first-named. Resonance splitting of the triple-bond fundamental may be due to (2900—700) and (1375+700)  $\text{cm}^{-1}$  combination frequencies in disubstituted acetylenes. Doubling of the 2100  $\text{cm}^{-1}$  fundamental in  $\text{OH}\cdot\text{CMe}_2\cdot\text{C}\equiv\text{CH}$  and  $\text{CBr}_2\text{CH}$  may be due to the second overtones of highly polarised symmetrical frequencies ( $\sim 700$   $\text{cm}^{-1}$ ) of  $\text{C}\equiv\text{CO}\cdot\text{C}$  and  $\text{C}(\cdot\text{C})_3$ , respectively. L. J. J.

**Raman spectra of amino-acids and related compounds. VI. Sarcosine, ethanolamine, choline, betaine, and betaine derivatives.** J. T. Edsall (*J. Amer. Chem. Soc.*, 1943, 65, 1767—1770).—Raman spectra of sarcosine and betaine and their hydrochlorides, phenyl-dimethyl- and pyridine-betaine hydrochloride, choline chloride,  $\text{OH}\cdot[\text{CH}_2]_2\cdot\text{NH}_2\cdot\text{HCl}$ , and  $(\text{CH}_2\cdot\text{NH}_2)_2\cdot 2\text{HCl}$  are reported and correlations between the spectra and structure are indicated. W. R. A.

**Conduction of electricity in highly insulating liquids.** C. S. Pao (*Physical Rev.*, 1943, [ii], 64, 60—74).—Investigations on the natural conductivity and on the conductivity induced by  $\gamma$ -rays in isooctane and liquid  $\text{O}_2$  show characteristics so different as to indicate that the natural conductivity is not due to stray radiation or to cosmic rays. Evidence is given supporting Plumley's theory (cf. A., 1941, I, 319) that the observed conductivity is due to dissociation of the liquid by the field, and against the view that it has a thermionic origin at the cathode, or that it is due to radiation. The relation  $\log \text{current} = \text{linear function of (field)}^{\frac{1}{2}}$  is verified. Curves for all data are given. N. M. B.

**Molecular compounds of *s*-trinitrobenzene with unsaturated ketones.**—See A., 1944, II, 16.

**Magnetochemical study of tervalent cobalt complexes.** R. W. Asmussen (*5 Nordiske Kemikermode*, 1939, 196—197).—All 6-covalent  $\text{Co}^{+++}$  complexes are diamagnetic. In the series  $[\text{Co}(\text{NH}_3)_6]^{3+}$  (I)  $\rightarrow [\text{Co}(\text{NO}_2)_6]^{3+}$  diamagnetic  $\chi$  falls in each direction to a min. at  $[\text{Co}(\text{NH}_3)_3(\text{NO}_2)_3]$ , while in the series (where known) (I)  $\rightarrow [\text{Co}(\text{H}_2\text{O})_6]^{3+}$  (II) vals. of  $\chi$  are const.  $\text{KCo}(\text{SO}_4)_2\cdot 12\text{H}_2\text{O}$  and  $\text{Co}_2(\text{SO}_4)_3\cdot 18\text{H}_2\text{O}$  are diamagnetic, and the cation should thus be formulated as (II). M. H. M. A.

**Structure of complex aluminium fluorides.** C. Brosset (*5 Nordiske Kemikermode*, 1939, 198—199).—Fluoroaluminates are considered as macromols., analogous to the silicates, built up of  $\text{AlF}_6$  groups, and showing 3-dimensional ( $\text{AlF}_3$ ) and 2-dimensional ( $\text{TiAlF}_6$ ) networks, chains ( $\text{Ti}_2\text{AlF}_8$ ), and simple mols. ( $\text{Na}_3\text{AlF}_6$ ). A scheme for representing these types by formulae is presented. M. H. M. A.

**Structure of diketene.** F. O. Rice and R. Roberts (*J. Amer. Chem. Soc.*, 1943, 65, 1677—1681).—Liquid diketene (I) was investigated by aseptically distilled, and shown to consist of a single substance. Thermal decomp. in the gas phase gives almost quant. yields of ketene without the formation of free radicals. Hence, according to the principle of least motion, (I) is cyclobutane-1:3-dione, although this may not represent the true state of the mol. in the liquid phase. Attention is drawn to the discrepancy between dipole moment data ( $\mu = 3.53$ ) and the present data on the nature of gaseous (I). W. R. A.

**Forces between hydrogen molecules.** H. Margenau (*Physical Rev.*, 1943, [ii], 64, 131—147).—Mathematical. By compounding the three types of force involved (exchange, quadrupole, and dispersion) so as to account fundamentally for the size and shape of the mols., a calculation is made of the entire interaction when two  $\text{H}_2$  mols. approach. The interaction curves are in fair agreement with empirical curves derived from the second virial coeffs. Quadrupole moments are computed, and the relation between the mol. problem and the corresponding at. problem (interaction between He atoms) is discussed (cf. A., 1940, I, 59). N. M. B.

**Partition function for liquids from the harmonic oscillator model.** F. A. Matsen and G. M. Watson (*J. Chem. Physics*, 1943, 11, 343—348).—Mathematical. The energy and frequency of vibration of the mols. of a liquid in their equilibrium positions are expressed in terms of the average intermol. distance by calculating the average potential or spherical symmetry from an assumed force field between pairs of mols. Free vol.,  $\Delta H$  of vaporisation, and the equation of state have been calc. from the resulting potential function. W. R. A.

**Relation between surface tension and vapour pressure of liquids and liquid mixtures.**—See A., 1943, I, 304.

### III.—CRYSTAL STRUCTURE.

**Atomic and electronic distributions in liquid nitrogen, nitric oxide, and nitrous oxide.** P. C. Sharrah (*J. Chem. Physics*, 1943, 11, 436—441).—X-Ray diffraction patterns are analysed by the Fourier integral method. Only one pronounced peak is found in each case. Diat. aggregates in liquid  $\text{O}_2$  and NO, comparable with gas mols.,



are indicated. The data are consistent with a linear but not with a triangular mol. for  $\text{N}_2\text{O}$ . L. J. J.

**Crystal structure of magnesium carbide.** M. A. Bredig (*J. Amer. Chem. Soc.*, 1943, **65**, 1482—1483).—It is not possible to ascribe a face-centred tetragonal crystal lattice to  $\text{MgC}_2$ , such as that of  $\text{CaC}_2$  I, but there is some indication that  $\text{MgC}_2$  may be isotypical with the metastable  $\text{CaC}_2$  III. W. R. A.

**Orientation of  $\text{Fe}_3\text{C}$  crystals in tempered steel.** M. Arbusov and G. Kurdjumov (*J. Physics, U.S.S.R.*, 1942, **6**, 163—166).—X-Ray diffraction data for samples of monocrust. austenitic steel containing 1.4% of C, after gradual heating to  $600^\circ$ , show a regular orientation of  $\text{Fe}_3\text{C}$  crystals with respect to the original austenite axes. The [100], [010], and [001] planes of  $\text{Fe}_3\text{C}$  are parallel with the [455], [011], and [522] planes of the austenite, respectively. L. J. J.

**Structure of salt hydrates.** A. T. Jensen (5 *Nordiske Kemikermode*, 1939, 201—203).—The crystal structure of  $\text{SrCl}_2 \cdot 6\text{H}_2\text{O}$  has been determined by successive Fourier approximations. The unit cell (4.105 Å long) contains 1 mol. Each Sr atom is equidistant from 2 other Sr (4.108 Å), and has 6 Cl at 4.90 Å and 6 others at 5.17 Å. The structure is based on chains of the type  $-\text{3H}_2\text{O}-\text{Sr}(\text{H}_2\text{O})_3-\text{3H}_2\text{O}-\text{Sr}(\text{H}_2\text{O})_3-$ , the Cl playing a minor part in the stability of the structure. The existence of a centre of symmetry in the crystal suggests that half the chains (statistically distributed) are rotated through  $60^\circ$  with respect to the other half. M. H. M. A.

**Configuration of starch in the starch-iodine complex.** III. X-Ray diffraction studies on the starch-iodine complex. R. E. Rundle and D. French (*J. Amer. Chem. Soc.*, 1943, **65**, 1707—1710).—From X-ray diffraction, amylose-I complex (I) has a hexagonal unit cell ( $a_0$  12.97,  $c_0$  7.91,  $d_{100}$  11.23 Å) and a helical structure, with  $a_0$  the diameter and  $c_0$  the length of one turn in the helix. These dimensions agree well with a helix consisting of six glucose residues per turn. (I) has been prepared by subjecting amylose in the "V" configuration to I vapour, when one I per 6 glucose residues is absorbed, although this may not be the max. possible absorption. In the "A" and "B" configurations amylose does not absorb I. W. R. A.

**Structure of synthetic chain polymers as shown by X-rays.** C. S. Fuller and W. O. Baker (*J. Chem. Educ.*, 1943, **20**, 3—10).—X-Ray fibre patterns of polyethylene, polyisobutylene, polyvinyl alcohol, polyvinylidene chloride, several polyesters and polyamides, and cellulose triacetate are reproduced and discussed. L. S. T.

**Long X-ray diffraction spacings of the keratins.** R. S. Bear (*J. Amer. Chem. Soc.*, 1943, **65**, 1784—1785).—X-Ray diffraction of porcupine quill ( $\alpha$ -) and feather ( $\beta$ -) keratins establishes fibre-axis periods of 198 and 95 Å. W. R. A.

**Ferritin. V. X-Ray diffraction data on ferritin and apoferritin.** I. Fankuchen (*J. Biol. Chem.*, 1943, **150**, 57—59; cf. A., 1943, II, 146).—X-Ray diffraction data show that ferritin (I) and apoferritin crystallise in face-centred cubes of identical cell size, and contain the same protein; the powder X-radiograms differ in line intensities. The packing of the mols. is not disturbed by the introduction of Fe in (I), the Fe atoms apparently occupying interstices between protein mols. R. L. E.

**Molecular structure determination by electron diffraction.** O. Hassel (5 *Nordiske Kemikermode*, 1939, 113—118).—A review. M. H. M. A.

**Electron diffraction.** G. P. Thomson (*J. Inst. Metals*, 1943, **69**, 191—199).—A lecture. The val. of electron diffraction methods in studying the nature of polish on metals, the orientation of oil mols. during boundary lubrication, and the structure and orientation of crystals deposited on other crystal surfaces and of compounds formed in the solid state by chemical action on cryst. solids, is discussed. A. R. P.

**Structure of the trimeride of phosphonitrile chloride,  $\text{P}_3\text{N}_3\text{Cl}_4$ .** L. O. Brockway and W. M. Bright (*J. Amer. Chem. Soc.*, 1943, **65**, 1551—1554).—Electron diffraction investigation of  $\text{P}_3\text{N}_3\text{Cl}_4$  vapour supports a hexagonal ring with P and N alternately and  $\text{Cl}_2$  attached in pairs to P atoms. The following vals. are given: P—N  $1.65 \pm 0.03$ ; P—Cl  $1.97 \pm 0.03$  Å; angle Cl—P—Cl  $107-110^\circ$ . W. R. A.

**Electron diffraction investigation of diphenylene.** J. Waser and V. Schomaker (*J. Amer. Chem. Soc.*, 1943, **65**, 1451—1455).—Electron diffraction investigations substantiate Lothrop's formula (annexed) with the C—C distance in the hexagonal ring  $1.41 \pm 0.02$  Å, the C—C distance (marked a)  $1.46 \pm 0.05$  Å, the C—H (assumed)  $1.10$  Å, and  $\alpha$   $121 \pm 3^\circ$ . Preliminary crystal structure investigations indicate a monoclinic unit cell containing 8 mols., space-group probably  $\text{C}_{2h}^2$ — $\text{P}2_1/a$ . Quantum-mechanical calculations of the resonance energy and relative bond strengths are given. W. R. A.

**Rotation of molecules and ions in crystals.** C. Finbak (5 *Nordiske Kemikermode*, 1939, 177—183).—A review. M. H. M. A.

**Propagation of order in crystal lattices.** J. Ashkin and W. E. Lamb, jun. (*Physical Rev.*, 1943, [ii], **64**, 169—178).—Mathematical. Zernike's problem of the propagation of order in a binary crystal alloy is discussed by a matrix formalism of co-operative phenomena. Results are compared with available theoretical treatment. The problem is generalised and cases of more complicated configurations are examined. N. M. B.

**Statistics of two-dimensional lattices with four components.** J. Ashkin and E. Teller (*Physical Rev.*, 1943, [ii], **64**, 178—184; cf. Kramers, A., 1941, I, 451).—Mathematical. Consideration of a two-dimensional square lattice containing four kinds of atoms, and assuming distinct potential energies of interaction between like and between unlike atoms, shows that where like atoms attract a simple "reciprocity" relation exists between the partition functions at "reciprocally" related pairs of temp. This relation enables a prediction of the nature of the transition point (only one being assumed) to be made and the Curie temp. to be located. The reciprocity relation for attraction between like atoms is found to be invalid for attraction between unlike atoms. N. M. B.

**Theory of magnetisation and hysteresis curves of polycrystalline ferromagnetics.** E. Kondorski (*J. Physics, U.S.S.R.*, 1942, **6**, 93—110).—A polycryst. ferromagnetic substance consisting of a set of regions with one direction of easy magnetisation is considered. The hysteresis loop for the elementary regions is assumed to be bounded by straight lines. A relation between the magnetisation and the field strength, involving the angular dispersion of the regional axes, is obtained. In the case of randomly distributed axes the consequences of the theory are compared with experimental results for Co, Fe, steel, and permalloy in weak magnetic fields. H. J. W.

**Magnetic rotatory power of crystalline nickel sulphate in the short infra-red spectrum.** S. Breen, J. N. Humphrey, and L. R. Ingersoll (*Physical Rev.*, 1943, [ii], **64**, 75—77).—Measurements on thin crystals of the  $\alpha$ -hexahydrate by the spectro-radiometric method in the range  $0.7-1.9 \mu$ . at room temp. and at  $-125^\circ$  give curves showing marked anomalies in the dispersion of the rotation at  $\sim 0.69 \mu$ . and at  $1.16 \mu$ , corresponding with those found in the optical rotation for these  $\lambda\lambda$ . The ratio of the rotation at low and room temp. itself gives an anomalous curve. The effects can be qualitatively explained on the basis of the inverse Zeeman effect. N. M. B.

**Adiabatic demagnetisation of iron alum.** J. A. Sauer (*Physical Rev.*, 1943, [ii], **64**, 94—112).—Mathematical. The effect, near  $0^\circ$  K., on the magnetic moment and entropy, of perturbations due to cryst. field and magnetic dipole-dipole coupling is calc. exactly to second-order terms in the magnetic coupling and to third-order terms in the cryst. potential. Theoretical vals. of the adiabatic moment agree with available experimental vals. A true thermodynamic scale is established, enabling the temp. to be calc. at any val. of the magnetic field during demagnetisation. The relation of this scale to the temp. determined by the magnetic method is discussed. N. M. B.

**Anomalous dependence of the resistance of zinc in a magnetic field.** N. M. Nachimovitch (*J. Physics, U.S.S.R.*, 1942, **6**, 111—113).—The resistance of a single Zn crystal at  $1.5^\circ$  and  $4.2^\circ$  K. as a function of the strength of a transverse magnetic field shows anomalies at  $H = 10^4$  and  $2 \times 10^4$  gauss. The effect is similar to that observed by de Haas *et al.* in single Bi crystals (cf. A., 1936, 18). H. J. W.

**Frequency spectrum of crystalline solids. II. General theory and applications to simple cubic lattices.** E. W. Montroll (*J. Chem. Physics*, 1943, **11**, 481—495; cf. A., 1942, I, 260).—The Born-Kármán model is used as the basis for methods of calculation of the frequency spectrum and thermodynamic functions of cryst. solids not very close to their m.p., by means of moments found from traces of powers of a matrix. A simple cubic lattice has a spectrum with two max., near its middle and high-frequency end. The height of the former increases and that of the latter decreases with increasing interaction between next nearest neighbours relative to that between nearest neighbours. Sp. heats are calc. L. J. J.

**Slip and twinning in magnesium single crystals at elevated temperatures.** P. W. Bakarian and C. H. Mathewson (*Amer. Inst. Min. Met. Eng., Tech. Publ.* 1561, 1943, 28 pp.; *Met. Tech.*, **10**, No. 3).—Single crystals of Mg were made by Bridgman's method from metal melted in vac. and cast in  $\text{H}_2$ . Specimens cut in numerous crystal orientations were compressed under various stresses at atm. temp. to  $340^\circ$ , and the mechanism of plastic deformation was studied by X-ray and microscopical analyses. Tensile tests were also made on specimens formed by attack with aq. 25% HCl solution, which produced a highly polished surface. The only methods of deformation observed were by slip on the basal plane of the original crystal, twinning on the {102} plane, slip on the basal plane of twinned regions, and cleavage on the {101} plane. Shock-compression tests did not cause the {101} twin formation reported by Schiebold and Siebel (A., 1931, 898). Tension tests showed that the slip direction on {001} or {101} is along the first-order digonal axis in the plane of slip. The {101} slip bands are irregular, resembling those found





in  $\alpha$ -Fe, and slip bands in twin and parent crystal matched. Sublimation pits formed at high temp. followed slip bands and sometimes twin boundaries. J. C. C.

**Directional characteristics of single-texture-structure copper strip.** M. Cook and T. L. Richards (*J. Inst. Metals*, 1943, 69, 201—207).—The resolved shear stress on the slip planes in slip directions has been calc. in terms of the applied stress in various directions for Cu strip with a single-texture structure resembling that of a single crystal. The strip, which had been cold-rolled to 95% reduction and annealed for 1 hr. at 550°, showed a max. tensile strength, and elongation at 45° to the direction of rolling, and min. tensile strength at 22.5° and 67.5° thereto. The resolved shear stress on the operating slip planes required to cause fracture is const. for all directions of test-piece except the 0° and 90° directions, in which the elongation is a min.; cups made with strip having a single texture show pronounced ears also in these directions. A. R. P.

**Pressure effect on linear rate of crystallisation of silicates.** M. P. Volarovitch and A. A. Leontieva (*J. Phys. Chem. Russ.*, 1943, 17, 45—50).—The rate ( $v$ ) of crystal growth of  $\text{Na}_2\text{Si}_2\text{O}_6$  in a glass containing  $\text{SiO}_2$  73.3,  $\text{Na}_2\text{O}$  26.7 wt.-% is max. at 760°. Max.  $v$  increases from  $1.2 \times 10^{-5}$  at 1 kg. per sq. cm. to  $9.3 \times 10^{-5}$  cm. per sec. at 700 kg. per sq. cm. As the pressure on the glass was transferred by compressed  $\text{N}_2$ ,  $\text{N}_2$  may be the cause of the increase in  $v$ . More probably  $\eta$  of glass is lowered by pressure; the rate of bending of a horizontal glass fibre supported at its ends is at 325 kg. per sq. cm.  $\sim 30$  times that at 1 kg. per sq. cm., both at 500—550°. J. J. B.

**Cohesion of solid benzene at its m.p.** G. Bruni (*Kolloid-Z.*, 1943, 103, 60—61).—The tensile strength of plates of solid  $\text{C}_6\text{H}_6$  at its m.p., prepared as free as possible from fissures, was found to be 14.5 kg. per sq. cm., and the breaking length 143.28 m. R. H. F.

#### IV.—PHYSICAL PROPERTIES OF SUBSTANCES.

**Mol. wt. of solid benzene derived from its cohesion.** G. Bruni (*Kolloid-Z.*, 1943, 103, 61—65; see above).—The author's general equation of state is applied to solid  $\text{C}_6\text{H}_6$  at its triple point. The mol. wt. calc. from it, using the experimental val. for the cohesion, corresponds with  $(\text{C}_6\text{H}_6)_{18}$ , exactly one ninth of the val. at the crit. point,  $(\text{C}_6\text{H}_6)_{182}$ . Some significance is attached to the factor 9, and the existence of a sub-unit of the H atom of at. wt. one ninth is postulated. R. H. F.

**Relation between m.p. and mol. wt. of paraffins.**—See B., 1943, I, 480.

**Viscosity and mol. wt. of solutions of cellulose and its derivatives.**—See B., 1943, II, 373.

**Electrical conductivity and isothermal Hall effect in cuprous oxide.** W. Feldman (*Physical Rev.*, 1943, [ii], 64, 113—118).—Investigations from room temp. to 700° show that at the higher temp. the conductivity is represented by  $\sigma = Ae^{-E/kT}$ , but that below 300° the exponential law is not obeyed. The max. and min. of the  $\sigma$  curves in the latter region are presumed to result from a combination of a saturation of clusters and a rapid decrease of mobility with temp. Hall effect measurements up to 450° show that the no. of current carriers does not obey the exponential law of temp. dependence. An anomaly in the mobility is observed at  $\sim 150^\circ$  where the mobility changes from a  $T^{-3}$  to a  $T^{-7}$  dependence. N. M. B.

**Effect of high electrostatic fields on the conductivity of tungsten.** P. L. Vissat (*Physical Rev.*, 1943, [ii], 64, 119—125).—Measurements on a W wire 0.0078 mm. diameter in vac. with fields of  $\sim 10^6$  v. per cm. showed that an increase in resistance always resulted from application of the field, the change was different for different temp. of the filament and variations of vac., no measurable change resulted unless the field exceeded a certain val., and a small leakage or ionisation current was associated with the changes in resistance. Calculations show that results are wholly explained by ionisation currents if it is assumed that most of the ionisation occurs near the surface of the wire. N. M. B.

**Magnetic moment of superconductors.** I. E. Nachutin (*J. Physics, U.S.S.R.*, 1942, 6, 114—115).—The magnetic moment of a single-crystal sphere of Sn at 2.59° K. for fields up to the crit. val. was measured. No significant difference between the behaviour in fields parallel to the tetrad axis and to one of the diad axes was detected. H. J. W.

**Magnetic susceptibility of oxygen and nitric oxide at low field strengths.** A. Burris and C. D. Hause (*J. Chem. Physics*, 1943, 11, 442—446).—Measurements of mass susceptibility with a Rankine magnetic balance at 1 atm. and  $\sim 15$  oersted give vals. of  $106.3 \pm 0.2 \times 10^{-6}$  for  $\text{O}_2$  and  $47.2 \times 10^{-6}$  for NO. For  $\text{O}_2$ ,  $\chi_M T$  is  $0.997 \pm 0.002$ , and for NO the vol. susceptibility is  $0.0590 \times 10^{-6}$ . The mass susceptibility of  $\text{H}_2\text{O}$  at 20° is taken as  $-0.7200 \times 10^{-6}$ . L. J. J.

**Magnetochemical studies. XL. Magnetic behaviour of uranium and uranium tetrachloride.** H. Bommer (*Z. anorg. Chem.*, 1941, 247,

249—258).—The susceptibility ( $\chi$ ) of Fe-free U was measured between 90° and 488° K.  $\chi$  is independent of the field strength between 195° and 488° K. U is paramagnetic, but the  $1/\chi_M T$  graph is not linear.  $\chi_{\text{at}}$  at room temp. =  $+620 \times 10^{-6}$ . The Th-U series does not conform with the earlier rules for the magnetic behaviour of transition elements.  $\text{UCl}_4$ , above room temp., obeys the Curie-Weiss law with  $\theta +50^\circ$ . The moment is 2.7 Bohr magnetons. Below room temp. at. binding occurs. J. F. H.

**Specific heat ratios in carbon dioxide.** L. Katz (*J. Chem. Physics*, 1943, 11, 496—497).—A no. of published vals. of  $\gamma$  for  $\text{CO}_2$  when reduced to zero pressure are  $>$  vals. calc. from spectroscopic data. L. J. J.

**Heat contents at high temperatures of the anhydrous chlorides of calcium, iron, magnesium, and manganese.** G. E. Moore (*J. Amer. Chem. Soc.*, 1943, 65, 1700—1703).—Vals. of heat contents from room temp. to 1670° K. have been determined for anhyd.  $\text{CaCl}_2$ ,  $\text{FeCl}_2$ ,  $\text{MgCl}_2$ , and  $\text{MnCl}_2$ . Vals. of m.p. and heats of fusion (g.-cal. per g.-formula wt.) are: 1055°,  $6780 \pm 80$ ; 950°,  $10,280 \pm 50$ ; 987°,  $10,300 \pm 50$ ; 923°,  $9000 \pm 50$ . Heat content and entropy increments are tabulated at 100° intervals from 400° to 1700° K. W. R. A.

**Thermal data. XVII. Heat capacity, entropy, and free energy of formation of cyclohexane. New method of heat transfer in low-temperature calorimetry.** R. A. Ruehrwein and H. M. Huffman (*J. Amer. Chem. Soc.*, 1943, 65, 1620—1625).—Vals. of  $C_p$  from 13° to 301° K. were measured calorimetrically in an apparatus (described) involving a new method of heat transfer by mechanical contact. Vals. of heat of transition, heat of fusion, and entropy and free energy at 298.16° K. are:  $1610.8 \pm 0.4$ ;  $639.8 \pm 0.3$  g.-cal. per mol.;  $48.84$  g.-cal. per degree per mol.;  $5.99$  kg.-cal. per mol. (See also C., 1944, Part I.) W. R. A.

**Triple point of water.** W. Waring (*Science*, 1943, 97, 221—222).—The triple point is at  $+0.0098^\circ$  and not at  $+0.0074^\circ$  as usually given. Inconsistencies in v.p. vals. for ice and water near 0° are pointed out. E. R. R.

**Relation between  $d_{15}^{15}$  and  $d_{15}^{20}$  for petroleum products.**—See B., 1943, I, 479.

**Vapour pressure curves for normal H and D compounds.** K. Stokland (5 *Nordiske Kemikermode*, 1939, 204—205).—V.p. curves have been determined for  $\text{Si}_n\text{H}_{2n+2}$  and  $\text{Si}_n\text{D}_{2n+2}$  ( $n = 1-4$ ) from 1 to 760 mm. Hg. When  $n = 1$ , the H compound has higher v.p. only below  $\sim 100$  mm. Hg. and when  $n = 2, 3$ , or 4 the D compounds have higher v.p. throughout, thus disproving Clusius' rules (A., 1938, I, 129). M. H. M. A.

**Determination of orthobaric curve and critical density and temperature with data for ethylene [di]chloride and boron tribromide.** K. Højendahl (5 *Nordiske Kemikermode*, 1939, 209—211).—Varying amounts of the material are sealed (air-free) into ampoules (8 cm. long, 4 mm. diameter); these are heated inside a Cu cylinder, and the temp. of disappearance of the meniscus is observed by the disappearance of a luminous reflected image.  $\text{BBr}_3$  has  $T_c = 300^\circ \pm 2^\circ$ ,  $D_c = 0.9$ ;  $\text{C}_2\text{H}_4\text{Cl}_2$  has  $T_c = 290^\circ \pm 2^\circ$ ,  $D_c = 0.45$ . M. H. M. A.

#### V.—SOLUTIONS, DISPERSIONS, AND MIXTURES.

**Statistical mechanics of binary mixtures.** T. Alfrey and H. Mark (*J. Chem. Physics*, 1943, 11, 496).—A reply to Kottler (A., 1943, I, 179). L. J. J.

**Specific heats of mixed acids at higher temperatures.** J. J. Morgan, D. A. Bender, and R. G. Capell (*Chem. Met. Eng.*, 1943, 50, No. 6, 122—124).—Determinations of sp. heats of mixtures of  $\text{HNO}_3$  and  $\text{H}_2\text{SO}_4$  are reported for 40°, 60°, 80°, and 100° and triangular plots are given. For these temp. the change of sp. heat with temp. is small. H. W. T.

**Conception of osmotic pressure.** A. Thiel (*Kolloid-Z.*, 1940, 91, 316—318).—An answer to Metcalf's criticisms (A., 1940, I, 354) of the author's theory of osmosis (*ibid.*, 316) and a criticism of Metcalf's theory. J. H. Ba.

**Determination of ionic weights by the dialysis method. II. Sources of error in the method.** A. von Kiss and V. Acs (*Z. anorg. Chem.*, 1941, 247, 190—204).—In solutions containing a foreign electrolyte in sufficient concn. the relation  $\lambda/\sqrt{M} = \lambda_\infty/\sqrt{M_\infty} = \text{const.}$  (I) holds;  $M$  and  $M_\infty$  are the wts. and  $\lambda$  and  $\lambda_\infty$  are the dialysis coeffs. of the reference and unknown ions respectively. For free diffusion Riecke's law,  $D_1/\sqrt{M_1} = D_2/\sqrt{M_2} = \text{const.}$  is only approx. true. Only ions with approx. equal wts. and similar structure can be compared. The external, "physical" hydration of the ions hinders diffusion and may lead to invalidity of equation (I). It is doubtful whether reliable hydration nos. can be obtained from the dialysis method. The various effects of complex formation may cause invalidity or indeterminateness of (I). The variable results obtained with different membranes show that narrow-pored membranes are unsuitable. It was shown experimentally that Cello-



phane and Cuprophane are unsuitable but that Cellafilter gives good constancy for  $\lambda_2/\sqrt{M_2}$ . J. F. H.

**Alloys of magnesium. XIV. Constitution of the magnesium-rich alloys of magnesium and manganese.** J. D. Grogan and J. L. Haughton (*J. Inst. Metals*, 1943, 69, 241—248).—Alloys with up to 5% Mn were prepared by reaction of a large mass of molten Mg with anhyd.  $\text{MnCl}_2$  and the liquidus of the system was then determined by analysing dip samples taken at definite temp. above the eutectic (651°, 2% Mn). The results showed the liquidus to be almost linear between the eutectic temp. and 860°, 7% Mn. From 0 to 2% Mn the liquidus lies very close to the solidus. The solid solubility of Mn in Mg decreases rapidly from ~2% at 650° to <0.5% at 450°.

A. R. P.

**Constitution of magnesium-manganese-zinc-aluminium alloys in the range 0–5% Mg, 0–2% Mn, 0–8% Zn. I. The liquidus.** E. Butchers, G. V. Raynor, and W. Hume-Rothery. **II. Composition of the  $\text{MnAl}_3$  phase.** G. V. Raynor and W. Hume-Rothery. **III. The 500° and 400° isothermals.** A. T. Little, G. V. Raynor, and W. Hume-Rothery (*J. Inst. Metals*, 1943, 69, 209—228, 415—421, 423—440).—I. Liquidus curves have been determined accurately for the systems Mg–Al and Zn–Al, and liquidus surfaces for the systems Mg–Zn–Al, Mg–Mn–Al, Mn–Zn–Al, and Mg–Mn–Zn–Al in the Al-rich region. Alloys containing Mn are of two classes in one of which  $\text{MnAl}_3$  and in the other  $\alpha$ -Al-rich solution is primary. Equations are given for all the curves and surfaces of primary crystallisation and for the binary eutectic surface in the quaternary system. The f.p. depression in the Mg–Zn–Al system is slightly < would be expected from a purely additive relation based on the liquidus curves of the binary systems.

II. From slowly cooled Mn–Al alloys with and without Mg or Zn or both, needles of  $\text{MnAl}_3$  were isolated by anodic dissolution of the Al in 2N-HCl or 2N- $\text{HNO}_3$ , and examined by X-rays and chemical analysis. The composition  $\text{MnAl}_3$  was confirmed. No Mg was dissolved by the compound when the alloy contained Mg, but a small amount (>0.4%) of Zn was dissolved when the alloy contained up to 8% Zn.

III. At 500° Al dissolves about 0.35% Mn, but additions of Mg or Zn reduce this val. to <0.1% with 4% Mg or 2% Zn. In the quaternary system the totally solid region at 500° is bounded by a vertical surface such that % Mg =  $12 - 1.32 \times (\% \text{ Zn}) + 0.052 \times (\% \text{ Zn})^2$ , and the homogeneous  $\alpha$ -field by a surface such that % Mn =  $1/[0.6 \times (\% \text{ Mg}) + 0.8 \times (\% \text{ Zn}) + 0.55 \sqrt{(\% \text{ Mg} \times \% \text{ Zn})} + 1.667]^2$ . Alloys with more Mn than that calc. from the second equation contain  $\text{MnAl}_3$  with or without a small amount of liquid according to the % of Zn and Mg. At 400° the amount of Mn retained in solid solution is negligible, all the alloys containing  $\text{MnAl}_3$  needles. In the Zn–Mg–Al system within the range studied the alloys consist of  $\alpha$  or  $\alpha + \text{Al}_3\text{Mg}_2\text{Zn}_3$ , the boundary between the two fields being given by  $(\text{at.}\% \text{ Zn})/(\text{at.}\% \text{ Mg}) = K$ ; this expression also holds for lower temp. with other vals. of  $K$  such that  $d \log K/dT = -Q/RT^2$ . In the quaternary system the alloys are of the  $\alpha + \text{MnAl}_3$  or  $\alpha + \text{MnAl}_3 + \text{Al}_3\text{Mg}_2\text{Zn}_3$  type; methods of calculating the boundary between the two fields are described.

A. R. P.

**Constitution of alloys of aluminium with manganese, silicon, and iron. I. Binary system aluminium-manganese. II. Ternary systems aluminium-manganese-silicon and aluminium-manganese-iron. H. W. L. Phillips. III. Ternary system aluminium-silicon-iron. IV. Quaternary system aluminium-manganese-silicon-iron.** H. W. L. Phillips and P. C. Varley (*J. Inst. Metals*, 1943, 69, 275—316, 317—350).—I. The Al–Mn system was investigated by thermal analysis and by micrographic examination of annealed and slowly cooled alloys. On slow cooling Al and  $\text{MnAl}_3$  form a eutectic at 2.16–2.2% Mn, 655°, but extrapolation from solubility measurements places the eutectic at 1.9% Mn. Peritectic reactions occur at 680°, liquid +  $\text{MnAl}_3 \rightarrow \text{MnAl}_5$ ; at 822°,  $\delta + \text{liquid} \rightarrow \text{MnAl}_3$ ; and at 880°, liquid +  $\epsilon \rightarrow \delta$ . The  $\delta$  and  $\epsilon$  phases were not identified. On slow cooling a sheath of reaction product envelops the primary phase and the solid alloys often contain metastable phases; completion of the reactions is obtained only by prolonged annealing just below the peritectic temp. The apparent reliquifaction which occurs on cooling alloys with 25–37% Mn through the range 680–700° is shown to be due to the difference in crystal habit between the primary  $\text{MnAl}_3$  above 700° and the  $\text{MnAl}_3$  formed peritectically at 680°.

II. The constitution of Al–Mn–Si alloys over the range in which Al is primary was studied as they were slowly cooled. The Al-rich alloys contain at least one of the phases  $\text{MnAl}_3$ , Si, and a ternary  $\alpha$ -(Mn–Si) phase formed peritectically from  $\text{MnAl}_3$ ; there is an invariant point at 649°, Mn 2, Si 1.3% at which  $\text{MnAl}_3$ ,  $\alpha$ -(Mn–Si), and Al are in equilibrium with liquid.  $\alpha$ -(Mn–Si) appears to have a variable composition; it forms a ternary eutectic with Si and Al at 573°, Si 11.75, Mn 0.75%. In alloys rich in Mn and Si the primary crystals consist of ternary  $\beta$ -(Mn–Si) which forms a eutectic complex with  $\text{MnAl}_3$ , reacts peritectically with liquid to give  $\text{MnAl}_3$  or  $\alpha$ -(Mn–Si), and has two invariant points in the boundaries of its primary field, (a) at 660°, Mn 3.4, Si 0.5% at which  $\text{MnAl}_3$ ,  $\beta$ -(Mn–Si), and  $\text{MnAl}_3$  are in equilibrium with liquid, and (b) at 658°, Mn 2.7,

Si 1.3% at which  $\text{MnAl}_3$ ,  $\beta$ -(Mn–Si), and  $\alpha$ -(Mn–Si) are in equilibrium with liquid. As in the binary Mn–Al alloys equilibrium is attained in the ternary alloys only after a prolonged high-temp. anneal. In Al-rich alloys a long anneal tends to complete the formation of  $\alpha$ -(Mn–Si) from  $\text{MnAl}_3$  and hence reduces the amount of free Si in the alloy, an important point in commercial alloys since free Si tends to impart a brown colour to the anodic film. In the Al–Mn–Fe system  $\text{MnAl}_3$ ,  $\text{FeAl}_3$ , and Al form a ternary eutectic at 654°, Mn 0.75, Fe 1.75%.  $\text{FeAl}_3$  forms eutectics with both  $\text{MnAl}_3$  and  $\text{MnAl}_3$  and can dissolve considerable Mn, whilst both Mn compounds will dissolve Fe.  $\text{MnAl}_3$ ,  $\text{MnAl}_3$ , and  $\text{FeAl}_3$  are in equilibrium with liquid at 730°, Fe 3.4, Mn 2.4%. Fe raises the peritectic temp. at which  $\text{MnAl}_3$  is formed and causes  $\text{MnAl}_3$  to be primary at a lower Mn content of the alloy. On adding Fe to commercial Mn–Al alloys, therefore, the size and no. of the  $\text{MnAl}_3$  crystals are increased and then  $\text{FeAl}_3$  appears; the crystals of both compounds are broken up on rolling and the particles restrict grain growth on annealing.

III. Earlier work on the constitution of the Al–Si–Fe system has been confirmed except that the liquidus temp. in the primary  $\text{FeAl}_3$  field were found to be slightly low owing to undercooling.

IV. The equilibria in the range from pure Al to 4:4:4:88 Fe–Si–Mn–Al alloy have been studied in detail. No quaternary compounds were found;  $\alpha$ -(Fe–Si) and  $\alpha$ -(Mn–Si) form a continuous series of solid solutions and there are six primary regions due to Al,  $\text{FeAl}_3$ ,  $\text{MnAl}_3$ ,  $\text{MnAl}_3$ ,  $\beta$ -(Mn–Si), and  $\alpha$ . Al forms binary eutectic surfaces with  $\text{FeAl}_3$ ,  $\text{MnAl}_3$ ,  $\alpha$ ,  $\beta$ -(Fe–Si), and Si;  $\text{FeAl}_3$  forms similar surfaces with  $\text{MnAl}_3$ ,  $\text{MnAl}_3$ , and  $\beta$ -(Mn–Si). The various peritectic reactions in the system rarely proceed to completion, envelopment frequently occurring and causing the persistence of many metastable constituents; undercooling and unsaturation of the solid phases often prevent attainment of equilibrium. Quaternary invariant points occur at (a) 731°, Mn 3.85, Si 0.35, Fe 2.35%, between liquid,  $\text{MnAl}_3$ ,  $\text{FeAl}_3$ ,  $\beta$ -(Mn–Si), and  $\text{MnAl}_3$ ; (b) 695°, Mn 2.60, Si 1.35, Fe 2.35%, between liquid,  $\text{FeAl}_3$ ,  $\beta$ -(Mn–Si),  $\text{MnAl}_3$ , and  $\alpha$ ; (c) 648°, Mn 0.35, Si 1.75, Fe 2.00%, between liquid,  $\text{FeAl}_3$ ,  $\text{MnAl}_3$ ,  $\alpha$ , and Al; (d) 575°, Mn 0.2, Si 11.7, Fe 0.6%, between liquid,  $\alpha$ ,  $\beta$ -(Fe–Si), Al, and Si. Final solidification of all the alloys occurs at the Al– $\alpha$ -Si or the Al– $\beta$ -(Fe–Si)–Si ternary eutectic according to the composition and the rate of diffusion of Fe into the solid phases in the early stages of solidification. In commercial Mn–Al alloys with incidental Fe and Si impurities a small amount of Mn is taken into solid solution by Al or  $\text{FeAl}_3$ , the remainder occurring as  $\text{MnAl}_3$  or associated with Fe and Si as  $\alpha$ . The Si is partly in solution in the Al, partly combined as  $\alpha$ - or  $\beta$ -(Fe–Si), and partly as free Si. Fe occurs as  $\text{FeAl}_3$ , dissolved in  $\text{MnAl}_3$ , or combined as  $\alpha$ - or  $\beta$ -(Fe–Si). Hot-working or annealing tends to complete the peritectic reactions involving the formation of  $\alpha$  from  $\text{MnAl}_3$  or  $\text{FeAl}_3$ , and thus leads to reduction in the amount of free Si.

A. R. P.

**Constitution of the iron-rich iron-nickel-silicon alloys at 600°.** E. S. Greiner and E. R. Jette (*Amer. Inst. Min. Met. Eng.*, 1943, *Tech. Publ.* 1573, 16 pp.; *Met. Tech.*, 10, No. 3).—This investigation was carried out by X-ray diffraction methods on homogenised powdered samples quenched from ~600°. In a ternary plot, the body-centred cubic  $\alpha$  phase is bounded by four two-phase areas separated by three three-phase areas. Three of the phases correspond in structure to similar phases in the binary Fe–Ni or Fe–Si alloys; two are new phases:  $\lambda$ , a cubic structure with an edge length of 6.131 Å and  $\epsilon$ , a tetragonal structure with  $a$  8.308 Å and  $c$  9.012 Å. The solid solubility of Ni in the  $\alpha$  phase changes from 3.5 at.-% in Fe–Ni alloys to 13.6 at.-% in ternary alloys containing 22.4 at.-% of Si.

J. C. C.

**Hardness of certain primary copper solid solutions.** J. H. Frye, jun., and K. W. Caum (*Amer. Inst. Min. Met. Eng.*, 1943, *Tech. Publ.* 1554, 8 pp.; *Met. Tech.*, 10, No. 2).—Meyer hardness analyses were carried out on alloys of Cu with >5% of Ge, Ga, Zn, and As, the tests being made on worked and annealed vac.-melted samples having a grain diameter of 0.074 mm. For a given at.-% of each solute, the Meyer hardness vals.  $P_s$  and  $P_a$  were  $\propto$  the calc. expansion of the Cu lattice.

J. C. C.

**Hardness and lattice stress in solid solutions.** J. H. Frye, jun., J. W. Caum, and R. M. Treco (*Amer. Inst. Min. Met. Eng.*, 1943, *Tech. Publ.* 1572, 7 pp.; *Met. Tech.*, 10, No. 3).—There is a single, simple relation between the increase in hardness and the increase in lattice stress when Zn dissolved in Cu is replaced by Ga, Ge, or As and when Cd in Ag is replaced by In, Sn, or Sb. In these relations, the overlap of the electron clouds of the ions as a possible factor additional to the lattice parameter in determining hardness is eliminated.

J. C. C.

**Ageing in the solid solution of silver in aluminium.** A. H. Geisler, C. S. Barrett, and R. F. Mehl (*Amer. Inst. Min. Met. Eng.*, 1943, *Tech. Publ.* 1557, 20 pp.; *Met. Tech.*, 10, No. 2).—X-Ray diffraction studies of Al alloys containing 10, 20, and 30% of Ag aged at 158–303° indicate that ageing is accompanied by pptn. of a transformation lattice  $\gamma'$  in thin plate-like particles which later transform into the equilibrium phase  $\gamma$ . The matrix planes along which the



platelets are formed can be determined from central radial streaks in Laue photographs. Microscopical examinations show that the  $\gamma$ - $\gamma$  transformation is accompanied by a hitherto unobserved discontinuous type of reaction nucleated at the grain boundaries and probably involving recrystallisation of the strained matrix. The mechanism of hardening is discussed; in these alloys the chief factors may be the pptn. of  $\gamma'$  and the stresses involved in keeping the equilibrium phase in this strained condition. J. C. C.

**Thermodynamical theory of restoration phenomena in the ageing of copper-aluminium alloys.** S. T. Konobeevski (*J. Inst. Metals*, 1943, 69, 397-413).—In the ageing of Cu-Al alloys the  $\text{CuAl}_2$  phase is pptd. in thin plates and, owing to its high degree of dispersion, can exist in metastable equilibrium in slightly supersaturated solution; when the temp. is raised the ppt. redissolves, thus producing the "restoration" observed when naturally aged duralumin is heated. From the temp. at which restoration is completed the relative amount of the pptd. phase may be calc. as a function of the temp. and total alloy concn. The dimensions of the equilibrium nuclei are independent of the total alloy concn, but the no. of pptd. crystals depends on the initial concn. of the solid solution since this determines the crit. magnitude of the nucleus and hence the energy of formation of the phase. If the no. of grains formed depends exponentially on their energy the magnitude of the pptd. crystals and the surface energy of the boundary between the pptd. phase and the solid solution can be estimated. On this theory the dimensions of the equilibrium crystal of  $\text{CuAl}_2$  formed during room-temp. ageing of Cu-Al alloys are diameter  $\sim 10^{-7}$  cm. and thickness  $\sim 3 \times 10^{-8}$  cm., vals. which agree closely with those found experimentally by other workers. In the 5% Cu-Al alloy the no. of pptd. crystals is  $1.3 \times 10^{10}$  per g. and in the 2% Cu alloy  $0.5 \times 10^{10}$  per g. The sp. surface energy is  $0.75 \times 10^{-5}$  g.-cal. per g. A. R. P.

**Effects of precipitation treatment of binary magnesium-aluminium alloys.** F. A. Fox and E. Lardner (*J. Inst. Metals*, 1943, 69, 373-396).—The structures produced by pptn. of  $\beta$  from supersaturated solid solutions of Al in Mg depend on the Al content, the pptn. temp., and, to a smaller extent, the time. At any temp. the ppt. first forms at the grain boundaries and then, at  $<200^\circ$ , grows into the grains in the form of closed waves producing a pearlitic structure; in large-grained alloys a mosaic type of pptn. appears soon after pearlite begins to form. In alloys with  $>8\%$  Al crystallographic osmondite forms, some time after the first appearance of pearlite, in those areas of the grain which are free from the latter, which then ceases to grow. Above  $200^\circ$  coarse sorbitic and pearlitic areas form from the grain boundaries inwards, mosaic outlines appear soon after the sorbite, and these are followed by crystallographic osmondite which rapidly coarsens to granular osmondite. For a given pptn. treatment the finest ppt. and the best mechanical properties of the alloy are obtained with the highest Al contents. A. R. P.

**Mechanism of precipitation from solid solutions of zinc in aluminium, magnesium in aluminium, and of some magnesium-base alloys.** A. H. Geisler, C. S. Barrett, and R. F. Mehl (*Amer. Inst. Min. Met. Eng.*, 1943, *Tech. Publ.* 1558, 22 pp.; *Met. Tech.*, 10, No. 2).—In Zn-Al alloys, X-ray diffraction, electrical resistivity, and hardness measurements indicate that age-hardening accompanies the formation on the octahedral matrix planes of coherent platelets having a strained lattice of the Zn type. On over-ageing, when softening is observed, the particles grow but break away from the matrix before they are thick enough to diffract as three-dimensional gratings. In Mg-Al alloys, coherent platelets first form on {100} matrix planes and grow to a well-defined Widmanstätten figure, subsequent pptn. occurring on {120} Al planes. Age-hardening occurs during the entire decomp. In Pb-Mg and Sn-Mg alloys, the platelets do not grow very large and hardening is negligible. The results lend support to a modified theory of age-hardening; crit. dispersion is not sufficient in itself to explain hardening, but it is necessary that the matrix and the ppt. should be closely related in orientation. Hardening is  $\propto$  the size to which these coherent particles may grow before breaking away from the matrix. J. C. C.

**Electrical properties of copper-manganese-aluminium alloys.** M. Cook and W. O. Alexander (*Trans. Faraday Soc.*, 1943, 39, 260-265).—The sp. resistance and temp. coeff. of resistance have been measured for 4 binary and 4 ternary alloys containing Cu 88.0-95.5%, Mn 5-10%, Al 1-5.5%, in the form of wire, hard drawn and annealed at  $600^\circ$ , over the range  $0-350^\circ$ . The tensile strength, elongation, and coeff. of thermal expansion were also determined. Alloys with  $\leq 2\%$  of Al do not scale at temp.  $<600^\circ$ . F. L. U.

**Magnetic behaviour of superconducting tin-zinc alloys.** B. G. Lazarev and I. E. Nachutin (*J. Physics, U.S.S.R.*, 1942, 6, 116-119).—Sn-Zn alloys containing 90%, 34%, and 10% of Sn and pure Sn were used. The crit. magnetic field is the same function of the temp. (between  $2.64^\circ$  and  $3.72^\circ$  K.) for all of these. In weak fields the magnetic behaviour of all the samples was identical, but in stronger fields the hysteresis increased with the proportion of Zn in the alloy. It is suggested that magnetic screening of the

Zn by superconducting grains of Sn and the formation of closed superconducting circuits are possible explanations of the observed effects. H. J. W.

**Solubility of salts in aqueous carbamide solutions.** K. J. Pedersen (5 *Nordiske Kemikermode*, 1939, 189-191).—The solubilities of 15 org. and inorg. salts in 0.25-1.0M. aq.  $\text{CO}(\text{NH}_2)_2$  at  $18^\circ$  have been determined (cf. A., 1939, I, 195).  $\text{Na}_2\text{C}_2\text{O}_4$  had a smaller solubility than in  $\text{H}_2\text{O}$ , but all the others showed increases,  $\alpha = (s - s_0)/cs$  being almost independent of  $c$ . Vals. for  $\alpha$  were in rough agreement with the theory that the increased solubilities are due partly to increased  $I$  and partly to increased  $\epsilon$ . M. H. M. A.

**Solubility of potassium iodide in potassium hydroxide solutions at  $20^\circ$ .** H. D. Kirschman and R. Pomeroy (*J. Amer. Chem. Soc.*, 1943, 65, 1695-1696).—Solubility and  $\rho$  of KI in 0-14.35N-KOH (1%  $\text{K}_2\text{CO}_3$ ) at  $20^\circ$  have been determined. The curves show no discontinuities. W. R. A.

**Electrical conductivities of salts and solubilities of barium sulphate in water-ethyl alcohol solutions.**—See A., 1944, I, 18.

**Solubility and dissociation of cryolite in aqueous [salt] solutions.** H. Buchwald (5 *Nordiske Kemikermode*, 1939, 259-260).—The solubility of  $\text{Na}_3\text{AlF}_6$  (I) in  $\text{H}_2\text{O}$  ( $0-95^\circ$ ) and dil. HCl, HF, NaCl, and NaF solutions ( $25^\circ$ ) has been determined. The solubility decreases with increasing  $[\text{Na}^+]$ ,  $[\text{F}^-]$ , and pH, but is unaffected by change in  $[\text{Cl}^-]$ . The pH of saturated (I) solution in dil. HCl is  $>$  theoretical and agrees with the complete dissociation:  $(\text{I}) \rightarrow 3\text{Na}^+ + \text{AlF}_6^{3-} + 2\text{F}^-$  ( $\text{H}^+ + \text{F}^- \rightarrow \text{HF}$ ). As  $K_8 = ([\text{Na}^+]^3 \cdot [\text{AlF}_6^{3-}] \cdot [\text{F}^-]^2)$  is nearly const. ( $\sim 2.7 \times 10^{-16}$ ) in all the above solutions it is concluded that this dissociation of (I) always occurs. M. H. M. A.

**Solubilities of high mol. wt. symmetrical normal aliphatic ketones.** F. M. Garland, C. W. Hoerr, W. O. Pool, and A. W. Ralston (*J. Org. Chem.*, 1943, 8, 344-357).—Solubilities of  $\text{COR}_2$  ( $\text{R} = n\text{-C}_6\text{H}_{13}$ ,  $\text{-C}_{11}\text{H}_{23}$ ,  $\text{-C}_{13}\text{H}_{27}$ ,  $\text{-C}_{15}\text{H}_{31}$ , and  $\text{-C}_{17}\text{H}_{35}$ ) in  $\text{C}_6\text{H}_6$ , cyclohexane,  $\text{CCl}_4$ ,  $\text{EtOAc}$ ,  $\text{BuOAc}$ ,  $\text{COMe}_2$ ,  $\text{COMeEt}$ ,  $\text{MeOH}$ , 95%  $\text{EtOH}$ ,  $\text{Pr}^i\text{OH}$ ,  $\text{Bu}^i\text{OH}$ ,  $\text{EtNO}_2$ , and  $\text{MeCN}$  at, usually,  $\sim 10-80^\circ$ , are recorded. R. S. C.

**Photoactivation of crystals.** G. Cohn (5 *Nordiske Kemikermode*, 1939, 192).—The adsorptive power of ZnS and CdS (I) phosphors for dyes is increased by illumination, but of (I) for phenolphthalein is decreased by illumination with light unabsorbed by (I). (Cf. A., 1939, I, 561.) M. H. M. A.

**Adsorption of vapours on carbonised coal.**—See B., 1943, I, 477.

**Surface tension of white phosphorus.** E. Hutchinson (*Trans. Faraday Soc.*, 1943, 39, 229-234).—The surface tension of white P has been measured by the max. bubble pressure method with  $\text{CO}_2$  over the range  $50.0-68.7^\circ$ . The respective vals. of  $\gamma$  at these temp. are  $69.70$  and  $64.95 \pm 0.3$  dynes per cm. The val. of the at. parachor of P in compounds is intermediate between those calc. from these results for ring structures  $\text{P}_4$  and  $\text{P}_8$ . The Eötvös const. is 1.38. A method for measuring interfacial tensions modelled on Sugden's max. bubble pressure method is described, and measurements are recorded for the tension of molten P against  $\text{H}_2\text{O}$ ,  $\text{C}_6\text{H}_6$ , cyclohexane,  $n\text{-C}_8\text{H}_{18}$ ,  $\text{EtOH}$ , and  $\text{COMe}_2$ . F. L. U.

**Surface energy and heat of vaporisation.** H. Dunken, H. Klapproth, and K. L. Wolf (*Kolloid-Z.*, 1940, 91, 232-243).—Stefan's relation between the mol. internal heat of vaporisation  $L_1$  and the total mol. surface energy  $W_s$ , viz.,  $L_1/W_s = \phi = 2$ , does not hold in general but depends on the co-ordination no. of the substance in the bulk ( $z$ ) and in the surface ( $z_s$ ). In general  $\phi = z/(z - z_s)$ . Vals. of  $\phi$  are calc. for various lattice structures. For liquids  $\phi$  (varies between 2.2 and 8.3) depends also on the difference in association in the vapour and liquid phases and for non-polar liquids has a val. 2.5-3.5. This indicates spherical symmetry in the mol. packing. Allowing for association in the liquid phase a similar val. of  $\phi$  is obtained for various alcohols. A knowledge of  $\phi$  can be used to assess the degree or heat of association of a liquid. J. H. BA.

**Capillary systems. XIX. Capillary back pressure, capillary diameter, and the passage of a phase boundary through a single capillary and capillary systems.** (Theoretical.) E. Manegold, K. Solf, and E. Albrecht (*Kolloid-Z.*, 1940, 91, 243-275).—Formulæ are derived for the times and pressures of exit, entrance, and bubble formation when a phase boundary passes through a capillary system. Calculations of these quantities are made for certain systems. Knöll's results (A., 1940, I, 273) are analysed in the light of the theory. J. H. BA.

**Surface diffusion.** H. Wergeland (5 *Nordiske Kemikermode*, 1939, 253).—The probability,  $S$ , that an adsorbed mol. will migrate to an adjacent activated point of the adsorbent in time  $t$  is given, with certain simplifying assumptions, by:  $S \propto \{1 - \Phi[Q/\sqrt{ct}]\}$ , where  $\Phi$  = Gaussian integral of error,  $Q$  = activation energy, and  $c$  = (mean?) variation. M. H. M. A.

**Influence of surface films of oil on evaporation of water.** R. W. Powell (*Trans. Faraday Soc.*, 1943, 39, 311-318).—The rate of vapourisation of  $\text{H}_2\text{O}$  through surface films of oil depends on the diffusion coeffs.  $D_1$  and  $D_2$  of  $\text{H}_2\text{O}$  in oil and in air, and on the



effective thickness of the oil and air layers in which diffusion occurs. The thickness of the air diffusion layer has been measured for various air speeds.  $D_o$ , measured for three different oils, increases with the thickness of the oil layer, and for thin films is  $\sim 3 \times 10^{-3}$  cm.<sup>2</sup> per sec. In agreement with previous workers it is concluded that unimol. oil films are ineffective, and that the relative reduction of evaporation increases with the speed of the air current when multimol. films are used.

F. L. U.

**Optical theory of chromatic emulsions and of the Christiansen experiment.** G. N. Ramachandran (*Proc. Indian Acad. Sci.*, 1943, **18**, A, 67—79).—The observations of Sethi (*Proc. Indian Assoc. Cult. Sci.*, 1921, **6**, 124) and Sogani (A., 1926, 336) can be explained by a theory based on diffraction of light by a sphere immersed in a medium of nearly the same refractive index. Expressions are derived for intensity and spectral character of transmitted and diffracted light.

L. J. J.

**Electrical conductivity of colloids.** T. R. Bolam and A. K. M. Trivedi (*Trans. Faraday Soc.*, 1943, **39**, 247—253).—The conductivity of Oden S sols decreases on dilution more rapidly than does the concn. Membrane equilibrium and conductivity data indicate that this is due to interionic action between the adsorbed polythionate ions and their counter-ions, leading to an apparent increase in  $\Lambda$  of the bound polythionate with increase in sol concn. This behaviour supports Hartley's theory (cf. A., 1939, **1**, 469) of the conductivity of electrolytes of unsymmetrical valency-type.

F. L. U.

**Development and present position of the theory of filtration of suspensions.** A. Briegleb-Müller (*Kolloid-Z.*, 1940, **92**, 285—299).—A crit. review of the literature. A bibliography is appended.

F. L. U.

**Silver sol.** H. R. Kruyt and H. L. van Nouhuys (*Kolloid-Z.*, 1940, **92**, 325—342).—Stable Ag sols are prepared by electrical dispersion in H<sub>2</sub>O, dil. NaOH, or saturated aq. AgOH, those made in presence of NaOH ( $\sim 10^{-3}$ N.) being the most highly disperse and the most stable. In all these sols the stabilising ion is AgO'. Dispersion in an atm. of O<sub>2</sub>-free H<sub>2</sub> or N<sub>2</sub> does not affect the result. The sols are coagulated by CO<sub>2</sub> owing to the conversion of AgOH into Ag<sub>2</sub>CO<sub>3</sub> and the consequent destruction of the source of AgO'. Electrolytes that do not form insol. Ag compounds behave normally, whilst those that do form such compounds bring about changes which vary with the relative amounts of Ag and electrolyte. KI reacts with the AgOH (or AgO') to give AgI and, if present in excess, AgI<sub>2</sub>'. Hence with a deficit of KI the stabilising AgO' is removed and coagulation ensues, whilst with excess of KI a second stabilising ion AgI<sub>2</sub>' is formed and eventually the whole of the Ag is converted into a sol of AgI stabilised by AgI<sub>2</sub>'. These changes occur only in the presence of O<sub>2</sub>, which oxidises the exposed surface of the Ag and thus enables the above reaction to proceed to completion. Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub> also reacts with AgO' to give a complex Ag ion capable of stabilising the sol. Sols stabilised with Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>, also those that have been long in contact with glass and are then stabilised by a silicate ion, are no longer coagulated by CO<sub>2</sub>.

F. L. U.

**Burton's rule for positive hydrosols. I. General and preparative.** H. Kauffmann (*Kolloid-Z.*, 1940, **92**, 343—354).—An improved arrangement is described for the electrical dispersion of Fe, Al, and Cu (as oxides) in H<sub>2</sub>O, consisting essentially in attaching one electrode to the armature of an a.c. electromagnet operating on a 50-cycle supply. The relative movement of the electrodes thus produced effectively prevents their welding together and trebles the max. concn. of colloidal material attainable (e.g., 1.24 g. Cu per l. instead of 0.4 g.). Sols of CuO, Al<sub>2</sub>O<sub>3</sub>, and Fe<sub>2</sub>O<sub>3</sub> have been prepared in this manner, the last two also by hydrolysis of the chlorides, and purified by dialysis for the experimental study of the applicability of Burton's rule, with regard to which the available data are inconclusive.

F. L. U.

**Effect of strong electrolytes on the viscosity of quartz suspensions.** A. von Buzágh and E. Erényi (*Kolloid-Z.*, 1940, **91**, 279—287).— $\eta_{rel}$  for pure quartz suspensions is given by  $\eta_{rel} = 1 + k_1 c + k_2 c^2$ ;  $k_1$  is almost independent of particle radius ( $r$ ) but  $k_2$  decreases with increasing  $r$ . In 0.1M-BaCl<sub>2</sub>  $\eta_{rel} = 1 + kc$  but  $k$  is  $>$  the val. required by the Einstein relation, and decreases with increasing  $r$ . The effect is due to dehydration and charge neutralisation by BaCl<sub>2</sub>, thus increasing the particle cohesion. It is found that  $k$  varies with  $r$  in the same way as the cohesion determined in other ways. Other salts also increase  $\eta_{rel}$  and their relative effects follow the valency and lyotropic series rules. AlCl<sub>3</sub> and Th(NO<sub>3</sub>)<sub>4</sub> show a max. in the  $\eta_{rel}$ - $c$  curves, and for acids these curves are steeper than for neutral salts. NaOH has little effect on  $\eta_{rel}$ . The univalent ions (but not the bivalent) agree with the theory of Ostwald connecting  $\eta_{rel}$  and activity.

J. H. BA.

**Ionic exchange on colloidal sulphur. II. Ionic exchange on lyophobic colloidal systems.** E. O. K. Verstraete (*Kolloid-Z.*, 1943, **103**, 25—42).—Displacement of H<sup>+</sup> ions on S sols by other cations was measured by determining the acid-equiv. of the sol and of the ultra-filtrate before and after addition of electrolyte. The extent

of exchange by different ions is in the order Ba  $>$  Sr  $>$  Ca  $>$  K  $>$  Na  $>$  Li  $>$  Mg. With cations of valency  $>2$  coagulation of the sol is so rapid that complete exchange does not occur, and other disturbing factors operate. The radius, polarisability, and degree of hydration of ions are considered to be the factors determining extent of displacement. The antagonism between H<sup>+</sup> or Na<sup>+</sup> and other cations is studied. It can be partly but not wholly accounted for if ionic concns. are replaced by activities.

R. H. F.

**Sedimentation volume and anomalous flow in lyophobic suspensions.** W. Gallay and I. E. Puddington (*Canad. J. Res.*, 1943, **21**, B, 171—178).—The sedimentation vol. ( $v$ ) of dried starch, MgO, Fe<sub>2</sub>O<sub>3</sub>, and talc in dry org. solvents is almost independent of the solvent, but with addition of H<sub>2</sub>O  $v$  increases. In the case of talc and Fe<sub>2</sub>O<sub>3</sub> addition of large amounts of H<sub>2</sub>O to non-polar solvents brings about a reduction in  $v$  to a val. approaching that in pure H<sub>2</sub>O. The increase in  $v$  is relatively large for anisodimensional particles like talc and small for spherical particles like starch. The increase in  $v$  is related to the degree of flocculation in the system, leading to a rigid branched-chain scaffolding type of structure.

C. R. H.

**Hydration of starch below the gelatinisation temperature.** W. Gallay and I. E. Puddington (*Canad. J. Res.*, 1943, **21**, B, 179—185).—The sedimentation vol. ( $v$ ) of aq. starch suspensions below the gelatinisation temp. and the ease of redispersion of the sediment increase with temp. At the lowest temp. investigated (3°) the suspensions show considerable dilatancy; at 50° some flocculation occurs. Between these temp. hydration increases continuously with temp. Starch dried at 45° in a vac. shows no dilatancy when dispersed with H<sub>2</sub>O, indicating that drying has affected its hydration capacity. Drying increases  $v$  and lowers the gelatinisation temp.; normal  $v$ , dilatancy, and gelatinisation temp. are restored if the dried starch is allowed to regain its moisture. The heat of wetting of dried starch is considerable and may result in local gelatinisation at the surface of the granules, leading to sticking and increased  $v$ .

C. R. H.

**Swelling and solubility of macromolecular materials.** J. N. Brønsted (5 *Nordiske Kemikermøde*, 1939, 188).—The swelling of macromol. materials in contact with liquids is to be considered as dissolution where the potential energy is  $\gg$  kinetic energy of the solute mols. Consequences are discussed.

M. H. M. A.

**Structural mechanics of visco-elastic continua. VII. Viscosity and chemical constitution of macromolecular systems.** H. Umstätter (*Kolloid-Z.*, 1943, **103**, 7—18).—Theoretical. A  $\eta$ -concn. function incorporating Staudinger's relation is derived thermodynamically, and the limits of its validity are examined. Macromols. are non-rigid and can therefore absorb part of the energy of solvent mols. on collision. Such inelastic collisions result in the formation of a sheath of solvent mols. around the solute mol.; solvation is thus accounted for without assumption of any special forces. Determination of particle size is possible from the flow curve and  $\eta$ -temp. function. Large mols. may rupture if the mol. cohesion between neighbouring chains is  $>$  the chain strength. There is thus an upper limit to mol. size above which mols. are mechanically unstable.

R. H. F.

**Constitution of soap solutions.** P. Ekwall (5 *Nordiske Kemikermøde*, 1939, 254).—A discussion of the properties of dil. soap solutions between the "crit." and "limiting" concns. At concns.  $<$  the latter soap behaves as a normal uni-univalent electrolyte.

M. H. M. A.

**Measurements on the dialysis of aqueous soap solutions.** O. Lamm (*Kolloid-Z.*, 1940, **91**, 275—279).—The rates of dialysis of KOAc and Na laurate (I) are compared when dialysis occurs into a small vol. of H<sub>2</sub>O to prevent hydrolysis. The rate for KOAc can be accounted for theoretically and that for (I) follows the same equation until the concn. in the small vol. is  $\sim 0.022$ , after which the rate is  $<$  the theoretical. This is not due to loss of permeability of the membrane or to membrane hydrolysis, but probably arises from micelle formation. The decrease in rate occurs at about the same concn. as a decrease in the free diffusion of (I).

J. H. BA.

**Relations between electrical conductivity and degree of dispersion of lyophilic colloids. III. Conductivity of sodium and potassium palmitate and stearate solutions in presence of *m*- and *p*-cresol.** E. Angelescu and A. Woinarosky (*Kolloid-Z.*, 1940, **92**, 355—361).—The conductivity of Na and K palmitates and stearates has been determined over the range 20—60° in 0.1 and 0.2N. solution in the presence of varying amounts of *m*- and *p*-cresol. The influence of the length of the hydrocarbon chain, of the soap cation, and of the concn. of the cresol is the same as for *o*-cresol (cf. A., 1943, **1**, 305). A comparison of the influence of the cresols on  $\eta$  (large effect) and on conductivity (small effect) indicates that the particles giving rise to increased  $\eta$  are not identical with those responsible for conduction.

F. L. U.

**Kinetic theory of rubber.** F. C. Auluck and D. S. Kothari (*J. Chem. Physics.*, 1943, **11**, 387—392).—Mathematical. Young's modulus for ideal rubber has been calc. by a statistical method, defining the macro-state of a chain-mol. by its length and not by the distance between the ends.

W. R. A.



**Elasticity of a network of long-chain molecules. II.** L. R. G. Treloar (*Trans. Faraday Soc.*, 1943, 39, 241—246; cf. A., 1943, I, 90).—Wall's treatment of the elasticity of a mol. network is extended to the general homogeneous type of deformation of rubber. An equation is derived for the work of deformation in terms of the three principal strains, from which some general stress-strain relations, involving only one physical const. of the material, are deduced. The formulæ are applied to some simple cases.

F. L. U.

**Fast and slow extension of plastic materials.** R. N. Haward (*Trans. Faraday Soc.*, 1943, 39, 267—280).—The work absorbed by a material under impact is considered to be governed either by the rate at which deformation can occur or by the amount of deformation possible. Results of experiments on the extension, at different rates, of celluloid, cellulose acetate, and poly-Me methacrylate are discussed, and it is concluded that the concept of "ideal total work," viz., the sum of the Hookean and non-ideal elastic work, each taking place at the max. initial stress, can be used in conjunction with that of the crit. impact velocity to bring fast and slow deformations of plastic material into a single picture. Experiments on the extension and breaking of cellulose acetate at different temp. indicate that adiabatic temp. changes during extension will not be large enough to alter the character of the deformation.

F. L. U.

**Gel formation in vinyl-divinyl copolymers.** W. H. Stockmayer and H. Jacobson (*J. Chem. Physics*, 1943, 11, 393).—The gel-point in the copolymerisation of vinyl and divinyl reactants permits the determination of the wt. average no. of reacted double bonds in a stable polymer chain.

W. R. A.

**Rheometry of organic glasses. I.** W. Scheele, M. Alfeis, and L. Lahaye (*Kolloid-Z.*, 1943, 103, 1—7).—Org. glasses are classified according to the type of flow curve obtained on subjecting them to deforming stresses. For pure flow the material is characterised by its  $\eta$ ; for quasi-flow  $\eta$  varies with applied stress. Measurements are made of velocity of flow of 4 polyvinyl acetates of varying degrees of polymerisation at temp. from 35° to 110° using Höppler's consistometer. For evaluation of the flow curves the concept of work of deformation is developed and shown to be a useful criterion of the material. Its log bears a linear relation to the reciprocal of the abs. temp. for the materials and temp. range examined.

R. H. F.

**Structures of cellulose fibres.** H. Ruska (*Kolloid-Z.*, 1940, 92, 276—285).—Electron-micrographs of transverse sections of cotton hairs and artificial cellulose fibres show a compact outer wall enclosing a matrix permeated by hollow spaces.

F. L. U.

**Bio colloids as high-molecular electrolytes. III. (a) Sphingomyelin. (b) Position of rubidium and caesium in the series of active alkali cations.** H. G. Bungenberg de Jong, L. Teunissen-van Zijp, and P. H. Teunissen (*Kolloid-Z.*, 1940, 91, 311—315).—A pure specimen of sphingomyelin has been prepared, the charge reversal concn. for  $\text{UO}_2^{++}$ ,  $\text{Ce}^{+++}$ ,  $\text{La}^{+++}$ ,  $\text{Co}(\text{NH}_3)_6^{+++}$ ,  $\text{Pb}^{++}$ ,  $\text{Ca}^{++}$ ,  $\text{Mg}^{++}$ ,  $\text{Sr}^{++}$ ,  $\text{Ba}^{++}$ ,  $\text{Li}^+$ ,  $\text{Na}^+$ , and  $\text{K}^+$  obtained, and the reciprocal hexol no. determined. The vals. agree with those of other phosphate colloids (A., 1938, I, 467). In general the charge reversal concn. is lower (except for  $\text{Na}^+$  and  $\text{K}^+$ ) for specimens with higher reciprocal hexol no., i.e., higher purity. The charge reversal concns. of Rb and Cs for Na agar, Na pectinate, ovolécithin, and soya-bean phosphatide are determined and placed in the alkali series previously obtained. They agree with the proposed theory concerning the polarisability of the ionogenic group and that of  $\text{H}_2\text{O}$ .

J. H. BA.

**Electrophoretic behaviour of hydrocarbons and the influence of temperature thereon.** H. W. Douglas (*Trans. Faraday Soc.*, 1943, 39, 305—311).—Mobilities of particles of dodecane (I), paraffin wax (II), and  $\Delta^8$ -octadecene (III) in aq. dispersions 0.01N. in  $\text{Na}^+$  have been measured at pH 2—12. The  $\zeta$ -pH curves for (I) and (II) are nearly coincident, whilst that for (III) rises more steeply. Mobilities increase with rise of temp. at a given pH, but the  $\zeta$ -potential is substantially unaffected over the range 25—40°. The heat of adsorption of  $\text{OH}^-$  is calc. to be  $\sim 800$  g.-cal. per g.-ion of  $\text{OH}^-$  adsorbed.

F. L. U.

initial concn. In the action of 40.8% aq. HCl on cellulose, complete hydrolysis to (I) occurs, and the reversion equilibrium is reached in 25 hr. at 20°.

F. L. U.

**Dissociation of hexa-arylethanes. Equilibria involving "mixed ethanes."** C. M. Himel and M. B. Mueller (*J. Amer. Chem. Soc.*, 1943, 65, 1654—1656).— $K_{12}$  for  $\text{E}_{12} \rightleftharpoons \text{R}_1 + \text{R}_2$ , where  $\text{R}_1$ ,  $\text{R}_2$  are different triarylmethyls and  $\text{E}_{12}$  is the corresponding hexa-arylethane, have been calc. from the data of Marvel and Himel (A., 1943, II, 27). Mixed ethanes have  $\Delta G$  of dissociation  $>$  that of the parent compounds, since  $K_{12} < K_1$  ( $\text{E}_{11} \rightleftharpoons 2\text{R}_1$ ) and  $K_2$  ( $\text{E}_{22} \rightleftharpoons 2\text{R}_2$ ).  $K_{12}$  may depend not only on  $K_1$  and  $K_2$  but also on the polarisation of the ethane linking, steric hindrance, or the effect of symmetry on  $\Delta S$  of dissociation.

W. R. A.

**Additive compounds of sulphur dioxide.** N. F. Albertson and W. C. Fernellius (*J. Amer. Chem. Soc.*, 1943, 65, 1687—1690).—The binary systems  $\text{SO}_2$  and dioxan, PhOMe,  $\text{Et}_2\text{S}$ ,  $\text{COMe}_2$ ,  $\text{NHPhMe}$ ,  $(\text{CH}_2)_2\text{O}$  are discussed. New compounds (1:1) between  $\text{SO}_2$  and dioxan,  $(\text{CH}_2)_2\text{O}$ , PhOMe, and  $\text{Et}_2\text{S}$  and a (1:2)  $\text{SO}_2$ -dioxan compound are reported.

W. R. A.

**Behaviour of trimethylamine, trimethylamino-sulphur trioxide, and trimethylamine oxide towards sulphur dioxide.** A. B. Burg (*J. Amer. Chem. Soc.*, 1943, 65, 1629—1635).— $\text{NMe}_3$  with  $\text{SO}_2$  gives  $\text{NMe}_3\text{SO}_2$  for the dissociation of which  $\Delta G^\circ$  is 28.95 — 0.07404T kg.-cal. Extensive solvation occurs in liquid  $\text{SO}_2$  but no definite secondary additive compounds, no ionisation, and no association were observed. Anhyd.  $\text{NMe}_3\text{O}$  absorbs  $\text{SO}_2$  at  $-80^\circ$  and yields  $\text{NMe}_3\text{O}_2\text{SO}_2$  which readily loses  $\text{SO}_2$  to give the very stable  $\text{NMe}_3\text{O}_2\text{SO}_2$ . This compound appears to be dimeric in solution in  $\text{SO}_2$ . The type of linking is discussed from the electronic point of view.

W. R. A.

**Constitution of ammoniacal solutions of mercuric salts.** J. Bjerrum (5 *Nordiske Kemikermøde*, 1939, 195—196).—Acid and alkaline  $\text{Hg}(\text{NO}_3)_2$ —0.5—2.0N- $\text{NH}_4\text{NO}_3$  solutions contain only amino- and no hydroxo-complexes. Vals. for  $\log K_n$  ( $K_n = [\text{Hg}(\text{NH}_3)_n]^{2+}/[\text{Hg}(\text{NH}_3)_{n-1}^{2+}][\text{NH}_3]$ ) at room temp. are:  $n = 1$ ,  $\sim 8.8$ ; 2,  $\sim 8.7$ ; 3, 0.83; 4, 0.95.

M. H. M. A.

**Refractometric investigations on three systems of aluminium nitrate and sodium acetate, tartrate, and citrate.** G. Spacu and E. Popper (*Kolloid-Z.*, 1943, 103, 19—24).—Refractive indices ( $n$ ) of aq. solutions of  $\text{Al}(\text{NO}_3)_3$  and  $\text{NaOAc}$ , Na tartrate and citrate and of binary mixtures of these are recorded. For mixtures the deviation between  $n$  observed and  $n$  calc. from the vals. for the components exhibits a max. at a certain concn. ratio in each case. This is attributed to complex formation, the compositions of the max. corresponding to the following complexes:  $[\text{Al}_2(\text{OAc})_4(\text{OH})_2]\text{OAc}$ ,  $[\text{Al}_2(\text{C}_4\text{H}_4\text{O}_6)_2(\text{OH})_2]\text{Na}_2$ , and  $[\text{Al}_2(\text{C}_6\text{H}_5\text{O}_7)_2]\text{Na}_2$  or  $[\text{Al}_2(\text{C}_6\text{H}_5\text{O}_7)_2(\text{OH})_2]\text{Na}_2$ . The failure of  $\text{OH}^-$  ions to ppt. Al in presence of acetates, tartrates, and citrates is accounted for by the formation of these complexes.

R. H. F.

**Solubility and dissociation of cryolite in aqueous solutions.**—See A., 1944, I, 12.

**Rates and equilibria in the ionisation of C—H bonds.** R. P. Bell (*Trans. Faraday Soc.*, 1943, 39, 253—259).—Data for the rates of ionisation of 12 carbonyl compounds in presence of bases and for the dependence of the rate on basic strength are used to deduce approx. vals. of the acid dissociation const.  $K_A$ . This ranges from  $10^{-8}$  for  $\text{CH}_3\text{Ac}\cdot\text{CO}_2\text{H}$  to  $10^{-20}$  for  $\text{COMe}_2$ .  $K_A$  calc. for  $\text{COPhMe}$  is  $10^{-19}$ , and for  $\text{CH}_3\text{Ac}_2$  is  $10^{-9}$ , both in agreement with other experimental data; the val.,  $1.5 \times 10^{-6}$ , usually quoted for  $\text{CH}_3\text{Ac}_2$  is incorrect. Reasons are given for considering the activity of unassociated  $\text{H}_2\text{O}$  in water at 25° to be  $\sim 0.13\text{M}$ , and if this val. is used to estimate the basic strength of  $\text{OH}^-$  the rates of ionisation of ketones in presence of  $\text{OH}^-$  show approx. agreement with other kinetic and equilibrium data, though there are some unexplained discrepancies. In the reaction  $\text{RH} + \text{B} \rightleftharpoons \text{BH} + \text{R}^-$  ( $\text{RH}$  = carbonyl compound,  $\text{B}^-$  = base) the effect of substituents in either reactant is to shift the potential energy curves along the energy axis without seriously changing their shape.

F. L. U.

**Basic strength of organic oxides of the elements of the nitrogen and sulphur groups.** P. Nylén (5 *Nordiske Kemikermøde*, 1939, 227—229).— $pK_A$  has been determined at 20° for  $\text{R}_2\text{R}'\text{XO}$  and  $\text{R}_2\text{ZO}$  ( $\text{R} = \text{Me}, \text{Et}$ ;  $\text{R}' = \text{Me}, \text{Et}, \text{Ph}$ ,  $o$ - and  $p$ - $\text{C}_6\text{H}_4\text{Me}$ ;  $\text{X} = \text{N}, \text{P}, \text{As}, \text{Sb}$ ;  $\text{Z} = \text{S}, \text{Se}, \text{Te}$ ). (Cf. A., 1942, I, 266.)

M. H. M. A.

**Simple approximate relation between successive dissociation constants of symmetrical inorganic oxygen acids.** T. L. Hill (*J. Amer. Chem. Soc.*, 1943, 65, 1664—1666).—An equation is derived, with which, provided that two  $K$  are known, further  $K$  of symmetrical inorg. O acids may be calc. The equation has been tested for neutral and charged oxyacids of P, As, S, Se, Te, and I. The equation is not restricted as to solvent.

W. R. A.

**Effect of sodium chloride on the ionisation of boric acid at various temperatures.** B. B. Owen and E. J. King (*J. Amer. Chem. Soc.*,

## VI.—KINETIC THEORY. THERMODYNAMICS.

**Reactions in the system cellulose-hydrogen chloride-water. III. Reversion of glucose and degradation of cellulose by concentrated hydrochloric acid.** H. Frahm (*Ber.*, 1941, 74, [B], 622—635; cf. B., 1943, II, 314).—The condensation of glucose (I) dissolved in 40.8% aq. HCl is a strictly reversible reaction conforming with the law of mass action. Equilibrium consts. determined for a series of concns. of (I) indicate that the main reactions are  $2(\text{I}) \rightleftharpoons \text{biase} + \text{H}_2\text{O}$ ,  $(\text{I}) + \text{biase} \rightleftharpoons \text{triglucosan} + 2\text{H}_2\text{O}$ , and  $2 \text{biase} \rightleftharpoons \text{tetraglucosan} + 2\text{H}_2\text{O}$ . The anhydrides are non-reducing. Variations of the equilibria with temp. are slight, and lead to a val.  $\sim 2$  kg.-cal. per mol. for the heat of reaction. The % of reversion products in the equilibrium mixture increases with the initial concn. of (I), but the highest yield of biase relative to anhydrides is obtained with a low



1943, 65, 1612—1620).—A method of determining the ionisation of a weak acid in salt solutions by means of cells containing buffered solutions without liquid junctions is described, which by changing the standard state to conform with each salt concn. is equiv. to the method of determining  $K$  in pure  $H_2O$ .  $E^\circ$  of the new standard states are given over a wide range of salt concn. and temp.  $K^\circ$  of  $HBO_2$  at seven concns. of  $NaCl$  between 0.02 and 3.0M. and at 5° intervals between 5° and 55°, have been determined. Calc. vals. for  $[\gamma_{H-\gamma_{BO_2}}/\gamma_{HBO_2}]_{M}$ ,  $\Delta H^\circ$ ,  $\Delta C_p^\circ$ , and  $\Delta S^\circ$  at various temp. are given. W. R. A.

**Acidic dissociation constants of phenoxyacetic acid and its derivatives.** N. V. Hayes and G. E. K. Branch (*J. Amer. Chem. Soc.*, 1943, 65, 1555—1564).—Vals. of  $K$  at 25° for  $OPh-CH_2-CO_2H$  (I) and 26 of its derivatives have been determined, and compared with those of  $BzOH$  and its derivatives. Excepting bromo- and iodo-phenoxyacetic acids, which are anomalously weak,  $K$  of  $m$ -derivatives can be calc. from those of the corresponding benzoic acids by Hammett's equations (cf. A., 1937, I, 142), whereas with  $p$ -derivatives, in which the substituent resonates strongly with the nucleus, calc. vals. are < the experimental vals. In  $o$ -derivatives the calc. vals. are > the experimental. An explanation, based on the differences between resonance in derivatives of (I) and  $BzOH$ , is advanced. W. R. A.

**Constants in the Debye-Hückel equation for activity coefficients.** G. G. Manov, R. G. Bates, W. J. Hamer, and S. F. Acree (*J. Amer. Chem. Soc.*, 1943, 65, 1765—1767).—The fundamental consts. given by Birge (*Rev. Mod. Physics*, 1941, 13, 233) and Wensel (A., 1939, I, 420) have been used to calc. the vals. of the consts.  $A$  and  $B$  (for unit vol. of solution and for unit wt. of solvent) of the Debye-Hückel equation for activity coeffs., and of  $2.30259RT/F$  at temp. from 0° to 100°. Contributions of  $\epsilon$  of the medium and of resonance between ions to the higher terms of the Debye-Hückel equations are discussed. W. R. A.

**Theory of new phase formation: cavitation.** J. B. Zeldovitch (*Acta Physicochim. U.R.S.S.*, 1943, 18, 1—22).—The probability of formation of a bubble in a liquid is treated as a particular case of the formation of a new phase. An equation of the Fourier-Fick type is obtained for the relationship between the rate of the direct and reverse processes of nucleus formation. In the case of cavitation, with a fluid of low v.p. under the action of a high negative pressure, the rate of formation of nuclei is determined by the  $\eta$  of the fluid. The dependence of the probability of cavitation on the duration of application of the negative pressure, and on the vol. of the region submitted to that pressure, is investigated. A. J. M.

**Range of existence of liquid crystals in the system potassium [salt of] methyl-orange-water.** F. Branner (5 *Nordische Kemikermode*, 1939, 207—209).—The system Me-orange K salt (I)— $H_2O$  has been studied at atm. pressure at room temp. to >80°. (I),  $2H_2O$  (rhombic) (stable at room temp. in presence of saturated solution) is converted, in presence of  $H_2O$ , at 36° into a two-phase mesomeric system, whence a buttery form of (I) (probably +  $1H_2O$ ) can be separated by filtration. The buttery form decomposes at 80° into anhyd. (I) + saturated solution. The clearing curve of the mesomeric system has been studied from 36° to 80° (0.1M. clears at 55°); hysteresis is exhibited. M. H. M. A.

**Nature of the difference in the constitution diagram of higher fatty acids and triglycerides.** G. B. Ravitsch and V. A. Volnova (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, 37, 59—62).—The constitution diagrams of stearic and palmitic acids and of the corresponding triglyceride system tristearin-tripalmitin are compared and explanations of differences are discussed. N. M. B.

**Equilibrium between silver bromide-chloride mixed crystals and bromide-chloride ions in solution.** H. Flood (5 *Nordische Kemikermode*, 1939, 191—192).—The results of Eastman and Milner (A., 1934, 31) have been confirmed over the whole range of  $AgCl$ - $AgBr$  solid solutions, which are thus regular solutions.  $\Delta H \propto N_{AgCl}N_{AgBr}$ , explaining the variation of  $K$  with composition of the solid phase. M. H. M. A.

**Heats of formation of  $MgO$ ,  $MgCl_2$ ,  $MgCl_2 \cdot H_2O$ ,  $MgCl_2 \cdot 2H_2O$ ,  $MgCl_2 \cdot 4H_2O$ , and  $MgCl_2 \cdot 6H_2O$ .** C. H. Shomate and E. H. Huffman (*J. Amer. Chem. Soc.*, 1943, 65, 1625—1629).—By measuring the heats of dissolution of these substances and  $Mg$  metal in 1.0N-HCl the following vals. for heats of formation ( $\Delta H_{298.15}$ ) have been obtained:  $MgO$  -143,840,  $MgCl_2$  -153,220,  $MgCl_2 \cdot H_2O$  -230,970,  $MgCl_2 \cdot 2H_2O$  -305,810,  $MgCl_2 \cdot 4H_2O$  -453,820,  $MgCl_2 \cdot 6H_2O$  -597,240 g.-cal. per mol. W. R. A.

**Electrical conductivities of salts and solubilities of barium sulphate in water-ethyl alcohol solutions.** B. Norberg and C. J. Clemensson (*Arkiv Kemi, Min., Geol.*, 1943, 16, A, No. 4, 9 pp.).—Vals. of  $\Lambda$  at 25° have been determined for solutions of  $KI$ ,  $KCl$ ,  $K_2SO_4$ , and  $BaCl_2$  in 10 and 20 wt.-% aq.  $EtOH$ , and of  $KI$ ,  $KCl$ ,  $LiCl$ ,  $Li_2SO_4$ , and  $BaCl_2$  in 30 and 40 wt.-%  $EtOH$ . Vals. of  $\Lambda_0$  and the ionic mobilities are calc. and discussed with reference to Walden's rule and the Onsager theory. Vals. of the solubility of  $BaSO_4$ , deduced from  $\Lambda$  measurements, range from  $3.270 \times 10^{-5}$  ( $H_2O$ ) to  $4.771 \times 10^{-7}$  g.-equiv. per l. (40 wt.-%  $EtOH$ ). A. J. E. W.

**Electrical conductivity of colloids.**—See A., 1944, I, 13.

**Differential moving boundary method for transference numbers.** L. G. Longworth (*J. Amer. Chem. Soc.*, 1943, 65, 1755—1765).—The movement of the boundary between regions of different concn. of the same electrolyte has been studied by the schlieren scanning method. Displacements  $\propto \partial n/\partial c$  ( $n$  = transference no.), and the behaviour of  $\partial n/\partial c$  in the concn. range of the boundary may be deduced from the schlieren patterns. The method compares favourably with the direct moving boundary method, and is applicable to salt solutions at concns. for which the latter method cannot be used. A solution, in good agreement with experimental data, of the differential equation for concn. boundaries is given for the case in which one boundary moves as a steady state. W. R. A.

**Transport numbers of aqueous silver nitrate in the presence of sucrose and measurements of the conductivity, viscosity, density, and refractivity.** D. N. Solanki and S. Mukerji (*J. Indian Chem. Soc.*, 1943, 20, 93—96).—The transport nos. of the ions in  $m/18-AgNO_3$  in the presence of 0—150 g. of sucrose (I) per l. have been measured at 25°. Conductivity,  $\eta$ ,  $d$ , and  $n_D$  data are also recorded. The transport no. of the  $Ag$  ion decreases with increasing (I) concn., reaching a min. with ~100 g. of (I) per l., and then increasing rapidly, whereas the  $\eta$  is a min. with ~25 g. of (I) per l. and the other properties change linearly with the (I) concn. The results are attributed to the hydration of the (I) mols. J. W. S.

**Formal electrode potentials of palladium in aqueous hydrochloric and perchloric acid solutions. Stability of chloropalladate ion.** D. H. Templeton, G. W. Watt, and C. S. Garner (*J. Amer. Chem. Soc.*, 1943, 65, 1608—1612).—The formal electrode potential,  $E^\circ$ , of  $Pd^{II}$  salts in 0.9952N-HCl has been determined at 15°, 25°, and 35°, and is const. over a 50-fold range in concn. of  $Pd^{II}$  salt.  $E^\circ$  at 25° has been measured in  $HCl$ - $HClO_4$  mixtures, such that total acid concn. and ionic strength were const., and in 4N- $HClO_4$ .  $Pd^{II}$  exists in  $Cl^-$  solutions mainly as  $PdCl_4^{2-}$ . The potential for the half-cell reaction  $Pd(s) + 4Cl^- (1f) = PdCl_4^{2-} (1-4f/HCl) + 2e$  is  $-0.6290 + 0.0080 \mu$ . [ $1.0 < \mu < 4.0$ ]; temp. coeff. 0.00046 v. per degree. Related thermodynamic consts. have been computed. For the half-cell reaction  $Pd(s) = Pd^{II} (4f/HClO_4) + 2e$ ,  $E^\circ_{25}$  is  $-0.987$  v. The val. of  $K$  for the dissociation of  $PdCl_4^{2-}$  at 25° is  $\sim 6 \times 10^{-14}$ . W. R. A.

**Electrochemical behaviour of the lead-tin couple in carbonate solutions.** G. Derge, H. Marcus, and A. H. Grobe (*Amer. Inst. Min. Met. Eng., Tech. Publ.* 1447, 1942; *Metals Tech.*, 9, No. 3, 7 pp.).—Measurements were made of (1) the potentials of Pb and Sn, and (2) currents produced when Sn and Pb electrodes were connected, in  $Na_2CO_3$ - $NaHCO_3$  solutions, pH 8.4—11.2. At pH 8.4 Pb is anodic to Sn, but at pH 9.5 to 11.2 Pb is cathodic. At pH 11.2 additions of  $Ag^+$ ,  $Bi^{3+}$ ,  $Cu^{2+}$ , and  $Zn^{2+}$  have little effect;  $Ni^{2+}$  and agar-agar reduce the current without altering the potential;  $K_2CrO_4$  and Na silicate lower potential and current, and reverse polarity. R. Ke.

**Discharge of hydrogen ions. I. Mercury.** A. Frumkin (*Acta Physicochim. U.R.S.S.*, 1943, 18, 23—57).—The vol. of  $H_2$  liberated on a Hg cathode was determined in 3N-HCl, 2.2N-HBr, and 3N-KI + 0.1N-HBr. The results confirm the dependence of overvoltage ( $\eta$ ) on c.d. Tafel's equation,  $\eta = a + b \log i$  ( $i$  = current,  $a$  and  $b$  = const.) holds for Hg up to a high c.d. Using a dropping Hg electrode, measurements of  $\eta$  at const.  $i$  should give a mean val. 0.008 v. > the val. at const. potential. Comparison of electrocapillary curves of acidified and alkaline solutions shows the absence of at. H on the surface of the Hg. The mean val. of  $\eta$  on Hg for 0.1N-HCl, 0.2N-HBr, and 0.1N- $H_2SO_4$  at 20° is  $1.428 + 0.115 \log i$ . When salts of multivalent cations ( $La^{3+}$  and  $Th^{4+}$ ) are added to dil. solutions of acids, the val. of the  $\psi_1$  potential changes from  $-$  to  $+$ . The increase of  $\eta$  produced by the addition of these ions is < the increase in the  $\psi_1$  potential. When salts with a common anion are added to HCl or HBr, a decrease of  $\eta$  is observed for low c.d., but an increase for high c.d., except when  $Na_2SO_4$  is added to  $H_2SO_4$ , when there is an increase of  $\eta$  for all c.d. A. J. M.

**Hydrogen overvoltage, especially on cementite.** E. Palmær (5 *Nordische Kemikermode*, 1939, 260—261).—The  $H$   $\eta$  is 0.06 ± 0.009 v. for Fe, and 0.12 ± 0.03 v. for cementite (no temp. given). Vals. are determined at low c.d. ( $> 0.8 \mu$  a. per  $cm^2$ ) to prevent depletion of  $H^+$  around the cathode; other precautions are described. M. H. M. A.

## VII.—ELECTROCHEMISTRY.

**Electrical conductivity of sodium deuteroxide in heavy water.** E. Rönass (5 *Nordische Kemikermode*, 1939, 188—189).—Determinations have been carried out at 18° and 25°. M. H. M. A.



## VIII.—REACTIONS.

**Hydroxyl in flames. II. Hydroxyl in the acetylene flame.** L. I. Avramenko (*Acta Physicochim. U.R.S.S.*, 1943, 18, 58—68).—There is a linear dependence of the concn. of non-excited and excited OH on the rate of combustion of a  $C_2H_2$ -air mixture. The stoichiometric mixture of air and  $C_2H_2$  gives a max. [OH], and such a mixture has max. rate of combustion. The emission spectrum of OH in a rarefied  $C_2H_2$ -air flame has been investigated, and it is shown that the method may be used to determine [OH] and [OH]. A. J. M.

**Interchange of hydrogen isotopes with complex salts. I. Kinetics of the interchange with the luteocobaltic complex.** J. S. Anderson, H. V. A. Briscoe, and N. L. Spoor. **II. Kinetics of the interchange with platinum and palladium tetrammines.** J. S. Anderson, H. V. A. Briscoe, L. H. Cobb, and N. L. Spoor (*J.C.S.*, 1943, 361—367, 367—372).—I. In contact with  $H_2O$ , D-containing  $[Co(NH_3)_4]Cl_2$  (I) and  $[Co en_3]Cl_2$  (II) [ $en = (CH_2NH_2)_2$ ] undergo isotope exchange at a rate  $v$  which follows a pseudo-unimol. law. The reactions have activation energies 28,400 and 28,100 g.-cal. per g.-mol. with (I) and (II), respectively. In both cases  $v \propto 1/[H^+]$ , but is almost independent of the concn. of ammine or the proportion of D which it contains. It is suggested that the  $Co-NH_3$  group can ionise as an acid, giving  $Co-NH_2^+$  and  $H^+$ , thus resembling aquo-ammines which can yield hydroxo-ammines by dissociation.

II. From the rate of isotope exchange between D-containing  $[Pt(NH_3)_4]Cl_2$  and  $[Pd(NH_3)_4]Cl_2$  and  $H_2O$  it is inferred that the rate of interchange with different metal ammine ions follows the order of their stabilities, viz.,  $Co > Pt > Pd$ . Besides interchange through dissociation yielding  $H^+$  ions,  $[Pd(NH_3)_4]Cl_2$  also undergoes interchange in acid solution through reversible dissociation of  $NH_3$  from the complex. The results are discussed in relation to the general theory of complex salts. J. W. S.

**Kinetics and mechanism of the racemisation of optically active cobaltic trisdiguanide complex.** P. Rây and N. K. Dutt (*J. Indian Chem. Soc.*, 1943, 20, 81—92).—The rates of racemisation of *d*- and *l*- $Co^{III}$  trisdiguanidinium chloro-*d*-tartrate (I) and of *d*- and *l*- $Co^{III}$  trisdiguanidinium chloride (II) (A., 1942, II, 78) have been studied in aq. solution at 40—60°. The activation energies (g.-cal. per g.-mol.) and vals. of  $\log PZ$  of the Arrhenius equation are *d*-(I), 21,350 and 9.14, *l*-(I) 22,310 and 9.8, (II) 13,930 and 4.16, respectively. Foreign cations retard the racemisation of active (II),  $Ca^{++}$ ,  $Cu^{++}$ ,  $Mn^{++}$ , and  $H^+$  having a most pronounced effect even at low concns., but the change is unaffected by anions other than  $OH^-$ , which has a strong accelerating effect. The inversion is interpreted on the basis of an excited condition in which the mol. can assume a distorted form but with the bond angles between each pair unchanged at 90°. From this form the mol. can pass into either the *d*- or *l*-form on losing its excess energy. J. W. S.

**Mechanism of the reaction between hydrogen sulphide and sulphur dioxide in liquid media.** N. F. Albertson and J. P. McReynolds (*J. Amer. Chem. Soc.*, 1943, 65, 1690—1691).—The rates of reaction of  $H_2S$  and  $SO_2$  in various liquids have been investigated. From these and previous data the following mechanism is proposed: (i) formation of a compound between  $H_2S$  and the medium by a H-bond, (ii) liberation of  $HS^+$  ions from the additive compound, (iii) reaction between  $SO_2$  (or its additive compounds) and  $HS^+$  ions. W. R. A.

**Blue perchromic acid. I. Kinetics of the decomposition of the blue perchromic acid in various organic media.** S. Prakash and R. C. Rai (*Proc. Indian Acad. Sci.*, 1943, 18, A, 1—7).—Blue perchromic acid decomposes by a first-order reaction in org. solvents, with a distinct induction period. Vals. of  $k$  in  $Et_2O$  at 10°, 20°, and 30° are, respectively, 0.002125, 0.005273, and 0.01711—0.02241. Addition of 33% of  $C_2H_5$ , PhMe, and xylene increases  $k$  by factors 1.79, 2.57, and 3.28, respectively, at 30°. L. J. J.

**Dilatometric method of measuring rates of reactions. Application to the rate of hydrolysis of acetal.** L. K. J. Tong and A. R. Olson (*J. Amer. Chem. Soc.*, 1943, 65, 1704—1707).—The effects of  $\Delta H$  of dissolution and reaction on the dilatometric determination of rate coeffs. have been analysed.  $\Delta H$  of dissolution and hydrolysis of  $CHMe(OEt)_2$  in  $H_2O$ , 4M-NaCl, and M- $KNO_3$ , determined calorimetrically, are respectively: -4700, 4100; -4250, 5100; -5560, 4500 g.-cal. per mol. Vol. changes during hydrolysis in these systems have been investigated, using a magnetically stirred dilatometer, and the  $H^+$ -catalysed rate coeff. at 25° is computed. W. R. A.

**Absorption of oxygen by glutathione in alkaline solutions. II. Kinetics of the reaction at pH 13.** M. B. Young and H. A. Young (*J. Amer. Chem. Soc.*, 1943, 65, 1681—1687).—The rate of absorption of  $O_2$  by glutathione at pH 13.0—13.3, catalysed by  $Cu^{++}$ , has been measured at various pressures of  $O_2$  and concns. of  $Cu^{++}$  and glutathione. A rate law is given, and a mechanism proposed for the reaction. W. R. A.

**Acid hydrolysis of *dl*-alkyl- $\beta$ -*d*-glucosides. I.** MacArthur (*Proc. Leeds Phil. Soc., Sci. Sect.*, 1943, 4, 69—74).—The hydrolysis of

*dl*- $\beta$ -methylbutyl- (I) and of 10 *sec*-alkyl- $\beta$ -*d*-glucosides by  $N-HCl$  at 80° follows a unimol. course, except towards the end of the hydrolysis when the hydrolysis coeff. ( $k$ ) increases.  $k$  is practically independent of the length of the alkyl chain and of its stereochemical configuration, in contrast to hydrolysis with emulsin.  $k$  for (I) is approx. half of  $k$  for the *sec*-glucosides. C. R. H.

**Kinetics of vinyl derivative polymerisation.** J. Ahere, G. Goldfinger, H. Mark, and H. Naidus (*J. Chem. Physics*, 1943, 11, 379—386).—Equations for the initial over-all rate of reaction and for the no. average polymerisation degree are derived, assuming that activation occurs by collision of an unactivated monomeride with another mol., that ease of deactivation varies with the type of nucleus, that termination of growth occurs by collision with another growing chain, an activated monomeride, a catalyst mol., or with chain-breaking impurities, and that for a certain period a steady state of activated centres is maintained. Propagation by normal chain growth and by chain transfer is considered. The equations are compared with experimental data on styrene polymerisations. W. R. A.

**Zone of activation in rate processes.** R. M. Barrer (*Trans. Faraday Soc.*, 1943, 39, 237—241).—The physical and statistical basis of the zone theory of diffusion and viscosity is outlined. The criticism advanced by Eley (A., 1943, I, 203) is inapplicable to the author's work. Further experimental behaviour is described which is predicted by the zone theory but is contrary to the transition state theory. F. L. U.

**Kinetics and mechanism of photographic development.** D. A. Frank-Kamenetzki (*Acta Physicochim. U.R.S.S.*, 1943, 18, 91—92).—The exponential increase of velocity of linear growth of an individual Ag nucleus with time (Rabinovitch, A., 1943, I, 93) can be explained on the assumption that rate of development is determined by the electrochemical oxidation of the developer proceeding on the whole surface of the Ag nucleus, the deposition of Ag taking place, however, only on its perimeter. The theory of Anastavitsch (*ibid.*, 95) is discussed. A. J. M.

**Catalysis of vanadate-hydriodic acid reaction by the oxalate ion.** C. R. Viswanadham and G. Gopala Rao (*Current Sci.*, 1943, 12, 229).—Preliminary.  $C_2O_4^{--}$  ions accelerate the vanadic acid-HI reaction. The catalysis is probably more concerned with the vanadate ion than with the HI, since the reactions  $Cr_2O_7^{--}$ -HI and  $Cr_2O_7^{--}$ -HBr are also accelerated by  $C_2O_4^{--}$  but reactions of HI with oxidising agents dissimilar to vanadate are not affected. J. F. H.

**Hydrolysis of hydrogen cyanide in acetic acid solutions with mineral acids as catalysts.** V. K. Kriebel, F. C. Duennebieber, and E. Colton (*J. Amer. Chem. Soc.*, 1943, 65, 1479—1482).—Hydrolysis of HCN, with HCl or  $H_2SO_4$  as catalyst, has been investigated in aq. and glacial AcOH and in AcOH-Ac $_2O$  mixtures. Rates of hydrolysis increase rapidly with decreasing  $[H_2O]$  in the solvent. HCl is the better catalyst, the rate being very sensitive to  $[HCl]$ . For HCl, the rate  $\propto$  (mean ion activity) $^2$ . No correlation of rate and physical properties was possible with  $H_2SO_4$  solutions. W. R. A.

**Oxidation processes. XV. Effect of reducing agents on the auto-oxidation of photographic developing agents.** A. Weissberger, D. S. Thomas, jun., and J. E. Lu Valle (*J. Amer. Chem. Soc.*, 1943, 65, 1489—1495).—The effect of ascorbic (I) and dihydroxymaleic acids on the autooxidation of *o*- and *p*- $C_6H_4(OH)_2$ ,  $\psi$ -cumarinol (II), *p*- $NH_2$ - $C_6H_4OH$ , metol, amidol, and *p*- $C_6H_4(NH_2)_2$  has been investigated. The retardation observed in most cases is explained by assuming that the quinonoid and semiquinonoid oxidation products catalyse the autooxidation, but are reduced by the inhibitors. (I) accelerates the autooxidation of (II) by the formation of semiquinones, which also explain the acceleration of the autooxidation of (I) by  $\psi$ -cumarinol. W. R. A.

**Activation of oxygen by solid surfaces.**—See A., 1944, III, 63.

**Mechanism of the steam-carbon reaction.** B. R. Warner (*J. Amer. Chem. Soc.*, 1943, 65, 1447—1451).—Present data show that CO and  $H_2$  are the primary products of the  $H_2O$ -C reaction and that  $CO_2$  is formed by the reaction  $CO + H_2O \rightleftharpoons CO_2 + H_2$  (I). The rate of gasification of C depends on the  $H_2$  adsorption isotherm, becoming const. above a steam saturation pressure.  $CH_3O$  and  $HCO_2H$  are suggested as adsorbed intermediates in the reactions  $C + HO \rightleftharpoons CO + H_2$  and (I), respectively. A theory for the catalysis of the steam-C reaction is proposed. W. R. A.

**Catalytic hydrogenation of carbon monoxide. Methane synthesis from water-gas.**—See B., 1943, II, 365.

**Catalysts for synthesis of carbon disulphide.**—See B., 1943, II, 365.

**Electrolytic polishing of metals.**—See B., 1943, I, 500.

**The Schuster band of ammonia and electrical synthesis of hydrazine.** E. J. B. Willey (*Trans. Faraday Soc.*, 1943, 39, 234—237).—Experiments on the decomp. of  $NH_3$  in electrical discharges support the view (cf. A., 1933, 1232) that the Schuster band at  $\lambda$  5635 originates in a reaction  $NH_3 + NH \rightarrow N_2H_4' \rightarrow N_2H_4 + hv$ . F. L. U.



**Photographic latent image.** I. Lattice energy and related quantities for hypothetical silver bromide crystal having the cubic ZnS type of structure. II. Outline of theory. M. L. Huggins (*J. Chem. Physics*, 1943, 11, 412—419, 419—426).—I. Lattice energy, equilibrium distance between atoms, density, and energy changes associated with electronic and ionic shifts are calc. for the cubic NaCl ( $B_1$ ) and cubic ZnS ( $B_3$ ) structures of AgBr. The latter has slightly higher energy, but may be stabilised by an extra electron or  $\text{Ag}^+$  ion. The  $B_3$  structure has the higher ionic conductivity.

II. According to the theory suggested, the latent image consists of small regions of  $B_3$  lattice structure in the Ag halide grains, stabilised by the presence of photo-electrons. The presence of an extra electron in a positive potential hole stabilises the  $B_3$  structure by 0.6 e.v. Replacement of some Br<sup>-</sup> by S<sup>-</sup>, or of  $\text{Ag}^+$  by  $\text{Hg}^{++}$ , or adsorption of polar dyes, should favour  $B_1$ – $B_3$  transition by facilitating the capture of photoelectrons. L. J. J.

**An effect in pure silver chloride crystals similar to the photographic Schwarzschild effect.** P. Meikljar (*Compt. rend. Acad. Sci. U.R.S.S.* 1941, 31, 226—229).—The absorption curves for the Ag–AgCl system are calc. for different sizes of colloidal Ag particle from the Rayleigh and Mie equations, and these curves are used, in conjunction with the experimentally obtained absorption curves of exposed pure AgCl crystals, to determine the average size of the colloidal Ag formed under varying conditions of exposure. Using three different intensity levels and a no. of exposure times for each intensity level, it is found that at all intensity levels the colloidal Ag particle increases in size with increased time of exposure, but for a given exposure time the particle size is the smaller the higher is the intensity. Although the intensity level and exposure times are some thousand times those normally employed with photographic material, it is suggested that this effect of intensity on the dispersion of the Ag particle is a factor in the mechanism of the Schwarzschild effect. Contrary to the Gurney–Mott theory of latent image formation, it is considered that the liberated electrons do not wander from their point of liberation, but cause local concns. which result, at high intensities, in a more highly dispersed latent image Ag centre. J. W. G.

**Activated oxalic acid.** P. S. MacMahon and B. B. Lal (*J. Indian Chem. Soc.*, 1943, 20, 143—152; cf. A., 1941, I, 18).—No evidence was obtained for the existence of activated  $\text{H}_2\text{C}_2\text{O}_4$ . When  $\text{n-H}_2\text{C}_2\text{O}_4$  is treated in absence of  $\text{O}_2$  and light with small quantities of  $\text{KMnO}_4$  or hydrated  $\text{MnO}_2$ , there persists, for a few min. after the consumption of the latter, a brownish coloration, probably due to the unstable acid  $\text{HMn}(\text{C}_2\text{O}_4)_2$ . This is the active principle involved in the slow reduction of  $\text{HgCl}_2$ . No reduction occurs if  $\text{HgCl}_2$  is added after its disappearance. The statement of Oberhauser and Schormüller (A., 1929, 793) that  $\text{KMnO}_4$  brings about this reduction in anhyd.  $\text{COMe}_2$  is not confirmed. In aq. solution, the replacement of  $\text{KMnO}_4$  by  $\text{Mn}^{++}$  ions gave negative results. Excess of  $\text{K}_2\text{C}_2\text{O}_4$  turns the brown solution pink with the formation of the more stable complex salt  $\text{Mn}(\text{KC}_2\text{O}_4)_3$ , which retains the ability to reduce  $\text{HgCl}_2$  quantitatively for 24 hr. in the dark. This compound is produced when  $\text{KMnO}_4$  in concn.  $>10^{-5}\text{N}$ . is slowly decolorised by  $\text{n-K}_2\text{C}_2\text{O}_4$ . In this case a non-linear relationship was observed between the quantity of  $\text{KMnO}_4$  and the amount of reduction of  $\text{HgCl}_2$ , which took several hr. to complete. With  $0.1\text{N-K}_2\text{C}_2\text{O}_4$  the amount of reduction was about 10 times that obtained with  $0.1\text{N-H}_2\text{C}_2\text{O}_4$  using the same quantities of  $\text{KMnO}_4$ . The reduction mechanism is explained by a long-chain process initiated by the formation of active  $\text{CO}_2^{\cdot}$  (or  $\text{C}_2\text{O}_4^{\cdot}$ ) ions  $[\text{Mn}(\text{C}_2\text{O}_4)_2] \rightarrow \text{C}_2\text{O}_4^{\cdot} + \text{Mn}(\text{C}_2\text{O}_4)_2$ ;  $\text{Mn}(\text{C}_2\text{O}_4)_2 \rightarrow \text{MnC}_2\text{O}_4 + \text{CO}_2 + \text{CO}_2^{\cdot}$ .  $\text{O}_2$  inhibits the reduction, although it actually lengthens the life of  $\text{HMn}(\text{C}_2\text{O}_4)_2$  apparently by removing one of the chain-carriers. No evidence was obtained to support the postulation by Launer (A., 1933, 476) of the formation of  $\text{CO}_2^{\cdot}$  from  $\text{CO}_2$  ions when applied to the  $\text{I-C}_2\text{O}_4^{\cdot}$  reaction. This reaction is retarded by traces of  $\text{Mn}^{++}$  which is converted into  $\text{Mn}(\text{KC}_2\text{O}_4)_3$  in diffused light. In air and in the dark  $\text{Mn}^{++}$  ions cause the reduction of  $\text{HgCl}_2$  by  $\text{K}_2\text{C}_2\text{O}_4$ , after an induction period, with gradually increasing rate,  $\text{Mn}(\text{KC}_2\text{O}_4)_3$  being formed simultaneously. No  $\text{Mn}(\text{KC}_2\text{O}_4)_3$  was formed from  $\text{Mn}^{++}$  ions and  $\text{K}_2\text{C}_2\text{O}_4$  alone until a trace of acid had been added. A mechanism not requiring the assumption of an activated form of  $\text{H}_2\text{C}_2\text{O}_4$  is suggested for the atm. oxidation of  $\text{H}_2\text{C}_2\text{O}_4$  with the formation of  $\text{H}_2\text{O}_2$  catalysed by  $\text{Mn}^{++}$  ions. Hydrated  $\text{MnO}_2$  reacts vigorously with conc.  $\text{H}_2\text{C}_2\text{O}_4$  with  $\text{CO}_2$  evolution, and a red filtrate can be obtained which will reduce  $\text{HgCl}_2$  in air. It apparently contains a peroxalate or manganioxalic acid,  $\text{Mn}(\text{HC}_2\text{O}_4)_3$ , relatively stable in excess of conc.  $\text{H}_2\text{C}_2\text{O}_4$ . No other simple carboxylic acid will reduce  $\text{HgCl}_2$  in presence of  $\text{KMnO}_4$ . L. H. L.

**Photochemical studies.** XXXVI. Quantum yields during the photochemical decomposition of methyl *n*-butyl ketone. J. E. Wilson and W. A. Noyes, jun. (*J. Amer. Chem. Soc.*, 1943, 65, 1547—1550).—Quantum yields of formation of the products of the decomp. of  $\text{COMeBu}^n$  have been determined as functions of  $I$ ,  $p$ ,  $\lambda$ , and  $T$ . Quantum yields of CO and  $\text{C}_2\text{H}_6$  are small and increase with  $T$ , whereas those of the main products are independent of the variables

studied. No discrimination between a free radical mechanism and a primary decomp. into final products is possible. W. R. A.

## IX.—PREPARATION OF INORGANIC SUBSTANCES.

**Reactions of solid substances. CXXIV. Course of sintering in copper powder.** G. F. Hüttig [with C. Bittner, R. Fehser, H. Hannawald, W. Heinz, W. Hennig, E. Herrmann, O. Hnevkovsky, and J. Pecher] (*Z. anorg. Chem.*, 1941, 247, 221—248).—Samples of pure, finely-divided Cu powder were heated in a stream of  $\text{H}_2$  under const. conditions to temp. from 100° to 800°. After cooling, the photomicrograph, X-ray diagram, pyknometric  $d$ , vol. (shaken down), solubility in dil.  $\text{HNO}_3$ , e.m.f., reactivity towards aq.  $\text{AgNO}_3$ , MeOH adsorption isotherm, and the catalytic activity for the decomp. of  $\text{H}_2\text{O}_2$  were measured. The method provides data only on the irreversible part of the process. At  $\sim 400^\circ$  a considerable contraction occurs, which is preceded by a distinct expansion. A "preshrinking," coupled with a similar initial expansion, is observed at  $\sim 200^\circ$ . The change in the other properties measured, for the most part, parallel those of the vol. The two contractions differ in that at 200° the process is essentially confined to the surface whilst at 400° the whole lattice is involved. The expansions observed probably correspond with an activated intermediate state. J. F. H.

**Complex cuprous thiosulphates.** G. Spacu and J. G. Murgulescu (*Kolloid-Z.*, 1940, 91, 294—310).—Complexes  $\text{XCu}_2\text{S}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ ,  $\text{X}_2\text{Cu}_2(\text{S}_2\text{O}_3)_2 \cdot x\text{H}_2\text{O}$  ( $\text{X} = \text{NH}_4$ , Na, K) are formed by addition of  $\text{X}_2\text{S}_2\text{O}_3$  to  $\text{Cu}(\text{NO}_3)_2$ ; their composition is checked by potentiometric titration and analysis of the ppts. In addition  $(\text{NH}_4)_2\text{Cu}(\text{S}_2\text{O}_3)_2 \cdot 4\text{H}_2\text{O}$ ,  $\text{K}_2\text{Cu}(\text{S}_2\text{O}_3)_2 \cdot 3\text{H}_2\text{O}$ , and  $\text{Na}_2\text{Cu}(\text{S}_2\text{O}_3)_2 \cdot x\text{H}_2\text{O}$ ,  $(\text{NH}_4)_2\text{Cu}(\text{S}_2\text{O}_3)_2 \cdot 2\text{NH}_4\text{NO}_3$ ,  $\text{K}_2\text{Cu}(\text{S}_2\text{O}_3)_2 \cdot 2\text{KNO}_3$ , and  $\text{Na}_2\text{Cu}(\text{S}_2\text{O}_3)_2 \cdot 2\text{NaNO}_3$  are formed. With  $\text{Cu}(\text{ClO}_3)_2$   $(\text{NH}_4)_2\text{S}_2\text{O}_3$  gives  $(\text{NH}_4)_2\text{Cu}(\text{S}_2\text{O}_3)_2 \cdot 2\text{NH}_4\text{ClO}_3$ . J. H. BA.

**Behaviour of cadmium hydroxide and mercuric oxide towards alkalis.** R. Scholder and E. Staufenbiel (*Z. anorg. Chem.*, 1941, 247, 259—276).—From solutions of  $\text{Cd}(\text{OH})_2$  in conc. aq. alkalis the following cryst. *cadmates* were prepared:  $\text{Na}_2[\text{Cd}(\text{OH})_4]$  (I),  $\text{Na}_2[\text{Cd}(\text{OH})_4] \cdot \frac{1}{2}\text{NaOH} \cdot 1\frac{1}{2}\text{H}_2\text{O}$  (II),  $\text{Na}_2[\text{Cd}(\text{OH})_4] \cdot (\text{H}_2\text{O})_2$  (III),  $\text{Sr}_2[\text{Cd}(\text{OH})_4]$  (IV), and  $\text{Ba}_2[\text{Cd}(\text{OH})_4]$  (V). The hydroxy-salt nature of (I) is shown by the course of thermal dehydration of the compound. (II) and (III) lose the  $\text{H}_2\text{O}$  outside the complex over  $\text{H}_2\text{SO}_4$ . At 100° the curve relating solubility of  $\text{Cd}(\text{OH})_2$  to normality of NaOH is cusp-shaped with a break at  $14.2\text{N}$ , owing to the solid phase becoming (I). From  $\text{Cd}(\text{OH})_2$ –NaOH–NaBr solutions,  $\text{Na}_2[\text{Cd}(\text{OH})_4] \cdot \frac{1}{2}\text{Br}_2 \cdot \frac{1}{2}\text{H}_2\text{O}$  can be prepared. Conc. aq. KOH gives cryst.  $\text{CdO}$  and  $\text{Cd}(\text{OH})_2$ . No mercurates could be prepared, the product being cryst.  $\text{HgO}$ . From  $\text{HgO}$ –NaOH–Na halide solutions the compounds  $2\text{HgO} \cdot \text{NaBr}$  and  $2\text{HgO} \cdot \text{NaI}$  were obtained. J. F. H.

**Addition of boron fluoride to hexamethylenetetramine.** A. B. Burg and La V. L. Martin (*J. Amer. Chem. Soc.*, 1943, 65, 1635—1637).—By adding  $\text{BF}_3$  to  $(\text{CH}_2)_6\text{N}_4$  in liquid  $\text{SO}_2$  the compound  $(\text{CH}_2)_6\text{N}_4 \cdot 4\text{BF}_3$  is formed. At const. pressure  $\text{BF}_3$  is removed without discontinuity as the temp. rises and tends towards a limit corresponding with  $(\text{CH}_2)_6\text{N}_4 \cdot \text{BF}_3$ . W. R. A.

**Borohydrides of gallium.** H. I. Schlesinger, H. C. Brown, and G. W. Schaeffer (*J. Amer. Chem. Soc.*, 1943, 65, 1786—1787).—When  $\text{GaMe}_3$  is treated with excess of  $\text{B}_2\text{H}_6$  at room temp. Ga and  $\text{H}_2$  are identified among the products and the equation  $\text{GaMe}_3 + 3\text{B}_2\text{H}_6 = \text{Ga} + 3\text{B}_2\text{Me}_3\text{H}_6 + 1.5\text{H}_2$  is suggested for the over-all reaction. This probably occurs by formation and autocatalytic decomp. of  $\text{Ga}(\text{BH}_4)_3$  occurring thus:  $2\text{GaMe}_3 + 9\text{B}_2\text{H}_6 = 2\text{Ga}(\text{BH}_4)_3 + 6\text{B}_2\text{Me}_3\text{H}_6 + 2\text{Ga}(\text{BH}_4)_3 = 2\text{Ga} + 3\text{B}_2\text{H}_6 + 3\text{H}_2$ . At  $-46^\circ$  dimethylgallium borohydride,  $\text{GaMe}_2\text{BH}_4$  (I), is formed:  $2\text{GaMe}_3 + 3\text{B}_2\text{H}_6 = 2\text{GaMe}_2\text{BH}_4 + 2\text{B}_2\text{Me}_3\text{H}_6$ . The extrapolated b.p. of (I) is  $92^\circ$  and its Trouton's const. is 23.5. W. R. A.

**Use of the exchange between carbon dioxide, carbonic acid, bicarbonate ion, and water for isotopic concentration.** A. F. Reid and H. C. Urey (*J. Chem. Physics*, 1943, 11, 403—412).—The exchange of O and C in the reactions (i)  $\text{CO}_2$  (dissolved) +  $\text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3$ , (ii)  $\text{CO}_2$  (dissolved) +  $\text{OH}^- \rightleftharpoons \text{HCO}_3^-$  can be catalysed by solid surfaces, e.g., glass fibres,  $\text{CaAl}_2\text{O}_6$ , increases in rate of up to 4 or 5 times and up to 2000 times, respectively, being found. Data for separation of O and C isotopes by a static bomb method and by fractionating columns at 1–50 atm. are recorded. L. J. J.

**Silicon arsenides.** W. Klemm and P. Pirscher (*Z. anorg. Chem.*, 1941, 247, 211—220).—Thermal analysis and X-ray investigation of the system Si–As reveal the existence of the compounds  $\text{SiAs}_2$ , decomp.  $944^\circ$ , and  $\text{SiAs}$ , congruent m.p.  $1083^\circ$ . The compounds exist over a small range; Si and As dissolve in each other but slightly. Both compounds are formed with increase in vol. The properties of the compounds and the alloying properties of Si and Ge with the elements of groups IV and V are discussed. J. F. H.

**Germanium (iso)cyanate.** A. W. Laubengayer and L. Reggel (*J. Amer. Chem. Soc.*, 1943, 65, 1783—1784).—To  $\text{GeCl}_4$  dissolved in



$C_6H_6$  was added powdered  $AgOCN$  in small quantities through a reflux condenser. The mixture was heated on a  $H_2O$ -bath for 1 hr., allowed to cool, filtered, and the filtrate on fractional distillation gave  $Ge(OCN)_4$ , b.p. 195–199°. It is a colourless liquid (doubtful whether cyanate or isocyanate) with  $\log_{10} p = 8.77-27640$  ( $\theta = 35^\circ$  to  $140^\circ$ ), mol. heat of vaporisation 12.6 kg.-cal., m.p.  $-8^\circ$ ,  $n_D^{25} 1.7694$ ,  $n_D^{20} 1.4793$ . W. R. A.

**History of nitrogen tribromide.** (A) L. Birckenbach and M. Linhard, (B) M. Schmeisser (*Z. anorg. Chem.*, 1941, **247**, 307, 308).—(A) A criticism of Schmeisser's claim to have first isolated a substance believed to be  $NBr_3 \cdot 6NH_3$  (A., 1942, I, 274) which the authors had prepared previously (A., 1929, 1285).

(B) An apology.

J. F. H.

**Behaviour of phosphoryl chloride, thionyl chloride, and sulphuryl chloride towards boron halides.** A. B. Burg and M. K. Ross (*J. Amer. Chem. Soc.*, 1943, **65**, 1637–1638).—Neither  $SOCl_2$  nor  $SO_2Cl_2$  reacts with  $BF_3$  or  $BCl_3$ . Although  $POCl_3$  does not react with  $BF_3$ , it forms  $POCl_3 \cdot BCl_3$ , rhombic crystals having  $\Delta G_{298}^\circ$  of dissociation of  $\sim -4.6$  kg.-cal.

W. R. A.

**Polythionic acids and their formation. IV. Reactions between polythionic acids and sulphurous or thiosulphuric acid.** H. Stamm, O. Seipold, and M. Goehring (*Z. anorg. Chem.*, 1941, **247**, 277–306).—Investigations were made of the systems polythionic acid– $H_2SO_3$  and polythionic acid– $H_2S_2O_3$  in aq. solution, in which the temp. ( $10-40^\circ$ ), pH (0–2), and concn. of the reactants were altered. Tri- (I), tetra- (II), penta- (III), and hexathionic acid (IV) were used. (I) is not decomposed by  $H_2SO_3$  at pH 1.6 except at  $40^\circ$ . (I) with  $H_2S_2O_3$  reaches an equilibrium  $H_2S_2O_3 + H_2S_2O_6 \rightleftharpoons H_2S_4O_6 + H_2SO_3$  (A), the equilibrium lying largely to the left at pH 1.6. The behaviour is complicated by the side-reaction:  $H^+ + S_2O_4^{2-} \rightarrow HSO_3^+ + S$  (B). (III) is also formed. (II) mainly reacts with  $H_2SO_3$  thus:  $H_2S_4O_6 + H_2SO_3 \rightleftharpoons H_2S_5O_6 + H_2SO_4$  (C = A reversed) at pH 1.7. The reaction velocity ( $v$ ) is increased by increase in  $[H_2SO_3]$  but to a smaller extent by increase in  $[H_2S_2O_6]$  since this also increases the velocity of the side-reaction:  $H_2S_4O_6 + H_2S_2O_3 \rightleftharpoons H_2S_5O_6 + H_2SO_3$  (D).  $v$  is not affected by temp. but is increased by increase in  $[H^+]$  and by adding NaCl. At higher temp. reaction (B) also occurs. (II) reacts with  $H_2S_2O_3$  according to equation (D). (III) reacts with  $H_2SO_3$  by equation (D) reversed until equilibrium is reached,  $[H^+]$  increasing up to this point. Increase in  $[H_2SO_3]$  or  $[H_2S_2O_6]$  or addition of NaCl all increase the reaction velocity. The remaining (III) is then slowly degraded to (I). (IV) reacts thus:  $H_2S_6O_6 + H_2SO_3 \rightarrow H_2S_7O_6 + H_2S_2O_3$  (E). Reactions (C), (D), and (E) are discussed in relation to the Wackenroder reaction.

J. F. H.

**Chlorine azide,  $CIN_3$ .** I. W. J. Frierson, J. Kronrad, and A. W. Browne. II. Interaction of chlorine azide and silver azide. **Azino-silver chloride,  $N_2AgCl$ .** W. J. Frierson and A. W. Browne (*J. Amer. Chem. Soc.*, 1943, **65**, 1696–1698, 1698–1700).— $CIN_3$ , prepared by (i)  $AgN_3 + Cl_2 \rightarrow AgCl + CIN_3$  and (ii)  $HN_3 + HOCl \rightleftharpoons CIN_3 + H_2O$ , is a yellow-orange or orange liquid freezing ( $\sim -100^\circ$ ) to an explosive yellow solid. Liquid  $CIN_3$  is not polar and does not act as an ionising solvent. It is slightly sol. in  $H_2O$  and readily sol. in  $C_6H_{10}$ ,  $C_6H_{12}$ ,  $C_6H_6$ , MeOH, EtOH, Et<sub>2</sub>O,  $COMe_2$ ,  $CHCl_3$ ,  $CCl_4$ , and  $CS_2$ . When gaseous  $CIN_3$  diluted with  $N_2$  is bubbled into excess of  $NH_3$  the reaction  $3CIN_3 + 8NH_3 \rightarrow N_2 + 3NH_4Cl + 3NH_4N_3$  occurs quantitatively. When a solution of  $CIN_3$  in anhyd.  $C_6H_{12}$  is kept at room temp. in a stoppered vessel for 2 hr. the reaction  $CIN_3 + C_6H_{12} \rightarrow HN_3 + C_6H_{11}Cl$  occurs. Its reactions with metals (Na, Mg, and Zn) and with P are discussed.

II.  $CIN_3$ , in the dry state and in non-aq. solutions, reacts with  $AgN_3$  to yield **azino-silver chloride,  $N_2AgCl$** , a dark blue solid stable at  $< -30^\circ$  but decomp. at higher temp. The following reactions have been observed:  $2N_2AgCl + Cl_2 \rightarrow 2CIN_3 + 2AgCl$ ;  $6N_2AgCl + 8NH_3 \rightarrow N_2 + 6NH_4N_3 + 6AgCl$ ;  $2N_2AgCl + SO_2 \rightarrow SO_2(N_2)_2 + 2AgCl$ . Tentative suggestions for the mechanism of formation and structure of the compound are advanced.

W. R. A.

**Corrosion of iron by ammonia.**—See B., 1943, I, 485.

**Reduction of potassium cyanopalladate (II) by potassium in liquid ammonia. Zero-valent compound of palladium.** J. J. Burbage and W. C. Fernelius (*J. Amer. Chem. Soc.*, 1943, **65**, 1484–1486).— $K_2Pd(CN)_4$  has been prepared by the action of K on  $K_2Pd(CN)_4$  in liquid  $NH_3$ . Its properties have been investigated and compared with those of  $K_2Ni(CN)_4$ . A compound  $K_2Pd(CN)_3$  was not obtained.

W. R. A.

*Note.*—Abstracts of papers on analysis and apparatus will be published in Section C (see Foreword).

## X.—LECTURE EXPERIMENTS AND HISTORICAL.

**Charles Tennant.** (Sir) W. Alexander (*Chem. and Ind.*, 1943, 411–416).

## XI.—GEOCHEMISTRY.

**Boron in hot springs at Tokaanu, Lake Taupo.** J. Healy (*New Zealand J. Sci. Tech.*, 1942, **24**, B, 1–17).—A geological, magnetic, and chemical survey of the area is described. The springs are alkaline and contain large quantities of  $Na_2B_4O_7$ . The origin of the B is discussed. J. E. P.

**Chemistry of lake sediments from Indian Tibet.** G. E. Hutchinson, A. Wollack, and J. E. Setlow (*Amer. J. Sci.*, 1943, **241**, 533–542).—Chemical and semi-quant. spectrographic analyses are recorded and discussed. Ca content is correlated with the presence or absence of an outlet. Mg increases only in the sediments of the more conc. closed lakes. Sr appears to follow Ca, but the Sr content is probably also lithologically controlled. Ba is probably sedimented with the silt fraction. The Ca content of the deep- $H_2O$  sediment of Pangong Tso has undergone changes; these may be due to a fall in  $H_2O$  level. Analyses for CaO and  $SiO_2$ , or a spectrographic comparison of Sr and Ba contents, should reveal periods of high and low levels in the history of a lake. The mean P content of the sediment ash is 0.10%, and loss of P from the  $H_2O$  by pptn. as  $Ca_3(PO_4)_2$  is of little importance in the economy of even the closed alkaline lakes. The ratio combined N : P varies from 1.7 to 7.8, and the proximate composition of org. matter is essentially that of other harmonic lake sediments.

L. S. T.

**Chemical composition of Lovozero eudialytites.** N. A. Eliseev and E. A. Sverjinskaja (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **31**, 244–245).—The eudialytites contain 60–70% of eudialyte. Chemical analyses of 3 different eudialytites are recorded. ZrO, ranges from 6.76 to 8.68%, and  $Nb_2O_5 + Ta_2O_5$  from 0.39 to 0.76, with  $Nb_2O_5$  predominating.

L. S. T.

**Porosity of geospheres.** G. A. Maximovitch (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **37**, 215–217).—Porosities of strata are calc. from 2572 determinations.

F. G. R.

**Mineralogy of the Iona [Murmansk] iron ore deposit.** G. P. Barsanov (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **31**, 246–250).—Magnetite, forsterite, titanclinochumite, schorlomite, phlogopite, and staffelite are described, and spectrum analyses recorded.

L. S. T.

**Fluorite in the Lower Permian deposits of the Bashkir autonomous Socialist Soviet Republic.** V. P. Florenski (*Compt. rend. Acad. Sci. U.R.S.S.*, 1941, **31**, 251–254).

L. S. T.

**Natural [electrical] potentials in sedimentary rocks.** P. A. Dickey (*Amer. Inst. Min. Met. Eng., Tech. Publ.* 1625, 1943; *Petrol. Tech.*, **6**, 10 pp.).—The potential of sandstones and conglomerates is found to be more strongly negative than that of shale. The difference is ascribed to preferential adsorption of ions by the rock materials.

A. R. Pe.

**Natural [electrical] potentials in [oil] well logging.** W. D. Mounce and W. M. Rust, jun. (*Amer. Inst. Min. Met. Eng., Tech. Publ.* 1626, 1943, *Petrol. Tech.*, **6**, 6 pp.).—Electroendosmosis accounts for only a small part of the observed potential variations. When saline (I) and fresh (II)  $H_2O$ , separated by a permeable membrane, are brought in contact with shale, an e.m.f. is set up so that current flows through the shale from (I) to (II). These conditions may be provided in a well by the contact of shale, drilling mud, and saline sand.

A. R. Pe.

**Nephelinised paragneisses of the Bancroft region, Ontario.** W. K. Summer and S. V. Burr (*Science*, 1943, **97**, 286–287).—A detailed geological and topographical map of the nepheline-bearing rock east of Bancroft village indicates a parasedimentary origin for the rock. The nepheline content varies both along and across the strike and much of the limestone is classed as “flow marble.” Nephelinisation is probably post-folding. The mechanics of the limestone-syntexis theory are disputed.

E. R. R.

**New method for studying sandy silt sediments (granulo-morphological analysis).** V. P. Baturin (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **37**, 66–68).—A survey and discussion of rolling and sliding processes with inclined planes of various materials.

N. M. B.

**Glauconite deposits in the Novo-Lialin district on the eastern slope of the Urals.** S. D. Rabinovitch (*Compt. rend. Acad. Sci. U.R.S.S.*, 1942, **37**, 63–65).—A short survey of the distribution and nature of deposits recently discovered.

N. M. B.

**Can the “lead method” be used on igneous rocks?** F. E. Wickman (*Arkiv Kemi, Min., Geol.*, 1943, **16**, A, No. 23, 9 pp.).—Mathematical. Age determinations can be made on igneous rocks by the Pb method, and unless the different samples of the differentiated rocks show large differences in radioactivity, the method is best used only on pre-Cambrian rocks. The abundance of Pb isotopes at the time of crystallisation can also be calc.

L. S. T.



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